GM 58344

MINERALOGICAL EXAMINATION AND MICROPROBE ANALYSIS OF FIVE ROCKS SAMPLES

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LAKEFIELD RESEARCH

Mineralogical Services

MINERALOGICAL EXAMINATION AND MICROPROBE ANALYSIS OF FIVE ROCK SAMPLES

submitted by
Noranda Mining and Exploration Inc.

Project managed by: Giovanni Di Prisco

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Summary

Five rock samples (18986M, 61344M, 61348M, 61349M, and 61302M) were submitted by Noranda Mining and Exploration Inc. for mineralogical examination. The main scope of this work was to determine the concentration of vanadium in Fe and Fe-Ti oxides.

Magnetite and ilmenite grains (a total of 60 grains) were analysed for vanadium with an electron microprobe. The average value of vanadium in magnetite is approximately 0.6 %. Vanadium concentrations in the analysed magnetite grains are fairly constant. In comparison, vanadium in ilmenite (~0.05 %) is approximately 10 less than in magnetite.

The five samples are mainly composed of coarse-grained intergrowths of non-opaque minerals (~35 % to 80 %; plagioclase, muscovite / sericite, chlorite, pyroxenes, epidote, quartz), magnetite (4 % to 35 %), and ilmenite (6.5 % to 20 %). Magnetite and ilmenite are mainly coarse- to very coarse-grained and occur as interstitial phases to silicate. Minor amounts of pyrite, pyrrhotite, rutile, and chalcopyrite, and trace amounts of sphalerite, goethite, and cubanite were also observed.

LAKEFIELD RESEARCH LIMITED
October 7, 1998

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INTRODUCTION

Noranda Mining and Exploration Inc. submitted five rock samples (Table 1) for mineralogical examination. The main scope of this work was principally to determine the concentration of vanadium in Fe and Fe-Ti oxides, and to provide a general overview of the mineralogical composition of the samples.

Table 1. List of Examined Samples

18986M
61344M
61348M
61349M
61302M

One polished section and one polished thin section were prepared from a portion of each sample. Mineralogical examinations were carried out on the entire surface of the polished section and polished thin section using transmitted and reflected light microscopy at magnifications ranging from 100X to 500X. A series of microprobe analyses of magnetite and ilmenite were preformed at the Ontario Geological Survey Geosciences Laboratories, in Sudbury.

OBSERVATIONS

A visual estimation of the mineral abundance(1) in the five samples is presented in the table below.

Mineral	Mineral Abundance				
	18986M	61344M	61348M	61349M	61302M
non-opaque minerals	50 %	35 %	72.5 %	80 %	50 %
magnetite	30 %	35 %	12 %	4 %	30 %
ilmenite	12 %	20 %	18 %	6.5 %	15 %
pyrite	5 %	7.5 %	2 %	4 %	-
rutile	2 %	-	1 %	5 %	-
chalcopyrite	0.5 %	1.5 %	0.5 %	0.2 %	0.5 %
sphalerite	<0.2 %	0.5 %	-	-	-
goethite	<0.2 %	-	-	0.2 %	-
pyrrhotite	-	0.5 %	-	-	4.5 %
cubanite	-	<0.2 %	-	-	<0.2 %

(1) estimated mineral abundance at +/- 3 to 5 % of the value

The five samples are mainly composed of non-opaque minerals (~35 % to 80 %; plagioclase, muscovite / sericite, chlorite, pyroxenes, epidote, quartz), magnetite (4 % to 35 %), and ilmenite (6.5 % to 20 %). Minor amounts of pyrite, pyrrhotite, rutile, and chalcopyrite, and trace amounts of sphalerite, goethite, and cubanite were also observed.

Magnetite ranges in size from greater than 2 mm to less than 5 μm, but occurs mainly as coarse- to very coarse-grained subhedral grains intergrown with silicate gangue and ilmenite. Locally, a minor amount of fine- to medium-grained magnetite is present as locked inclusions in ilmenite and non-opaque minerals, and is fracture-controlled in ilmenite. Ilmenite ranges in size from approximately 1.5 mm to less than 5 μm. Ilmenite is mainly present as a coarse-grained interstitial phase, intergrown with magnetite and silicate gangue. Ilmenite also occurs as very fine-grained exsolution lamellae in magnetite, and as locked inclusions in magnetite. In samples 18986M, 61348M, and 61349M, ilmenite is rimmed by rutile and titanite, and in sample 61349M, there is extensive alteration of ilmenite by rutile and titanite.

ELECTRON MICROPROBE RESULTS

The five samples were submitted for electron microprobe analysis of magnetite and ilmenite grains, with particular interest in vanadium. These oxide grains were analysed with a Cameca SX-50 electron microprobe at the Ontario Geological Survey Geosciences Laboratories, Sudbury. Electron microprobe analyses for magnetite and ilmenite are summarized in the following tables. Details of electron microprobe results are presented in Appendix 1.

