REPORT ON THE INTERPRETATION OF ELECTRON MICROPROBE ANALYSES OF A MANGANOCOLUMBITE CRYSTAL

LOWTHER TOWNSHIP PEGMATITE

HEARST, ONTARIO

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SUMMARY

Large (4 cm long) (Nb,Ta)-oxide crystal collected by Byng Mining was submitted to SGS Lakefield Research Limited for electron microprobe analysis in order to correctly name the mineral. The microprobe results indicate that the large crystal is manganocolumbite ($MnNb_2O_6$). Much smaller minerals that were adjacent to, inclusions within and alteration products of the manganocolumbite crystal were also analyzed by an electron microprobe in order to identify them. The most common minerals adjacent to the manganocolumbite crystal are: albite, microcline and muscovite. The muscovite occurs as euhedral inclusions within the albite. Trace amounts of minerals rich in REE, U and Th occur adjacent to the manganocolumbite crystal: liandratite (Nb-U phase), monazite-(Th) (Th-P phase), huttonite (Th-Si phase), aeschynite-(Ca) (REE-Nb-Ta-Ti phase) and monazite-(Ce) (REE-P phase). The manganocolumbite is altered to fersmite/vigezzite (Ca-Nb phase).

INTRODUCTION

Lowther Township pegmatite is a sodic lepidolite-subtype pegmatite located in Lowther Township, south of Hearst, northeastern Ontario. The pegmatite is characterized by abundant cleavelandite (platy variety of albite), lepidolite pods and very coarse-grained white to pink beryl crystals. The pegmatite is enriched in rare elements and minerals such as Li (spodumene and lepidolite), Cs (lepidolite, potassium feldspar and beryl), Rb (lepidolite and potassium feldspar), Nb (ferrocolumbite and manganocolumbite), Ta (manganotantalite), Mn (spessartine), B (tourmaline) and Be (beryl). The Lowther Township pegmatite has two showings: the Decoy and the Moskito which are both on the same mining claim.

Sample BZ-H was collected from the Beryl Zone of the Decoy Showing by Byng Mining and examined by Dr. Julie Selway, senior project geologist for CCIC and a member of the Association of Professional Geoscientist of Ontario (#0738). Dr. Julie Selway completed a Ph.D. thesis on tourmaline in granitic rare-element pegmatites. The sample contained 4 cm long black (Nb,Ta)-oxide crystals which were sent to SGS Lakefield Research Limited for electron microprobe analysis in order to correctly identify them. Manganocolumbite and manganotantalite are almost identical in hand sample and there is a solid solution series between them. Microprobe analysis of their compositions is the best way to distinguish between them. Manganocolumbite is Nb-dominant end member, and manganotantalite is the Ta-dominate end member and is an ore mineral of Ta.

Analytical conditions used by SGS Lakefield during the microprobe analyses are given in their report entitled "Electron microprobe analysis of one manganocolumbite crystal" and dated July 16, 2008. This report is an interpretation of the analytical results in SGS Lakefield's report.

SAMPLE DESCRIPTION

The BZ-H sample from the Beryl Zone mostly consists of very coarse-grained pink to white platy cleavelandite (albite) and a radiating fan of black manganocolumbite blades with fine-grained muscovite coatings (Figure 1). Fine-grained black manganocolumbite also occurs interstitial to the cleavelandite plates. There are also a few vugs between cleavelandite plates. The cleavelandite has a brick-red hematite coating as a late-stage alteration product.

Figure 1. A photo of manganocolumbite crystals in cleavelandite sample number BZ-H

INTERPRETATION OF MICROPROBE ANALYSIS

Coarse-grained (Nb,Ta)-oxide crystal

The 4 cm long (Nb, Ta)-oxide crystal shown in Figure 1 was cut into two cross sections and mounted in a polished thin section (Figure 2). A total of 22 microprobe analyses were collected along two cross sections as shown in red in Figure 2. The results are given in Appendix 1, Table 1 and plotted in the columbite-tantalite quadrilateral in Figure 3. The crystal is manganocolumbite with an average Mn/(Mn+Fe) ratio of 0.684 and Ta/(Ta+Nb) ratio of 0.148. The crystal is fairly homogeneous with a slight Mn-enrichment along its rim relative its core. The manganocolumbite crystal contains trace amounts of Ti, Sn, W and Pb.

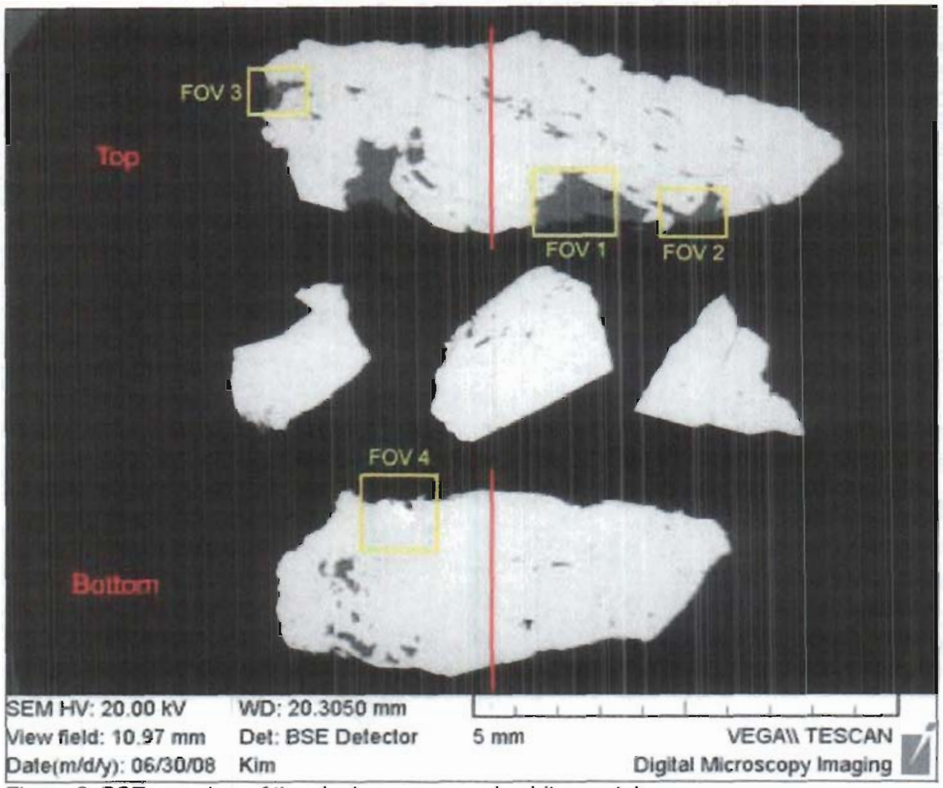

Figure 2. BSE overview of the single manganocolumbite crystal.
Two lines of analysis were completed along the top and bottom cross-sections.

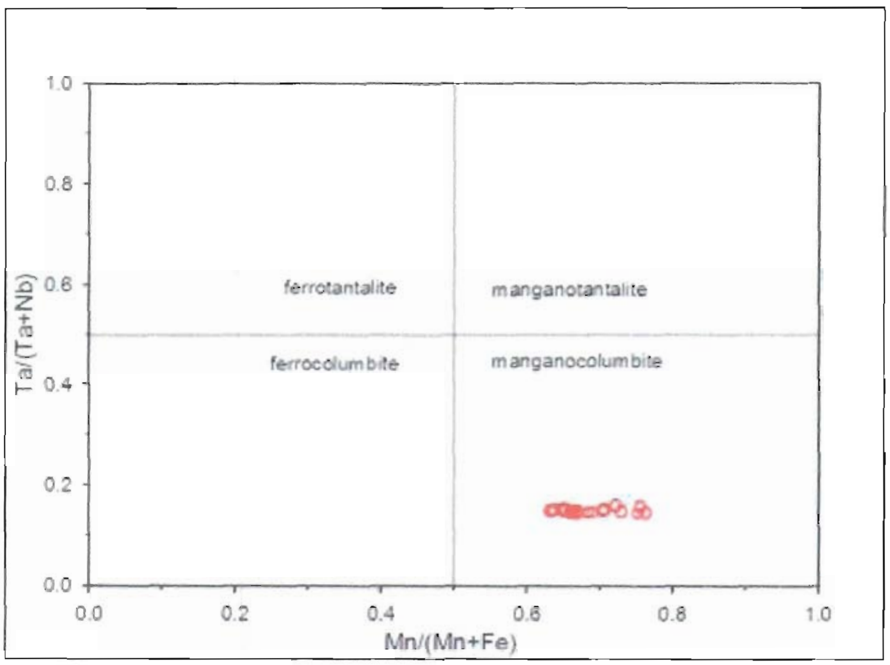

Figure 3. Analyses of manganocolumbite in the columbite-tantalite quadrilateral.

