



Natural Resources

Mines

# **GEOCHEMICAL DATA FROM HIGH-GRADE IRON-ORE DEPOSITS AND ALTERED AND UNALTERED IRON FORMATION IN THE LABRADOR TROUGH (NTS 23J AND 23O)**

**J. Conliffe**

**Open File LAB/1667**

**St. John's, Newfoundland  
May, 2016**

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## SUMMARY

This Open File release consists of whole-rock geochemical data from 79 iron formation samples from the Menihek and Schefferville areas in the Labrador Trough (NTS 23J and 23O; Figure 1). These samples were collected as part of a mineral deposit study investigating the genesis of high-grade iron-ore deposits in the Labrador Trough (Conliffe, 2016), and represent samples of high-grade (>55% Fe) iron-ore deposits from former and active mine sites and undeveloped prospects (DSO Project), as well as samples of altered iron formation from close to known deposits and samples of least-altered iron formation from elsewhere in the region (Taconite Project). More detailed information on the regional geological setting, geological characteristics of the high-grade iron-ore deposits and interpretation of the geochemical data are found in Conliffe (2016).

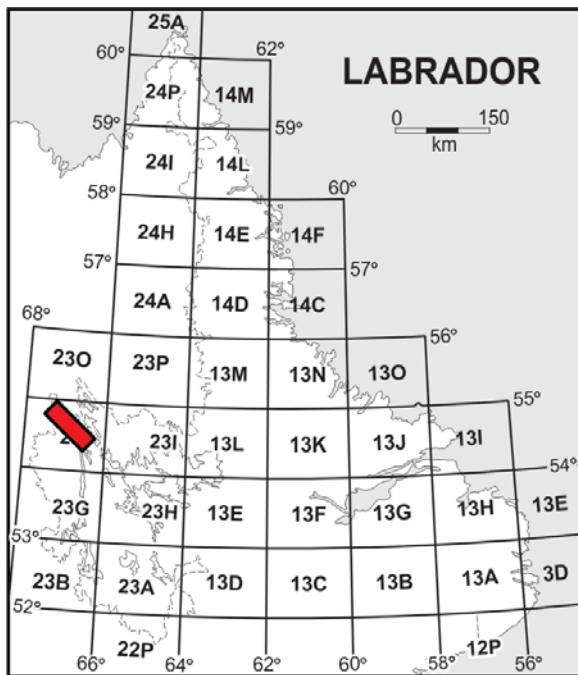


Figure 1. Location of study area.

## NOTES ON DATABASE

This database includes the results of whole-rock, trace-element and rare-earth element (REE) analysis of 79 samples collected between 2012 and 2015. These samples represent outcrop samples, samples taken from active mine faces, and exploration trenches, samples taken from stockpiled ore material and drillcore and drill-cutting samples. Also included are the sample location data and a brief sample description. The location data for samples are presented in Appendix A, with locations in Universal Transverse Mercator (UTM) eastings and northings (zone 19; NAD27). The location of drill-core and drill-cutting samples represents the collar location. The data are tabulated below and are also available in digital format (*i.e.*, \*.csv comma-separated values files).

All analyses were carried out at the GSNL geochemistry laboratory in St. John's and analytical methods are described in Table 1. Samples were milled using ceramic and tungsten carbide mills, and due to possible contaminations from the tungsten carbide mill, W and Co values are not reported for samples from 2013, 2014 and 2015. Major elements are reported in weight percent (wt. %), and trace elements are reported in parts per million (ppm). Major-element compositions (plus Cr, Zr and Ba) were analyzed by ICP-OES methods, following lithium tetraborate and metaborate fusion. REE and selected trace elements were determined by ICP-MS analysis following an identical sample digestion procedure, whereas other trace elements (As, Be, Cu, Li, Mn, Ni, Pb, Rb, Sc, Ti, Zn, V, Co) were analyzed by ICP-MS after total acid digestion.

Volatiles are represented as LOI (loss-on-ignition) at 1000°C, which represents the breakdown of all minerals and release of all volatiles. The LOI was also calculated after heating selected high-

**Table 1.** Analytical methods for geochemical analysis

Analysis	Method	Preparation/Digestion
SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , MgO, CaO, Na <sub>2</sub> O, K <sub>2</sub> O, TiO <sub>2</sub> , MnO, P <sub>2</sub> O <sub>5</sub> , Cr, Zr, Ba	Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES-FUS)	50-50 Lithium Tetraborate Lithium Metaborate Fusion
As, Be, Cu, Li, Mn, Ni, Pb, Rb, Sc, Ti, Zn, V, Co	Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)	Hf-HCl-HNO <sub>3</sub> -HClO <sub>4</sub> (total digestion)
V, Co, Ga, Ge, As, Sr, Y, Nb, Mo, Cd, Sn, Cs, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Tl, Bi, Th, U	Inductively Coupled Plasma Mass Spectrometry (ICP-MS-FUS)	50-50 Lithium Tetraborate Lithium Metaborate Fusion
LOI	Gravimetric (Grav) at 1000°C and 400°C	None

grade iron-ore samples to 400°C. The LOI at 400°C results in the liberation of water from goethite but not from carbonates and clay minerals. This allows the percentage of goethite in the sample to be calculated, which is approximately 10 times the LOI at 400°C (calculating for the H<sub>2</sub>O content of pure hydrated goethite based on stoichiometric ratio to Fe<sub>2</sub>O<sub>3</sub>).

The mass percent of Fe in each sample was calculated from the total Fe<sub>2</sub>O<sub>3</sub> values, using the conversion factor of 100 wt. % Fe<sub>2</sub>O<sub>3</sub> to 69.95 wt. % Fe.

Analytical duplicates were inserted at a frequency of one in 20, with the duplicate selected at random. In addition, a selection of reference standards was analyzed, also at a frequency of one in 20. For ICP-OES-FUS (major element) and ICP-MS-FUS (trace element), standards were supplied by the Canadian Certified Reference Materials Project (SCH-1) and the United States Geological Survey (AGV-1, W-2). Two standards were used for ICP-OES-FUS (trace element) analysis, supplied by the Canadian Certified Reference Materials Project (SY-4, WGB-1). The raw, unprocessed data from duplicates and standards are included in Appendix E, and can be used by the reader to assess accuracy and precision.

If a value of -99 is reported for a given element, it was not analyzed for that element in the sample. A value of -1 for LOI\_1000C indicates gain-on-ignition (*i.e.*, a net increase in weight). All other negative numbers indicate the concentration of the specific element in the sample was below the detection limit (*e.g.*, -0.01 indicates the measured value was below the detection limit of 0.01). Detection limits are listed for each element in Appendices B, C, D and E.

## **ABBREVIATIONS USED IN THE DATABASE**

DSO	Direct Shipping Ore
GC	Green Chert Iron Formation
JUIF	Jasper Upper Iron Formation
LC	Lean Chert Iron Formation
LIF	Lower Iron Formation
LOI	Loss On Ignition
LRC	Lower Red Cherty Iron Formation
LRGC	Lower Red Green Cherty Iron Formation
MIF	Middle Iron Formation
PGC	Pink Grey Cherty Iron Formation
SCIF	Silicate Carbonate Iron Formation
UIF	Upper Iron Formation
URC	Upper Red Cherty Iron Formation

## **ACKNOWLEDGMENTS**

Sample preparation and analyses were carried out under the supervision of Chris Finch of the GSNL Geochemistry Laboratory. Garrett Martin and Alex Calon provided able assistance during fieldwork and Wayne Tuttle is thanked for his excellent logistical support in Goose Bay. Tata Steel Minerals Canada, New Millennium and Labrador Iron Mines are thanked for access to drillcore, mine sites and exploration properties, and for providing samples. Pauline Honarvar provided a helpful review of an early draft of this file.

## **REFERENCE**

Conliffe, J.

2016: Geology and geochemistry of high-grade iron-ore deposits in the Kivivic, Timmins and Ruth Lake areas, western Labrador. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 16-1, pages 1-26.

## Appendix A - Sample Locations and Descriptions

Sample_Num	Lab_Num	Year	Collec	Project	Type	Showing	Drillhook	From_m	To_m	UTMEast	UTMNorth	UTMZone	Datum	NTS_Map	Litho_code	Sub_Litho
JC12-068	10440693	2012		DSO	Mine	James Mine				639362	6071887	19	NAD27 23/15		High Mn	Blue Ore
JC12-069	10440694	2012		DSO	Mine	James Mine				639362	6071887	19	NAD27 23/15		Blue	Blue Ore
JC12-070	10440695	2012		Taconite	Mine	James South Mine				639864	6071315	19	NAD27 23/15		Blue	Blue Ore
JC12-085	10440703	2012		Taconite	Drillcore	LabMag	12HR-1278PH	61.4	61.5	6083770	6083770	19	NAD27 23/14		MIF	URC
JC12-086	10440704	2012		Taconite	Drillcore	Howells Lake	12HR-1314	238.2	238.4	6102271	6102271	19	NAD27 23/0/03		MIF	URC
JC12-087	10440705	2012		Taconite	Drillcore	Perault Lake	12PL-1020D	31.9	32.22	6061871	6061871	19	NAD27 23/10		MIF	URC
JC12-088	10440706	2012		Taconite	Drillcore	LabMag	12HR-1278PH	110.3	110.5	6083770	6083770	19	NAD27 23/14		LIF	LRGC
JC12-091	10440707	2012		DSO	Outcrop	LabMag				611822	6085537	19	NAD27 23/14		MIF	URC
JC12-098	10440709	2012		DSO	Mine	Timmins 4				621278	6084957	19	NAD27 23/14		Blue	Blue Ore
TI4a	10441117	2012		DSO	Mine	Timmins 4				620982	6085350	19	NAD27 23/14		Blue	Blue Ore
TI4b	10441118	2012		DSO	Mine	Timmins 4				620982	6085350	19	NAD27 23/14		Blue	Blue Ore
13JC_C95	10440905	2013		DSO	Trench	Goodwood				605230	6107010	19	NAD27 23/0/03		Blue	Blue Ore
13JC_C96	10440906	2013		DSO	Trench	Kivivic 5				608812	6103368	19	NAD27 23/0/03		Blue	Blue Ore
13JC_C97	10440907	2013		DSO	Trench	Kivivic 4				610089	6101329	19	NAD27 23/0/03		Blue	Blue Ore
13JC_C98	10440908	2013		DSO	Trench	Goodwood				605479	6107095	19	NAD27 23/0/03		Yellow	Yellow Ore
13JC027A01	10440844	2013		Taconite	Outcrop	French Mine				635997	6076428	19	NAD27 23/15		LIF	SCIF
13JC028A01	10440845	2013		Taconite	Outcrop	French Mine				636028	6076451	19	NAD27 23/15		MIF	LRC
13JC029A01	10440846	2013		Taconite	Outcrop	French Mine				636091	6076480	19	NAD27 23/15		MIF	PGC
13JC030A01	10440847	2013		Taconite	Outcrop	French Mine				636128	6076508	19	NAD27 23/15		MIF	URC
13JC031A01	10440848	2013		Taconite	Outcrop	French Mine				635976	6076493	19	NAD27 23/15		LIF	SCIF
13JC032A01	10440849	2013		Taconite	Outcrop	French Mine				636010	6076520	19	NAD27 23/15		MIF	LRC
13JC033A01	10440851	2013		Taconite	Outcrop	French Mine				636081	6076601	19	NAD27 23/15		MIF	URC
13JC034A01	10440852	2013		Taconite	Outcrop	French Mine				636030	6076541	19	NAD27 23/15		MIF	PGC
13JC048A01	10440854	2013		Taconite	Outcrop	Ruth 8				636732	6072596	19	NAD27 23/15		MIF	LRC
13JC049A01	10440855	2013		Taconite	Outcrop	Ruth 8				636889	6072590	19	NAD27 23/15		MIF	PGC
13JC050A01	10440856	2013		Taconite	Outcrop	Ruth 8				636956	6072527	19	NAD27 23/15		MIF	PGC
13JC051A01	10440857	2013		Taconite	Outcrop	Ruth 8				636975	6072486	19	NAD27 23/15		MIF	LRC
13JC052A01	10440858	2013		Taconite	Outcrop	Ruth 8				636975	6072463	19	NAD27 23/15		MIF	LRC
13JC052B01	10440859	2013		Taconite	Outcrop	Ruth 8				636975	6072463	19	NAD27 23/15		MIF	n/a
13JC056A01	10440862	2013		DSO	Outcrop	Denault 2				636521	6077727	19	NAD27 23/15		Duricrust	Duricrust
13JC057A01	10440863	2013		DSO	Outcrop	Denault 1				635483	6079101	19	NAD27 23/15		Duricrust	Duricrust
13JC061A01	10440865	2013		DSO	Mine	Fleming 7				625144	6083129	19	NAD27 23/14		Red	Red Ore
13JC064A01	10440866	2013		DSO	Drill cuttings	Sunny 1				612492	6101304	19	NAD27 23/0/03		Blue	Blue Ore
13JC066A01	10440867	2013		DSO	Outcrop	Kivivic 5				608420	6103751	19	NAD27 23/0/03		Ruth	Ruth
13JC067A01	10440868	2013		DSO	Outcrop	Kivivic 2				608742	6104275	19	NAD27 23/0/03		Blue	Blue Ore
13JC068A01	10440869	2013		Taconite	Outcrop	Irony Mountain				618198	6085099	19	NAD27 23/14		MIF	LRC
13JC069A02	10440871	2013		Taconite	Outcrop	Irony Mountain				618214	6085049	19	NAD27 23/14		MIF	GC
13JC070A01	10440872	2013		DSO	Outcrop	Ruth 8				637052	6072446	19	NAD27 23/15		Blue	Blue Ore
13JC071A01	10440873	2013		DSO	Outcrop	Ruth 8				637184	6072272	19	NAD27 23/15		MIF	n/a
13JC072A01	10440874	2013		DSO	Outcrop	Ruth 8				637222	6072138	19	NAD27 23/15		Blue	Blue Ore
13JC080A01	10440883	2013		DSO	Stockpile	Redmond 1				646170	6061718	19	NAD27 23/10		Canga	Canga
13JC088A01	10440894	2013		Taconite	Outcrop	Ore Zone				633216	6079758	19	NAD27 23/14		MIF	LRC
13JC089A01	10440895	2013		Taconite	Outcrop	Ore Zone	Schefferville Taconite			635628	6076931	19	NAD27 23/15		UIF	JUIF
13JC095A01	10440896	2013		Taconite	Outcrop	Ore Zone				635524	6076981	19	NAD27 23/15		MIF	LRC
13JC096A01	10440897	2013		Taconite	Outcrop	Ore Zone				634295	6077366	19	NAD27 23/15		MIF	PGC
13JC097A01	10440898	2013		Taconite	Outcrop	Ore Zone				634295	6077366	19	NAD27 23/15		MIF	LRC
13JC098A01	10440901	2013		Taconite	Outcrop	Ore Zone				638757	6074346	19	NAD27 23/15		MIF	LRC
13JC098B01	10440902	2013		Taconite	Outcrop	Ore Zone				638757	6074346	19	NAD27 23/15		SCIF	SCIF
13JC098C01	10440903	2013		Taconite	Outcrop	Ore Zone				638757	6074346	19	NAD27 23/15		MIF	PGC
13JC099A01	10440904	2013		Taconite	Outcrop	Ore Zone				637710	6074944	19	NAD27 23/15		Ruth	Ruth
14JC018A01	10441053	2014		Taconite	Outcrop	Wishart 4				633498	6069340	19	NAD27 23/15		Ruth	Ruth



## Appendix A - Sample Locations and Descriptions

Sample_Num	Lab_Num	YearCollec	Project	Type	Showing	Drillhook	From_m	To_m	UTMEast	UTMNorth	UTMZone	Datum	NTS_Map	Litho_code	Sub_Litho
14JC031A01	10441069	2014	Taconite	Outcrop	Elizabeth Lake		635493	6071326	19	NAD27	23J/15		Ruth	Ruth	
14JC033A01	10441072	2014	Taconite	Outcrop	Elizabeth Lake		635548	6071436	19	NAD27	23J/15		SCIF	SCIF	
14JC033B01	10441073	2014	Taconite	Outcrop	Elizabeth Lake		635548	6071436	19	NAD27	23J/15		MIF	LRC	
14JC034A01	10441074	2014	Taconite	Outcrop	Elizabeth Lake		635598	6071488	19	NAD27	23J/15		UIF	n/a	
14JC035A01	10441075	2014	Taconite	Outcrop	Elizabeth Lake		635674	6071477	19	NAD27	23J/15		Ruth	Ruth	
14JC036A01	10441076	2014	Taconite	Outcrop	Elizabeth Lake		635768	6071498	19	NAD27	23J/15		Ruth	Ruth	
14JC037A01	10441077	2014	Taconite	Outcrop	Elizabeth Lake		635797	6071583	19	NAD27	23J/15		MIF	LRC	
14JC038A01	10441089	2014	Taconite	Outcrop	Elizabeth Lake		635821	6071614	19	NAD27	23J/15		MIF	URC	
14JC039A01	10441078	2014	Taconite	Outcrop	Elizabeth Lake		635922	6071583	19	NAD27	23J/15		UIF	n/a	
14JC040A01	10441079	2014	Taconite	Outcrop	Dolly Ridge		643510	6078203	19	NAD27	23J/15		Memheh		
14JC041A01	10441081	2014	Taconite	Outcrop	Dolly Ridge		643387	6078251	19	NAD27	23J/15		UIF	LC	
14JC042A01	10441082	2014	Taconite	Outcrop	Dolly Ridge		643323	6078202	19	NAD27	23J/15		UIF	JUIF	
14JC042B01	10441091	2014	Taconite	Outcrop	Dolly Ridge		643323	6078202	19	NAD27	23J/15		MIF	URC	
14JC043A01	10441092	2014	Taconite	Outcrop	Dolly Ridge		643294	6078182	19	NAD27	23J/15		MIF	PGC	
14JC044A01	10441083	2014	Taconite	Outcrop	Dolly Ridge		643207	6078174	19	NAD27	23J/15		MIF	PGC	
14JC045A01	10441084	2014	Taconite	Outcrop	Dolly Ridge		643184	6078094	19	NAD27	23J/15		LIF	SCIF	
14JC046A01	10441085	2014	Taconite	Outcrop	Dolly Ridge		643156	6077988	19	NAD27	23J/15		Ruth		
14JC046B01	10441086	2014	Taconite	Outcrop	Dolly Ridge		643156	6077988	19	NAD27	23J/15		Wishart		
14JC047A01	10441087	2014	DSO	Outcrop	Dolly Ridge		643156	6077988	19	NAD27	23J/15		Ruth		
15JC002B01	10441112	2015	DSO	Mine	Kivivic 2		608649	6104377	19	NAD27	23O/03		Blue	Blue Ore	
15JC003A01	10441114	2015	DSO	Mine	Kivivic 1C		607529	6103750	19	NAD27	23O/03		Blue	Blue Ore	
15JC003A02	10441115	2015	DSO	Mine	Kivivic 1C		607529	6103750	19	NAD27	23O/03		Blue	Blue Ore	
15JC003B01	10441116	2015	DSO	Mine	Kivivic 1C		607529	6103750	19	NAD27	23O/03		Yellow	Yellow Ore	
15JC-C008	10441104	2015	DSO	Drillcore	Howse	HW-D14-12	51.4	51.5	619339	6085796	19	NAD27	23J/14	Blue	Blue Ore
15JC-C009	10441105	2015	DSO	Drillcore	Howse	HW-D14-12	57.6	57.7	619339	6085796	19	NAD27	23J/14	Blue	Blue Ore
15JC-C010	10441106	2015	DSO	Drillcore	Howse	HW-D14-16	41.5	41.6	619367	6085991	19	NAD27	23J/14	Blue	Blue Ore
15JC-C011	10441107	2015	DSO	Drillcore	Howse	HW-D14-16	37.5	37.6	619367	6085991	19	NAD27	23J/14	Yellow	Yellow Ore