Table 2. Magnetite Electron Microprobe Analyses: Average of All Analysed Grains

Sample	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
18986M	0.04	16.09	0.01	2.73	0.09	**1.15**	0.07	0.43	75.45	0.02	0.29	96.36	31.18	47.39	99.49
61344M	0.09	7.89	0.01	2.25	0.10	**0.83**	0.43	0.27	83.10	0.03	0.04	95.03	48.78	39.21	99.91
61348M	0.04	13.39	0.00	5.69	0.10	**1.25**	0.07	0.37	74.32	0.01	0.05	95.29	31.97	45.55	98.49
61349M	0.04	10.20	0.01	0.01	0.10	**1.25**	0.08	0.34	82.34	0.02	0.01	94.40	45.11	41.75	98.92
61302M	0.05	0.35	0.00	0.01	0.08	**0.99**	0.08	0.01	91.57	0.02	0.02	93.17	65.37	32.75	99.72

* total iron
concentrations reported in weight %

Table 3. Ilmenite Electron Microprobe Analyses: Average of All Analysed Grains

Sample	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
18986M	0.01	51.79	0.01	0.02	0.01	**0.10**	0.06	1.32	46.83	0.00	0.01	100.15	1.70	45.30	100.32
61344M	0.01	51.84	0.00	0.03	0.02	**0.02**	1.01	0.80	46.32	0.01	0.02	100.07	2.54	44.04	100.33
61348M	0.01	50.88	0.03	0.04	0.01	**0.10**	0.05	1.23	47.66	0.02	0.01	100.02	3.42	44.58	100.37
61349M	0.02	51.47	0.00	0.01	0.02	**0.15**	0.06	1.65	46.25	0.01	0.03	99.67	1.70	44.73	99.84
61302M	0.01	51.01	0.00	0.02	0.02	**0.08**	0.18	2.11	46.21	0.01	0.02	99.64	2.98	43.53	99.94

* total iron
concentrations reported in weight %

Table 4. Average Values of Magnetite per Sample

Sample	FeO* (wt. %)	TiO_2 (wt. %)	V_2O_5 (wt. %)
18986M	75.45	16.09	**1.15**
61344M	83.10	7.89	**0.83**
61348M	74.32	13.39	**1.25**
61349M	82.34	10.20	**1.25**
61302M	91.57	0.35	**0.99**

* total iron

Table 5. Average Values of Ilmenite per Sample

Sample	FeO* (wt. %)	TiO_2 (wt. %)	V_2O_5 (wt. %)
18986M	46.83	51.79	**0.10**
61344M	46.32	51.84	**0.02**
61348M	47.66	50.88	**0.10**
61349M	46.25	51.47	**0.15**
61302M	46.21	51.01	**0.08**

* total iron

Table 6. Average of All Magnetite and Ilmenite Grains for All Samples

Average for All Samples	FeO* (wt. %)	Fe (wt. %)	TiO_2 (wt. %)	Ti (wt. %)	V_2O_5 (wt. %)	V (wt. %)
all magnetite grains	81.36	**63.2**	9.58	**5.7**	**1.09**	**0.61**
all ilmenite grains	46.65	**36.3**	51.40	**30.8**	**0.09**	**0.05**

* total iron

A total of 38 magnetite grains and 22 ilmenite grains were analysed by electron microprobe. In magnetite, vanadium oxide (V_2O_5) values range from 0.83 % to 1.25 % (average values per sample), with a constant value of approximately 1 % V_2O_5. In ilmenite, vanadium oxide (V_2O_5) values range from 0.02 % to 0.15 % (average values per sample), with a constant value of approximately 0.1 % V_2O_5. Vanadium (V) in magnetite averages 0.6 %, approximately 10 times more than the average vanadium (V) concentration in ilmenite (0.05 %).