Field Of View 1

Field of View 1 (FOV1) shows an albite crystal adjacent to the manganocolumbite crystal and fine-grained muscovite and quartz inclusions within the albite (Figure 4). The analyses for the muscovite (FOV1-1) and albite (FOV1-5) are given in Appendix 1, Tables 2 and 3. The feldspar compositions are end-member albite (Na-rich) and are plotted in Figure 5.

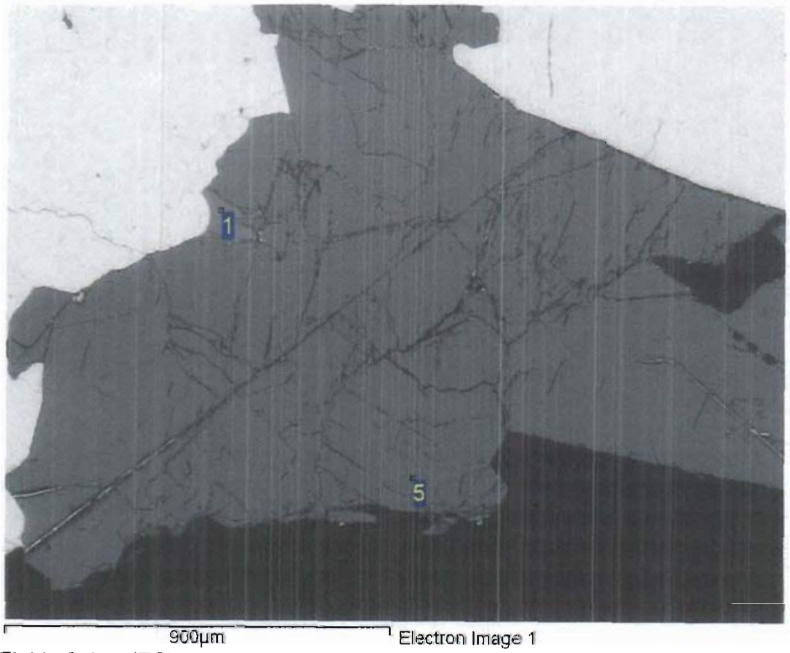

Figure 4. Field of view (FOV) 1.
FOV1 is taken from the top piece of the manganocolumbite crystal (BSE image). Mineral 1 is muscovite (FOV1-1) and Mineral 5 is albite (FOV1-5). The dark BSE crystals on the right hand side are quartz.

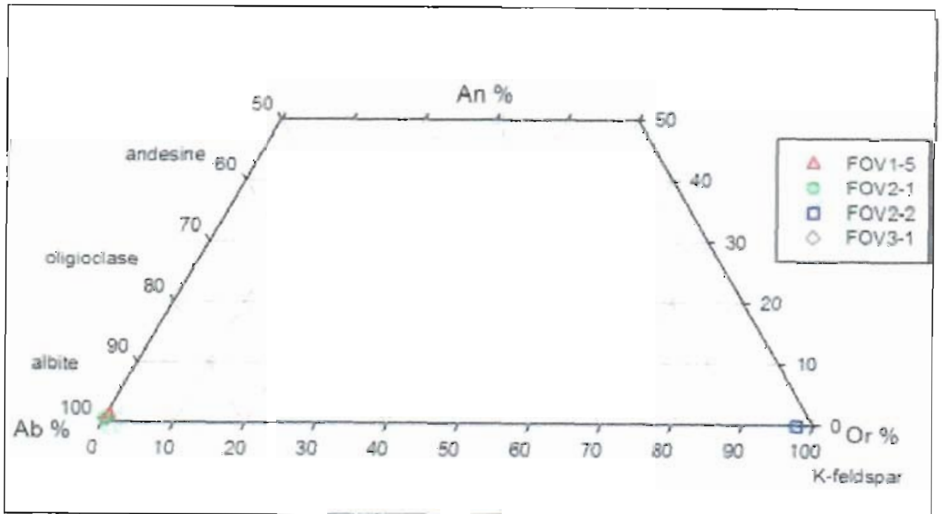

Figure 5. Ternary graph of feldspar compositions.
An % = Ca/(Ca+Na+K), Ab % = Na/(Ca+Na+K), Or % = K/(Ca+Na+K).

Field of View 2

Field of View 2 (FOV2) shows albite, microcline and muscovite along the edge of the manganocolumbite crystal (Figure 6). The analyses for the albite (FOV2-1) and microcline (FOV2-2) are given in Appendix 1, Table 3 and for muscovite (FOV2-3) in Appendix 1, Table 2.

The feldspar compositions are end-member albite (Na-rich) and end member microcline (K-feldspar) and are plotted in Figure 5. Figure 6 shows manganocolumbite intrudes the feldspar along cleavage planes and thus must have crystallized after the feldspar.

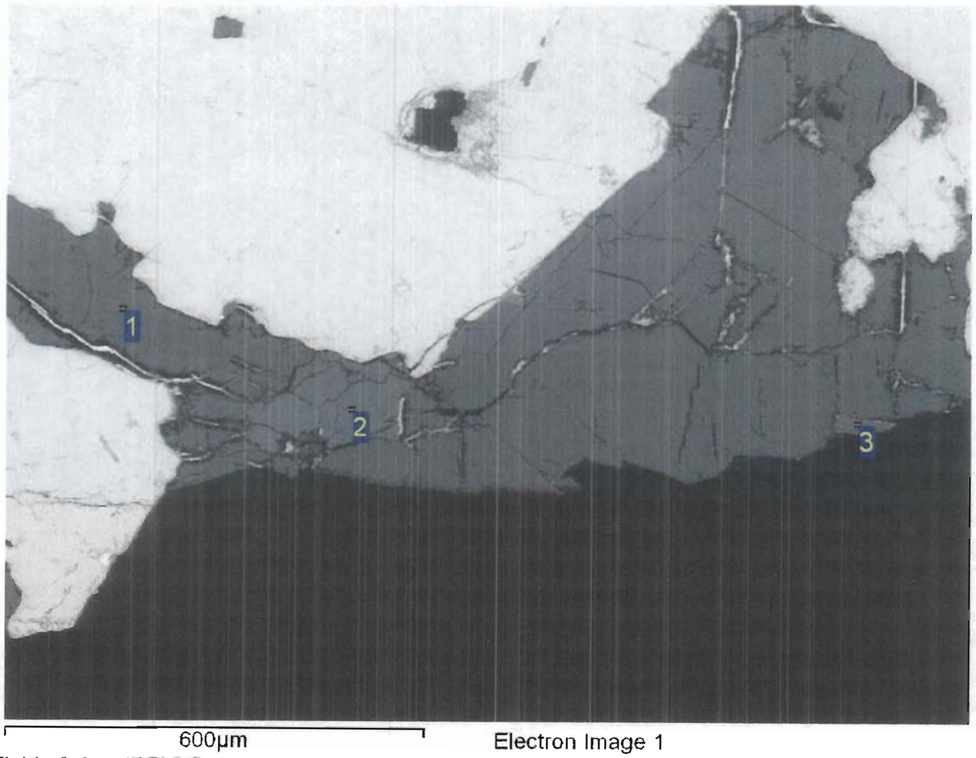

Figure 6. Field of view (FOV) 2
FOV2 is taken from the top piece of the manganocolumbite crystal. Mineral 1 is albite, mineral 2 is microcline and Mineral 3 is muscovite.

Field of View 3

Field of View 3 (FOV3) shows albite, muscovite and Nb-U phase along the edge of the manganocolumbite crystal (Figure 7). The analyses for albite (FOV3-1) are given in Appendix 1, Table 3, muscovite (FOV3-4) in Appendix 1, Table 2 and Nb-U phase (FOV3-5) in Appendix 1, Table 4. The albite has an end-member composition which is plotted in Figure 5. The muscovite occurs as inclusions within the albite.

The Nb-U phase (FOV3-5) has high uranium contents and is thus likely metamict. The radioactive decay of the uranium cations likely damaged the crystal structure of the mineral which allowed water to seep in. Since water can not be analyzed for with an electron microprobe, the oxide wt.% totals are lower than 100%. This Nb-U phase is probably liandratite ($U^{6+}(Nb,Ta)_2O_8$), but other possibilities are petscheckite ($U^{4+}Fe^{2+}(Nb,Ta)_2O_8$), or uranopyrochlore ($(U,Ca,Ce)_2(Nb,Ta)_2O_6(OH,F)$). Liandratite occurs as a secondary mineral at other pegmatite localities.