## Appendix A - Sample Locations and Descriptions

Sample_Num	Mag_suscep	Description
JC12-068	12.4	Hard blue high grade ore with secondary pyroclucite
JC12-069	-99	Lump ore from treat rock
JC12-070	0.698	Strongly leached and friable hematite ore
JC12-085	1001	URC with magnetite and carbonate bands and discontinuous red chert layers
JC12-086	587	URC with magnetite and red chert layers
JC12-087	313	URC with magnetite and red chert layers
JC12-088	1129	LRGC with massive magnetite bands
JC12-091	1442	Band of magnetite from URC
JC12-098	-99	Friable high grade blue ore from Timmins 4 (stripped section)
T14a	-99	High grade blue ore
T14b	-99	High grade blue ore
131C_C95	-99	NML Bulk Sample (located in Gagnon Quarry)
131C_C96	-99	NML Bulk Sample (located in Gagnon Quarry)
131C_C97	-99	NML Bulk Sample (located in Gagnon Quarry)
131C_C98	-99	NML Bulk Sample (located in Gagnon Quarry)
131C027A01	0.147	Altered SCIF with bands of quartz rich and shale rich
131C028A01	15	Altered LRC, with leaching most intense in red chert layers
131C029A01	1.01	Altered PGC with layers rich in hematite and goethite (after carbonate)
131C030A01	6.08	Altered URC iron formation with some secondary goethite and leaching of chert layers
131C031A01	0.358	Weakly altered SCIF with brown slaty layers and limonite alteration
131C032A01	285	Weakly altered and leached LRC
131C033A01	4.01	Weakly altered URC with red chert bands and thin quartz veinlets
131C034A01	88	Weakly altered PGC iron formation above LRC
131C048A01	3.06	Possible LRC with jasper fragments in matrix of hematite, carbonate and magnetite.
131C049A01	198	Possible PGC, weakly altered with brown chert (minor goethite) and magnetite layers
131C050A01	17.6	Weakly altered granular PGC granular chert, magnetite and minor jasper fragments
131C051A01	2.67	Altered chert breccia/conglomerate with strong leaching of chert fragments in hematite matrix
131C052A01	0.687	Hard, enriched iron formation with secondary goethite from margin of Ruth 8 Deposit
131C052B01	13.5	Strongly leached chert unit from margins of Ruth 8 Deposit
131C056A01	0.516	Hard blue ore overlying high grade iron ore occurrence, with abundant secondary goethite (duricrust)
131C057A01	8.18	Hard blue ore overlying high grade iron ore occurrence, with abundant secondary goethite (duricrust)
131C061A01	-99	Sample of high-grade red ore from Fleming 7 Pit
131C064A01	1.2	Blue ore fragments from drillcore cuttings (drillhole 10-27), unknown depth
131C067A01	0.071	Strongly leached Ruth Formation with red and white bands
131C068A01	923	Banded PGC or LRC, magnetite bands and pink granular bands
131C069A02	1077	Outcrop of high grade blue ore exposed in trench (location of bulk sample)
131C070A01	1.34	Blue ore with hematite and goethite
131C071A01	9.77	Leached brecciated low grade iron formation
131C072A01	16.4	Slaty blue ore
131C080A01	1.03	Rubble ore (canga) with clasts of high-grade hematite cemented by goethite and with clay filling matrix
131C088A01	17.6	LRC with jasper bands and iron oxide bands, granular texture
131C089A01	531	PGC with granular quartz, iron oxides and minor pink carbonate
131C095A01	687	Grey cherty iron formation
131C096A01	34.5	LGC with low magnetite content
131C097A01	305	Grey iron rich PGC Iron Formator
131C097A02	684	LRC with jasper bands
131C098A01	141	LRC with magnetite and jasper bands
131C098B01	231	Thinly banded SCIF
131C098C01	765	Grey cherty PGC
131C099A01	0.729	Slaty Ruth formation
141C018A01	0.4	Weakly altered Ruth Formation shale on upper limb of tight overturned syncline

## Appendix A - Sample Locations and Descriptions

Sample_Num	Mag_suscep	Description
141C031A01	0.25	Finely laminated Ruth Formation shale
141C033A01	310	Brown weathering SCIF, characteristic weathered surface. Fresh SCIF is green, fine grained with carbonates, Fe silicates and minor magnetite. Pink to grey LRC. Lower contact gradational with increase in disseminated magnetite. Generally massive with magnetite, quartz and carbonate. Some jasper band and layers with conglomerate texture
141C033B01	300	Low grade iron formation with characteristic carbonate pitting on weathered surface. Fresh surface white to brown with leopard texture. Mineralogy is dominantly quartz and carbonate with goethite in vugs. UIF?
141C034A01	0.5	Finely laminated Ruth Formation shale
141C035A01	0.6	Finely laminated Ruth Formation shale
141C036A01	0.2	Finely laminated Ruth Formation shale
141C037A01	800	Pink to grey possible LRC. Well banded with ink cherty bands and magnetite bands with jasper casts
141C038A01	1075	Pink to grey possible URC. Well banded with pink cherty bands and massive magnetite bands, jasper casts in places. Strongly magnetic
141C039A01	0.2	Quartz and carbonate rich iron formation with leopard texture and carbonate pitting (UIF?);
141C040A01	0.1	Black to grey, generally graphitic Menihok Shale, above iron formation
141C041A01	0.5	Green, fine to medium grained lean cherty iron formation with some layering and bedding. Located just below upper contact with Menihok Formation shale
141C042A01	69	Well bedded UIIF, with layers of disseminated magnetite, quartz and carbonate (Fe silicate?)
141C042B01	226	Red to grey URC with layers and pods of red jasper and layers of magnetite rich IF
141C043A01	80	Pink to grey possible URC or PGC. Much less jasper than previous station, dominantly pink cherty with magnetite rich pods. Some carbonate pitting on outcrops
141C044A01	90	Pink to grey, possible PGC, with alternating pink chert layers with pods of magnetite and magnetite rich layers with pods of chert
141C045A01	0.5	Black to brown to white weathering SCIF with abundant Mn staining. Fresh surface green, fine grained Fe silicate rich SCIF
141C046A01	0.5	Fissile Ruth Formation shales, directly above contact with Wishart Formation
141C046B01	-99	Green to white Wishart Formation quartzite
141C047A01	1.8	Fine grained Ruth Formation shale with thicker carbonate layers and minor pyrite
151C002B01	1	High grade blue ore
151C003A01	-99	Blue ore, dominantly hematite with minor goethite
151C003A02	-99	Blue ore, dominantly hematite with minor goethite
151C003B01	-99	Yellow ore, retaining original sedimentary textures (banding) and goethite-rich
151C-C008	-99	Friable high grade blue ore
151C-C009	1.2	Hard band of hematite in friable blue ore
151C-C010	-99	Friable high grade blue ore
151C-C011	0.5	Yellow ore with abundant goethite

## Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	Lab_Num	Showing	Project	YearAnalyz	SiO2	Al2O3	Fe2O3 Total	MgO	CaO	Na2O	K2O	TiO2
Unit					%	%	%	%	%	%	%	%
Method					ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS
2012 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2013 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2014 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2015 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
JC12-068	10440693	James Mine	DSO	2012	0.62	0.34	82.64	0.03	0.02	0.04	0.35	0.008
JC12-069	10440694	James Mine	DSO	2012	2.94	0.07	93.47	0.03	0.01	0.02	0.02	0.003
JC12-070	10440695	James South Mine	DSO	2012	0.51	0.08	95.54	-0.01	-0.01	0.04	0.05	-0.001
JC12-085	10440703	LabMag	Taconite	2012	47.88	0.13	44.07	0.67	2.70	0.02	0.08	0.003
JC12-086	10440704	Howells Lake	Taconite	2012	42.81	0.14	52.71	0.89	0.69	0.03	0.08	0.021
JC12-087	10440705	Perault Lake	Taconite	2012	47.01	0.17	45.61	0.83	2.03	0.02	0.04	0.002
JC12-088	10440706	LabMag	Taconite	2012	45.96	0.17	44.33	0.95	3.27	0.04	0.04	0.015
JC12-091	10440707	LabMag	Taconite	2012	25.32	0.11	71.05	0.87	0.04	0.01	0.07	0.009
JC12-098	10440709	Timmins 4	DSO	2012	1.84	0.43	95.78	0.03	0.02	0.06	0.07	0.007
131C_C95	10440905	Goodwood	DSO	2013	1.64	0.37	95.86	0.03	0.02	0.07	0.09	0.025
131C_C96	10440906	Goodwood	DSO	2013	12.01	0.21	85.82	0.11	0.07	0.08	0.10	0.022
131C_C97	10440907	Kivivic 4	DSO	2013	2.56	0.66	93.80	0.03	0.05	0.16	0.19	0.078
131C_C98	10440908	Goodwood	DSO	2013	10.75	0.81	83.14	0.07	0.05	0.10	0.14	0.035
131C027A01	10440844	Burnt Creek 3	Taconite	2013	66.52	0.25	28.14	0.02	0.01	0.04	0.03	0.012
131C028A01	10440845	Burnt Creek 3	Taconite	2013	50.81	0.07	47.58	0.61	0.01	0.04	0.02	0.005
131C029A01	10440846	Burnt Creek 3	Taconite	2013	41.97	0.13	54.42	0.08	-0.01	0.02	-0.01	0.002
131C030A01	10440847	Burnt Creek 3	Taconite	2013	27.53	0.06	69.08	0.01	0.01	0.03	0.01	0.001
131C031A01	10440848	Burnt Creek 3	Taconite	2013	29.81	0.15	59.82	-0.01	-0.01	0.02	0.04	0.014
131C032A01	10440849	Burnt Creek 3	Taconite	2013	43.38	0.06	56.23	-0.01	-0.01	0.02	-0.01	-0.001
131C033A01	10440851	Burnt Creek 3	Taconite	2013	55.82	0.02	43.70	0.01	0.02	-0.01	-0.01	0.002
131C034A01	10440852	Burnt Creek 3	Taconite	2013	60.24	0.02	36.36	0.05	-0.01	0.02	-0.01	-0.001
131C048A01	10440854	Ruth 8	Taconite	2013	46.53	0.04	51.36	-0.01	-0.01	0.02	-0.01	-0.001
131C049A01	10440855	Ruth 8	Taconite	2013	42.15	0.02	56.42	0.02	0.03	0.01	-0.01	0.003
131C050A01	10440856	Ruth 8	Taconite	2013	33.97	0.03	62.55	0.02	-0.01	0.02	-0.01	-0.001
131C051A01	10440857	Ruth 8	Taconite	2013	39.30	0.10	57.83	-0.01	-0.01	0.02	-0.01	-0.001
131C052A01	10440858	Ruth 8	Taconite	2013	3.12	1.10	87.82	-0.01	-0.01	-0.01	0.115	0.001
131C052B01	10440859	Ruth 8	Taconite	2013	78.31	0.16	19.28	0.02	-0.01	0.02	0.02	0.012
131C056A01	10440862	Denault ?	DSO	2013	2.24	0.15	85.48	-0.01	-0.01	0.03	0.04	-0.001
131C057A01	10440863	Denault 1	DSO	2013	7.61	0.34	83.63	0.02	0.02	0.01	-0.01	-0.001
131C061A01	10440865	Fleming 7	DSO	2013	2.61	1.94	88.04	0.01	0.03	0.02	0.02	0.219
131C064A01	10440866	Sunny 1	DSO	2013	4.47	0.39	92.32	0.04	0.02	0.03	0.02	0.052
131C066A01	10440867	Kivivic 5	DSO	2013	67.72	13.19	7.91	0.78	0.03	0.05	3.54	0.564
131C067A01	10440868	Kivivic 2	DSO	2013	3.36	0.42	93.45	0.02	0.01	0.02	0.02	-0.001
131C068A01	10440869	Irony Mountain	Taconite	2013	27.50	0.05	72.15	0.47	0.02	0.02	0.02	-0.001
131C069A02	10440871	Irony Mountain	Taconite	2013	90.78	0.12	6.64	0.13	0.02	0.02	0.06	0.001
131C070A01	10440872	Ruth 8	DSO	2013	1.96	0.43	92.73	-0.01	0.01	0.03	0.04	0.014
131C071A01	10440873	Ruth 8	DSO	2013	63.53	0.03	34.21	0.06	0.01	0.02	0.04	-0.001
131C072A01	10440874	Ruth 8	DSO	2013	6.74	0.09	87.75	0.02	0.01	0.03	0.01	-0.001
131C080A01	10440883	Redmond 1	DSO	2013	1.79	2.33	90.34	-0.01	0.03	0.07	0.08	0.144
131C088A01	10440894	Ore Zone	Taconite	2013	42.17	0.10	56.70	0.11	0.03	0.08	0.10	0.003
131C089A01	10440895	Ore Zone	Taconite	2013	47.82	0.05	50.58	0.09	0.04	0.08	0.10	0.005
131C095A01	10440896	Ore Zone	Taconite	2013	49.50	0.02	46.95	3.33	0.02	0.10	0.12	0.003
131C096A01	10440897	Ore Zone	Taconite	2013	71.69	0.05	24.52	2.26	0.13	0.02	0.02	-0.001
131C097A01	10440898	Ore Zone	Taconite	2013	41.38	0.13	49.64	3.55	0.51	0.07	0.11	0.011
131C097A02	10440899	Ore Zone	Taconite	2013	21.81	0.18	74.62	1.85	0.32	0.10	0.17	0.017
131C098A01	10440901	Ore Zone	Taconite	2013	73.62	0.09	21.02	1.74	0.07	0.05	0.06	0.002

## Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	Lab_Num	Showing	Project	YearAnalyz	SiO2	Al2O3	Fe2O3 Total	MgO	CaO	Na2O	K2O	TiO2
Unit					%	%	%	%	%	%	%	%
					ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS
2012 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2013 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2014 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2015 Detection Limit					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001
131C098B01	10440902	Ore Zone	Taconite	2013	40.17	0.08	54.01	3.29	0.05	0.09	0.16	0.006
131C098C01	10440903	Ore Zone	Taconite	2013	48.75	0.05	46.40	2.97	0.04	0.09	0.12	0.004
131C099A01	10440904	Ore Zone	Taconite	2013	40.79	12.02	26.58	2.52	0.19	0.14	4.05	0.626
141C018A01	10441053	Wishart 4	Taconite	2014	60.77	2.39	25.40	1.66	0.10	-0.01	0.08	0.105
141C031A01	10441069	Elizabeth Lake	Taconite	2014	53.15	13.36	12.21	0.81	0.04	0.09	9.09	1.786
141C033A01	10441072	Elizabeth Lake	Taconite	2014	49.29	0.03	45.03	3.78	0.05	0.02	0.07	0.002
141C033B01	10441073	Elizabeth Lake	Taconite	2014	44.89	0.02	50.58	0.04	0.01	0.03	0.08	0.002
141C034A01	10441074	Elizabeth Lake	Taconite	2014	45.77	0.04	47.67	-0.01	0.03	-0.01	-0.01	0.003
141C035A01	10441075	Elizabeth Lake	Taconite	2014	46.93	4.72	30.73	1.15	0.12	0.03	0.12	0.656
141C036A01	10441076	Elizabeth Lake	Taconite	2014	49.79	11.97	15.01	1.45	0.15	-0.01	7.36	1.714
141C037A01	10441077	Elizabeth Lake	Taconite	2014	35.53	0.10	62.83	0.22	0.02	0.03	0.06	0.007
141C038A01	10441089	Elizabeth Lake	Taconite	2014	44.21	0.02	56.47	0.17	0.02	-0.01	-0.01	0.003
141C039A01	10441078	Elizabeth Lake	Taconite	2014	88.44	0.08	10.23	0.02	0.02	-0.01	-0.01	0.013
141C040A01	10441079	Dolly Ridge	Taconite	2014	60.46	14.47	5.42	1.94	0.05	0.83	4.38	0.611
141C041A01	10441081	Dolly Ridge	Taconite	2014	64.47	9.71	13.84	4.15	0.14	0.05	1.94	1.011
141C042A01	10441082	Dolly Ridge	Taconite	2014	41.64	4.09	45.37	2.06	0.09	0.53	2.59	0.376
141C042B01	10441091	Dolly Ridge	Taconite	2014	57.24	2.00	37.99	0.46	0.12	0.29	1.28	0.102
141C043A01	10441092	Dolly Ridge	Taconite	2014	83.94	0.24	13.37	0.30	0.21	0.06	0.19	0.016
141C044A01	10441083	Dolly Ridge	Taconite	2014	39.98	0.64	56.97	0.95	0.05	0.09	0.18	0.058
141C045A01	10441084	Dolly Ridge	Taconite	2014	62.16	0.75	12.04	0.91	9.76	0.11	0.34	0.079
141C046A01	10441086	Dolly Ridge	Taconite	2014	53.47	8.39	19.44	0.73	0.08	0.09	4.74	0.932
141C046B01	10441085	Dolly Ridge	Taconite	2014	89.98	3.12	3.13	0.64	0.06	0.68	1.23	0.062
141C047A01	10441087	Dolly Ridge	Taconite	2014	44.09	0.72	37.42	1.89	1.77	-0.01	0.02	0.066
151C002B01	10441112	Kivivic 2	DSO	2015	6.08	0.07	93.40	0.02	0.04	0.05	0.04	0.009
151C003A01	10441114	Kivivic 1C	DSO	2015	1.06	0.19	95.48	0.02	0.03	0.04	0.02	0.057
151C003A02	10441115	Kivivic 1C	DSO	2015	1.09	0.23	96.90	-0.01	0.02	0.04	0.05	0.043
151C003B01	10441116	Kivivic 1C	DSO	2015	1.80	0.91	88.92	0.02	0.03	0.04	0.05	0.021
151C-C008	10441104	Howse	DSO	2015	1.03	0.26	98.37	0.03	0.04	0.03	0.02	0.013
151C-C009	10441105	Howse	DSO	2015	1.11	0.44	96.26	-0.01	0.04	0.03	0.02	0.019
151C-C010	10441106	Howse	DSO	2015	3.93	2.14	88.89	0.04	0.06	0.04	0.05	0.197
151C-C011	10441107	Howse	DSO	2015	2.32	0.54	89.88	0.06	0.07	0.05	0.04	0.041
T14a	10441117	Timmins 4	DSO	2015	1.53	0.29	96.60	0.03	0.06	0.05	0.05	0.011
T14b	10441118	Timmins 4	DSO	2015	0.86	0.13	97.47	0.02	0.04	0.04	0.03	0.003

### Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	MnO	P2O5	Cr	Zr	Ba	LOI_100C	LOI_400C	Total	Fe	As	Be	Cu	Li	Mn	Ni	Pb	Rb
Unit	%	%	ppm	ppm	ppm	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	Calculated	OES	OES	OES	OES	ICP-OES	OES	OES	OES
2012 Detection Limit	0.001	0.001	1	1	1	0.01	0.01	0.01		0.1	0.1	1	0.1	1	1	1	1
2013 Detection Limit	0.001	0.001	1	1	1	0.01	0.01	0.01		0.1	0.1	1	0.1	1	1	1	1
2014 Detection Limit	0.001	0.001	1	1	1	0.01	0.01	0.01	2	0.1	0.1	1	0.1	1	1	1	1
2015 Detection Limit	0.001	0.001	1	1	1	0.01	0.01	0.01	2	0.1	0.1	1	0.1	1	1	1	1
JC12-068	11.315	0.009	1	24	672	3.41	1.39	98.77	57.81	-99	1.3	27	0.7	59938	29	11	12
JC12-069	0.139	0.109	-1	18	19	2.52	1.68	99.34	65.38	-99	1.5	4	0.7	634	35	-1	1
JC12-070	0.077	0.038	3	-1	4	0.39	0.07	96.78	66.83	-99	0.6	2	-0.1	170	68	-1	1
JC12-085	0.400	0.014	2	15	23	2.25	-99	98.21	30.83	-99	1.4	3	2.2	2685	27	-1	5
JC12-086	0.696	0.024	-1	22	11	0.91	-99	99.01	36.87	-99	2.1	4	1.4	4547	30	1	2
JC12-087	0.321	0.011	3	14	4	2.71	-99	98.76	31.91	-99	1.3	5	1.4	2212	25	-1	1
JC12-088	0.499	0.014	3	13	19	3.47	-99	98.75	31.01	-99	0.7	3	2.3	3238	29	-1	3
JC12-091	0.827	0.012	2	25	8	-1	-99	98.32	49.70	-99	1.6	4	1.1	5452	38	-1	2
JC12-098	0.108	0.035	8	11	12	1.09	0.37	99.46	67.00	-99	2.2	4	0.3	387	32	-1	1
131C_C95	0.114	0.049	4	35	18	2.36	1.43	100.63	67.04	-99	0.8	6	0.4	651	41	16	3
131C_C96	0.223	0.027	2	31	34	1.91	1.15	100.59	60.02	-99	1.2	6	0.8	1409	40	10	3
131C_C97	0.361	0.111	7	58	16	1.98	1.88	99.99	65.59	-99	0.8	7	1.6	2271	44	4	-1
131C_C98	0.318	0.071	3	35	46	5.27	3.56	100.75	58.14	-99	0.6	14	1.2	2083	40	3	3
131C027A01	0.057	0.159	-1	18	2	5.02	-99	100.26	19.68	-99	1.3	16	1.1	403	26	2	-1
131C028A01	0.062	0.006	-1	16	28	1.09	-99	100.31	33.28	-99	1.0	5	2.8	329	28	3	1
131C029A01	0.050	0.010	-1	24	2	2.64	-99	99.32	38.06	-99	1.2	4	1.2	277	33	3	-1
131C030A01	0.126	0.077	-1	25	23	3.16	-99	100.09	48.31	-99	0.9	4	0.8	673	32	6	-1
131C031A01	0.987	0.029	-1	24	21	8.70	-99	99.58	41.83	-99	1.2	13	0.9	6383	39	5	-1
131C032A01	0.057	0.013	2	26	7	0.21	-99	100.47	39.32	-99	1.6	8	3.0	303	35	5	2
131C033A01	0.056	0.022	-1	14	3	0.94	-99	100.54	30.56	-99	1.3	5	1.3	295	26	4	-1
131C034A01	0.033	-0.001	-1	13	8	1.32	-99	98.04	25.43	-99	0.5	6	2.7	200	25	2	-1
131C048A01	0.043	0.010	-1	16	5	2.41	-99	100.42	35.92	-99	1.0	6	0.8	232	32	3	-1
131C049A01	0.056	0.062	-1	16	4	2.02	-99	100.78	39.45	-99	1.9	5	1.5	302	34	4	-1
131C050A01	0.065	0.024	-1	9	8	3.09	-99	99.79	43.74	-99	1.7	7	2.2	306	33	4	-1
131C051A01	0.068	0.039	2	18	4	3.18	-99	100.55	40.44	-99	1.4	6	0.5	368	38	5	1
131C052A01	0.092	0.096	3	22	5	6.80	4.70	99.16	61.41	-99	1.6	14	0.3	420	42	5	2
131C056A01	0.025	0.016	2	7	3	1.15	-99	99.01	13.48	-99	1.4	5	1.8	171	17	1	-1
131C057A01	0.084	0.278	2	14	1	10.87	8.59	99.21	59.78	-99	1.6	17	0.3	390	47	-1	-1
131C061A01	0.093	0.036	-1	14	2	8.43	6.58	100.19	58.48	-99	0.9	7	0.3	424	40	-1	2
131C064A01	0.108	0.196	12	68	39	5.83	1.42	99.02	61.56	-99	1.1	6	0.4	440	43	-1	3
131C066A01	0.025	0.138	5	33	16	1.92	0.48	99.40	64.56	-99	0.6	4	0.4	450	36	-1	2
131C067A01	0.174	0.032	72	141	448	5.27	-99	99.21	5.53	-99	2.5	38	27.3	163	21	-1	103
131C068A01	0.078	0.010	4	14	24	1.29	0.61	98.79	65.35	-99	1.9	4	0.9	652	33	-1	2
131C069A02	0.127	0.002	-1	9	3	1.49	-99	99.38	4.64	-99	0.4	-1	0.3	1045	8	-1	-1
131C070A01	0.090	0.073	17	17	16	3.33	1.95	98.71	64.85	-99	0.9	6	-0.1	379	42	-1	4
131C071A01	0.056	0.009	3	4	5	0.52	-99	98.48	23.92	-99	0.9	3	2.2	315	21	-1	-1
131C072A01	0.303	0.160	1	12	228	3.93	2.86	99.04	61.37	-99	0.7	5	0.7	1453	35	-1	1
131C080A01	0.093	0.203	20	78	13	5.22	3.43	100.31	63.18	-99	0.6	12	0.1	522	40	-1	3
131C088A01	0.078	0.016	1	19	58	0.41	-99	99.80	39.65	-99	1.5	6	2.3	455	29	4	-1
131C089A01	0.052	0.015	4	14	4	1.82	-99	100.65	35.37	-99	2.2	5	1.7	356	31	3	-1
131C095A01	0.051	0.009	1	14	7	-1	-99	100.10	32.83	-99	1.7	5	2.5	368	31	3	2
131C096A01	0.113	0.029	1	6	14	0.62	-99	99.46	17.14	-99	0.8	10	4.3	815	23	2	-1
131C097A01	1.698	0.022	3	15	5	2.90	-99	100.07	34.71	-99	0.9	5	0.3	10825	32	4	3
131C097A02	0.285	0.025	5	28	48	0.68	-99	100.00	52.18	-99	3.2	9	4.2	1774	38	2	7
131C098A01	0.632	0.017	5	6	11	0.82	-99	98.11	14.70	-99	0.7	4	2.4	5018	20	1	-1

### Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	MnO	P2O5	Cr	Zr	Ba	LOI_100C	LOI_400C	Total	Fe	As	Be	Cu	Li	Mn	Ni	Pb	Rb
Unit	%	%	ppm	ppm	ppm	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	Grav	Grav	Calculated	OES	OES	OES	OES	OES	ICP-OES	OES	OES	OES
2012 Detection Limit	0.001	0.001	1	1	1	0.01	0.01				0.1	1	0.1	1	1	1	1
2013 Detection Limit	0.001	0.001	1	1	1	0.01	0.01				0.1	1	0.1	1	1	1	1
2014 Detection Limit	0.001	0.001	1	1	1	0.01	0.01	2	2	2	0.1	1	0.1	1	1	1	1
2015 Detection Limit	0.001	0.001	1	1	1	0.01	0.01	2	2	2	0.1	1	0.1	1	1	1	1
131C098B01	0.269	0.033	2	14	5	1.72	-99	99.87	37.77	-99	0.6	5	0.1	1798	34	1	7
131C098C01	0.097	0.011	-1	16	14	-1	-99	98.53	32.45	-99	1.1	5	8.9	687	32	1	3
131C099A01	1.740	0.120	18	736	326	10.78	-99	99.56	18.59	-99	4.6	19	57.9	11849	37	-1	88
141C018A01	0.444	0.013	8	105	7	8.76	-99	99.73	17.76	10	0.6	6	15.5	3459	27	-1	4
141C031A01	0.049	0.247	35	253	559	7.85	-99	98.67	8.54	30	1.8	34	14.4	388	28	5	128
141C033A01	0.265	0.025	-1	12	4	2.20	-99	100.78	31.49	7	1.4	6	-0.1	1847	31	-1	8
141C033B01	0.911	0.011	12	12	2	3.93	-99	100.50	35.37	14	1.6	5	-0.1	6320	35	-1	4
141C034A01	0.055	0.015	-1	5	2	6.23	-99	99.82	33.34	-2	0.8	6	-0.1	367	33	-1	4
141C035A01	0.489	0.190	26	150	24	14.08	-99	99.10	21.49	35	3.3	18	13.4	3688	39	6	8
141C036A01	0.089	0.425	32	201	657	11.03	-99	98.99	10.50	46	1.3	38	22.4	638	26	9	96
141C037A01	0.224	0.025	-1	21	25	-1	-99	99.03	43.94	15	1.3	5	9.4	1493	35	-1	7
141C038A01	0.042	0.015	-1	12	4	-1	-99	100.85	39.49	24	1.0	6	0.7	304	31	-1	6
141C039A01	0.016	0.009	-1	5	3	1.14	-99	99.97	7.15	15	0.5	7	0.9	135	13	-1	4
141C040A01	0.053	0.103	104	137	643	10.07	-99	98.39	3.79	13	2.6	132	52.3	468	59	20	157
141C041A01	0.088	0.134	145	224	349	3.46	-99	98.98	9.68	12	13.8	15	216.9	737	18	-1	73
141C042A01	0.329	0.046	16	101	286	1.03	-99	98.15	31.73	25	2.7	11	27.0	2464	32	-1	85
141C042B01	0.206	0.043	9	71	197	0.57	-99	100.29	26.56	35	1.4	38	1.0	1535	25	-1	20
141C043A01	0.088	0.002	1	9	26	0.21	-99	98.64	9.35	5	1.7	6	1.8	784	13	-1	7
141C044A01	0.145	0.020	3	21	39	0.98	-99	100.07	39.84	19	1.2	5	1.9	1045	31	-1	13
141C045A01	1.057	0.035	4	10	42	12.70	-99	99.93	8.42	3	0.3	4	1.1	8289	13	-1	16
141C046A01	0.802	0.177	40	334	352	11.98	-99	100.84	13.59	43	3.6	34	59.6	6183	29	17	138
141C047A01	0.497	0.072	38	15	23	14.33	-99	100.88	26.17	5	0.7	13	-0.1	3647	25	-1	17
151C002B01	0.099	0.019	3	28	17	0.58	0.19	100.40	65.32	8	0.8	4	0.4	549	-1	-1	4
151C003A01	0.077	0.125	4	49	5	2.45	1.65	99.55	66.78	7	0.7	7	0.3	450	-1	-1	6
151C003A02	0.186	0.055	2	36	6	-99	0.72	99.82	67.77	13	0.6	6	0.3	1155	-1	5	8
151C003B01	0.068	0.031	3	34	6	7.59	5.81	99.48	62.19	12	0.6	8	-0.1	407	-1	-1	4
151C-C008	0.097	0.052	2	33	18	0.87	0.35	100.82	68.80	19	1.3	9	0.6	558	-1	-1	6
151C-C009	0.352	0.075	4	43	47	0.71	0.33	99.06	67.32	19	1.8	14	0.4	2125	-1	-1	6
151C-C010	0.326	0.144	9	105	132	2.28	1.09	98.09	62.17	34	1.4	9	0.8	2037	-1	4	9
151C-C011	0.186	0.197	5	32	17	6.61	4.95	100.01	62.86	34	1.5	14	0.3	1128	-1	-1	6
T14a	0.166	0.027	4	30	32	0.55	0.18	99.37	67.56	23	1.6	6	0.7	962	-1	-1	7
T14b	0.241	0.021	4	26	22	0.55	0.17	99.40	68.17	27	1.6	6	0.4	1434	-1	-1	7

### Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	Unit	Method	Sc ppm OES	Ti ppm OES	Zn ppm OES	V ppm OES	Co ppm OES	V ppm ICP-MS-FUS	Co ppm ICP-MS-FUS	Ga ppm ICP-MS-FUS	Ge ppm ICP-MS-FUS	As ppm ICP-MS-FUS	Sr ppm ICP-MS-FUS	Y ppm ICP-MS-FUS	Nb ppm ICP-MS-FUS	Mo ppm ICP-MS-FUS	Cd ppm ICP-MS-FUS
JC12-068			0.4	15	36	-99	-99	11	86	3	18	34	39	15	4	-2	-99
JC12-069			-0.1	2	29	-99	-99	11	9	-1	19	29	-2	10	1	-2	-99
JC12-070			-0.1	-1	44	-99	-99	30	2	2	18	6	3	2	8	8	-99
JC12-085			-0.1	10	22	-99	-99	23	4	1	10	12	10	3	3	-2	-99
JC12-086			-0.1	108	30	-99	-99	8	173	-1	13	20	9	14	3	-2	-99
JC12-087			-0.1	48	20	-99	-99	7	61	-1	13	8	15	5	7	3	-99
JC12-088			-0.1	12	24	-99	-99	-5	53	-1	12	10	7	3	4	-2	-99
JC12-091			-0.1	28	34	-99	-99	17	6	1	19	10	-2	8	7	2	-99
JC12-098			-0.1	19	29	-99	-99	-5	2	-1	22	-5	8	3	8	-2	-99
131C_C95			-0.1	112	38	-99	-99	18	7	1	22	26	4	3	4	-2	0.7
131C_C96			-0.1	111	35	-99	-99	18	13	1	25	25	6	6	4	-2	0.6
131C_C97			1.7	221	36	-99	-99	33	6	3	25	12	2	13	13	-2	-0.2
131C_C98			0.9	157	39	-99	-99	24	85	2	21	27	4	5	8	-2	0.3
131C027A01			0.1	72	31	-99	-99	11	50	1	8	12	-1	14	4	-2	-0.2
131C028A01			-0.1	10	18	-99	-99	15	51	-1	16	25	-1	5	2	-2	-0.2
131C029A01			-0.1	-1	23	-99	-99	15	26	-1	17	14	-1	3	4	-2	-0.2
131C030A01			-0.1	-1	52	-99	-99	12	24	-1	16	30	1	5	3	2	0.4
131C031A01			-0.1	62	46	-99	-99	9	17	-1	11	21	1	13	2	-2	0.3
131C032A01			-0.1	14	26	-99	-99	19	26	-1	14	12	-1	7	4	-2	-0.2
131C033A01			-0.1	-1	19	-99	-99	18	55	-1	11	10	2	8	3	2	-0.2
131C034A01			-0.1	-1	16	-99	-99	6	41	-1	13	12	-1	1	3	-2	0.3
131C048A01			-0.1	-1	21	-99	-99	24	47	-1	16	20	1	5	2	-2	0.2
131C049A01			-0.1	-1	23	-99	-99	16	27	-1	16	14	-1	7	2	2	-0.2
131C050A01			-0.1	-1	24	-99	-99	8	21	-1	15	17	-1	6	4	-2	0.4
131C051A01			-0.1	-1	28	-99	-99	22	43	-1	13	27	-1	2	4	-2	-0.2
131C052A01			2.1	592	43	-99	-99	27	15	3	18	78	-1	7	5	-2	0.3
131C052B01			0.6	112	11	-99	-99	9	47	-1	6	14	-1	2	4	-2	-0.2
131C056A01			-0.1	-1	52	-99	-99	21	14	-1	13	11	-1	13	2	2	-0.2
131C057A01			-0.1	-1	58	-99	-99	8	21	-1	23	36	-1	4	3	-2	0.3
131C061A01			1.5	1021	53	-99	-99	140	21	6	21	61	183	14	18	3	0.5
131C064A01			-0.1	229	37	-99	-99	43	100	1	23	19	8	11	9	-2	0.7
131C066A01			14.2	2866	25	-99	-99	217	104	21	4	9	18	23	17	3	0.4
131C067A01			-0.1	-1	39	-99	-99	33	14	1	20	48	3	18	3	2	0.4
131C068A01			-0.1	-1	43	-99	-99	7	18	-1	25	6	-1	-1	2	-2	0.3
131C069A02			0.3	37	8	-99	-99	15	81	-1	3	-5	2	-1	5	2	-0.2
131C070A01			-0.1	64	48	-99	-99	34	5	-1	22	36	2	8	5	9	0.6
131C071A01			-0.1	-1	16	-99	-99	13	62	-1	12	13	1	1	3	3	-0.2
131C072A01			-0.1	-1	38	-99	-99	23	28	-1	19	32	2	8	4	3	0.8
131C080A01			2.0	582	44	-99	-99	32	9	5	23	55	1	5	9	3	0.6
131C088A01			-0.1	-1	19	-99	-99	20	28	-1	12	32	4	41	2	-2	-0.2
131C089A01			-0.1	9	29	-99	-99	10	21	-1	17	30	-1	5	3	-2	0.3
131C095A01			-0.1	-1	29	-99	-99	8	19	-1	20	16	-1	-1	1	-2	0.4
131C096A01			0.1	16	18	-99	-99	12	34	-1	10	22	3	5	4	-2	0.3
131C097A01			-0.1	43	22	-99	-99	19	16	-1	17	16	4	5	3	-2	0.3
131C097A02			-0.1	25	27	-99	-99	24	16	-1	17	36	4	11	5	-2	0.2
131C098A01			0.3	43	13	-99	-99	8	57	-1	8	11	5	5	3	-2	0.4