APPENDIX 1

ELECTRON MICROPROBE RESULTS

Table 1. Electron Microprobe Analyses from Sample 18986M *(PS7763)*

Grain	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
ilm1c	0.00	52.16	0.00	0.00	0.02	0.11	0.06	1.33	46.17	0.00	0.00	99.85	0.60	45.64	99.91
ilm2c	0.01	52.06	0.00	0.02	0.00	0.12	0.06	1.27	46.64	0.00	0.00	100.17	1.12	45.63	100.28
ilm3c	0.01	50.54	0.00	0.00	0.00	0.09	0.05	1.34	48.01	0.00	0.02	100.07	4.29	44.14	100.50
ilm4c	0.01	52.41	0.02	0.07	0.03	0.06	0.05	1.35	46.49	0.00	0.01	100.49	0.78	45.79	100.57
mag1c	0.03	13.05	0.00	3.36	0.10	1.28	0.06	0.31	79.26	0.02	0.01	97.48	37.20	45.79	101.21
mag2c	0.04	21.21	0.00	0.15	0.09	1.00	0.05	0.58	73.28	0.01	0.03	96.44	24.33	51.38	98.87
mag3c	0.04	12.46	0.00	2.15	0.10	1.31	0.08	0.34	77.65	0.00	1.10	95.23	38.10	43.37	99.05
mag4c	0.04	17.01	0.05	11.15	0.08	1.04	0.04	0.44	69.52	0.04	0.00	99.40	21.14	50.50	101.52
mag5c	0.01	16.94	0.00	1.13	0.10	1.14	0.09	0.51	74.60	0.01	0.64	95.19	30.65	47.02	98.26
mag6c	0.05	14.03	0.00	0.39	0.09	1.15	0.08	0.38	78.44	0.04	0.19	94.83	37.26	44.91	98.57
mag7c	0.05	17.95	0.02	0.81	0.09	1.10	0.08	0.44	75.41	0.00	0.03	95.96	29.59	48.78	98.92

* total iron
ilm: ilmenite; mag: magnetite; c: centre
concentrations reported in weight %

Table 2. Electron Microprobe Analyses from Sample 61344M *(PS7764)*

Grain	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
ilm1c	0.00	51.58	0.00	0.04	0.03	0.06	1.49	0.71	46.02	0.00	0.01	99.95	3.26	43.09	100.27
ilm2c	0.03	51.87	0.00	0.02	0.01	0.00	0.74	0.84	46.56	0.00	0.04	100.12	2.31	44.48	100.35
ilm3c	0.01	52.21	0.00	0.04	0.01	0.00	0.90	0.89	46.26	0.01	0.02	100.35	2.03	44.43	100.55
ilm4c	0.01	51.71	0.00	0.01	0.01	0.02	0.90	0.76	46.45	0.02	0.00	99.87	2.56	44.14	100.13
mag1c	0.05	3.93	0.02	1.76	0.13	1.04	0.37	0.15	86.61	0.02	0.00	94.08	56.33	35.92	99.72
mag2c	0.04	9.79	0.00	2.65	0.19	1.44	0.39	0.36	80.50	0.04	0.00	95.41	42.92	41.88	99.71
mag3c	0.03	8.64	0.00	2.65	0.17	1.27	0.36	0.33	81.65	0.05	0.07	95.22	45.67	40.55	99.79
mag4c	0.04	13.14	0.00	6.64	0.17	1.59	1.12	0.49	75.36	0.05	0.02	98.60	33.39	45.32	101.95
mag5c	0.02	16.34	0.00	1.83	0.10	0.85	0.36	0.58	75.30	0.04	0.05	95.47	32.22	46.31	98.70
mag6c	0.04	11.28	0.00	2.16	0.13	1.00	0.61	0.27	79.76	0.01	0.00	95.26	41.79	42.16	99.45
mag7c	0.02	5.77	0.00	2.44	0.14	1.12	0.35	0.20	84.67	0.03	0.08	94.82	52.08	37.81	100.04
vein 1	0.43	0.01	0.00	0.00	0.00	0.00	0.07	0.00	92.41	0.01	0.03	92.95	67.81	31.39	99.74
vein 2	0.08	0.02	0.08	0.00	0.01	0.00	0.12	0.02	92.55	0.00	0.00	92.87	68.48	30.93	99.73

* total iron
ilm: ilmenite; mag: magnetite; c: centre
concentrations reported as weight %

Table 3. Electron Microprobe Analyses from Sample 61348M *(PS7765)*

Grain	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
ilm1c	0.01	50.80	0.03	0.03	0.00	0.12	0.04	1.19	47.69	0.00	0.01	99.84	3.40	44.64	100.28
ilm2c	0.00	50.24	0.06	0.00	0.01	0.06	0.05	1.20	48.37	0.02	0.01	100.00	4.83	44.01	100.48
ilm3c	0.00	51.26	0.00	0.03	0.02	0.05	0.06	1.33	47.38	0.02	0.02	100.18	3.00	44.67	100.48
ilm4c	0.01	51.23	0.01	0.09	0.01	0.15	0.04	1.20	47.20	0.03	0.01	99.97	2.44	45.00	100.22
mag1c	0.04	14.87	0.00	4.84	0.10	1.18	0.07	0.41	72.70	0.01	0.00	94.20	29.41	46.23	97.15
mag2c	0.03	14.66	0.00	3.90	0.11	1.17	0.08	0.39	74.57	0.00	0.03	94.94	31.60	46.14	98.11
mag3c	0.05	9.03	0.01	9.13	0.09	1.30	0.06	0.26	74.03	0.01	0.03	93.98	35.57	42.03	97.55
mag4c	0.06	14.60	0.00	7.54	0.10	1.21	0.06	0.40	71.73	0.01	0.08	95.74	27.56	46.93	98.50
mag5c	0.05	14.57	0.01	7.71	0.11	1.25	0.05	0.40	71.42	0.01	0.08	95.65	27.16	46.98	98.37
mag6c	0.01	15.36	0.00	5.81	0.12	1.20	0.07	0.41	74.38	0.02	0.04	97.43	29.50	47.83	100.38
mag7c	0.06	10.66	0.00	0.90	0.10	1.43	0.07	0.32	81.39	0.02	0.14	95.03	43.01	42.69	99.40