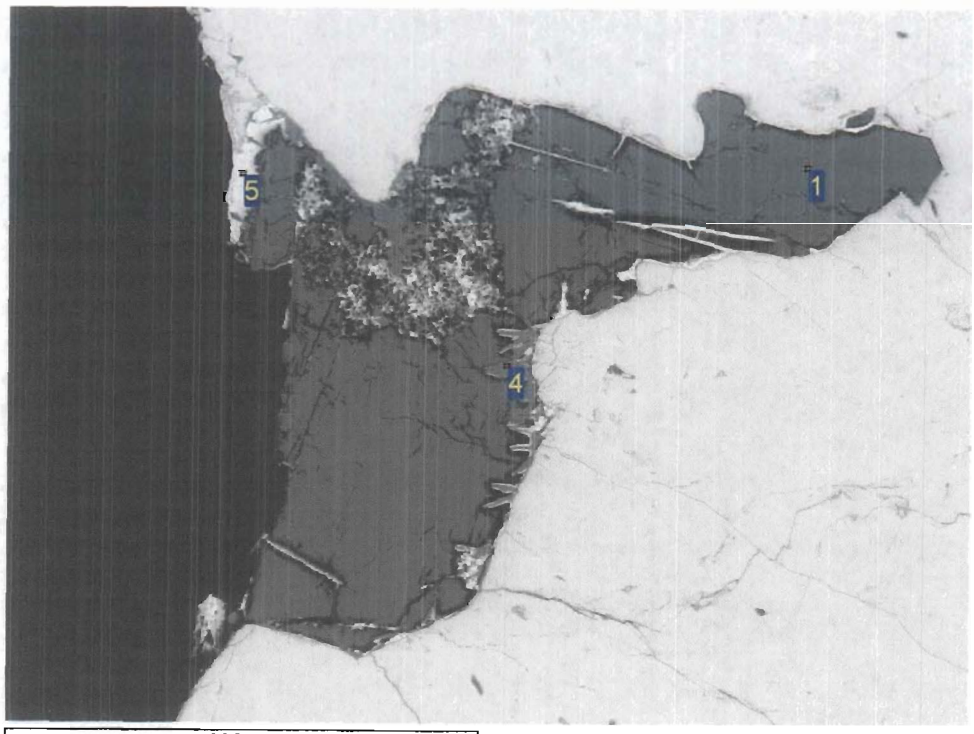

Figure 7. Field of view (FOV) 3
FOV3 is taken from the top piece of the manganocolumbite crystal. Mineral 1 is albite with small laths of muscovite (Mineral 4) occurring between the boundary of this and the manganocolumbite crystal. Mineral 5 is a complex Nb-U bearing phase.

Field of View 4

Field of View 4 (FOV4) shows a cluster of rare-earth element (REE)-bearing minerals along the edge of the manganocolumbite crystal (Figure 8). The analysis for the Th-P phase (FOV4-1) is given in Appendix 1, Table 5, for REE-Nb-Ta-Ti phase (FOV4-2) in Appendix 1, Table 6 and for monazite-(Ce) (FOV4-3) in Appendix 1, Table 7. The monazite-(Ce) (FOV4-3) has Ce>La>Nd>Pr in the REE-site.

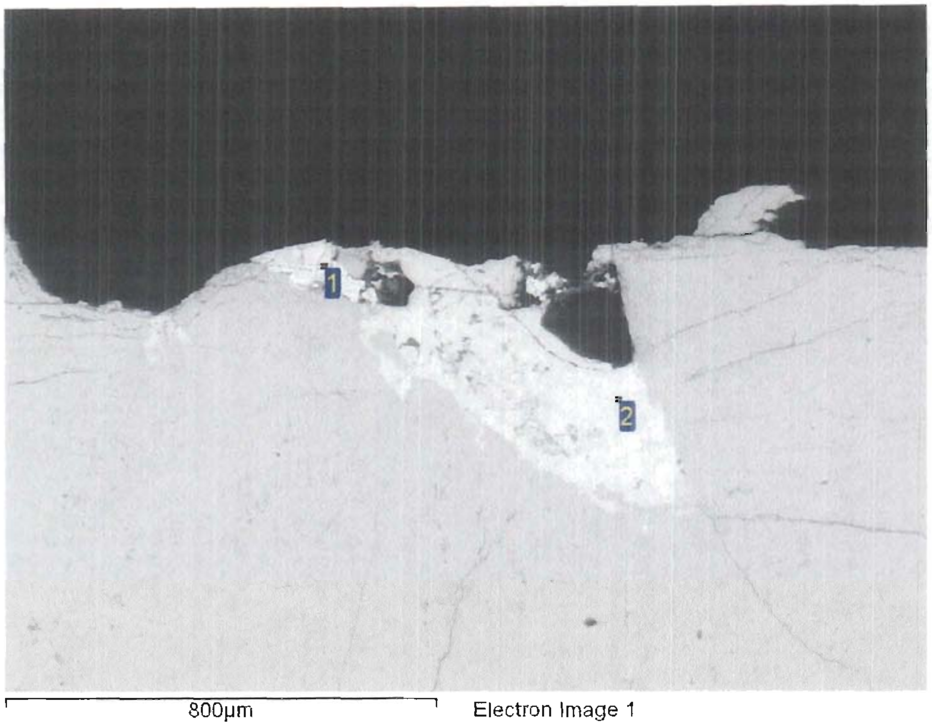

Figure 8. Field of view (FOV) 4
FOV4 is taken from the bottom piece of the manganotantalite crystal. Mineral 1 is a Th-phosphate grain and mineral 2 is a complex REE-bearing phase.

There are two analyses of the Th-P phase (FOV4-1). The first analysis has P > Si and is likely monazite-Th ($ThPO_4$) and the second analysis has Si > P and is likely huttonite ($ThSiO_4$). There is a solid solution series between monazite and huttonite, as they have the same crystal structure. The Th-P phase has high uranium contents and is thus likely metamict with water in its structure. Thus, the oxide wt. % totals for the two analyses are lower than 100%.

The REE-Nb-Ta-Ti phase (FOV4-2) has Ca>Sm>Gd>Nd>Ce in the REE-site and Ti>Nb>Ta in the Ti+Nb+Ta-site. This phase is likely aeschynite-(Ca) with a chemical formula of $(Ca,Sm,Gd)(Ti,Nb,Ta)_2(O,OH)_6$. This phase has high uranium contents and is thus likely metamict with water in its structure. Thus, the oxide wt. % totals are lower than 100%. The presence of elevated Gd values (7.33-7.58 wt. % Gd_2O_3) in this phase is rare in nature.

Ca alteration of manganocolumbite

The large manganocolumbite crystal is altered to a Ca-Nb phase (Appendix 1, Table 8). The Ca-Nb phase is likely fersmite ($(Ca,Ce,Na)(Nb,Ta,Ti)_2(O,OH,F)_6$) or vigezzite ($(Ca,Ce)(Nb,Ta,Ti)_2O_6$).

GEOCHEMISTRY

Sample BZ-H which consists mostly of cleavelandite and manganocolumbite was analyzed to determine its bulk whole rock composition (Appendix 1, Table 9). The assay has an extremely low oxide total of 31.6 wt% which is probably due to an incorrect value for SiO_2 of 6.88 wt%. Since the sample contains approximately 80 vol% albite, this SiO_2 value should be ~ 68 wt.%. The assay contains high Nb and Ta values (2.52 wt.% Nb_2O_5 and 7.85 wt.% Ta_2O_5) which correlates with the abundance of manganocolumbite in the sample. The assay also contains elevated REE, Th and U contents which correlate to the REE, Th and U-bearing minerals identified in this report.

CONCLUSIONS

Sample BZ-H from the beryl zone of the Lowther Township pegmatite contains a 4 cm long manganocolumbite crystal which is surrounded by cleavelandite (albite) and accessory muscovite, microcline and quartz. Trace amounts of minerals rich in REE, U and Th occur adjacent to the manganocolumbite crystal: liandratite (Nb-U phase), monazite-(Th) (Th-P phase), huttonite (Th-Si phase), aeschynite-(Ca) (REE-Nb-Ta-Ti phase) and monazite-(Ce) (REE-P phase). The manganocolumbite is altered to fersmite/vigezzite (Ca-Nb phase).

APPENDIX 1

Tables of Electron Microprobe Analyses and Whole Rock Assay

Table 1. Chemical analyses of manganocolumbite.