**Appendix B - Major-element ICP-OES-FUS Data for Samples**

Sample_Num	Method	Sc	Ti	Zn	V	Co	V	Co	Cr	Fe	Ga	Ge	As	Sr	Y	Nb	Mo	Cd
		ppm OES	ppm OES	ppm OES	ppm OES	ppm OES	ppm OES	ppm OES	ppm OES	ppm OES	ppm OES	ppm ICP-MS-FUS	ppm ICP-MS-FUS	ppm ICP-MS-FUS	ppm ICP-MS-FUS	ppm ICP-MS-FUS	ppm ICP-MS-FUS	ppm ICP-MS-FUS
2012 Detection Limit	0.1	1	1	1	5	1	1	1	5	2	1	1	1	2	1	1	2	0.2
2013 Detection Limit	0.1	1	1	1	5	1	1	1	5	1	1	1	1	1	1	1	2	0.2
2014 Detection Limit	0.1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	2	0.2
2015 Detection Limit	0.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	0.2
131C098B01	-0.1	29	25	-99	-99	-99	10	8	-1	15	-1	15	-5	-1	2	3	3	-0.2
131C098C01	-0.1	19	22	-99	-99	-99	13	29	-1	17	-1	17	9	2	2	3	-2	0.6
131C099A01	5.0	3860	92	-99	-99	-99	186	24	36	18	36	18	22	14	75	178	10	0.6
141C018A01	0.7	551	23	-99	-99	-99	81	-99	6	8	6	8	-99	3	21	45	3	0.3
141C031A01	16.5	9644	43	-99	-99	-99	290	-99	21	9	21	9	-99	22	27	51	9	-0.2
141C033A01	-0.1	8	32	-99	-99	-99	12	-99	-1	13	-1	13	-99	2	3	1	-2	-0.2
141C033B01	-0.1	3	43	-99	-99	-99	19	-99	-1	12	-1	12	-99	1	7	1	-2	-0.2
141C034A01	-0.1	2	31	-99	-99	-99	20	-99	-1	4	-1	4	-99	-1	5	5	-2	-0.2
141C035A01	8.9	3522	51	-99	-99	-99	295	-99	14	12	14	12	-99	6	28	33	5	-0.2
141C036A01	17.7	10096	35	-99	-99	-99	271	-99	27	10	27	10	-99	31	24	42	10	-0.2
141C037A01	-0.1	24	25	-99	-99	-99	16	-99	1	7	1	7	-99	2	4	4	-2	-0.2
141C038A01	-0.1	-1	26	-99	-99	-99	13	-99	-1	12	-1	12	-99	1	5	1	-2	-0.2
141C039A01	0.3	64	15	-99	-99	-99	10	-99	-1	2	-1	2	-99	-1	1	4	-2	-0.2
141C040A01	16.7	2197	177	-99	-99	-99	880	-99	19	6	19	6	-99	39	25	11	3	-0.2
141C041A01	8.6	6642	58	-99	-99	-99	756	-99	24	12	24	12	-99	14	19	64	-2	-0.2
141C042A01	6.3	2481	51	-99	-99	-99	60	-99	9	9	9	9	-99	17	8	17	-2	-0.2
141C042B01	2.2	644	26	-99	-99	-99	19	-99	4	7	4	7	-99	9	4	9	-2	-0.2
141C043A01	0.7	92	10	-99	-99	-99	6	-99	-1	5	-1	5	-99	5	1	3	-2	-0.2
141C044A01	1.4	314	33	-99	-99	-99	24	-99	-1	12	-1	12	-99	3	2	3	-2	-0.2
141C045A01	1.7	545	13	-99	-99	-99	21	-99	1	5	1	5	-99	154	3	1	-2	-0.2
141C046A01	11.9	5345	37	-99	-99	-99	399	-99	23	10	23	10	-99	20	35	55	8	-0.2
141C046B01	2.6	233	11	-99	-99	-99	11	-99	5	4	5	4	-99	15	1	2	-2	-0.2
141C047A01	1.1	393	25	-99	-99	-99	33	-99	2	8	2	8	-99	15	6	2	-2	-0.2
151C002B01	-0.1	-1	31	4	-1	-99	-99	-99	1	37	1	37	-99	-1	9	7	-2	-0.2
151C003A01	0.2	231	40	15	-1	-99	-99	-99	1	31	1	31	-99	5	4	2	-2	-0.2
151C003A02	0.3	173	38	16	-1	-99	-99	-99	2	41	2	41	-99	2	3	4	-2	-0.2
151C003B01	2.3	65	40	9	-1	-99	-99	-99	2	34	2	34	-99	2	3	3	-2	-0.2
151C-C008	0.1	12	33	9	-1	-99	-99	-99	2	35	2	35	-99	6	3	5	-2	-0.2
151C-C009	0.4	63	36	22	2	-99	-99	-99	3	38	3	38	-99	15	4	8	-2	1.2
151C-C010	4.4	991	45	47	7	-99	-99	-99	4	28	4	28	-99	78	14	25	3	-0.2
151C-C011	1.8	135	48	22	4	-99	-99	-99	3	31	3	31	-99	9	12	3	-2	-0.2
Tl4a	0.3	16	28	15	3	-99	-99	-99	2	39	2	39	-99	12	6	2	-2	-0.2
Tl4b	0.1	-1	29	18	3	-99	-99	-99	2	36	2	36	-99	12	6	-1	-2	-0.2

## Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Numr	Sn	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	1	0.5	0.1	0.1	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1
2013 Detection Limit	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1	0.1
2014 Detection Limit	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1	0.1
2015 Detection Limit	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1	0.1
JC12-068	-1	-0.5	11.1	54.3	2.86	13.2	2.6	0.68	3.5	0.5	3.1	0.5	1.7
JC12-069	-1	-0.5	1.8	10.1	0.43	2.1	0.4	0.16	0.9	0.2	1.1	0.2	0.8
JC12-070	-1	-0.5	1.2	7.3	0.34	1.4	0.3	0.10	0.4	-0.1	0.4	-0.1	0.3
JC12-085	-1	-0.5	1.6	3.3	0.26	1.3	0.2	0.06	0.3	-0.1	0.4	-0.1	0.3
JC12-086	-1	-0.5	5.9	9.4	1.13	5.5	1.4	0.36	1.8	0.2	1.7	0.3	1.1
JC12-087	-1	-0.5	2.4	5.2	0.68	2.5	0.7	0.28	0.8	0.1	0.8	0.3	0.6
JC12-088	-1	-0.5	1.2	2.7	0.39	1.1	0.4	0.20	0.4	-0.1	0.4	0.2	0.4
JC12-091	-1	-0.5	7.1	8.6	1.23	4.5	0.9	0.37	1.2	0.2	1.1	0.3	0.8
JC12-098	2	-0.5	1.3	2.7	0.28	1.0	0.3	0.06	0.3	-0.1	0.3	-0.1	0.3
131C_C95	-1	-0.5	2.4	8.9	0.5	1.9	0.4	0.15	0.5	-0.1	0.5	0.1	0.4
131C_C96	-1	-0.5	6.0	33.2	1.1	3.7	0.6	0.19	0.6	0.1	0.8	0.2	0.6
131C_C97	1	-0.5	4.0	22.6	0.6	2.5	0.5	0.20	1.1	0.2	1.4	0.4	1.2
131C_C98	-1	-0.5	5.8	30.5	1.2	4.0	0.9	0.21	0.8	0.1	0.8	0.2	0.6
131C027A01	1	-0.5	12.1	18.4	2.6	11.0	2.0	0.39	2.1	0.3	2.1	0.4	1.2
131C028A01	1	-0.5	3.2	1.6	0.4	1.6	0.4	0.10	0.4	-0.1	0.6	0.1	0.4
131C029A01	2	-0.5	1.2	3.2	0.3	1.4	0.2	0.10	0.5	-0.1	0.5	-0.1	0.4
131C030A01	2	-0.5	2.2	9.9	0.7	2.5	0.5	0.22	0.6	0.1	0.7	0.2	0.5
131C031A01	-1	-0.5	9.9	17.7	1.7	6.9	1.2	0.37	1.4	0.2	1.3	0.3	1.0
131C032A01	1	-0.5	3.7	4.8	0.5	2.0	0.5	0.19	0.8	0.1	0.9	0.2	0.6
131C033A01	-1	-0.5	5.6	16.6	0.8	3.3	0.6	0.16	0.8	0.1	0.9	0.2	0.6
131C034A01	1	-0.5	0.8	1.6	0.2	0.5	0.1	-0.05	0.2	-0.1	0.2	-0.1	0.1
131C048A01	-1	-0.5	2.0	6.2	0.4	1.7	0.3	0.12	0.4	-0.1	0.6	0.1	0.5
131C049A01	-1	-0.5	4.7	7.2	0.6	2.4	0.6	0.25	0.8	0.1	1.0	0.2	0.7
131C050A01	-1	-0.5	2.0	5.0	0.6	2.2	0.4	0.25	0.8	0.1	0.8	0.2	0.5
131C051A01	-1	-0.5	1.6	7.5	0.2	1.0	0.3	0.07	0.3	-0.1	0.3	-0.1	0.3
131C052A01	-1	-0.5	6.7	29.2	2.0	8.0	1.5	0.43	1.3	0.2	1.2	0.3	0.9
131C052B01	-1	-0.5	1.0	3.4	0.2	1.1	0.2	0.08	0.2	-0.1	0.2	-0.1	0.2
131C056A01	1	-0.5	6.8	12.4	1.7	8.2	1.8	0.45	1.8	0.3	1.8	0.3	0.9
131C057A01	-1	-0.5	2.3	30.8	0.8	3.0	0.8	0.20	0.8	0.1	0.6	0.1	0.4
131C061A01	-1	-0.5	43.7	78.7	8.3	30.6	5.0	1.25	4.3	0.4	2.7	0.5	1.3
131C064A01	-1	-0.5	5.2	14.0	1.2	4.5	0.9	0.25	1.2	0.2	1.3	0.3	0.9
131C066A01	2	2.0	31.5	46.3	7.4	27.5	5.5	1.03	4.7	0.8	4.3	0.8	2.5
131C067A01	-1	-0.5	1.9	3.8	0.3	1.6	0.6	0.23	1.3	0.2	1.9	0.5	1.6
131C068A01	-1	-0.5	1.1	1.2	-0.1	0.6	-0.1	-0.05	-0.1	-0.1	-0.1	-0.1	-0.1
131C069A02	-1	-0.5	2.5	2.0	0.2	0.6	0.1	-0.05	0.1	-0.1	0.1	-0.1	0.1
131C070A01	-1	-0.5	1.9	13.8	0.7	3.0	0.8	0.24	0.9	0.1	1.1	0.2	0.8
131C071A01	-1	-0.5	1.5	3.0	0.2	0.7	0.1	-0.05	0.2	-0.1	0.1	-0.1	0.1
131C072A01	-1	-0.5	5.4	15.1	1.3	4.5	1.1	0.36	1.3	0.2	1.1	0.3	0.7
131C080A01	-1	-0.5	2.6	10.3	1.0	3.5	0.9	0.24	0.8	0.1	1.0	0.2	0.6
131C088A01	-1	-0.5	13.1	5.8	3.1	16.1	3.4	1.07	4.8	0.7	4.6	1.1	3.1
131C089A01	-1	-0.5	2.7	7.5	0.4	2.1	0.4	0.16	0.6	-0.1	0.6	0.1	0.5
131C095A01	-1	-0.5	-0.5	1.0	-0.1	0.3	-0.1	-0.05	0.1	-0.1	0.2	-0.1	0.2
131C096A01	-1	-0.5	2.4	4.7	0.5	2.3	0.6	0.15	0.6	0.1	0.7	0.1	0.5
131C097A01	-1	-0.5	4.1	4.7	0.6	2.6	0.5	0.16	0.6	-0.1	0.6	0.1	0.4
131C097A02	-1	-0.5	5.8	10.6	1.1	4.7	1.2	0.34	1.9	0.3	1.9	0.4	1.2
131C098A01	-1	-0.5	3.0	4.3	0.5	2.3	0.4	0.11	0.5	-0.1	0.5	0.1	0.3

**Appendix B - Major-element ICP-OES-FUS Data for Samples**

Sample_Num	Unit	Method	Sn		Cs		La		Ce		Pr		Nd		Sm		Eu		Gd		Tb		Dy		Ho		Er	
			ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS
2012 Detection Limit			1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2013 Detection Limit			1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2014 Detection Limit			1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2015 Detection Limit			1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13JC098B01			-1	0.5	2.3	3.1	0.4	0.4	1.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
13JC098C01			-1	-0.5	1.0	2.3	0.2	0.2	0.8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
13JC099A01			6	1.3	133.8	271.4	31.4	31.4	116.2	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7
14JC018A01			-1	-0.5	37.0	61.2	7.3	7.3	26.1	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
14JC031A01			1	-0.5	51.1	86.6	10.9	10.9	41.2	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
14JC033A01			-1	0.5	3.2	4.7	0.4	0.4	1.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
14JC033B01			-1	-0.5	3.7	5.0	0.5	0.5	2.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
14JC034A01			-1	-0.5	1.6	2.5	0.2	0.2	0.9	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
14JC035A01			1	0.5	31.9	61.4	7.4	7.4	28.2	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
14JC036A01			2	0.7	60.8	110.0	14.9	14.9	56.5	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
14JC037A01			-1	-0.5	4.9	8.7	0.9	0.9	3.9	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
14JC038A01			-1	-0.5	2.1	2.4	0.3	0.3	1.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
14JC039A01			-1	-0.5	1.0	1.4	0.1	0.1	0.6	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
14JC040A01			3	5.5	36.7	70.4	8.4	8.4	31.2	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
14JC041A01			6	0.7	31.4	64.8	7.3	7.3	28.2	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
14JC042A01			-1	1.9	13.1	24.5	2.2	2.2	8.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
14JC042B01			-1	0.6	6.4	14.6	1.3	1.3	4.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
14JC043A01			-1	-0.5	1.3	1.3	-0.1	-0.1	0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
14JC044A01			-1	0.6	2.3	5.0	0.4	0.4	1.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
14JC045A01			-1	1.0	4.3	4.9	0.6	0.6	2.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
14JC046A01			3	2.0	63.0	110.7	14.7	14.7	53.5	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
14JC046B01			-1	-0.5	6.4	13.3	1.1	1.1	4.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
14JC047A01			-1	1.2	5.2	8.3	0.8	0.8	3.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
15JC002B01			-1	-0.5	-0.5	4.2	0.2	0.2	0.9	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
15JC003A01			-1	-0.5	2.4	2.7	0.2	0.2	1.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
15JC003A02			-1	-0.5	-0.5	2.7	-0.1	-0.1	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
15JC003B01			-1	-0.5	0.7	2.1	0.2	0.2	0.8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
15JC-C008			-1	-0.5	2.0	5.0	0.5	0.5	2.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
15JC-C009			1	-0.5	13.9	24.7	3.2	3.2	12.7	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
15JC-C010			-1	-0.5	19.7	31.0	4.3	4.3	17.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
15JC-C011			-1	-0.5	1.0	3.7	0.3	0.3	1.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tl4a			-1	-0.5	25.7	28.0	3.8	3.8	13.9	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	
Tl4b			-1	-0.5	6.7	18.7	1.3	1.3	5.1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	

### Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Remarks
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	
2012 Detection Limit	0.05	0.1	0.04	0.2	0.1	1	0.1	0.4	0.1	0.05	
2013 Detection Limit	0.05	0.1	0.05	0.2	0.5		0.1	0.4	0.1	0.05	
2014 Detection Limit	0.05	0.1	0.05	0.2	0.5	1	0.1	0.5	0.1	0.05	
2015 Detection Limit	0.05	0.1	0.05	0.2	0.5		0.1	0.5	0.1	0.1	
JC12-068	0.18	1.2	0.13	-0.2	-0.5	2	-0.1	-0.4	0.4	0.35	
JC12-069	0.08	0.7	-0.05	-0.2	-0.5	2	-0.1	-0.4	-0.1	0.15	
JC12-070	-0.05	0.3	-0.05	0.9	-0.5	3	-0.1	-0.4	0.1	0.66	REFUSED AND REANALYZED
JC12-085	-0.05	0.2	-0.05	0.2	-0.5	-1	-0.1	-0.4	-0.1	-0.05	
JC12-086	0.09	0.7	-0.05	0.3	-0.5	2	-0.1	-0.4	-0.1	-0.05	
JC12-087	0.18	0.6	0.16	-0.2	0.6	7	0.1	-0.4	0.2	0.14	
JC12-088	0.12	0.3	0.14	-0.2	-0.5	4	-0.1	-0.4	0.2	0.18	
JC12-091	0.10	0.6	0.10	-0.2	-0.5	3	-0.1	-0.4	0.2	0.07	
JC12-098	-0.05	0.2	-0.05	0.2	-0.5	-1	-0.1	-0.4	0.1	0.05	
13FC_C95	0.06	0.3	-0.05	0.3	-0.5	-99	-0.1	1.1	0.4	0.67	
13FC_C96	0.09	0.4	0.07	0.4	-0.5	-99	-0.1	0.9	0.2	0.46	
13FC_C97	0.14	0.9	0.12	1.3	0.7	-99	-0.1	0.4	1.5	0.52	
13FC_C98	0.07	0.5	0.07	0.4	-0.5	-99	-0.1	0.7	0.7	0.63	
13FC027A01	0.17	1.0	0.12	0.3	0.8	-99	-0.1	-0.4	0.2	0.49	
13FC028A01	0.05	0.3	-0.05	-0.2	0.9	-99	-0.1	-0.4	0.1	0.06	
13FC029A01	0.06	0.2	-0.05	0.3	1.6	-99	-0.1	0.5	0.2	0.09	
13FC030A01	0.11	0.5	0.10	0.3	1.1	-99	-0.1	1.0	0.1	0.32	
13FC031A01	0.14	0.7	0.12	0.3	-0.5	-99	-0.1	0.6	0.3	0.27	
13FC032A01	0.08	0.5	0.08	0.2	1.6	-99	-0.1	0.6	0.1	0.06	
13FC033A01	0.08	0.5	0.13	-0.2	4.4	-99	-0.1	-0.4	-0.1	0.13	
13FC034A01	-0.05	0.1	-0.05	-0.2	3.2	-99	-0.1	1.0	-0.1	0.05	
13FC048A01	0.06	0.4	0.05	-0.2	1.8	-99	-0.1	0.7	0.1	0.17	
13FC049A01	0.10	0.6	0.09	-0.2	1.7	-99	-0.1	0.5	-0.1	0.19	
13FC050A01	0.09	0.4	0.07	0.2	1.3	-99	-0.1	1.1	-0.1	0.09	
13FC051A01	-0.05	0.3	-0.05	-0.2	1.7	-99	-0.1	0.5	0.1	0.81	
13FC052A01	0.12	0.8	0.12	0.6	-0.5	-99	-0.1	0.9	0.3	0.54	
13FC052B01	-0.05	0.2	-0.05	0.3	2.9	-99	-0.1	1.4	-0.1	0.08	
13FC056A01	0.13	0.8	0.10	-0.2	-0.5	-99	-0.1	-0.4	0.1	0.63	
13FC057A01	-0.05	0.4	-0.05	0.3	-0.5	-99	-0.1	1.0	0.1	0.22	
13FC061A01	0.22	1.3	0.21	1.6	0.9	-99	-0.1	1.2	1.8	2.10	
13FC064A01	0.16	0.8	0.14	1.1	0.8	-99	-0.1	1.7	1.2	0.66	
13FC066A01	0.37	2.5	0.37	4.4	1.2	-99	-0.1	2.2	13.7	5.85	
13FC067A01	0.21	1.1	0.15	-0.2	-0.5	-99	-0.1	1.0	0.1	0.34	
13FC068A01	-0.05	-0.1	-0.05	-0.2	1.3	-99	-0.1	0.7	-0.1	-0.05	
13FC069A02	-0.05	0.1	-0.05	0.4	8.3	-99	-0.1	-0.4	-0.1	0.06	
13FC070A01	0.10	0.6	0.09	0.4	-0.5	-99	-0.1	1.7	0.2	1.03	
13FC071A01	-0.05	0.2	-0.05	-0.2	5.2	-99	-0.1	1.2	-0.1	0.10	
13FC072A01	0.17	0.5	0.15	0.3	1.1	-99	0.1	1.5	0.3	0.81	
13FC080A01	0.07	0.5	0.08	1.6	-0.5	-99	-0.1	2.3	3.0	1.10	
13FC088A01	0.36	2.0	0.31	-0.2	3.2	-99	-0.1	-0.4	-0.1	0.07	
13FC089A01	0.06	0.3	-0.05	0.3	1.1	-99	-0.1	1.3	-0.1	0.05	
13FC095A01	-0.05	0.2	-0.05	-0.2	1.3	-99	-0.1	1.2	-0.1	-0.05	
13FC096A01	0.06	0.3	-0.05	-0.2	2.5	-99	-0.1	0.9	-0.1	-0.05	
13FC097A01	0.05	0.3	-0.05	0.4	-0.5	-99	-0.1	1.1	0.1	0.05	
13FC097A02	0.16	0.9	0.11	-0.2	0.8	-99	-0.1	0.6	0.2	0.23	
13FC098A01	-0.05	0.3	-0.05	-0.2	4.1	-99	-0.1	1.1	0.1	-0.05	

## Appendix B - Major-element ICP-OES-FUS Data for Samples

Sample_Num	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U	Remarks
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	
2012 Detection Limit	0.05	0.1	0.04	0.2	0.1	1	0.1	0.4	0.1	0.05	
2013 Detection Limit	0.05	0.1	0.05	0.2	0.5		0.1	0.4	0.1	0.05	
2014 Detection Limit	0.05	0.1	0.05	0.2	0.5	1	0.1	0.5	0.1	0.05	
2015 Detection Limit	0.05	0.1	0.05	0.2	0.5		0.1	0.5	0.1	0.1	
13JC098B01	-0.05	0.1	-0.05	0.4	-0.5	-99	0.2	0.5	0.1	-0.05	
13JC098C01	-0.05	0.2	-0.05	-0.2	1.7	-99	-0.1	0.7	-0.1	-0.05	
13JC099A01	1.13	7.8	1.09	17.5	12.0	-99	-0.1	1.3	17.2	5.39	
14JC018A01	0.29	1.9	0.23	2.7	4.0	-99	-0.1	0.9	5.4	1.15	
14JC031A01	0.39	2.6	0.43	6.1	4.9	-99	-0.1	-0.4	7.0	11.20	
14JC033A01	-0.05	0.1	-0.05	-0.2	0.5	-99	-0.1	-0.4	-0.1	0.09	
14JC033B01	0.07	0.6	-0.05	-0.2	1.2	-99	-0.1	-0.4	-0.1	-0.05	
14JC034A01	0.06	0.5	-0.05	-0.2	2.2	-99	-0.1	-0.4	-0.1	0.20	
14JC035A01	0.41	2.6	0.44	3.3	2.5	-99	-0.1	-0.4	4.6	5.59	
14JC036A01	0.40	2.4	0.32	4.7	4.2	-99	-0.1	-0.4	7.9	12.24	
14JC037A01	0.07	0.4	-0.05	-0.2	2.2	-99	-0.1	-0.4	0.1	0.08	
14JC038A01	0.08	0.4	0.06	-0.2	2.0	-99	-0.1	-0.4	-0.1	0.05	
14JC039A01	-0.05	-0.1	-0.05	-0.2	8.5	-99	-0.1	-0.4	-0.1	0.11	
14JC040A01	0.37	2.4	0.32	3.8	1.5	-99	-0.1	-0.4	12.4	8.40	
14JC041A01	0.31	2.3	0.34	5.8	6.3	-99	-0.1	-0.4	4.4	4.58	
14JC042A01	0.14	0.8	0.06	1.9	1.7	-99	-0.1	-0.4	1.7	0.26	
14JC042B01	0.06	0.5	-0.05	1.3	3.8	-99	-0.1	-0.4	1.1	0.12	
14JC043A01	-0.05	-0.1	-0.05	0.2	7.6	-99	-0.1	-0.4	0.2	-0.05	
14JC044A01	-0.05	0.2	-0.05	0.2	1.3	-99	-0.1	-0.4	0.1	-0.05	
14JC045A01	-0.05	0.1	-0.05	0.2	-0.5	-99	-0.1	-0.4	0.1	-0.05	
14JC046A01	0.61	4.0	0.55	7.0	5.9	-99	-0.1	-0.4	10.9	9.33	
14JC046B01	-0.05	-0.1	-0.05	0.9	5.0	-99	-0.1	-0.4	1.8	0.32	
14JC047A01	0.06	0.5	-0.05	0.4	0.8	-99	-0.1	-0.4	0.4	0.09	
15JC002B01	-0.05	0.3	-0.05	-0.2	1.3	2	-0.5	-0.5	-0.1	0.1	
15JC003A01	0.10	0.6	0.09	0.5	1.9	2	-0.5	-0.5	1.0	0.2	
15JC003A02	-0.05	0.2	-0.05	-0.2	1.1	1	-0.5	-0.5	0.5	0.2	
15JC003B01	0.05	0.4	0.06	-0.2	1.5	-1	-0.5	-0.5	0.3	0.8	
15JC-C008	-0.05	0.3	-0.05	-0.2	-0.5	1	-0.5	-0.5	0.3	0.4	
15JC-C009	0.08	0.5	0.07	0.3	-0.5	-1	-0.5	-0.5	0.9	1.1	
15JC-C010	0.22	1.5	0.23	1.8	-0.5	-1	-0.5	-0.5	3.6	2.6	
15JC-C011	0.15	0.9	0.14	-0.2	-0.5	-1	-0.5	-0.5	0.3	1.6	
T14a	0.08	0.5	0.07	-0.2	1.0	4	-0.5	-0.5	0.2	0.6	
T14b	0.09	0.5	0.06	-0.2	0.9	4	-0.5	-0.5	-0.1	1.0	

### Appendix C - Trace-element ICP-OES Data for Samples

Sample_Num	Lab_Num	Showing	Project	Year/Analyze	As ppm	Be ppm	Cu ppm	Li ppm	Mn ppm	Ni ppm	Pb ppm	Rb ppm	Sc ppm	Ti ppm	Zn ppm	V ppm	Co ppm
Unit					ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES
2012	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1	1	1
2013	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1	1	1
2014	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1	1	1
2015	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1	1	1
JC12-068	10440693	James Mine	DSO	2012	-99	1.3	27	0.7	59938	29	11	12	0.4	15	36	-99	-99
JC12-069	10440694	James Mine	DSO	2012	-99	1.5	4	0.7	634	35	-1	1	-0.1	2	29	-99	-99
JC12-070	10440695	James South Mine	DSO	2012	-99	0.6	2	-0.1	170	68	-1	1	-0.1	-1	44	-99	-99
JC12-085	10440703	LabMag	Taconite	2012	-99	1.4	3	2.2	2685	27	-1	5	-0.1	10	22	-99	-99
JC12-086	10440704	Howells Lake	Taconite	2012	-99	2.1	4	1.4	4547	30	1	2	-0.1	108	30	-99	-99
JC12-087	10440705	Perault Lake	Taconite	2012	-99	1.3	5	1.4	2212	25	-1	1	-0.1	48	20	-99	-99
JC12-088	10440706	LabMag	Taconite	2012	-99	0.7	3	2.3	3238	29	-1	1	-0.1	12	24	-99	-99
JC12-091	10440707	LabMag	Taconite	2012	-99	1.6	4	1.1	5452	38	-1	2	-0.1	28	34	-99	-99
JC12-098	10440709	Timmins 4	DSO	2012	-99	2.2	4	0.3	387	32	-1	1	-0.1	19	29	-99	-99
13JC_C95	10440905	Goodwood	DSO	2013	-99	0.8	6	0.4	651	41	16	3	-0.1	112	38	-99	-99
13JC_C96	10440906	Goodwood	DSO	2013	-99	1.2	6	0.8	1409	40	10	3	-0.1	111	35	-99	-99
13JC_C97	10440907	Kivivic 4	DSO	2013	-99	0.8	7	1.6	2271	44	4	-1	1.7	221	36	-99	-99
13JC_C98	10440908	Goodwood	DSO	2013	-99	0.6	14	1.2	2083	40	3	3	0.9	157	39	-99	-99
13JC027A01	10440844	Burnt Creek 3	Taconite	2013	-99	1.3	16	1.1	403	26	2	-1	0.1	72	31	-99	-99
13JC028A01	10440845	Burnt Creek 3	Taconite	2013	-99	1.0	5	2.8	329	28	3	1	-0.1	10	18	-99	-99
13JC029A01	10440846	Burnt Creek 3	Taconite	2013	-99	1.2	4	1.2	277	33	3	-1	-0.1	-1	23	-99	-99
13JC030A01	10440847	Burnt Creek 3	Taconite	2013	-99	0.9	4	0.8	673	32	4	6	-0.1	-1	52	-99	-99
13JC031A01	10440848	Burnt Creek 3	Taconite	2013	-99	1.2	13	0.9	6383	39	5	-1	-0.1	62	46	-99	-99
13JC032A01	10440849	Burnt Creek 3	Taconite	2013	-99	1.6	8	3.0	303	35	5	2	-0.1	14	26	-99	-99
13JC033A01	10440851	Burnt Creek 3	Taconite	2013	-99	1.3	5	1.3	295	26	4	-1	-0.1	-1	19	-99	-99
13JC034A01	10440852	Burnt Creek 3	Taconite	2013	-99	0.5	6	2.7	200	25	2	-1	-0.1	-1	16	-99	-99
13JC048A01	10440854	Ruth 8	Taconite	2013	-99	1.0	6	0.8	232	32	3	-1	-0.1	-1	21	-99	-99
13JC049A01	10440855	Ruth 8	Taconite	2013	-99	1.9	5	1.5	302	34	4	-1	-0.1	-1	23	-99	-99
13JC050A01	10440856	Ruth 8	Taconite	2013	-99	1.7	7	2.2	306	33	4	-1	-0.1	-1	24	-99	-99
13JC051A01	10440857	Ruth 8	Taconite	2013	-99	1.4	6	0.5	368	38	5	1	-0.1	-1	28	-99	-99
13JC052A01	10440858	Ruth 8	Taconite	2013	-99	1.6	14	0.3	420	42	5	2	2.1	592	43	-99	-99
13JC052B01	10440859	Ruth 8	Taconite	2013	-99	1.4	5	1.8	171	17	1	-1	0.6	112	11	-99	-99
13JC056A01	10440862	Denault ?	DSO	2013	-99	1.6	17	0.3	390	47	-1	-1	-0.1	-1	52	-99	-99
13JC057A01	10440863	Denault 1	DSO	2013	-99	0.9	7	0.3	424	40	-1	2	-0.1	-1	58	-99	-99
13JC061A01	10440865	Fleming 7	DSO	2013	-99	1.1	6	0.4	440	43	-1	3	1.5	1021	53	-99	-99
13JC064A01	10440866	Sunny 1	DSO	2013	-99	0.6	4	0.4	450	36	-1	2	-0.1	229	37	-99	-99
13JC066A01	10440867	Kivivic 5	DSO	2013	-99	2.5	38	27.3	163	21	-1	103	14.2	2866	25	-99	-99
13JC067A01	10440868	Kivivic 2	DSO	2013	-99	1.9	4	0.9	652	33	-1	2	-0.1	-1	39	-99	-99
13JC068A01	10440869	Irony Mountain	Taconite	2013	-99	0.4	4	1.3	370	36	-1	2	-0.1	-1	43	-99	-99
13JC069A02	10440871	Irony Mountain	Taconite	2013	-99	0.4	-1	0.3	1045	8	-1	-1	0.3	37	8	-99	-99
13JC070A01	10440872	Ruth 8	DSO	2013	-99	0.9	6	-0.1	379	42	-1	4	-0.1	64	48	-99	-99
13JC071A01	10440873	Ruth 8	DSO	2013	-99	0.9	3	2.2	315	21	-1	-1	-0.1	-1	16	-99	-99
13JC072A01	10440874	Ruth 8	DSO	2013	-99	0.7	5	0.7	1453	35	-1	1	-0.1	-1	38	-99	-99
13JC080A01	10440883	Redmond 1	DSO	2013	-99	0.6	12	0.1	522	40	-1	3	2.0	582	44	-99	-99
13JC088A01	10440894	Ore Zone	Taconite	2013	-99	1.5	6	2.3	455	29	4	-1	-0.1	-1	19	-99	-99
13JC089A01	10440895	Ore Zone	Taconite	2013	-99	2.2	5	1.7	356	31	3	-1	-0.1	9	29	-99	-99
13JC095A01	10440896	Ore Zone	Taconite	2013	-99	1.7	5	2.5	368	31	3	2	-0.1	-1	29	-99	-99
13JC096A01	10440897	Ore Zone	Taconite	2013	-99	0.8	10	4.3	815	23	2	-1	0.1	16	18	-99	-99
13JC097A01	10440898	Ore Zone	Taconite	2013	-99	0.9	5	0.3	10825	32	4	3	-0.1	43	22	-99	-99
13JC097A02	10440899	Ore Zone	Taconite	2013	-99	3.2	9	4.2	1774	38	2	7	-0.1	25	27	-99	-99
13JC098A01	10440901	Ore Zone	Taconite	2013	-99	0.7	4	2.4	5018	20	1	-1	0.3	43	13	-99	-99