* total iron
ilm: ilmenite; mag: magnetite; c: centre
concentrations reported in weight %

Table 4. Electron Microprobe Analyses from Sample 61349M *(PS7766)*

Grain	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
ilm1	0.01	51.62	0.00	0.01	0.03	0.14	0.05	1.80	45.81	0.03	0.01	99.51	1.22	44.71	99.63
ilm2	0.03	51.64	0.00	0.01	0.03	0.14	0.07	1.79	45.79	0.00	0.00	99.50	1.14	44.76	99.61
ilm3	0.01	51.18	0.00	0.00	0.01	0.14	0.05	1.67	46.90	0.02	0.04	100.01	2.75	44.43	100.29
ilm4	0.01	51.62	0.00	0.00	0.04	0.17	0.06	1.56	45.82	0.02	0.03	99.33	0.95	44.96	99.42
ilm5	0.02	51.45	0.01	0.02	0.01	0.13	0.07	1.58	46.49	0.00	0.04	99.83	1.94	44.75	100.02
mag1c	0.03	7.61	0.04	0.04	0.10	1.39	0.08	0.27	84.88	0.02	0.01	94.47	50.06	39.83	99.49
mag2c	0.05	8.06	0.03	0.00	0.11	1.33	0.09	0.25	84.42	0.04	0.03	94.39	49.27	40.09	99.33
mag3c	0.03	4.51	0.00	0.00	0.12	1.40	0.08	0.13	87.64	0.03	0.00	93.94	56.19	37.08	99.57
mag4c	0.02	10.26	0.00	0.00	0.14	1.57	0.09	0.33	81.52	0.00	0.01	93.93	43.80	42.11	98.32
mag5c	0.07	10.56	0.00	0.00	0.10	1.04	0.05	0.39	82.25	0.02	0.00	94.47	44.94	41.81	98.98
mag6c	0.06	12.61	0.01	0.01	0.08	1.10	0.09	0.44	80.41	0.00	0.01	94.81	40.82	43.68	98.90
mag7c	0.03	17.76	0.00	0.01	0.08	0.93	0.07	0.60	75.28	0.01	0.00	94.78	30.67	47.68	97.85

* total iron
ilm: ilmenite; mag: magnetite; c: centre
concentrations reported in weight %

Table 5. Electron Microprobe Analyses from Sample 61302M *(PS7767)*

Grain	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
ilm1	0.00	51.44	0.04	0.02	0.01	0.07	0.17	2.10	45.65	0.00	0.01	99.50	1.86	43.98	99.69
ilm2	0.02	51.77	0.00	0.03	0.00	0.10	0.15	2.15	45.36	0.00	0.00	99.57	1.20	44.28	99.69
ilm3	0.00	50.47	0.01	0.03	0.02	0.05	0.17	2.18	46.64	0.02	0.02	99.59	4.12	42.94	100.00
ilm4	0.00	52.20	0.00	0.01	0.02	0.06	0.16	2.10	45.11	0.02	0.02	99.70	0.57	44.60	99.75
ilm5	0.01	49.59	0.00	0.01	0.03	0.10	0.22	2.00	47.72	0.00	0.02	99.70	6.01	42.31	100.30
mag1r	0.13	0.33	0.00	0.00	0.09	1.01	0.12	0.01	90.94	0.01	0.00	92.64	64.78	32.64	99.13
mag2r	0.06	0.38	0.00	0.00	0.10	1.05	0.07	0.03	91.53	0.01	0.00	93.21	65.13	32.93	99.73
mag3r	0.08	0.25	0.00	0.03	0.08	1.05	0.11	0.02	91.82	0.00	0.00	93.42	65.53	32.85	99.99
mag4r	0.08	0.14	0.00	0.00	0.07	1.01	0.12	0.03	91.71	0.04	0.00	93.21	65.71	32.58	99.79
mag5vein	0.02	0.83	0.01	0.02	0.07	0.95	0.04	0.01	91.47	0.00	0.01	93.43	64.73	33.23	99.92
mag6vein	0.05	0.59	0.00	0.00	0.07	0.95	0.08	0.00	91.47	0.02	0.02	93.25	65.06	32.93	99.77
mag7c	0.03	0.05	0.01	0.00	0.07	1.00	0.11	0.00	91.28	0.02	0.06	92.63	65.62	32.23	99.20
mag8c	0.02	0.18	0.01	0.00	0.08	0.95	0.06	0.01	91.70	0.03	0.02	93.07	65.79	32.50	99.67

* total iron
ilm: ilmenite; mag: magnetite; c: centre; r: rim
concentrations reported in weight %

Ontario

CERTIFICATE OF ANALYSIS

GEOSCIENCE LABORATORIES
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Phone : **705-652-2000**
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Certificate Date : **09/03/1998**
Submission Date : **06/26/1998**
GL Job No. : **98-0140**
Delivery Via : **FAX**
QC Requested : **NO**

Method Code reported with this certificate : **EMP-100**

Method Code	Description	Qty	Status
EMP-100	Microprobe/ Grain	5	COMPLETE

Please refer to GL Job No. 98-0140 if you have any questions.