	Top Xtal 1	Top Xtal 2	Top Xtal 3	Top Xtal 4	Top Xtal 5	Top Xtal 6	Top Xtal 7	Top Xtal 8	Top Xtal 9	Top Xtal 10	Top Xtal 11
wt% oxide values from microprobe											
Na2O	0.015	0.018	0.020	0.011	0.023	0.032	0.008	0.004	0.019	0.011	0.015
CaO	0.000	0.007	0.041	0.000	0.000	2.440	0.000	0.000	0.000	0.004	0.210
FeO	6.839	6.347	6.588	7.360	6.987	3.789	6.946	6.587	6.766	5.424	4.849
MnO	13.635	13.655	13.280	12.677	12.827	12.119	13.417	13.170	13.420	14.520	14.586
MgO	0.013	0.012	0.003	0.010	0.005	0.035	0.007	0.008	0.012	0.013	0.010
TiO2	0.922	1.169	1.439	1.411	1.401	1.356	1.154	1.108	1.123	0.931	1.001
Nb2O5	61.329	61.094	60.269	60.620	60.765	58.904	61.571	61.366	61.012	60.944	61.256
Ta2O5	17.679	17.295	17.302	17.456	17.548	16.659	17.183	17.142	17.312	17.433	17.091
SnO2	0.100	0.143	0.202	0.209	0.208	0.214	0.175	0.178	0.150	0.142	0.114
WO3	0.550	0.000	0.100	0.200	0.370	0.260	0.050	0.280	0.130	0.150	0.120
PbO	0.126	0.088	0.057	0.124	0.088	0.106	0.088	0.073	0.126	0.093	0.109
ThO2	0.000	0.035	0.000	0.000	0.006	0.003	0.000	0.008	0.000	0.019	0.000
UO2	0.000	0.000	0.000	0.050	0.070	0.060	0.020	0.001	0.020	0.003	0.000
Sb2O3	0.044	0.016	0.026	0.006	0.036	0.047	0.020	0.024	0.051	0.031	0.048
Bi2O3	0.000	0.000	0.000	0.000	0.000	0.008	0.009	0.000	0.003	0.000	0.000
Sc2O3	0.018	0.023	0.021	0.035	0.025	0.000	0.029	0.023	0.025	0.026	0.006
Total oxides	101.271	99.902	99.349	100.169	100.358	96.032	100.678	99.972	100.169	99.744	99.415
calculation of structural formula based on 6 oxygens											
Na	0.002	0.002	0.002	0.001	0.003	0.004	0.001	0.000	0.002	0.001	0.002
Ca	0.000	0.000	0.003	0.000	0.000	0.162	0.000	0.000	0.000	0.000	0.014
Fe	0.341	0.320	0.333	0.370	0.351	0.197	0.347	0.331	0.340	0.274	0.245
Mn	0.689	0.696	0.681	0.645	0.652	0.638	0.679	0.671	0.683	0.743	0.747
Mg	0.001	0.001	0.000	0.001	0.000	0.003	0.001	0.001	0.001	0.001	0.001
Ti	0.041	0.053	0.065	0.064	0.063	0.063	0.052	0.050	0.051	0.042	0.045
Nb	1.653	1.663	1.649	1.647	1.648	1.655	1.662	1.668	1.658	1.664	1.674
Ta	0.287	0.283	0.285	0.285	0.286	0.282	0.279	0.280	0.283	0.286	0.281
Sn	0.002	0.003	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003
W	0.008	0.000	0.002	0.003	0.006	0.004	0.001	0.004	0.002	0.002	0.002
Pb	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.001	0.002	0.002	0.002
Th	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
Sb	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Bi	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sc	0.001	0.001	0.001	0.002	0.001	0.000	0.002	0.001	0.001	0.001	0.000
Total cations	3.029	3.025	3.027	3.026	3.018	3.018	3.029	3.013	3.029	3.023	3.016
cation ratios and sums											
Mn/(Mn+Fe)	0.669	0.685	0.671	0.636	0.650	0.764	0.662	0.669	0.668	0.731	0.753
Ta/(Ta+Nb)	0.148	0.146	0.147	0.148	0.148	0.145	0.144	0.144	0.146	0.147	0.144
A site	0.002	0.002	0.005	0.001	0.003	0.166	0.001	0.000	0.002	0.002	0.015
B site	1.031	1.017	1.014	1.016	1.003	0.838	1.026	1.003	1.025	1.018	0.993
C site	1.996	2.006	2.008	2.009	2.013	2.014	2.002	2.010	2.003	2.003	2.008

Table 1. Manganocolumbite analyses continued

	Bott Xtal 1	Bott Xtal 2	Bott Xtal 3	Bott Xtal 4	Bott Xtal 5	Bott Xtal 6	Bott Xtal 7	Bott Xtal 8	Bott Xtal 9	Bott Xtal 10	Bott Xtal 11
wt% oxide values from microprobe											
Na2O	0.022	0.032	0.066	0.005	0.074	0.016	0.035	0.019	0.031	0.008	0.008
CaO	0.000	0.155	0.010	0.000	0.087	0.013	0.167	0.071	0.427	0.000	0.000
FeO	5.769	5.038	5.825	6.841	7.019	7.098	7.574	6.795	5.866	7.653	6.100
MnO	14.875	15.439	13.914	13.352	13.065	12.961	13.208	13.092	13.834	13.046	13.518
MgO	0.012	0.005	0.010	0.013	0.015	0.007	0.002	0.010	0.010	0.003	0.007
TiO2	1.002	1.246	1.138	1.103	1.450	1.445	1.378	1.374	1.354	1.176	1.006
Nb2O5	60.056	59.567	60.517	60.976	60.132	60.381	59.947	60.333	59.841	60.671	61.482
Ta2O5	18.789	18.289	17.847	17.678	17.905	17.946	17.731	17.599	17.352	17.556	17.418
SnO2	0.118	0.131	0.124	0.115	0.225	0.192	0.175	0.195	0.213	0.154	0.124
WO3	0.340	0.270	0.200	0.200	0.160	0.180	0.560	0.360	0.300	0.320	0.250
PbO	0.068	0.089	0.094	0.064	0.047	0.100	0.094	0.098	0.099	0.086	0.057
ThO2	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.000	0.032	0.000	0.000
UO2	0.000	0.000	0.000	0.000	0.019	0.065	0.011	0.047	0.015	0.000	0.000
Sb2O3	0.032	0.051	0.025	0.050	0.034	0.051	0.032	0.050	0.034	0.014	0.005
Bi2O3	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007
Sc2O3	0.015	0.002	0.011	0.026	0.015	0.026	0.014	0.025	0.000	0.025	0.026
Total oxides	101.102	100.314	99.781	100.424	100.247	100.481	100.970	100.068	99.408	100.712	100.008
calculation of structural formula based on 6 oxygens											
Na	0.003	0.004	0.008	0.001	0.009	0.002	0.004	0.002	0.004	0.001	0.001
Ca	0.000	0.010	0.001	0.000	0.006	0.001	0.011	0.005	0.028	0.000	0.000
Fe	0.289	0.254	0.294	0.343	0.353	0.356	0.379	0.342	0.297	0.383	0.307
Mn	0.756	0.789	0.712	0.679	0.665	0.659	0.669	0.668	0.710	0.662	0.689
Mg	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001
Ti	0.045	0.057	0.052	0.050	0.066	0.065	0.062	0.062	0.062	0.053	0.046
Nb	1.628	1.624	1.653	1.654	1.634	1.638	1.622	1.642	1.639	1.643	1.672
Ta	0.306	0.300	0.293	0.289	0.293	0.293	0.289	0.288	0.286	0.286	0.285
Sn	0.003	0.003	0.003	0.003	0.005	0.005	0.004	0.005	0.005	0.004	0.003
W	0.005	0.004	0.003	0.003	0.002	0.003	0.009	0.006	0.005	0.005	0.004
Pb	0.001	0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001
Th	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
U	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
Sb	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
Bi	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sc	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001
Total cations	3.040	3.047	3.023	3.026	3.037	3.027	3.052	3.025	3.038	3.040	3.008
cation ratios and sums											
Mn/(Mn+Fe)	0.723	0.756	0.708	0.664	0.653	0.649	0.638	0.661	0.705	0.633	0.692
Ta/(Ta+Nb)	0.158	0.156	0.151	0.148	0.152	0.152	0.151	0.149	0.149	0.148	0.146
A site	0.003	0.014	0.008	0.001	0.014	0.003	0.015	0.007	0.031	0.001	0.001
B site	1.046	1.043	1.007	1.023	1.019	1.016	1.048	1.011	1.008	1.045	0.996
C site	1.991	1.991	2.007	2.002	2.003	2.009	1.989	2.008	1.999	1.993	2.011

Table 2. Chemical analyses of muscovite.