### Appendix C - Trace-element ICP-OES Data for Samples

Sample_Num	Lab_Num	Showing	Project	Year/Analyze	As ppm	Be ppm	Cu ppm	Li ppm	Mn ppm	Ni ppm	Pb ppm	Rb ppm	Sc ppm	Ti ppm	Zn ppm	V ppm	Co ppm
Unit	Method				ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES
2012	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1		
2013	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1		
2014	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1		
2015	Detection Limit				0.1	0.1	1	0.1	1	1	1	1	0.1	1	1		
13JC098B01	10440902	Ore Zone	Taconite	2013	-99	1.6	5	0.1	1798	34	1	7	-0.1	29	25	-99	-99
13JC098C01	10440903	Ore Zone	Taconite	2013	-99	1.1	5	8.9	687	32	1	3	-0.1	19	22	-99	-99
13JC099A01	10440904	Ore Zone	Taconite	2013	-99	4.6	19	57.9	11849	37	-1	88	5.0	3860	92	-99	-99
14JC018A01	10441053	Wishart 4	Taconite	2014	10	0.6	6	15.5	3459	27	-1	4	0.7	551	23	-99	-99
14JC031A01	10441069	Elizabeth Lake	Taconite	2014	30	1.8	34	14.4	388	28	5	128	16.5	9644	43	-99	-99
14JC033A01	10441072	Elizabeth Lake	Taconite	2014	7	1.4	6	-0.1	1847	31	-1	8	-0.1	8	32	-99	-99
14JC033B01	10441073	Elizabeth Lake	Taconite	2014	14	1.6	5	-0.1	6320	35	-1	4	-0.1	3	43	-99	-99
14JC034A01	10441074	Elizabeth Lake	Taconite	2014	-2	0.8	6	-0.1	367	33	-1	4	-0.1	2	31	-99	-99
14JC035A01	10441075	Elizabeth Lake	Taconite	2014	35	3.3	18	13.4	3688	39	6	8	8.9	3522	51	-99	-99
14JC036A01	10441076	Elizabeth Lake	Taconite	2014	46	1.3	38	22.4	638	26	9	96	17.7	10096	35	-99	-99
14JC037A01	10441077	Elizabeth Lake	Taconite	2014	15	1.3	5	9.4	1493	35	-1	7	-0.1	24	25	-99	-99
14JC038A01	10441089	Elizabeth Lake	Taconite	2014	24	1.0	6	0.7	304	31	-1	6	-0.1	-1	26	-99	-99
14JC039A01	10441078	Elizabeth Lake	Taconite	2014	15	0.5	7	0.9	135	13	-1	4	0.3	64	15	-99	-99
14JC040A01	10441079	Dolly Ridge	Taconite	2014	13	2.6	132	52.3	468	59	20	157	16.7	2197	177	-99	-99
14JC041A01	10441081	Dolly Ridge	Taconite	2014	12	13.8	15	216.9	737	18	-1	73	8.6	6642	58	-99	-99
14JC042A01	10441082	Dolly Ridge	Taconite	2014	25	2.7	11	27.0	2464	32	-1	85	6.3	2481	51	-99	-99
14JC042B01	10441091	Dolly Ridge	Taconite	2014	35	1.4	38	1.0	1535	25	-1	20	2.2	644	26	-99	-99
14JC043A01	10441092	Dolly Ridge	Taconite	2014	5	1.7	6	1.8	784	13	-1	7	0.7	92	10	-99	-99
14JC044A01	10441083	Dolly Ridge	Taconite	2014	19	1.2	5	1.9	1045	31	-1	13	1.4	314	33	-99	-99
14JC045A01	10441084	Dolly Ridge	Taconite	2014	3	0.3	4	1.1	8289	13	-1	16	1.7	545	13	-99	-99
14JC046A01	10441086	Dolly Ridge	Taconite	2014	43	3.6	34	59.6	6183	29	17	138	11.9	5345	37	-99	-99
14JC046B01	10441085	Dolly Ridge	Taconite	2014	2	0.3	5	12.5	161	8	-1	30	2.6	233	11	-99	-99
14JC047A01	10441087	Dolly Ridge	Taconite	2014	5	0.7	13	-0.1	3647	25	-1	17	1.1	393	25	-99	-99
15JC002B01	10441112	Kivivic 2	DSO	2015	8	0.8	4	0.4	549	-1	-1	4	-0.1	-1	31	4	-1
15JC003A01	10441114	Kivivic 1C	DSO	2015	7	0.7	7	0.3	450	-1	-1	6	0.2	231	40	15	-1
15JC003A02	10441115	Kivivic 1C	DSO	2015	13	0.6	6	0.3	1155	-1	5	8	0.3	173	38	16	-1
15JC003B01	10441116	Kivivic 1C	DSO	2015	12	0.6	8	-0.1	407	-1	-1	4	2.3	65	40	9	-1
15JC-C008	10441104	Howse	DSO	2015	19	1.3	9	0.6	558	-1	-1	6	0.1	12	33	9	-1
15JC-C009	10441105	Howse	DSO	2015	19	1.8	14	0.4	2125	-1	-1	6	0.4	63	36	22	2
15JC-C010	10441106	Howse	DSO	2015	34	1.4	9	0.8	2037	-1	4	9	4.4	991	45	47	7
15JC-C011	10441107	Howse	DSO	2015	34	1.5	14	0.3	1128	-1	-1	6	1.8	135	48	22	4
T14a	10441117	Timmins 4	DSO	2015	23	1.6	6	0.7	962	-1	-1	7	0.3	16	28	15	3
T14b	10441118	Timmins 4	DSO	2015	27	1.6	6	0.4	1434	-1	-1	7	0.1	-1	29	18	3

## Appendix D - Trace-element ICP-MS-FUS Data for Samples

Sample_Num	Lab_Num	Showing	Project	Year	Analyz	V	Co	Ga	Ge	As	Sr	Y	Nb	Mo
Unit						ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
						ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit						5	1	1	1	5	2	1	1	2
2013 Detection Limit						5	1	1	1	5	1	1	1	2
2014 Detection Limit						5	1	1	1	5	1	1	1	2
2015 Detection Limit						5	1	1	1	5	1	1	1	2
JC12-068	I0440693	James Mine	DSO	2012		11	86	3	18	34	39	15	4	-2
JC12-069	I0440694	James Mine	DSO	2012		11	9	-1	19	29	-2	10	1	-2
JC12-070	I0440695	James South Mine	DSO	2012		30	2	2	18	6	3	2	2	8
JC12-085	I0440703	LabMag	Taconite	2012		23	4	1	10	12	10	3	3	-2
JC12-086	I0440704	Howells Lake	Taconite	2012		8	173	-1	13	20	9	14	3	-2
JC12-087	I0440705	Perault Lake	Taconite	2012		7	61	-1	13	8	15	5	3	3
JC12-088	I0440706	LabMag	Taconite	2012		-5	53	-1	12	10	7	3	4	-2
JC12-091	I0440707	LabMag	Taconite	2012		17	6	1	19	10	-2	8	7	2
JC12-098	I0440709	Timmins 4	DSO	2012		-5	2	-1	13	-5	8	3	8	-2
I31C_C95	I0440905	Goodwood	DSO	2013		18	7	1	22	26	4	3	4	-2
I31C_C96	I0440906	Kivivic 5	DSO	2013		18	13	1	25	6	6	6	4	-2
I31C_C97	I0440907	Kivivic 4	DSO	2013		33	6	3	25	12	2	13	13	-2
I31C_C98	I0440908	Goodwood	DSO	2013		24	85	2	21	27	4	5	8	-2
I31C027A01	I0440844	Burnt Creek 3	Taconite	2013		11	50	1	8	12	-1	14	4	-2
I31C028A01	I0440845	Burnt Creek 3	Taconite	2013		15	51	-1	16	25	-1	5	2	-2
I31C029A01	I0440846	Burnt Creek 3	Taconite	2013		15	26	-1	17	14	-1	3	4	-2
I31C030A01	I0440847	Burnt Creek 3	Taconite	2013		12	24	-1	16	30	1	5	3	-2
I31C031A01	I0440848	Burnt Creek 3	Taconite	2013		9	17	-1	11	21	1	13	2	-2
I31C032A01	I0440849	Burnt Creek 3	Taconite	2013		19	26	-1	14	12	-1	7	4	-2
I31C033A01	I0440851	Burnt Creek 3	Taconite	2013		18	55	-1	10	10	2	8	3	2
I31C034A01	I0440852	Burnt Creek 3	Taconite	2013		6	41	-1	13	12	-1	1	3	-2
I31C048A01	I0440854	Ruth 8	Taconite	2013		24	47	-1	16	20	1	5	2	-2
I31C049A01	I0440855	Ruth 8	Taconite	2013		16	27	-1	16	14	-1	7	2	2
I31C050A01	I0440856	Ruth 8	Taconite	2013		8	21	-1	15	17	-1	6	4	-2
I31C051A01	I0440857	Ruth 8	Taconite	2013		22	43	-1	13	27	-1	2	4	-2
I31C052A01	I0440858	Ruth 8	Taconite	2013		27	15	3	18	78	-1	7	5	-2
I31C052B01	I0440859	Ruth 8	Taconite	2013		9	47	-1	6	14	-1	2	4	-2
I31C056A01	I0440862	Denault ?	DSO	2013		21	14	-1	13	11	-1	13	2	2
I31C057A01	I0440863	Denault 1	DSO	2013		8	21	-1	23	36	-1	4	3	-2
I31C061A01	I0440865	Fleming 7	DSO	2013		140	21	6	21	61	183	14	18	3
I31C064A01	I0440866	Sunny 1	DSO	2013		43	100	1	23	19	8	11	9	-2
I31C066A01	I0440867	Kivivic 5	DSO	2013		217	104	21	4	9	18	23	17	3
I31C067A01	I0440868	Kivivic 2	DSO	2013		33	14	1	20	48	3	18	3	2
I31C068A01	I0440869	Irony Mountain	Taconite	2013		7	18	-1	25	6	-1	-1	2	-2
I31C069A02	I0440871	Irony Mountain	Taconite	2013		15	81	-1	3	-5	2	-1	5	2
I31C070A01	I0440872	Ruth 8	DSO	2013		34	5	-1	22	36	2	8	5	9
I31C071A01	I0440873	Ruth 8	DSO	2013		13	62	-1	12	13	1	1	3	3
I31C072A01	I0440874	Ruth 8	DSO	2013		23	28	-1	19	32	2	8	4	-2
I31C080A01	I0440883	Redmond 1	DSO	2013		32	9	5	23	55	1	5	9	3
I31C088A01	I0440894	Ore Zone	Taconite	2013		20	28	-1	12	32	4	41	2	-2
I31C089A01	I0440895	Ore Zone	Taconite	2013		10	21	-1	17	30	-1	5	3	-2
I31C095A01	I0440896	Ore Zone	Taconite	2013		8	19	-1	20	16	-1	-1	1	-2
I31C096A01	I0440897	Ore Zone	Taconite	2013		12	34	-1	10	22	3	5	4	-2
I31C097A01	I0440898	Ore Zone	Taconite	2013		19	16	-1	17	19	4	5	3	-2
I31C097A02	I0440899	Ore Zone	Taconite	2013		24	16	-1	17	36	4	11	5	-2
I31C098A01	I0440901	Ore Zone	Taconite	2013		8	57	-1	8	11	5	5	3	-2



### Appendix D - Trace-element ICP-MS-FUS Data for Samples

Sample_Num	Lab_Num	Showing	Project	Year	Analyz	V	Co	Ga	Ge	As	Sr	Y	Nb	Mo
Unit						ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
						ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit						5	1	1	1	5	2	1	1	2
2013 Detection Limit						5	1	1	1	5	1	1	1	2
2014 Detection Limit						5	1	1	1	5	1	1	1	2
2015 Detection Limit						5	1	1	1	5	1	1	1	2
131C098B01	10440902	Ore Zone	Taconite	2013		10	8	-1	15	-5	-1	2	3	3
131C098C01	10440903	Ore Zone	Taconite	2013		13	29	-1	17	9	2	2	3	-2
131C099A01	10440904	Ore Zone	Taconite	2013		186	24	36	18	22	14	75	178	10
141C018A01	10441053	Wishart 4	Taconite	2014		81	-99	6	8	-99	3	21	45	3
141C031A01	10441069	Elizabeth Lake	Taconite	2014		290	-99	21	9	-99	22	27	51	9
141C033A01	10441072	Elizabeth Lake	Taconite	2014		12	-99	-1	13	-99	2	3	1	-2
141C033B01	10441073	Elizabeth Lake	Taconite	2014		19	-99	14	12	-99	1	7	1	-2
141C034A01	10441074	Elizabeth Lake	Taconite	2014		20	-99	-1	4	-99	-1	5	5	-2
141C035A01	10441075	Elizabeth Lake	Taconite	2014		295	-99	14	12	-99	6	28	33	5
141C036A01	10441076	Elizabeth Lake	Taconite	2014		271	-99	27	10	-99	31	24	42	10
141C037A01	10441077	Elizabeth Lake	Taconite	2014		16	-99	1	7	-99	2	4	4	-2
141C038A01	10441089	Elizabeth Lake	Taconite	2014		13	-99	-1	12	-99	1	5	1	-2
141C039A01	10441078	Elizabeth Lake	Taconite	2014		10	-99	-1	2	-99	-1	1	4	-2
141C040A01	10441079	Dolly Ridge	Taconite	2014		880	-99	19	6	-99	39	25	11	3
141C042A01	10441082	Dolly Ridge	Taconite	2014		756	-99	24	12	-99	14	19	64	-2
141C042B01	10441091	Dolly Ridge	Taconite	2014		60	-99	9	9	-99	17	8	17	-2
141C043A01	10441092	Dolly Ridge	Taconite	2014		19	-99	4	7	-99	9	4	9	-2
141C044A01	10441083	Dolly Ridge	Taconite	2014		6	-99	-1	5	-99	5	1	3	-2
141C045A01	10441084	Dolly Ridge	Taconite	2014		24	-99	-1	12	-99	3	2	3	-2
141C046A01	10441086	Dolly Ridge	Taconite	2014		21	-99	1	5	-99	154	3	1	-2
141C046B01	10441085	Dolly Ridge	Taconite	2014		399	-99	23	10	-99	20	35	55	8
141C047A01	10441087	Dolly Ridge	Taconite	2014		11	-99	5	4	-99	15	1	2	-2
151C002B01	10441112	Kivivic 2	DSO	2015		33	-99	2	8	-99	15	6	2	-2
151C003A01	10441114	Kivivic 1C	DSO	2015		-99	-99	1	37	-99	5	4	2	-2
151C003A02	10441115	Kivivic 1C	DSO	2015		-99	-99	2	41	-99	-1	9	7	-2
151C003B01	10441116	Kivivic 1C	DSO	2015		-99	-99	2	34	-99	2	3	4	-2
151C-C008	10441104	Howse	DSO	2015		-99	-99	2	35	-99	6	3	3	-2
151C-C009	10441105	Howse	DSO	2015		-99	-99	3	38	-99	15	4	5	-2
151C-C010	10441106	Howse	DSO	2015		-99	-99	4	28	-99	78	14	25	3
151C-C011	10441107	Howse	DSO	2015		-99	-99	3	31	-99	9	12	3	-2
Tl4a	10441117	Timmins 4	DSO	2015		-99	-99	2	39	-99	12	6	2	-2
Tl4b	10441118	Timmins 4	DSO	2015		-99	-99	2	36	-99	12	6	-1	-2