CERTIFIED BY

Rob Campbell, Laboratory Manager

Date : Sept 9/98

Client	Giovanni Di Prisco	GEOSCIENCE LABORATORIES REPORT
	Lakefield Research	ELECTRON MICROPROBE ANALYSIS
Mineral	Oxides	Data reviewed by Dave Crabtree
Sample	Various	
Job #	98-0140.oxi	
Analyst	D. Crabtree	
Analyst Approved	August 6th 1998	

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
Ilmenite (Fe2O3 calculated on the basis of 3 oxygens)															
PS7763-ilm1c	0.00	52.16	0.00	0.00	0.02	0.11	0.06	1.33	46.17	0.00	0.00	99.85	0.60	45.64	99.91
PS7763-ilm2c	0.01	52.06	0.00	0.02	0.00	0.12	0.06	1.27	46.64	0.00	0.00	100.17	1.12	45.63	100.28
PS7763-ilm3c	0.01	50.54	0.00	0.00	0.00	0.09	0.05	1.34	48.01	0.00	0.02	100.07	4.29	44.14	100.50
PS7763-ilm4c	0.01	52.41	0.02	0.07	0.03	0.06	0.05	1.35	46.49	0.00	0.01	100.49	0.78	45.79	100.57
PS7764-ilm1c	0.00	51.58	0.00	0.04	0.03	0.06	1.49	0.71	46.02	0.00	0.01	99.95	3.26	43.09	100.27
PS7764-ilm2c	0.03	51.87	0.00	0.02	0.01	0.00	0.74	0.84	46.56	0.00	0.04	100.12	2.31	44.48	100.35
PS7764-ilm3c	0.01	52.21	0.00	0.04	0.01	0.00	0.90	0.89	46.26	0.01	0.02	100.35	2.03	44.43	100.55
PS7764-ilm4c	0.01	51.71	0.00	0.01	0.01	0.02	0.90	0.76	46.45	0.02	0.00	99.87	2.56	44.14	100.13
PS7765-ilm1c	0.01	50.80	0.03	0.03	0.00	0.12	0.04	1.19	47.69	0.00	0.01	99.94	3.40	44.64	100.28
PS7765-ilm2c	0.00	50.24	0.06	0.00	0.01	0.06	0.05	1.20	48.37	0.02	0.01	100.00	4.83	44.01	100.48
PS7765-ilm3c	0.00	51.26	0.00	0.03	0.02	0.05	0.06	1.33	47.38	0.02	0.02	100.18	3.00	44.67	100.48
PS7765-ilm4c	0.01	51.23	0.01	0.09	0.01	0.15	0.04	1.20	47.20	0.03	0.01	99.97	2.44	45.00	100.22
PS7766-ilm1	0.01	51.62	0.00	0.01	0.03	0.14	0.05	1.80	45.81	0.03	0.01	99.51	1.22	44.71	99.63
PS7766-ilm2	0.03	51.64	0.00	0.01	0.03	0.14	0.07	1.79	45.79	0.00	0.00	99.50	1.14	44.76	99.61
PS7766-ilm3	0.01	51.18	0.00	0.00	0.01	0.14	0.05	1.67	46.90	0.02	0.04	100.01	2.75	44.43	100.29
PS7766-ilm4	0.01	51.62	0.00	0.00	0.04	0.17	0.06	1.56	45.82	0.02	0.03	99.33	0.95	44.96	99.42
PS7766-ilm5	0.02	51.45	0.01	0.02	0.01	0.13	0.07	1.58	46.49	0.00	0.04	99.83	1.94	44.75	100.02
PS7767-ilm1	0.00	51.44	0.04	0.02	0.01	0.07	0.17	2.10	45.65	0.00	0.01	99.50	1.86	43.98	99.69
PS7767-ilm2	0.02	51.77	0.00	0.03	0.00	0.10	0.15	2.15	45.36	0.00	0.00	99.57	1.20	44.28	99.69
PS7767-ilm3	0.00	50.47	0.01	0.03	0.02	0.05	0.17	2.18	46.64	0.02	0.02	99.59	4.12	42.94	100.00
PS7767-ilm4	0.00	52.20	0.00	0.01	0.02	0.06	0.16	2.10	45.11	0.02	0.02	99.70	0.57	44.60	99.75
PS7767-ilm5	0.01	49.59	0.00	0.01	0.03	0.10	0.22	2.00	47.72	0.00	0.02	99.70	6.01	42.31	100.30