wt% oxide values from microprobe								
	FOV 1-1	FOV 1-1	FOV 2-3	FOV 2-3	FOV 3-4	FOV 3-4		
SiO2	47.654	46.977	45.640	49.263	51.316	49.426		
TiO2	0.144	0.201	0.108	0.295	0.115	0.279		
Al2O3	34.613	35.087	33.344	32.340	32.058	33.305		
FeO	4.385	4.307	4.120	3.839	2.943	3.835		
MnO	0.149	0.101	0.123	0.128	0.195	0.124		
MgO	0.019	0.130	0.243	0.112	0.052	0.053		
CaO	0.004	0.021	0.016	0.016	0.017	0.007		
Na2O	0.149	0.092	0.156	0.081	0.076	0.087		
K2O	6.844	6.896	9.100	7.852	8.005	8.308		
F	0.098	0.071	0.099	0.808	1.375	0.327		
Cl	0.008	0.005	0.018	0.000	0.009	0.008		
Cr2O3	0.009	0.000	0.000	0.005	0.033	0.000		
NiO	0.012	0.000	0.000	0.000	0.007	0.004		
Li2O*	0.000	0.000	0.000	0.176	0.352	0.026		
H2O*	4.451	4.454	4.317	4.117	3.929	4.395		
Subtotal	98.539	98.342	97.284	99.031	100.482	100.183		
O=F,Cl	0.043	0.031	0.046	0.340	0.581	0.139		
Total	98.496	98.311	97.238	98.691	99.901	100.044		
calculation of structural formula based on 20 oxygens, (OH) + F + Cl = 4 apfu								ideal value
Si	6.351	6.276	6.265	6.565	6.714	6.511		
Al iv	1.649	1.724	1.735	1.435	1.286	1.489	tetrahedral	8
Al vi	3.788	3.801	3.659	3.644	3.659	3.683		
Ti	0.014	0.020	0.011	0.030	0.011	0.028		
Cr	0.001	0.000	0.000	0.001	0.003	0.000		
Fe	0.489	0.481	0.473	0.428	0.322	0.423		
Mn	0.017	0.011	0.014	0.014	0.022	0.014		
Mg	0.004	0.026	0.050	0.022	0.010	0.010		
Ni	0.001	0.000	0.000	0.000	0.001	0.000		
Li*	0.000	0.000	0.000	0.094	0.185	0.014	octahedral	4
Ca	0.001	0.003	0.002	0.002	0.002	0.001		
Na	0.039	0.024	0.042	0.021	0.019	0.022		
K	1.163	1.175	1.593	1.335	1.336	1.396	K-site	2
OH*	3.957	3.969	3.953	3.659	3.429	3.862		
F	0.041	0.030	0.043	0.341	0.569	0.136		
Cl	0.002	0.001	0.004	0.000	0.002	0.002	OH-site	4
TOTAL	17.517	17.541	17.844	17.591	17.571	17.591	total cations	18
cation ratios and sums								
oct. total	4.314	4.339	4.207	4.233	4.213	4.172		
K-site total	1.202	1.202	1.637	1.358	1.358	1.419		
Al total	5.437	5.525	5.395	5.080	4.944	5.172		
Fe/Fe+Mg	0.992	0.949	0.905	0.951	0.969	0.976		

LiO_2 calc. from Monier & Robert (1986)
H_2O calculation after Tindle and Webb (1990) European Journal of Mineralogy, vol. 2, pgs. 595-610.
(0.31134*Fluorine)-0.075895 (Monier & Robert 1996),
but see also (0.336*F)-0.123 (quoted in Tindle & Webb 1990)

Table 3. Chemical analyses of feldspar (albite and microcline).

wt% oxide values from microprobe								
	FOV 1-5	FOV 1-5	FOV 2-1	FOV 2-1	FOV 2-2	FOV 2-2	FOV 3-1	FOV 3-1
SiO2	68.988	69.454	68.641	68.541	64.319	64.279	68.773	68.537
TiO2	0.043	0.022	0.000	0.000	0.000	0.005	0.043	0.000
Al2O3	20.684	20.551	19.938	19.987	18.517	18.594	20.696	20.307
FeO	0.000	0.043	0.003	0.019	0.000	0.000	0.035	0.019
MnO	0.034	0.000	0.019	0.012	0.071	0.012	0.000	0.000
MgO	0.010	0.010	0.004	0.000	0.001	0.006	0.011	0.000
CaO	0.253	0.262	0.154	0.122	0.007	0.000	0.153	0.142
Na2O	11.160	10.991	11.776	11.491	0.252	0.266	11.042	11.125
K2O	0.104	0.089	0.060	0.056	16.184	16.338	0.088	0.091
BaO	0.000	0.038	0.005	0.000	0.000	0.007	0.029	0.004
Total oxides	101.276	101.460	100.600	100.228	99.351	99.507	100.870	100.225
calculation of structural formula based on 8 oxygens								
Si	2.970	2.982	2.981	2.984	2.991	2.987	2.971	2.980
Al	1.050	1.040	1.021	1.026	1.015	1.019	1.054	1.041
Ti	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000
Fe	0.000	0.002	0.000	0.001	0.000	0.000	0.001	0.001
Mn	0.001	0.000	0.001	0.000	0.003	0.000	0.000	0.000
Mg	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000
Ca	0.012	0.012	0.007	0.006	0.000	0.000	0.007	0.007
Na	0.932	0.915	0.992	0.970	0.023	0.024	0.925	0.938
K	0.006	0.005	0.003	0.003	0.960	0.968	0.005	0.005
Ba	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Total cations	4.972	4.957	5.006	4.990	4.992	4.999	4.966	4.971
cation ratios and sums								
Ca+Na+K	0.949	0.932	1.002	0.979	0.983	0.992	0.937	0.950
An %	1.2	1.3	0.7	0.6	0.0	0.0	0.8	0.7
Ab %	98.2	98.2	99.0	99.1	2.3	2.4	98.7	98.8
Or %	0.6	0.5	0.3	0.3	97.7	97.6	0.5	0.5

Table 4. Chemical analyses of Nb-U phase (liandratite).

wt% oxide values from microprobe				
	FOV3-5	FOV3-5	FOV3-5	
MnO	0.00	0.03	0.09	
FeO	2.43	2.04	2.46	
TiO2	0.79	0.62	0.82	
Ta2O5	3.50	3.33	3.20	
Nb2O5	31.36	30.94	31.05	
ThO2	2.83	2.11	2.59	
UO3	20.39	21.98	20.82	
SiO2	0.89	0.86	0.89	
Total oxides	62.19	61.91	61.92	
calculation of structural formula based on 8 oxygens				
Mn2+	0.000	0.004	0.011	
Fe2+	0.285	0.242	0.290	
Ti4+	0.083	0.066	0.087	
Ta5+	0.134	0.128	0.123	
Nb5+	1.991	1.983	1.980	
Th4+	0.090	0.068	0.083	
U6+	0.602	0.655	0.617	
Si4+	0.125	0.122	0.126	
Total cations	3.311	3.268	3.316	
cation sums				**ideal value**
Nb-site	2.125	2.111	2.103	2
U-site	1.185	1.157	1.214	1

Table 5. Chemical analyses of Th-P phase.

wt% oxide values from microprobe			
	FOV4-1	FOV4-1	
CaO	0.18	0.00	
UO2	0.20	1.31	
ThO2	64.34	64.38	
Y2O3	0.07	0.27	
P2O5	14.59	3.54	
FeO	1.02	3.08	
TiO2	0.00	0.06	
PbO	0.12	0.00	
SiO2	1.89	4.13	
ZrO2	0.16	0.17	
Al2O3	1.29	0.31	
total oxides	83.86	77.25	
calculation of structural formula based on 4 oxygens			
Ca2+	0.011	0.000	
U4+	0.003	0.024	
Th4+	0.866	1.190	
Y3+	0.002	0.012	
P5+	0.731	0.243	
Fe2+	0.050	0.209	
Ti4+	0.000	0.004	
Pb2+	0.002	0.000	
Si4+	0.112	0.336	
Zr4+	0.005	0.007	
Al3+	0.090	0.030	
total cations	1.872	2.054	
cation sums			**ideal value**
Th-site	0.882	1.226	1
(P,Si)-site	0.990	0.829	1

The first analysis has P > Si and is likely monazite-Th and the second analysis has Si > P and is likely huttonite.