### Appendix D - Trace-element ICP-MS-FUS Data for Samples

Sample_Numr	Cd	Sn	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	0.2	1	0.5	0.1	0.1	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1
2013 Detection Limit	0.2	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1
2014 Detection Limit	0.2	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1
2015 Detection Limit	0.2	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1
JC12-068	-99	-1	-0.5	11.1	54.3	2.86	13.2	2.6	0.68	3.5	0.5	3.1	0.5
JC12-069	-99	-1	-0.5	1.8	10.1	0.43	2.1	0.4	0.16	0.9	0.2	1.1	0.2
JC12-070	-99	-1	-0.5	1.2	7.3	0.34	1.4	0.3	0.10	0.4	-0.1	0.4	-0.1
JC12-085	-99	-1	-0.5	1.6	3.3	0.26	1.3	0.2	0.06	0.3	-0.1	0.4	-0.1
JC12-086	-99	-1	-0.5	5.9	9.4	1.13	5.5	1.4	0.36	1.8	0.2	1.7	0.3
JC12-087	-99	-1	-0.5	2.4	5.2	0.68	2.5	0.7	0.28	0.8	0.1	0.8	0.3
JC12-088	-99	-1	-0.5	1.2	2.7	0.39	1.1	0.4	0.20	0.4	-0.1	0.4	0.2
JC12-091	-99	-1	-0.5	7.1	8.6	1.23	4.5	0.9	0.37	1.2	0.2	1.1	0.3
JC12-098	-99	2	-0.5	1.3	2.7	0.28	1.0	0.3	0.06	0.3	-0.1	0.3	-0.1
13FC_C95	0.7	-1	-0.5	2.4	8.9	0.5	1.9	0.4	0.15	0.5	-0.1	0.5	0.1
13FC_C96	0.6	-1	-0.5	6.0	33.2	1.1	3.7	0.6	0.19	0.6	0.1	0.8	0.2
13FC_C97	-0.2	1	-0.5	4.0	22.6	0.6	2.5	0.5	0.20	1.1	0.2	1.4	0.4
13FC_C98	0.3	-1	-0.5	5.8	30.5	1.2	4.0	0.9	0.21	0.8	0.1	0.8	0.2
13FC027A01	-0.2	1	-0.5	12.1	18.4	2.6	11.0	2.0	0.39	2.1	0.3	2.1	0.4
13FC028A01	-0.2	1	-0.5	3.2	1.6	0.4	1.6	0.4	0.10	0.4	-0.1	0.6	0.1
13FC029A01	-0.2	2	-0.5	1.2	3.2	0.3	1.4	0.2	0.10	0.5	-0.1	0.5	-0.1
13FC030A01	0.4	2	-0.5	2.2	9.9	0.7	2.5	0.5	0.22	0.6	0.1	0.7	0.2
13FC031A01	0.3	-1	-0.5	9.9	17.7	1.7	6.9	1.2	0.37	1.4	0.2	1.3	0.3
13FC032A01	-0.2	1	-0.5	3.7	4.8	0.5	2.0	0.5	0.19	0.8	0.1	0.9	0.2
13FC033A01	-0.2	-1	-0.5	5.6	16.6	0.8	3.3	0.6	0.16	0.8	0.1	0.9	0.2
13FC034A01	0.3	1	-0.5	0.8	1.6	0.2	0.5	0.1	-0.05	0.2	-0.1	0.2	-0.1
13FC048A01	0.2	-1	-0.5	2.0	6.2	0.4	1.7	0.3	0.12	0.4	-0.1	0.6	0.1
13FC049A01	-0.2	-1	-0.5	4.7	7.2	0.6	2.4	0.6	0.25	0.8	0.1	1.0	0.2
13FC050A01	0.4	-1	-0.5	2.0	5.0	0.6	2.2	0.4	0.25	0.8	0.1	0.8	0.2
13FC051A01	-0.2	-1	-0.5	1.6	7.5	0.2	1.0	0.3	0.07	0.3	-0.1	0.3	-0.1
13FC052A01	0.3	-1	-0.5	6.7	29.2	2.0	8.0	1.5	0.43	1.3	0.2	1.2	0.3
13FC052B01	-0.2	-1	-0.5	1.0	3.4	0.2	1.1	0.2	0.08	0.2	-0.1	0.2	-0.1
13FC056A01	-0.2	1	-0.5	6.8	12.4	1.7	8.2	1.8	0.45	1.8	0.3	1.8	0.3
13FC057A01	0.3	-1	-0.5	2.3	30.8	0.8	3.0	0.8	0.20	0.8	0.1	0.6	0.1
13FC061A01	0.5	-1	-0.5	43.7	78.7	8.3	30.6	5.0	1.25	4.3	0.4	2.7	0.5
13FC064A01	0.7	-1	-0.5	5.2	14.0	1.2	4.5	0.9	0.25	1.2	0.2	1.3	0.3
13FC066A01	0.4	2	2.0	31.5	46.3	7.4	27.5	5.5	1.03	4.7	0.8	4.3	0.8
13FC067A01	0.4	-1	-0.5	1.9	3.8	0.3	1.6	0.6	0.23	1.3	0.2	1.9	0.5
13FC068A01	0.3	-1	-0.5	1.1	1.2	-0.1	0.6	-0.1	-0.05	-0.1	-0.1	-0.1	-0.1
13FC069A02	-0.2	-1	-0.5	2.5	2.0	0.2	0.6	0.1	-0.05	0.1	-0.1	0.1	-0.1
13FC070A01	0.6	-1	-0.5	1.9	13.8	0.7	3.0	0.8	0.24	0.9	0.1	1.1	0.2
13FC071A01	-0.2	-1	-0.5	1.5	3.0	0.2	0.7	0.1	-0.05	0.2	-0.1	0.1	-0.1
13FC072A01	0.8	-1	-0.5	5.4	15.1	1.3	4.5	1.1	0.36	1.3	0.2	1.1	0.3
13FC080A01	0.6	-1	-0.5	2.6	10.3	1.0	3.5	0.9	0.24	0.8	0.1	1.0	0.2
13FC088A01	-0.2	-1	-0.5	13.1	5.8	3.1	16.1	3.4	1.07	4.8	0.7	4.6	1.1
13FC089A01	0.3	-1	-0.5	2.7	7.5	0.4	2.1	0.4	0.16	0.6	-0.1	0.6	0.1
13FC095A01	0.4	-1	-0.5	-0.5	1.0	-0.1	0.3	-0.1	-0.05	0.1	-0.1	0.2	-0.1
13FC096A01	0.3	-1	-0.5	2.4	4.7	0.5	2.3	0.6	0.15	0.6	0.1	0.7	0.1
13FC097A01	0.3	-1	-0.5	4.1	4.7	0.6	2.6	0.5	0.16	0.6	-0.1	0.6	0.1
13FC097A02	0.2	-1	-0.5	5.8	10.6	1.1	4.7	1.2	0.34	1.9	0.3	1.9	0.4
13FC098A01	0.4	-1	-0.5	3.0	4.3	0.5	2.3	0.4	0.11	0.5	-0.1	0.5	0.1

### Appendix D - Trace-element ICP-MS-FUS Data for Samples

Sample_Num	Cd	Sn	Cs	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	0.2	1	0.5	0.1	0.1	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1
2013 Detection Limit	0.2	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1
2014 Detection Limit	0.2	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1
2015 Detection Limit	0.2	1	0.5	0.5	0.5	0.1	0.2	0.1	0.05	0.1	0.1	0.1	0.1
13JC098B01	-0.2	-1	0.5	2.3	3.1	0.4	1.4	0.2	0.05	0.2	-0.1	0.2	-0.1
13JC098C01	0.6	-1	-0.5	1.0	2.3	0.2	0.8	0.2	-0.05	0.3	-0.1	0.4	-0.1
13JC099A01	0.6	6	1.3	133.8	271.4	31.4	116.2	19.7	2.94	16.8	2.5	14.4	2.7
14JC018A01	0.3	-1	-0.5	37.0	61.2	7.3	26.1	3.9	0.97	3.6	0.5	3.3	0.7
14JC031A01	-0.2	1	-0.5	51.1	86.6	10.9	41.2	7.5	1.78	6.0	0.9	5.0	0.9
14JC033A01	-0.2	-1	0.5	3.2	4.7	0.4	1.6	0.3	0.08	0.3	-0.1	0.4	-0.1
14JC033B01	-0.2	-1	-0.5	3.7	5.0	0.5	2.2	0.3	0.14	0.5	-0.1	0.7	0.1
14JC034A01	-0.2	-1	-0.5	1.6	2.5	0.2	0.9	0.3	0.05	0.4	-0.1	0.6	-0.1
14JC035A01	-0.2	1	0.5	31.9	61.4	7.4	28.2	5.4	1.42	4.6	0.8	4.2	0.9
14JC036A01	-0.2	2	0.7	60.8	110.0	14.9	56.5	8.8	2.22	6.8	0.9	4.8	0.9
14JC037A01	-0.2	-1	-0.5	4.9	8.7	0.9	3.9	0.7	0.22	0.8	0.1	0.7	0.2
14JC038A01	-0.2	-1	-0.5	2.1	2.4	0.3	1.3	0.4	0.12	0.5	-0.1	0.7	0.2
14JC039A01	-0.2	-1	-0.5	1.0	1.4	0.1	0.6	0.1	-0.05	0.1	-0.1	-0.1	-0.1
14JC040A01	-0.2	3	5.5	36.7	70.4	8.4	31.2	5.3	1.08	4.5	0.7	3.9	0.7
14JC041A01	-0.2	6	0.7	31.4	64.8	7.3	28.2	5.3	0.72	4.2	0.5	3.4	0.7
14JC042A01	-0.2	-1	1.9	13.1	24.5	2.2	8.7	1.8	0.57	1.5	0.3	1.5	0.3
14JC043A01	-0.2	-1	0.6	6.4	14.6	1.3	4.5	0.9	0.24	0.8	0.1	0.8	0.1
14JC044A01	-0.2	-1	-0.5	1.3	1.3	-0.1	0.4	-0.1	-0.05	-0.1	-0.1	-0.1	-0.1
14JC045A01	-0.2	-1	1.0	2.3	5.0	0.4	1.5	0.3	0.10	0.3	-0.1	0.2	-0.1
14JC046A01	-0.2	-1	1.0	4.3	4.9	0.6	2.4	0.5	0.19	0.5	-0.1	0.3	-0.1
14JC046B01	-0.2	3	2.0	63.0	110.7	14.7	53.5	9.8	1.96	7.6	1.2	6.8	1.4
14JC047A01	-0.2	-1	-0.5	6.4	13.3	1.1	4.0	0.6	0.15	0.4	-0.1	0.1	-0.1
15JC002B01	-0.2	-1	1.2	5.2	8.3	0.8	3.2	0.4	0.19	0.8	0.1	0.7	0.1
15JC003A01	-0.2	-1	-0.5	-0.5	4.2	0.2	0.9	0.2	0.10	0.4	-0.1	0.4	0.1
15JC003A02	-0.2	-1	-0.5	2.4	2.7	0.2	1.0	0.3	0.14	0.6	0.1	0.9	0.2
15JC003B01	-0.2	-1	-0.5	-0.5	2.7	-0.1	0.4	0.2	0.06	0.2	-0.1	0.3	-0.1
15JC-C008	-0.2	-1	-0.5	0.7	2.1	0.2	0.8	0.2	0.13	0.4	-0.1	0.5	0.1
15JC-C009	-0.2	-1	-0.5	2.0	5.0	0.5	2.3	0.3	0.12	0.4	-0.1	0.5	0.1
15JC-C010	1.2	1	-0.5	13.9	24.7	3.2	12.7	1.9	0.47	1.2	0.2	0.8	0.2
15JC-C011	-0.2	-1	-0.5	19.7	31.0	4.3	17.8	3.8	1.03	3.2	0.4	2.5	0.5
T14a	-0.2	-1	-0.5	1.0	3.7	0.3	1.7	0.5	0.24	1.0	0.2	1.4	0.3
T14b	-0.2	-1	-0.5	25.7	28.0	3.8	13.9	2.1	0.57	1.4	0.2	1.1	0.2
	-0.2	-1	-0.5	6.7	18.7	1.3	5.1	0.9	0.26	0.9	0.1	1.0	0.2

### Appendix D - Trace-element ICP-MS-FUS Data for Samples

Sample_Num	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.1	0.4	0.1	0.05
2013 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5		0.1	0.4	0.1	0.05
2014 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.1	0.4	0.1	0.05
2015 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.5	0.5	0.1	0.1
JC12-068	1.7	0.18	1.2	0.13	-0.2	-0.5	2	-0.1	-0.4	0.4	0.35
JC12-069	0.8	0.08	0.7	-0.05	-0.2	-0.5	2	-0.1	-0.4	-0.1	0.15
JC12-070	0.3	-0.05	0.3	-0.05	0.9	-0.5	3	-0.1	-0.4	0.1	0.66
JC12-085	0.3	-0.05	0.2	-0.05	0.2	-0.5	-1	-0.1	-0.4	-0.1	-0.05
JC12-086	1.1	0.09	0.7	-0.05	0.3	-0.5	2	-0.1	-0.4	-0.1	-0.05
JC12-087	0.6	0.18	0.6	0.16	-0.2	0.6	7	0.1	-0.4	0.2	0.14
JC12-088	0.4	0.12	0.3	0.14	-0.2	-0.5	4	-0.1	-0.4	0.2	0.18
JC12-091	0.8	0.10	0.6	0.10	-0.2	-0.5	3	-0.1	-0.4	0.2	0.07
JC12-098	0.3	-0.05	0.2	-0.05	0.2	-0.5	-1	-0.1	-0.4	0.1	0.05
13FC_C95	0.4	0.06	0.3	-0.05	0.3	-0.5	-99	-0.1	1.1	0.4	0.67
13FC_C96	0.6	0.09	0.4	0.07	0.4	-0.5	-99	-0.1	0.9	0.2	0.46
13FC_C97	1.2	0.14	0.9	0.12	1.3	0.7	-99	-0.1	0.4	1.5	0.52
13FC_C98	0.6	0.07	0.5	0.07	0.4	-0.5	-99	-0.1	0.7	0.7	0.63
13FC027A01	1.2	0.17	1.0	0.12	0.3	0.8	-99	-0.1	-0.4	0.2	0.49
13FC028A01	0.4	0.05	0.3	-0.05	-0.2	0.9	-99	-0.1	-0.4	0.1	0.06
13FC029A01	0.4	0.06	0.2	-0.05	0.3	1.6	-99	-0.1	0.5	0.2	0.09
13FC030A01	0.5	0.11	0.5	0.10	0.3	1.1	-99	-0.1	1.0	0.1	0.32
13FC031A01	1.0	0.14	0.7	0.12	0.3	-0.5	-99	-0.1	0.6	0.3	0.27
13FC032A01	0.6	0.08	0.5	0.08	0.2	1.6	-99	-0.1	-0.4	0.1	0.06
13FC033A01	0.6	0.08	0.5	0.13	-0.2	4.4	-99	-0.1	-0.4	-0.1	0.13
13FC034A01	0.1	-0.05	0.1	-0.05	-0.2	3.2	-99	-0.1	1.0	-0.1	0.05
13FC048A01	0.5	0.06	0.4	0.05	-0.2	1.8	-99	-0.1	0.7	0.1	0.17
13FC049A01	0.7	0.10	0.6	0.09	-0.2	1.7	-99	-0.1	0.5	-0.1	0.19
13FC050A01	0.5	0.09	0.4	0.07	0.2	1.3	-99	-0.1	1.1	-0.1	0.09
13FC051A01	0.3	-0.05	0.3	-0.05	-0.2	1.7	-99	-0.1	0.5	0.1	0.81
13FC052A01	0.9	0.12	0.8	0.12	0.6	-0.5	-99	-0.1	0.9	0.3	0.54
13FC052B01	0.2	-0.05	0.2	-0.05	0.3	2.9	-99	-0.1	1.4	-0.1	0.08
13FC056A01	0.9	0.13	0.8	0.10	-0.2	-0.5	-99	-0.1	-0.4	0.1	0.63
13FC057A01	0.4	-0.05	0.4	-0.05	0.3	-0.5	-99	-0.1	1.0	0.1	0.22
13FC061A01	1.3	0.22	1.3	0.21	1.6	0.9	-99	-0.1	1.2	1.8	2.10
13FC064A01	0.9	0.16	0.8	0.14	1.1	0.8	-99	-0.1	1.7	1.2	0.66
13FC066A01	2.5	0.37	2.5	0.37	4.4	1.2	-99	-0.1	2.2	13.7	5.85
13FC067A01	1.6	0.21	1.1	0.15	-0.2	-0.5	-99	-0.1	1.0	0.1	0.34
13FC068A01	-0.1	-0.05	-0.1	-0.05	-0.2	1.3	-99	-0.1	0.7	-0.1	-0.05
13FC069A02	0.1	-0.05	0.1	-0.05	0.4	8.3	-99	-0.1	-0.4	-0.1	0.06
13FC070A01	0.8	0.10	0.6	0.09	0.4	-0.5	-99	-0.1	1.7	0.2	1.03
13FC071A01	0.1	-0.05	0.2	-0.05	-0.2	5.2	-99	-0.1	1.2	-0.1	0.10
13FC072A01	0.7	0.17	0.5	0.15	0.3	1.1	-99	0.1	1.5	0.3	0.81
13FC080A01	0.6	0.07	0.5	0.08	1.6	-0.5	-99	-0.1	2.3	3.0	1.10
13FC088A01	3.1	0.36	2.0	0.31	-0.2	3.2	-99	-0.1	-0.4	-0.1	0.07
13FC089A01	0.5	0.06	0.3	-0.05	0.3	1.1	-99	-0.1	1.3	-0.1	0.05
13FC095A01	0.2	-0.05	0.2	-0.05	-0.2	1.3	-99	-0.1	1.2	-0.1	-0.05
13FC096A01	0.5	0.06	0.3	-0.05	-0.2	2.5	-99	-0.1	0.9	-0.1	-0.05
13FC097A01	0.4	0.05	0.3	-0.05	0.4	-0.5	-99	-0.1	1.1	0.1	0.05
13FC097A02	1.2	0.16	0.9	0.11	-0.2	0.8	-99	-0.1	0.6	0.2	0.23
13FC098A01	0.3	-0.05	0.3	-0.05	-0.2	4.1	-99	-0.1	1.1	0.1	-0.05