Client	**Giovanni Di Prisco**	GEOSCIENCE LABORATORIES REPORT
	Lakefield Research	ELECTRON MICROPROBE ANALYSIS
Mineral	**Oxides**	Data reviewed by Dave Crabtree
Sample	**Various**	
Job #	**98-0140.oxi**	
Analyst	**D. Crabtree**	
Analyst Approved	**August 6th 1998**	

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
Magnetite (Fe2O3 calculated on the basis of 4 oxygens)															
PS7763-mag1c	0.03	13.05	0.00	3.36	0.10	1.28	0.06	0.31	79.26	0.02	0.01	97.48	37.20	45.79	101.21
PS7763-mag2c	0.04	21.21	0.00	0.15	0.09	1.00	0.05	0.58	73.28	0.01	0.03	96.44	24.33	51.38	98.87
PS7763-mag3c	0.04	12.46	0.00	2.15	0.10	1.31	0.08	0.34	77.65	0.00	1.10	95.23	38.10	43.37	99.05
PS7763-mag4c	0.04	17.01	0.05	11.15	0.08	1.04	0.04	0.44	69.52	0.04	0.00	99.40	21.14	50.50	101.52
PS7763-mag5c	0.01	16.94	0.00	1.13	0.10	1.14	0.09	0.51	74.60	0.01	0.64	95.19	30.65	47.02	98.26
PS7763-mag6c	0.05	14.03	0.00	0.39	0.09	1.16	0.08	0.38	78.44	0.04	0.19	94.83	37.26	44.91	98.57
PS7763-mag7c	0.05	17.95	0.02	0.81	0.09	1.10	0.08	0.44	75.41	0.00	0.03	95.96	29.59	48.78	98.92
PS7764-mag1c	0.05	3.93	0.02	1.76	0.13	1.04	0.37	0.15	86.61	0.02	0.00	94.08	56.33	35.92	99.72
PS7764-mag2c	0.04	9.79	0.00	2.65	0.19	1.44	0.39	0.36	80.50	0.04	0.00	95.41	42.92	41.88	99.71
PS7764-mag3c	0.03	8.64	0.00	2.65	0.17	1.27	0.36	0.33	81.65	0.05	0.07	95.22	45.67	40.55	99.79
PS7764-mag4c	0.04	13.14	0.00	6.64	0.17	1.59	1.12	0.49	75.36	0.05	0.02	98.60	33.39	45.32	101.95
PS7764-mag5c	0.02	16.34	0.00	1.83	0.10	0.85	0.36	0.58	75.30	0.04	0.05	95.47	32.22	46.31	98.70
PS7764-mag6c	0.04	11.28	0.00	2.16	0.13	1.00	0.61	0.27	79.76	0.01	0.00	95.26	41.79	42.16	99.45
PS7764-mag7c	0.02	5.77	0.00	2.44	0.14	1.12	0.35	0.20	84.67	0.03	0.08	94.82	52.08	37.81	100.04
PS7764-vein1	0.43	0.01	0.00	0.00	0.00	0.00	0.07	0.00	92.41	0.01	0.03	92.95	67.81	31.39	99.74
PS7764-vein2	0.08	0.02	0.08	0.00	0.01	0.00	0.12	0.02	92.55	0.00	0.00	92.87	68.48	30.93	99.73
PS7765-mag1c	0.04	14.87	0.00	4.84	0.10	1.18	0.07	0.41	72.70	0.01	0.00	94.20	29.41	46.23	97.15
PS7765-mag2c	0.03	14.66	0.00	3.90	0.11	1.17	0.08	0.39	74.57	0.00	0.03	94.94	31.60	46.14	98.11
PS7765-mag3c	0.05	9.03	0.01	9.13	0.09	1.30	0.06	0.26	74.03	0.01	0.03	93.98	35.57	42.03	97.55
PS7765-mag4c	0.06	14.60	0.00	7.54	0.10	1.21	0.06	0.41	71.73	0.00	0.04	95.74	27.56	46.93	98.50
PS7765-mag5c	0.05	14.57	0.01	7.71	0.11	1.25	0.05	0.40	71.42	0.01	0.06	95.65	27.16	46.98	98.37
PS7765-mag6c	0.01	15.36	0.00	5.81	0.12	1.20	0.07	0.41	74.38	0.02	0.04	97.43	29.50	47.83	100.38
PS7765-mag7c	0.06	10.66	0.00	0.90	0.10	1.43	0.07	0.32	81.39	0.02	0.14	95.09	43.01	42.69	99.40
PS7766-mag1c	0.03	7.61	0.04	0.04	0.10	1.39	0.08	0.27	84.88	0.02	0.01	94.47	50.06	39.83	99.49
PS7766-mag2c	0.05	8.06	0.03	0.00	0.11	1.33	0.09	0.25	84.42	0.04	0.03	94.39	49.27	40.09	99.33
PS7766-mag3c	0.03	4.51	0.00	0.00	0.12	1.40	0.08	0.13	87.64	0.03	0.00	93.94	56.19	37.08	99.57
PS7766-mag4c	0.02	10.26	0.00	0.00	0.14	1.57	0.09	0.33	81.52	0.00	0.01	93.93	43.80	42.11	98.32
PS7766-mag5c	0.07	10.56	0.00	0.00	0.10	1.04	0.05	0.39	82.25	0.02	0.00	94.47	44.94	41.81	98.98
PS7766-mag6c	0.06	12.61	0.01	0.01	0.08	1.10	0.09	0.44	80.41	0.00	0.01	94.81	40.82	43.68	98.90
PS7766-mag7c	0.03	17.76	0.00	0.01	0.08	0.93	0.07	0.60	75.28	0.01	0.00	94.78	30.67	47.68	97.85
PS7767-mag1r	0.13	0.33	0.00	0.00	0.09	1.01	0.12	0.01	90.94	0.01	0.00	92.64	64.78	32.65	99.13
PS7767-mag2r	0.06	0.38	0.00	0.00	0.10	1.05	0.07	0.03	91.53	0.01	0.00	93.21	65.13	32.93	99.73
PS7767-mag3r	0.08	0.25	0.00	0.03	0.08	1.05	0.11	0.02	91.82	0.00	0.00	93.42	65.53	32.85	99.99
PS7767-mag4r	0.08	0.14	0.00	0.00	0.07	1.01	0.12	0.03	91.71	0.04	0.00	93.21	65.71	32.58	99.79
PS7767-mag5vein	0.02	0.83	0.01	0.02	0.07	0.95	0.04	0.01	91.47	0.00	0.01	93.43	64.73	33.23	99.92