Table 6. Chemical analyses of REE-Nb-Ta-Ti phase (aeschynite-(Ca)).

wt% oxide values from microprobe				
	FOV4-2	FOV4-2	FOV4-2	
TiO2	15.85	15.33	16.46	
Ta2O5	19.78	19.56	19.79	
Nb2O5	17.88	18.17	17.77	
Ce2O3	2.82	3.30	2.91	
Nd2O3	5.70	5.75	5.33	
Sm2O3	8.11	8.29	8.17	
Gd2O3	7.33	7.58	7.34	
ThO2	3.55	3.49	3.50	
UO2	3.47	2.92	3.43	
CaO	2.95	2.86	2.99	
total oxides	87.44	87.25	87.69	
calculation of structural formula based on 6 oxygens				
Ti4+	0.938	0.913	0.965	
Ta5+	0.423	0.421	0.420	
Nb5+	0.636	0.650	0.626	
Ce3+	0.081	0.096	0.083	
Nd3+	0.160	0.163	0.148	
Sm3+	0.220	0.226	0.219	
Gd3+	0.191	0.199	0.190	
Th4+	0.064	0.063	0.062	
U4+	0.061	0.051	0.060	
Ca2+	0.249	0.243	0.250	
total cations	3.023	3.024	3.024	
cation sums				**ideal value**
Ti+Nb+Ta	1.997	1.984	2.011	2
REE-site	1.026	1.041	1.012	1

Table 7. Chemical analyses of monazite-(Ce).

wt% oxide values from microprobe				
	FOV4-3	FOV4-3	FOV4-3	
P2O5	29.10	28.38	28.60	
SiO2	0.37	0.35	0.38	
ThO2	1.54	1.22	1.50	
Al2O3	0.02	0.00	0.02	
La2O3	9.49	11.39	9.99	
Ce2O3	33.08	34.41	33.22	
Pr2O3	7.31	6.26	7.02	
Nd2O3	13.27	10.87	12.68	
MgO	0.02	0.00	0.00	
CaO	0.14	0.07	0.05	
FeO	0.07	1.07	0.02	
SmO	3.57	1.96	3.32	
Na2O	0.01	0.00	0.00	
total oxides	97.99	95.98	96.80	
calculation of structural formula based on 4 oxygens				
P5+	0.994	0.986	0.992	
Si4+	0.015	0.014	0.016	
Th4+	0.014	0.011	0.014	
Al3+	0.001	0.000	0.001	
La3+	0.141	0.172	0.151	
Ce3+	0.489	0.517	0.498	
Pr3+	0.107	0.094	0.105	
Nd3+	0.191	0.159	0.185	
Mg2+	0.001	0.000	0.000	
Ca2+	0.006	0.003	0.002	
Fe2+	0.002	0.037	0.001	
Sm2+	0.052	0.029	0.049	
Na+	0.001	0.000	0.000	
Total cations	2.015	2.024	2.013	
cation sums				**ideal value**
Si-site	1.009	1.000	1.008	1
REE-site	1.005	1.022	1.006	1

Table 8. Chemical analyses of Ca-Nb phase (Fersmite or Vigezzite).

wt% oxide values from microprobe					
	1	2	3	4	
CaO	8.168	7.998	9.507	9.426	
FeO	3.043	5.244	3.753	3.790	
MnO	1.908	3.637	2.950	2.128	
TiO2	1.496	1.580	1.401	1.448	
Nb2O5	56.846	53.810	57.418	56.188	
Ta2O5	16.203	16.622	16.401	16.592	
SiO2	2.208	1.061	1.185	1.012	
Total	89.872	89.952	92.615	90.584	
calculation of structural formula based on 6 oxygens					
Ca	0.554	0.555	0.634	0.644	
Fe	0.161	0.284	0.195	0.202	
Mn	0.102	0.199	0.156	0.115	
Ti	0.071	0.077	0.066	0.069	
Nb	1.626	1.575	1.617	1.620	
Ta	0.279	0.293	0.278	0.288	
Si	0.140	0.069	0.074	0.065	
Total	2.932	3.052	3.019	3.004	
cation sums					**ideal value**
Ca-site	0.817	1.038	0.985	0.961	1
Nb-site	2.115	2.014	2.034	2.042	2

Table 9. Assay for sample BZ-H

Elements	Units	BZ-H
SiO_2	%	6.88
Al_2O_3	%	4.62
Fe_2O_3(T)	%	5.89
MnO	%	10.6
MgO	%	< 0.01
CaO	%	0.15
Na_2O	%	2.07
K_2O	%	0.39
TiO_2	%	0.708
P_2O_5	%	< 0.01
LOI	%	0.55
Total	%	31.6
Be	ppm	18
Zn	ppm	328
Pb	ppm	271
Rb	ppm	201
Y	ppm	404
Zr	ppm	279
Sn	ppm	94
Cs	ppm	64.7
La	ppm	106
Ce	ppm	389
Nd	ppm	385
Sm	ppm	143
Gd	ppm	129
Dy	ppm	74.8
Hf	ppm	41.7
W	ppm	90
Th	ppm	248
U	ppm	> 1000
Nb	ppm	17600
Ta	ppm	64300
Li	ppm	65
Nb_2O_5	%	2.52
Ta_2O_5	%	7.85

Note: the assay value for SiO_2 is likely incorrect.

SGS

SGS Minerals Services
P.O. Box 4300, 185 Concession Street,
Lakefield, Ontario K0L 2H0
Phone: 705-652-2112 Fax: 705-652-3123

CERTIFICATE OF ANALYSIS

MI1014-MAY08
Microprobe Profiles (and traces recalculated as oxides)
Analyse Quantitative CAMECA
Laboratoire de Microanalyse - Universite Laval
Label : MnTaSGS
Mon Jul 7 15:10:13 2008
Stoi Analysis
Compound Percents

	Major elements						Position	*Minor + Traces*											
	MnO	FeO	TiO_2	Ta_2O_5	Nb_2O_5	Total	(microns)	CaO	WO_2	Sb_2O_3	U_2O_3	Bi_2O_3	PbO*	Sc_2O_3	SnO_2	ThO_2	Na_2O	MgO	Total
Top Xtal 1	13.635	6.839	0.922	17.679	61.329	100.404	0	0.000	0.052	0.044	0.000	0.000	0.126	0.018	0.100	0.000	0.015	0.013	0.369
Top Xtal 2	13.655	6.347	1.169	17.295	61.094	99.560	389	0.007	0.000	0.016	0.000	0.000	0.088	0.023	0.143	0.035	0.018	0.012	0.342
Top Xtal 3	13.280	6.588	1.439	17.302	60.269	98.878	778	0.041	0.096	0.026	0.000	0.000	0.057	0.021	0.202	0.000	0.020	0.003	0.467
Top Xtal 4	12.677	7.360	1.411	17.456	60.620	99.524	1167	0.000	0.189	0.006	0.049	0.000	0.124	0.035	0.209	0.000	0.011	0.010	0.633
Top Xtal 5	12.827	6.987	1.401	17.548	60.765	99.528	1556	0.000	0.340	0.036	0.068	0.000	0.088	0.025	0.208	0.006	0.023	0.005	0.798
Top Xtal 6	12.119	3.789	1.356	16.659	58.904	92.827	1945	2.440	0.245	0.047	0.055	0.008	0.106	0.000	0.214	0.003	0.032	0.035	3.186
Top Xtal 7	13.417	6.946	1.154	17.183	61.571	100.271	2334	0.000	0.043	0.020	0.021	0.009	0.088	0.029	0.175	0.000	0.008	0.007	0.401
Top Xtal 8	13.170	6.587	1.108	17.142	61.366	99.373	2723	0.000	0.299	0.024	0.001	0.000	0.073	0.023	0.178	0.008	0.004	0.008	0.619
Top Xtal 9	13.420	6.766	1.123	17.312	61.012	99.633	3112	0.000	0.120	0.051	0.018	0.003	0.126	0.025	0.150	0.000	0.019	0.012	0.523
Top Xtal 10	14.520	5.424	0.931	17.433	60.944	99.252	3501	0.004	0.140	0.031	0.003	0.000	0.093	0.026	0.142	0.019	0.011	0.013	0.482
Top Xtal 11	14.586	4.849	1.001	17.091	61.256	98.783	3890	0.210	0.116	0.048	0.000	0.000	0.109	0.006	0.114	0.000	0.015	0.010	0.628