### Appendix D - Trace-element ICP-MS-FUS Data for Samples

Sample_Num	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Bi	Th	U
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.1	0.4	0.1	0.05
2013 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.1	0.4	0.1	0.05
2014 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.1	0.4	0.1	0.05
2015 Detection Limit	0.1	0.05	0.1	0.05	0.2	0.5	1	0.5	0.5	0.1	0.1
13JC098B01	0.2	-0.05	0.2	-0.05	0.4	-0.5	-99	0.2	0.5	0.1	-0.05
13JC098C01	0.2	-0.05	0.2	-0.05	-0.2	1.7	-99	-0.1	0.7	-0.1	-0.05
13JC099A01	8.0	1.13	7.8	1.09	17.5	12.0	-99	-0.1	1.3	17.2	5.39
14JC018A01	2.2	0.29	1.9	0.23	2.7	4.0	-99	-0.1	0.9	5.4	1.15
14JC031A01	2.9	0.39	2.6	0.43	6.1	4.9	-99	-0.1	-0.4	7.0	11.20
14JC033A01	0.3	-0.05	0.1	-0.05	-0.2	0.5	-99	-0.1	-0.4	-0.1	0.09
14JC033B01	0.5	0.07	0.6	-0.05	-0.2	1.2	-99	-0.1	-0.4	-0.1	-0.05
14JC034A01	0.4	0.06	0.5	-0.05	-0.2	2.2	-99	-0.1	-0.4	-0.1	0.20
14JC035A01	2.8	0.41	2.6	0.44	3.3	2.5	-99	-0.1	-0.4	4.6	5.59
14JC036A01	2.6	0.40	2.4	0.32	4.7	4.2	-99	-0.1	-0.4	7.9	12.24
14JC037A01	0.5	0.07	0.4	-0.05	-0.2	2.2	-99	-0.1	-0.4	0.1	0.08
14JC038A01	0.5	0.08	0.4	0.06	-0.2	2.0	-99	-0.1	-0.4	-0.1	0.05
14JC039A01	0.1	-0.05	-0.1	-0.05	-0.2	8.5	-99	-0.1	-0.4	-0.1	0.11
14JC040A01	2.4	0.37	2.4	0.32	3.8	1.5	-99	-0.1	-0.4	12.4	8.40
14JC041A01	2.2	0.31	2.3	0.34	5.8	6.3	-99	-0.1	-0.4	4.4	4.58
14JC042A01	1.0	0.14	0.8	0.06	1.9	1.7	-99	-0.1	-0.4	1.7	0.26
14JC042B01	0.5	0.06	0.5	-0.05	1.3	3.8	-99	-0.1	-0.4	1.1	0.12
14JC043A01	0.1	-0.05	-0.1	-0.05	0.2	7.6	-99	-0.1	-0.4	0.2	-0.05
14JC044A01	0.2	-0.05	0.2	-0.05	0.2	1.3	-99	-0.1	-0.4	0.1	-0.05
14JC045A01	0.2	-0.05	0.1	-0.05	0.2	-0.5	-99	-0.1	-0.4	0.1	-0.05
14JC046A01	4.3	0.61	4.0	0.55	7.0	5.9	-99	-0.1	-0.4	10.9	9.33
14JC046B01	0.1	-0.05	-0.1	-0.05	0.9	5.0	-99	-0.1	-0.4	1.8	0.32
14JC047A01	0.5	0.06	0.5	-0.05	0.4	0.8	-99	-0.1	-0.4	0.4	0.09
15JC002B01	0.3	-0.05	0.3	-0.05	-0.2	1.3	2	-0.5	-0.5	-0.1	0.1
15JC003A01	0.7	0.10	0.6	0.09	0.5	1.9	2	-0.5	-0.5	1.0	0.2
15JC003A02	0.2	-0.05	0.2	-0.05	-0.2	1.1	1	-0.5	-0.5	0.5	0.2
15JC003B01	0.4	0.05	0.4	0.06	-0.2	1.5	-1	-0.5	-0.5	0.3	0.8
15JC-C008	0.3	-0.05	0.3	-0.05	-0.2	-0.5	1	-0.5	-0.5	0.3	0.4
15JC-C009	0.5	0.08	0.5	0.07	0.3	-0.5	-1	-0.5	-0.5	0.9	1.1
15JC-C010	1.6	0.22	1.5	0.23	1.8	-0.5	-1	-0.5	0.8	3.6	2.6
15JC-C011	1.0	0.15	0.9	0.14	-0.2	-0.5	-1	-0.5	-0.5	0.3	1.6
Tl4a	0.6	0.08	0.5	0.07	-0.2	1.0	4	-0.5	-0.5	0.2	0.6
Tl4b	0.7	0.09	0.5	0.06	-0.2	0.9	4	-0.5	-0.5	-0.1	1.0

### Appendix E - Major- and Trace-element Data for Standards and Duplicate Samples

Sample_Num	Lab_Num	Year	SiO2 %	Al2O3 %	Fe2O3 Total %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	MnO %
Method			ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS	ICP-OES-FUS
2012 Detection Limit			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.001
2013 Detection Limit			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.001
2014 Detection Limit			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.001
2015 Detection Limit			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.001
13IC032A01	10440849	2013	43.38	0.06	56.23	0.47	-0.01	0.02	-0.01	-0.001	0.057
13IC032A01 (Dup)	10440850	2013	43.01	0.06	56.45	0.48	0.01	0.03	0.01	0.005	0.055
13IC068A01	10440869	2013	27.50	0.05	72.15	0.47	0.02	0.02	0.02	-0.001	0.078
13IC068A01 (Dup)	10440870	2013	27.94	0.05	72.09	0.48	0.02	0.03	0.04	-0.001	0.078
14IC038A01	10441089	2014	44.21	0.02	56.47	0.17	0.02	-0.01	-0.01	0.003	0.042
14IC038A01 (Dup)	10441090	2014	44.46	0.04	56.26	0.17	0.03	-0.01	-0.01	0.003	0.042
15IC-C007	10441103	2015	8.07	1.20	89.15	0.03	0.04	0.03	0.05	0.238	0.080
15IC-C007 (Dup)	10441110	2015	8.08	1.24	89.00	0.03	0.04	0.05	0.05	0.246	0.079
AGV-1	10440700	2012	58.20	17.06	7.10	1.51	4.90	4.36	2.93	1.065	0.102
SCH-1	10440860	2013	8.11	0.96	85.50	0.03	0.04	0.05	0.04	0.039	0.995
W-2	10440880	2013	51.18	15.21	10.68	6.35	10.64	2.23	0.64	1.026	0.172
SCH-1	10440900	2013	8.20	0.99	86.58	0.04	0.05	0.05	0.05	0.039	1.016
SCH-1	10441080	2014	8.28	0.98	84.66	0.03	0.06	0.06	0.08	0.043	1.028
SCH-1	10441100	2015	8.43	1.03	87.52	0.05	0.06	0.04	0.04	0.048	1.074

**Appendix E - Major- and Trace-element Data for Standards and Duplicate Samples**

Sample_Num	P2O5		Cr	Zr	Ba	LOI_1000C		LOI_400C		Total	Fe		As		Be		Cu		Li		Mn	
	ICP-OES-FUS	%				ppm	ppm	ICP-OES-FUS	ICP-OES-FUS		Grav	%	Grav	%	Calculated	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES
2012 Detection Limit	0.001		1	1	1	0.01	0.01	0.01	0.01						0.1	0.1	1	1	0.1	0.1	1	
2013 Detection Limit	0.001		1	1	1	0.01	0.01	0.01	0.01						0.1	0.1	1	1	0.1	0.1	1	
2014 Detection Limit	0.001		1	1	1	0.01	0.01	0.01	0.01			2	2	0.1	0.1	1	1	0.1	0.1	0.1	0.1	1
2015 Detection Limit	0.001		1	1	1	0.01	0.01	0.01	0.01			2	2	0.1	0.1	1	1	0.1	0.1	0.1	0.1	1
13IC032A01	0.013		2	26	7	0.21	0.21	-99	100.47			39.32	-99	1.6	1.6	8	8	3.0	3.0	3.0	303	
13IC032A01 (Dup)	0.013		-1	26	6	0.21	0.21	-99	100.32			39.48	-99	1.6	1.6	7	7	3.0	3.0	3.0	304	
13IC068A01	0.010		4	11	7	-1	-1	-99	100.32			50.45	-99	0.4	0.4	4	4	1.3	1.3	1.3	370	
13IC068A01 (Dup)	0.010		-1	13	3	-1	-1	-99	100.72			50.41	-99	0.4	0.4	4	4	1.4	1.4	1.4	371	
14IC038A01	0.015		-1	12	4	-1	-1	-99	100.85			39.49	24	1.0	1.0	6	6	0.7	0.7	0.7	304	
14IC038A01 (Dup)	0.016		-1	12	6	-1	-1	-99	100.94			39.35	24	1.0	1.0	6	6	0.6	0.6	0.6	305	
15IC-C007	0.181		9	70	31	1.41	1.41	-99	100.49			62.35	24	1.2	1.2	9	9	0.6	0.6	0.6	484	
15IC-C007 (Dup)	0.179		8	72	31	1.45	1.45	-99	100.45			62.25	24	1.3	1.3	9	9	0.7	0.7	0.7	482	
AGV-1	0.496		9	213	1253	-99	-99	-99	97.72			4.97	-99	2.8	2.8	6	6	38.0	38.0	38.0	768	
SCH-1	0.120		9	30	97	-99	-99	-99	95.90			59.79	-99	0.3	0.3	82	82	40.6	40.6	40.6	897	
W-2	0.121		80	92	182	-99	-99	-99	98.26			7.47	-99	2.5	2.5	5	5	34.9	34.9	34.9	760	
SCH-1	0.122		10	31	108	-99	-99	-99	97.14			60.54	-99	0.3	0.3	89	89	43.5	43.5	43.5	949	
SCH-1	0.124		9	42	101	-99	-99	-99	95.34			59.21	2	2.6	2.6	5	5	38.5	38.5	38.5	848	
SCH-1	0.128		9	45	114	-99	-99	-99	98.42			61.21	2	2.5	2.5	5	5	36.1	36.1	36.1	797	

### Appendix E - Major- and Trace-element Data for Standards and Duplicate Samples

Sample_Num	Ni	Pb	Rb	Sc	Ti	Zn	V	Co	V	Co	Ga	Ge	As
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	1	1	1	0.1	1	1	5	1	5	1	1	1	5
2013 Detection Limit	1	1	1	0.1	1	1	5	1	5	1	1	1	5
2014 Detection Limit	1	1	1	0.1	1	1	5	1	5	1	1	1	5
2015 Detection Limit	1	1	1	0.1	1	1	1	1	1	1	1	1	1
13JC032A01	35	5	2	-0.1	14	26	-99	-99	19	26	1	14	12
13JC032A01 (Dup)	35	5	2	-0.1	14	26	-99	-99	20	28	1	14	15
13JC068A01	36	-1	2	-0.1	-1	43	-99	-99	7	18	-1	25	6
13JC068A01 (Dup)	36	-1	2	-0.1	-1	43	-99	-99	6	17	1	29	-5
14JC038A01	31	-1	6	-0.1	-1	26	-99	-99	13	-99	-1	12	-99
14JC038A01 (Dup)	31	-1	4	-0.1	-1	26	-99	-99	12	-99	1	12	-99
15JC-C007	-1	-1	6	6.0	1062	34	138	-1	-99	-99	6	24	-99
15JC-C007 (Dup)	-1	-1	5	6.1	1087	34	138	-1	-99	-99	6	26	-99
AGV-1	9	4	47	1.0	1763	86	-99	-99	129	16	22	4	5
SCH-1	54	1	19	39.9	4903	33	-99	-99	41	18	3	25	55
W-2	12	-1	52	0.8	1670	88	-99	-99	268	44	17	3	-5
SCH-1	61	4	21	43.1	5148	35	-99	-99	42	17	3	23	49
SCH-1	11	-1	56	0.8	1770	96	-99	-99	35	-99	4	16	-99
SCH-1	6	-1	53	1.0	1703	92	5	1	-99	-99	3	31	-99



**Appendix E - Major- and Trace-element Data for Standards and Duplicate Samples**

Sample_Num	Sr		Y		Nb		Mo		Cd		Sn		Cs		La		Ce		Pr		Nd	
	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS
2012 Detection Limit	2	1	1	1	1	1	2	2	0.2	0.2	1	1	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2013 Detection Limit	1	1	1	1	1	1	2	2	0.2	0.2	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.2
2014 Detection Limit	1	1	1	1	1	1	2	2	0.2	0.2	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.2
2015 Detection Limit	1	1	1	1	1	1	2	2	0.2	0.2	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.2
13JC032A01	1	7	4	4	4	4	2	2	-0.2	-0.2	1	1	-0.5	-0.5	3.7	3.7	4.8	4.8	0.5	0.5	2.0	2.0
13JC032A01 (Dup)	1	7	4	4	4	4	-2	-2	0.3	0.3	1	1	-0.5	-0.5	2.0	2.0	4.4	4.4	0.4	0.4	2.0	2.0
13JC068A01	1	1	2	2	2	2	-2	-2	0.3	0.3	-1	-1	-0.5	-0.5	1.1	1.1	1.2	1.2	-0.1	-0.1	0.6	0.6
13JC068A01 (Dup)	1	1	2	2	2	2	-2	-2	0.3	0.3	-1	-1	-0.5	-0.5	1.0	1.0	1.3	1.3	0.1	0.1	0.5	0.5
14JC038A01	1	5	1	1	1	1	-2	-2	-0.2	-0.2	-1	-1	-0.5	-0.5	2.1	2.1	2.4	2.4	0.3	0.3	1.3	1.3
14JC038A01 (Dup)	1	5	2	2	2	2	-2	-2	-0.2	-0.2	-1	-1	-0.5	-0.5	2.2	2.2	2.5	2.5	0.3	0.3	1.5	1.5
15JC-C007	96	8	12	12	12	12	4	4	-0.2	-0.2	-1	-1	-0.5	-0.5	8.0	8.0	19.0	19.0	2.2	2.2	9.1	9.1
15JC-C007 (Dup)	100	9	13	13	13	13	5	5	-0.2	-0.2	-1	-1	-0.5	-0.5	9.2	9.2	19.8	19.8	2.3	2.3	9.6	9.6
AGV-1	665	17	16	16	16	16	4	4	-99	-99	4	4	0.8	0.8	40.1	40.1	69.7	69.7	8.4	8.4	33.0	33.0
SCH-1	27	13	7	7	7	7	3	3	0.5	0.5	1	1	-0.5	-0.5	14.1	14.1	37.7	37.7	3.0	3.0	11.9	11.9
W-2	194	20	9	9	9	9	-2	-2	-0.2	-0.2	2	2	-0.5	-0.5	11.2	11.2	22.5	22.5	2.9	2.9	12.4	12.4
SCH-1	25	13	7	7	7	7	3	3	0.3	0.3	-1	-1	-0.5	-0.5	13.7	13.7	36.7	36.7	2.7	2.7	10.5	10.5
SCH-1	25	12	6	6	6	6	2	2	-0.2	-0.2	-1	-1	-0.5	-0.5	12.7	12.7	33.8	33.8	2.5	2.5	9.7	9.7
SCH-1	24	12	5	5	5	5	2	2	-0.2	-0.2	-1	-1	-0.5	-0.5	13.6	13.6	36.8	36.8	2.9	2.9	11.4	11.4

**Appendix E - Major- and Trace-element Data for Standards and Duplicate Samples**

Sample_Num	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS	ICP-MS-FUS
2012 Detection Limit	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.05	0.2
2013 Detection Limit	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.05	0.2
2014 Detection Limit	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.05	0.2
2015 Detection Limit	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.05	0.2
13IC032A01	0.5	0.19	0.8	0.1	0.9	0.2	0.6	0.08	0.5	0.08	0.2
13IC032A01 (Dup)	0.5	0.22	0.8	0.1	1.0	0.2	0.7	0.11	0.5	0.08	1.0
13IC068A01	-0.1	-0.05	-0.1	-0.1	-0.1	-0.1	-0.1	-0.05	-0.1	-0.05	-0.2
13IC068A01 (Dup)	0.1	-0.05	-0.1	-0.1	0.1	-0.1	-0.1	-0.05	0.1	-0.05	0.2
14IC038A01	0.4	0.12	0.5	-0.1	0.7	0.2	0.5	0.08	0.4	0.06	-0.2
14IC038A01 (Dup)	0.4	0.06	0.5	-0.1	0.6	0.2	0.5	0.07	0.6	-0.05	-0.2
15IC-C007	1.7	0.47	1.6	0.2	1.5	0.3	0.9	0.12	0.8	0.13	0.8
15IC-C007 (Dup)	1.9	0.51	1.7	0.3	1.4	0.3	0.9	0.13	0.9	0.12	0.9
AGV-1	5.6	1.61	5.2	0.6	3.5	0.7	1.9	0.24	1.7	0.25	5.0
SCH-1	1.9	0.59	2.0	0.3	1.9	0.4	1.2	0.16	1.1	0.14	0.6
W-2	3.0	1.07	3.7	0.6	3.8	0.7	2.1	0.31	1.9	0.30	2.5
SCH-1	1.9	0.53	1.9	0.3	2.0	0.4	1.2	0.17	1.0	0.13	0.6
SCH-1	1.8	0.46	1.8	0.3	1.6	0.4	1.3	0.15	0.8	0.13	0.4
SCH-1	2.0	0.52	1.8	0.3	1.9	0.4	1.1	0.16	1.0	0.13	0.4

**Appendix E - Major- and Trace-element Data for Standards and Duplicate Samples**

Sample_Num Unit	Ta		W		Tl		Bi		Th		U	
	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS	ppm	ICP-MS-FUS
2012 Detection Limit	0.5	1	0.1	0.1	0.1	0.4	0.1	0.1	0.05	0.05	0.05	0.05
2013 Detection Limit	0.5	1	0.1	0.1	0.1	0.4	0.1	0.1	0.05	0.05	0.05	0.05
2014 Detection Limit	0.5	1	0.1	0.1	0.1	0.4	0.1	0.1	0.05	0.05	0.05	0.05
2015 Detection Limit	0.5	1	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1
13IC032A01	1.6	-99	-0.1	-0.1	-0.1	-0.4	0.1	0.1	0.06	0.06	0.06	0.06
13IC032A01 (Dup)	2.1	-99	-0.1	-0.1	-0.1	1.0	0.3	0.3	0.06	0.06	0.06	0.06
13IC068A01	1.3	-99	-0.1	-0.1	-0.1	0.7	-0.1	-0.1	-0.05	-0.05	-0.05	-0.05
13IC068A01 (Dup)	1.3	-99	-0.1	-0.1	-0.1	0.6	-0.1	-0.1	-0.05	-0.05	-0.05	-0.05
14IC038A01	2.0	-99	-0.1	-0.1	-0.1	-0.4	-0.1	-0.1	0.05	0.05	0.05	0.05
14IC038A01 (Dup)	2.0	-99	-0.1	-0.1	-0.1	-0.4	-0.1	-0.1	0.06	0.06	0.06	0.06
15JC-C007	-0.5	-1	-0.5	-0.5	-0.5	-0.5	1.5	1.5	1.8	1.8	1.8	1.8
15JC-C007 (Dup)	-0.5	2	-0.5	-0.5	-0.5	-0.5	1.5	1.5	1.8	1.8	1.8	1.8
AGV-1	1.2	2	-0.1	-0.1	-0.1	-0.4	6.0	6.0	1.89	1.89	1.89	1.89
SCH-1	-0.5	-99	-0.1	-0.1	-0.1	1.2	0.7	0.7	1.12	1.12	1.12	1.12
W-2	0.5	-99	-0.1	-0.1	-0.1	-0.4	2.1	2.1	0.49	0.49	0.49	0.49
SCH-1	-0.5	-99	-0.1	-0.1	-0.1	0.9	0.7	0.7	1.13	1.13	1.13	1.13
SCH-1	-0.5	-99	-0.1	-0.1	-0.1	-0.4	0.7	0.7	1.00	1.00	1.00	1.00
SCH-1	-0.5	2	-0.5	-0.5	-0.5	-0.5	0.6	0.6	1.1	1.1	1.1	1.1