Client	**Giovanni Di Prisco**	GEOSCIENCE LABORATORIES REPORT
	Lakefield Research	ELECTRON MICROPROBE ANALYSIS
Mineral	**Oxides**	Data reviewed by Dave Crabtree
Sample	**Various**	
Job #	**98-0140.oxi**	
Analyst	**D. Crabtree**	
Analyst Approved	**August 6th 1998**	

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
PS7767-mag6vein	0.05	0.59	0.00	0.00	0.07	0.95	0.08	0.00	91.47	0.02	0.02	93.25	65.06	32.93	99.77
PS7767-mag7c	0.03	0.05	0.01	0.00	0.07	1.00	0.11	0.00	91.28	0.02	0.06	92.63	65.62	32.23	99.20
PS7767-mag8c	0.02	0.18	0.01	0.00	0.08	0.95	0.06	0.01	91.70	0.03	0.02	93.07	65.79	32.50	99.67

Client	**Giovanni Di Prisco**	**GEOSCIENCE LABORATORIES REPORT**
	Lakefield Research	**ELECTRON MICROPROBE ANALYSIS**
Mineral	**Oxides**	Data reviewed by Dave Crabtree
Sample	**Various**	
Job #	**98-0140.oxi**	
Analyst	**D. Crabtree**	
Analyst Approved	**August 6th 1998**	

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total

QUALITY CONTROL

Analytical Conditions:	**20kV, 30nA, spot size 1-3 microns.**
Routine:	**Custom WDS spinel routine.**
Correction Procedure:	**PAP with on line Tikb-Vka correction.**

Important note:

Due to variations in LOD and LOQ with sample matrix, these values are approximated in this report. LOD's for EDS data represent the best case scenario (i.e. no peak overlaps) Precision is best when data exceed the LOQ.The Geoscience Laboratories tracks long and short term precision on a variety of mineral standards. If you have any specific requirements please contact us.