	Major elements						Position	*Minor + Traces*											
	MnO	FeO	TiO_2	Ta_2O_5	Nb_2O_5	Total	(microns)	CaO	WO_2	Sb_2O_3	U_2O_3	Bi_2O_3	PbO*	Sc_2O_3	SnO_2	ThO_2	Na_2O	MgO	Total
Bott Xtal 1	14.875	5.769	1.002	18.789	60.056	100.491	0	0.000	0.318	0.032	0.000	0.004	0.068	0.015	0.118	0.000	0.022	0.012	0.589
Bott Xtal 2	15.439	5.038	1.246	18.289	59.567	99.579	371	0.155	0.249	0.051	0.000	0.000	0.089	0.002	0.131	0.000	0.032	0.005	0.714
Bott Xtal 3	13.914	5.825	1.138	17.847	60.517	99.241	742	0.010	0.187	0.025	0.000	0.000	0.091	0.011	0.121	0.000	0.066	0.010	0.527
Bott Xtal 4	13.352	6.841	1.103	17.678	60.976	99.950	1113	0.000	0.184	0.050	0.000	0.000	0.064	0.026	0.115	0.000	0.005	0.013	0.458
Bott Xtal 5	13.065	7.019	1.450	17.905	60.132	99.571	1484	0.087	0.148	0.034	0.019	0.000	0.047	0.015	0.225	0.000	0.074	0.015	0.664
Bott Xtal 6	12.961	7.098	1.445	17.946	60.381	99.831	1855	0.013	0.170	0.051	0.063	0.000	0.100	0.026	0.192	0.000	0.016	0.007	0.638
Bott Xtal 7	13.208	7.574	1.378	17.731	59.947	99.838	2226	0.167	0.521	0.032	0.011	0.000	0.094	0.014	0.175	0.042	0.035	0.002	1.093
Bott Xtal 8	13.092	6.795	1.374	17.599	60.333	99.193	2597	0.071	0.338	0.050	0.045	0.000	0.098	0.025	0.195	0.000	0.019	0.010	0.852
Bott Xtal 9	13.834	5.866	1.354	17.352	59.841	98.247	2968	0.427	0.276	0.034	0.014	0.000	0.099	0.000	0.213	0.032	0.031	0.010	1.136
Bott Xtal 10	13.046	7.653	1.176	17.556	60.671	100.102	3339	0.000	0.295	0.014	0.000	0.000	0.086	0.025	0.154	0.000	0.008	0.003	0.585
Bott Xtal 11	13.518	6.100	1.006	17.418	61.482	99.524	3710	0.000	0.230	0.005	0.000	0.007	0.057	0.026	0.124	0.000	0.008	0.007	0.464

**Pb: Value most likely over estimated due to interference with Nb*

Detection limits (%)

MnO	0.125	Ca	0.013
FeO	0.830	W	0.095
TiO_2	0.049	Sb	0.009
Ta_2O_5	0.232	U	0.016
Nb_2O_5	0.103	Bi	0.016
		Pb*	0.017
		Sc	0.003
		Sn	0.008
		Th	0.018
		Na	0.004
		Mg	0.002

Kim Gibbs, H.B.Sc., P.Geo.
Senior Mineralogist

All electron microprobe analyses were conducted by Marc Choquette, Ph.D at Laval University

PROPERTY VISIT REPORT

Lowther Pegmatite Property

Lowther and Shetland Townships, Ontario

Byng Mining
P.O. Box 1001
Hearst, Ontario P0L 1N0

Prepared By:

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Brad Leonard, M.Sc., P.Geo.

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List of Figures and pictures

Executive Summary

On January 17, 2008, Brad Leonard, Exploration Manager of Caracle Creek Internation Consulting Inc. visited the Decoy showing of the Byng Mining Lowther pegmatite property. The purpose of the site visit was to collect samples from the Decoy showing in order for CCIC to provide QP services to Byng Mining in future press releases. A total of 5 grab samples were collected from a stripped area measuring approximately 6 m by 2½ m. Highlights of results include 3.93% Be and 2,97% Nb. Analytica results from the site visit compare favourably with results reported by Byng Mining from samples collected from the same area. Reccomendations for future exploration include thorough mapping and sampling of the pegmatites in the summer months in order to determine complete strike length of the veins. Trenching and diamond drilling should also be contemplated in order to determine vertical extent of the pegmatitic areas.

1.0 Property visit January 17, 2008

At the request of Mr. Gery Lecours, a visit was made to the Lowther Pegmatite property in Lowther and Shetland Townships on January 17, 2008 by Mr. Brad Leonard, Exploration manager of Caracle Creek International Consulting Inc. (CCIC). The purpose of the site visit was to collect samples from the Decoy showing in order for CCIC to provide QP services to Byng Mining in future press

Access to the property was gained via Highway 583 South from Hearst, Ontario for 20 km and then by snow machine for the final 16 km.

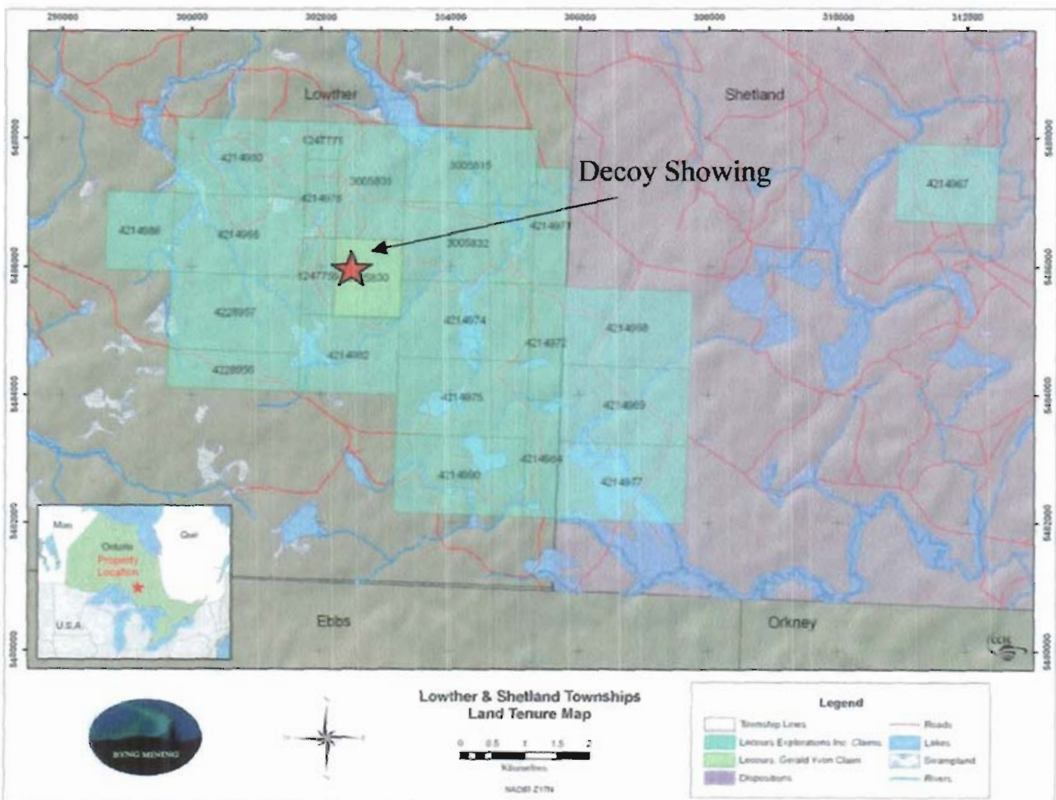

Figure 1. Byng Mining claims and Decoy Showing location

1.1 Decoy Showing

The Decoy showing as described by Dr. Fred Breaks of the Ontario Geological Survey (OGS) is a rare-element pegmatite occurring at the metamorphic transition between medium and high grade metasedimentary rocks. The pegmatite occurs as a lens-shaped body, 3.7 to 11m in width over a minimum length of 110m, in which the long axis of the pegmatite is oriented at 110 degrees. Where it has the greatest width, the pegmatite is enclosed in a north-tapering mass of garnet-biotite pegmatitic grantie that is locally enriched in sodium (4.81 weight per cent Na2O) proximal to the Lowther Township pegmatite. There is a gradational contact between the Lowther Township pegmatite and its parent granite (potassic pegmatite). The white, coarsely graphic parent granite contains blocky perthitic pink to white potassium feldspar, coarse-grained green muscovite (up to 5.5 cm across) and minor black tourmaline and garnet. The pegmatitic granite is enclosed within massive biotite-hornblende diorite." (reference: Open File Report 6195, 2006)

The property visit consisted of examining an exposed area measuring approximately 5 metres by 2½ metres (Figure 1). Additional areas were not inspected due to snow cover. A total of 5 grab samples were collected and sent to SGS Lakefield prep labs in Sudbury for analysis. Sample locations are provided on Figure 1 and GPS points of sample locations are in Table 1. Analytical results are provided in Appendix 1. Highlights of the analytical results are as follows:

ANALYTE	Be	Nb
METHOD	ICP90Q	ICP90Q
DETECTION	0.01	0.01
UNITS	%	%
269023	3.93	N.A.
269026	1.07	N.A.
269027	N.A.	2.37

Analytica results from the site visit compare favourably with results reported by Byng Mining from samples collected from the same area.