Fe2O3	0.03	0.01	0.02	0.00	0.01	0.00	0.11	0.00	89.66	0.00	0.00	89.83	99.64	0.00	99.82
Fe2O3	0.03	0.01	0.00	0.00	0.01	0.00	0.15	0.04	89.93	0.00	0.00	90.16	99.95	0.00	100.17
Fe2O3	0.03	0.03	0.00	0.00	0.01	0.00	0.13	0.03	89.60	0.01	0.01	89.84	99.58	0.00	99.82
Fe2O3	0.04	0.02	0.00	0.00	0.01	0.00	0.15	0.01	89.86	0.01	0.00	90.09	99.86	0.00	100.10
Fe2O3	0.04	0.00	0.00	0.00	0.00	0.00	0.13	0.00	89.74	0.01	0.02	89.94	99.73	0.00	99.93
MnTiO3	0.02	52.17	0.21	0.01	0.00	0.01	0.01	46.64	0.06	0.01	0.02	99.15	0.07	0.00	99.15
MnTiO3	0.04	52.30	0.26	0.05	0.00	0.00	0.01	46.59	0.02	0.01	0.00	99.28	0.00	0.02	99.28
MnTiO3	0.03	52.11	0.19	0.05	0.00	0.00	0.02	47.02	0.02	0.02	0.00	99.46	0.02	0.00	99.46
MnTiO3	0.04	52.20	0.25	0.02	0.00	0.05	0.01	46.92	0.01	0.00	0.00	99.49	0.02	0.00	99.49
MnTiO3	0.04	52.24	0.21	0.04	0.00	0.01	0.00	46.69	0.05	0.00	0.00	99.28	0.05	0.00	99.29
chrRV1	0.05	0.40	0.00	9.19	61.98	0.18	14.07	0.25	13.13	0.07	0.08	99.39	1.10	12.14	99.50
chrRV1	0.05	0.40	0.03	9.17	62.39	0.15	13.98	0.30	13.19	0.07	0.08	99.81	0.95	12.33	99.90
chrRV1	0.06	0.42	0.05	9.13	62.39	0.16	13.95	0.26	13.18	0.06	0.13	99.78	0.82	12.44	99.86
chrRV1	0.05	0.41	0.04	9.11	63.21	0.17	14.02	0.25	13.27	0.08	0.06	100.65	0.68	12.65	100.72
chrRV1	0.07	0.40	0.04	9.15	63.00	0.16	14.00	0.26	13.14	0.06	0.04	100.32	0.59	12.60	100.38
ilmMSU	0.04	46.75	1.00	0.01	0.03	0.11	0.36	4.53	46.31	0.01	0.06	99.20	9.17	38.06	100.12
ilmMSU	0.01	46.81	1.04	0.02	0.03	0.10	0.32	4.53	46.07	0.02	0.02	98.96	8.78	38.17	99.83
ilmMSU	0.02	46.48	1.08	0.03	0.03	0.11	0.35	4.48	46.24	0.00	0.05	98.88	9.23	37.94	99.80
ilmMSU	0.00	46.61	0.97	0.03	0.03	0.07	0.36	4.41	45.96	0.00	0.04	98.47	8.92	37.93	99.36
ilmMSU	0.02	46.30	0.95	0.02	0.02	0.06	0.33	4.56	46.34	0.01	0.06	98.67	9.81	37.51	99.65
ilmMSU	0.02	46.72	1.02	0.01	0.03	0.08	0.35	4.59	46.23	0.01	0.08	99.13	9.25	37.90	100.06
ilmMSU	0.01	46.77	1.12	0.04	0.01	0.07	0.35	4.56	45.80	0.00	0.06	98.78	8.54	38.12	99.64
ilmMSU	0.03	46.50	1.02	0.02	0.02	0.10	0.34	4.48	45.72	0.02	0.04	98.28	8.68	37.91	99.15

Client	**Giovanni Di Prisco**	**GEOSCIENCE LABORATORIES REPORT**
	Lakefield Research	**ELECTRON MICROPROBE ANALYSIS**
Mineral	**Oxides**	Data reviewed by Dave Crabtree
Sample	**Various**	
Job #	**98-0140.oxi**	
Analyst	**D. Crabtree**	
Analyst Approved	**August 6th 1998**	

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
Standard	chrTNC	ilmMSU	ilmMSU	chrTNC	chrTNC	chrTNC	chrTNC	ilmMSU	ilmMSU	chrTNC					
Average wt%	L.O.D.	46.618	1.025	9.150	62.594	L.O.D.	14.004	4.518	46.084	L.O.D.	L.O.D.				
Expected wt% *	L.O.D.	46.756	0.980	8.900	62.850	L.O.D.	13.840	4.600	46.419	L.O.D.	L.O.D.				
Trueness % rel.		-0.296	4.592	2.809	-0.407		1.185	-1.793	-0.722						
Mode	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS				
L.O.D. wt%	0.019	0.021	0.052	0.019	0.025	0.034	0.012	0.025	0.036	0.031	0.045				
L.O.Q. wt%	0.063	0.070	0.173	0.063	0.083	0.113	0.040	0.083	0.120	0.103	0.150				
Count time (seconds)	20	20	20	20	20	30	20	15	15	20	20				

** Expected Values are from long term in-house charcterization of mineral standards.

QC note

1) None of the reported values for these mineral standards are certified;" trueness" is therefore based on available chemical data.
2) n.d. not determined for the specified mineral standard.
3) L.O.D. = Limit of Detection, precision ~ +/- 100%.
4) L.O.Q. = Limit of quantification (3.3 x L.O.D), precision ~ 10-30%.
5) Reported count times are for both peak and background measurements.
6) FeO* - total Iron expressed as FeO
8) Fe2+/Fe3+ calculations are based on charge balance.