Picture 1-1 Covering over the stripped area on the Decoy showing

Picture 1-2 Covering over the stripped area on the Decoy showing

Picture 1-3 removing the cover from the Decoy showing in order to examine the showing

Picture 1-4 large beryl crystal


Picture 1-5 another large beryl crystal surrounded by spodumene, mica and cleavleandite

1.2 General Comments and Observations

Table 1 Sample Descriptions for visit to Lowther Twp pegmatite property for Byng Mining

Sample #	Description
269023	Large white pink with slight green Beryl crystal (20-30 cm in size)
269024	v. coarse lepedolite
269025	Coarse pink feldspar Xl apx 10 cm in size
269026	Cg pink feldspar and white Beryl. Area of Cs anom collected by Byng
269027	Cg garnets (up to 1.5 cm in size) with coarse grained muscovite and minor pinkish feldspar (area of Ta anon collected by Byng)

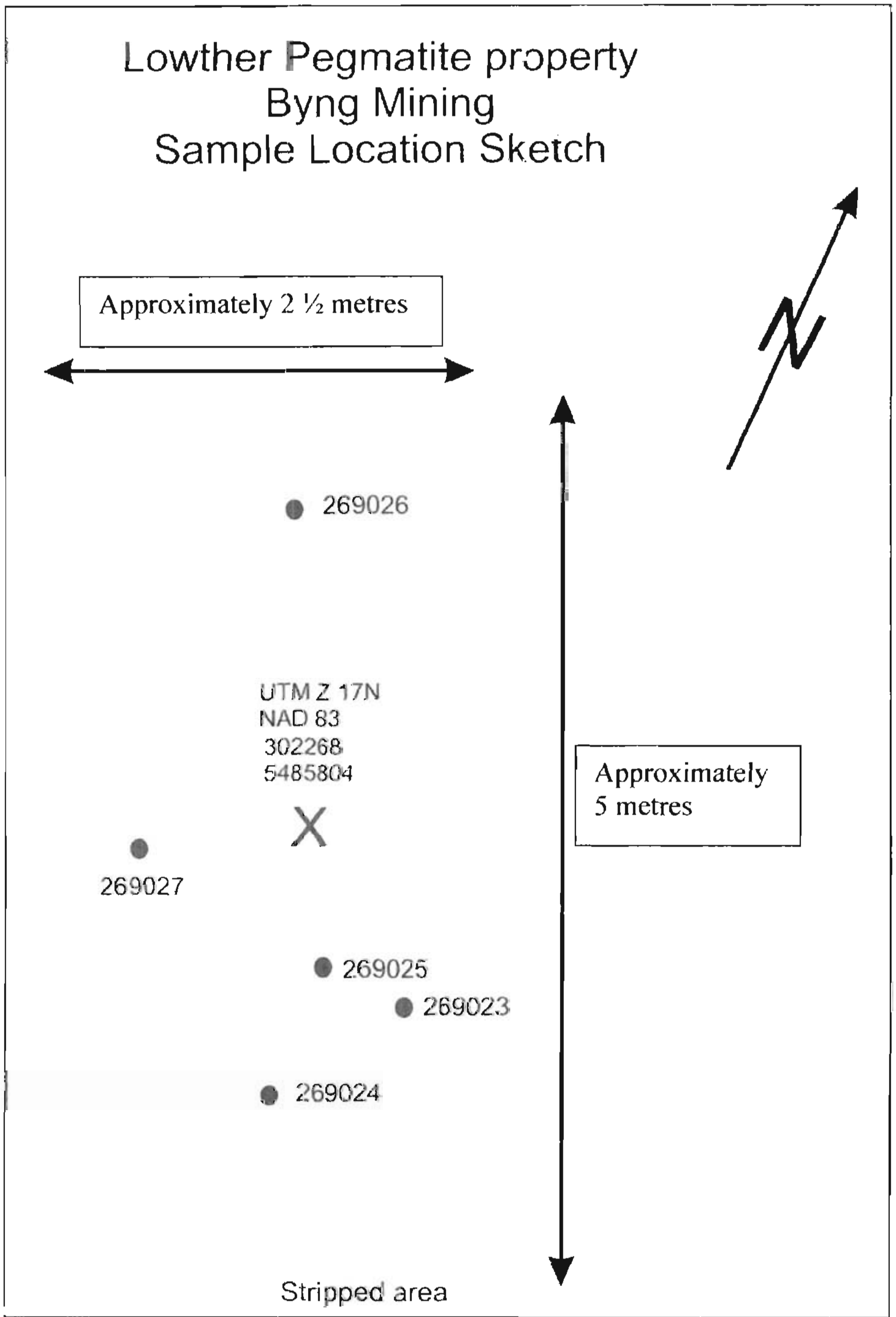

Figure 1 Sketch map of showing and sample locations

1.3 Recommendations

The area should be thoroughly mapped and sampled in the summer months in order to determine complete strike length of the veins. Trenching and diamond drilling should also be contemplated in order to determine vertical extent of the pegmatitic mineralization.

Respectfully submitted

Brad Leonard
Exploration Manager, CCIC Canada

Appendix 1

Sample Results

ANALYTE	Be	Li	Zn	Cs	Nb	Rb	Sn	Ta	Zr
METHOD	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A
DETECTION	5	10	5	0.1	1	0.2	1	0.5	0.5
UNITS	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
269023	>2500	3930	98	4740	4	393	3	2.3	<0.5
269024	67	8640	107	653	74	2770	36	54.1	0.7
269025	35	10	32	21.1	5330	68.8	15	1540	15.5
269026	>2500	6900	97	5720	341	1460	37	51.2	113
269027	28	370	183	389	>10000	792	407	3060	3690
DUP-269023	>2500	3860	93	4790	3	395	3	2.7	0.6

Re-analysis of samples over detection limits

ANALYTE	Be	Nb
METHOD	ICP90Q	ICP90Q
DETECTION	0.01	0.01
UNITS	%	%
269023	3.93	N.A.
269026	1.07	N.A.
269027	N.A.	2.37
DUP-269023	4.02	N.A.

SGS

Certificate of Analysis

Work Order: SU03506

To: Caracle Creek International Consulting Date. Feb 14 2008

Attn. Exploration Manager Brad Leonard
17 Frood Rd
Suite 2
SUDBURY
ONTARIO P3C 4Y9

P O No	BYNG MINING PROJECT
Project No	BYNG MINING
No Of Samples	5
Date Submitted	Jan 22 2008
Report Comprises	Pages 1 to 2 (Inclusive of Cover Sheet)

Distribution of unused material:

Discard after 90 days. 5 Pulps

Certified By ____________________
Gavin McGill
Operations Manager

ISO 17025 Accredited for Specific Tests. SCC No. 456

Report Footer

L.N.R. = Listed not received
n.a. = Not applicable
I.S. = Insufficient Sample
-- = No result

*INF = Composition of this sample makes detection impossible by this method

M after a result denotes ppb to ppm conversion, % denotes ppm to % conversion

Methods marked with an asterisk (e.g. *NAA08V) were subcontracted

Subject to SGS General Terms and Conditions

SGS

Element	Be	Li	Zn	Cs	Nb	Rb	Sn	Ta	Zr
Method	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A	ICM90A
Det.Lim.	5	10	5	0 1	1	0 2	1	0 5	0 5
Units	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
269023	>2500	3930	98	4740	4	393	3	2 3	<0 5
269024	67	8640	107	653	74	2770	36	54 1	0 7
269025	35	10	32	21 1	5330	68 8	15	1540	15 5
269026	>2500	6900	97	5720	341	1460	37	51 2	113
269027	28	370	183	389	>10000	792	407	3060	3690
*Dup 269023	>2500	3860	93	4790	3	395	3	2 7	0 6

SGS

Certificate of Analysis

Work Order: 099151

To: Caracle Creek International Consulting
Attn: Exploration Manager Brad Leonard
17 Frood Rd
Suite 2
SUDBURY
ONTARIO P3C 4Y9

Date Apr 09. 2008

P.O. No	POH SU03506
Project No	BYNG MINING
No. Of Samples	3
Date Submitted	Mar 28. 2008
Report Comprises	Pages 1 to 2 (Inclusive of Cover Sheet)

Distribution of unused material:

Discard after 90 days 3 Pulps

Certified By ____________________

Gavin McGill
Operations Manager

ISO 17025 Accredited for Specific Tests. SCC No. 456

Report Footer
L.N.R. = Listed not received
n.a. = Not applicable
S = Insufficient Sample
-- = No result
INF = Composition of this sample makes detection impossible by this method
M after a result denotes ppb to ppm conversion. % denotes ppm to % conversion
Methods marked with an asterisk (e.g. *NAA08V) were subcontracted

SGS

Element	Be	Nb
Method	ICP90Q	ICP90Q
Det.Lim.	0.01	0.01
Units	%	%
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269027	N.A.	2.37
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