An Investigation by High Definition Mineralogy into

THE MINERALOGICAL CHARACTERISTICS OF AN IRON RICH SAMPLE AND A SILICATE SAMPLE FROM TIMMINS, ONTARIO

prepared for

STONEWATER RESOURCES

Custom Mineralogy, MI5007-JUL13 – Final Report
August 27, 2013

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Executive Summary

This summary report describes a mineralogical and analytical test program conducted on five samples (TM 13-3 to 13-7) using optical mineralogy and electron microscopy, QEMSCAN analysis, magnetic separation by Davis Tube, Fe by Titration, SG and whole rock analyses conducted on five samples submitted by Stonewater Resources. The purpose of the mineralogical work was to determine the Fe species and the presence of talc.

A summary of the results is presented below.

Sample TM 13-6

The sample consists primarily of magnetite, minor goethite and silicate minerals (mainly quartz).

The sample consists primarily of massive and granular magnetite and gangue minerals. The contacts between magnetite and gangue minerals are generally sharp on the mesoscopic level. The sample is generally fine grained (<200 µm). Magnetite ranges in size from ~10 µm to less than 150 µm. It is rarely up to 200 µm.

Sample TM 13-3

The sample consists mainly of amphiboles and chlorite with trace amounts of other minerals. Note that *talc* occurs as a trace mineral.

Introduction

This summary report describes a mineralogical and analytical test program using optical mineralogy and electron microscopy, QEMSCAN analysis, magnetic separation by Davis Tube, Fe by Titration, SG and whole rock analyses conducted on five samples submitted by Stonewater Resources. The purpose of the mineralogical work was to determine the Fe species and the presence of talc.

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Electron Microscopy: Aldis Margot
Optical Mineralogy: Tassos Grammatikopoulos
Report preparation by: Tassos Grammatikopoulos
Report reviewed by: Stephanie Downing

Testwork Summary

1. Sample Receipt and Preparation

Five samples, referred to as TM-13-3 to 7 (Table 1), from a Fe ore property in Timmins, Ontario, were submitted to the mineralogy department at SGS Canada Inc., Lakefield site, by Stonewater Resources. They were assigned the LIMS number MI5007-JUL13.

One polished thin section was made from sample TM 13-3 and two polished sections from the TM 13-6 for mineralogical examination.

The SG of the samples was measured on the rock specimens. The samples were then crushed to -10 mesh and representative sub-samples were riffled for whole rock analysis by X-ray fluorescence for all samples, and Fe by titration for samples TM 13-5 and TM 13-6. Iron was calculated for the rest of the sample by conversion from Fe_2O_3 to Fe. Further, sub-samples were riffled from TM 13-5 and 13-6 and stage crushed to 106 µm for the Davis Tube tests.

The mineralogical examination was carried out using both optical mineralogy and QEMSCAN technology for TM 13-6 and QEMSCAN technology for TM 13-3. The QEMSCAN analysis was done using the Field Stitch (FS) mode of measurement. The FS maps a sample that has been mounted in the polished section. It collects a chemical spectrum at a set interval within the field of view. Each field of view is then processed offline and a pseudo image of the core sample is produced. The pixel spacing for the analysis was 15 µm. The polished thin sections were also examined with an optical microscope in both transmitted and reflected light.

Table 1: Sample ID and test Work Requested

Sample No.	WRA	%Talc	% Fe	SG	Davis Tube
TM 13-3	X	X			
TM 13-4	X		X	X	
TM 13-5	X		X	X	X
TM 13-6	X		X	X	X
TM 13-7	X		X	X	

The certificate of analysis is given in Appendix A.

2. SG Results

The specific gravity (SG) results are presented in Table 2.

Table 2: SG Results

No.	ID	Description	Dry Rock	Weight in Water	Water Displacemt	Density (g/cm^3)	Density (lbs/ft^3)
1	TM 13-4		1052.2	687.0	365.2	**2.88**	179.9
2	TM 13-5		1501.5	1054.0	447.5	**3.36**	209.5
3	TM 13-6		432.5	335.1	97.4	**4.44**	277.3
4	TM 13-7		1126.4	790.7	335.7	**3.36**	209.5

3. WRA by XRF and Fe by Titration Results

The results from the whole rock analysis (WRA) by X-ray fluorescence (XRF) are presented in Table 3 and Table 4.

Table 3: WRA by XRF Results

Sample ID	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
TM-13-3	44.60	8.18	11.50	20.10	7.77	0.70	0.02	0.41	0.04	0.17	0.29	0.02	7.10	101.00
TM-13-4	65.00	0.55	27.50	0.66	0.16	0.01	0.04	0.04	0.09	0.90	0.01	< 0.01	5.66	100.60
TM-13-5	52.70	0.12	46.90	0.27	0.43	0.01	< 0.01	< 0.01	0.13	0.02	0.02	< 0.01	-0.58	100.10
TM-13-6	12.90	0.14	88.50	0.10	0.17	0.01	< 0.01	< 0.01	0.16	0.02	0.01	< 0.01	-2.08	99.90
TM-13-7	42.60	0.22	56.30	0.14	0.03	0.02	0.02	< 0.01	0.14	0.03	0.01	< 0.01	0.59	100.10

Table 4: Fe by Titration Results

Sample ID	Fe %
TM-13-5	33.39
TM-13-6	62.5

4. Davis Tube Results

The results from the Davis Tube Tests are presented in Table 5. The Mags fraction from both samples and the Non Mags from the TM-13-5 were submitted for WRA by XRF. Note that there was not enough material from the Non Mags from the TM-13-6 for the analysis. It should be noted that the % Mags in the TM-13-5 is lower than that in the Non-Mags indicating a lower liberation value of magnetite in the former.

Table 5: Davis Tube Results

DAVIS TUBE TEST

Test Conditions:

Water flow:	1000 mL per minute
Tube Speed:	100 strokes per minute
Current to Poles:	1.5 amperes
Retention Time:	4 minutes

Project # : **MI5007-JUL13**

Sample	Weight	Mags	Non-mags	% Mags
TM-13-5	21.4	13.8	7.6	64.5
TM-13-6	19.9	18.2	1.8	91.2

5. Optical Mineralogy

5.1. Sample TM 13-6

The sample consists primarily of massive and granular magnetite and gangue minerals (Table 6). The contacts between magnetite and gangue minerals are generally sharp on the mesoscopic level.

Representative photomicrographs from the optical microscope are presented in Figure 2 to Figure 4.

Table 6: Mineral Abundance and Characteristics for TM 13-6

Mineral	Mineral Abundance	Textural Characterization
Magnetite	~92%	• It ranges in size from ~10 µm to less than 150 µm. It is rarely up to 200 µm. • It is typically granular, and subhedral, while locally euhedral and anhedral. • Forms polycrystalline aggregates but layering is not apparent. • Magnetite is generally free of inclusions and alteration by hematite. • Minor goethite (2-3%) is present but it occurs intestinal to the magnetite grains.
Gangue Minerals	~8%	• Gangue minerals are fine-grained minerals and range from <20 to 200 µm in size.

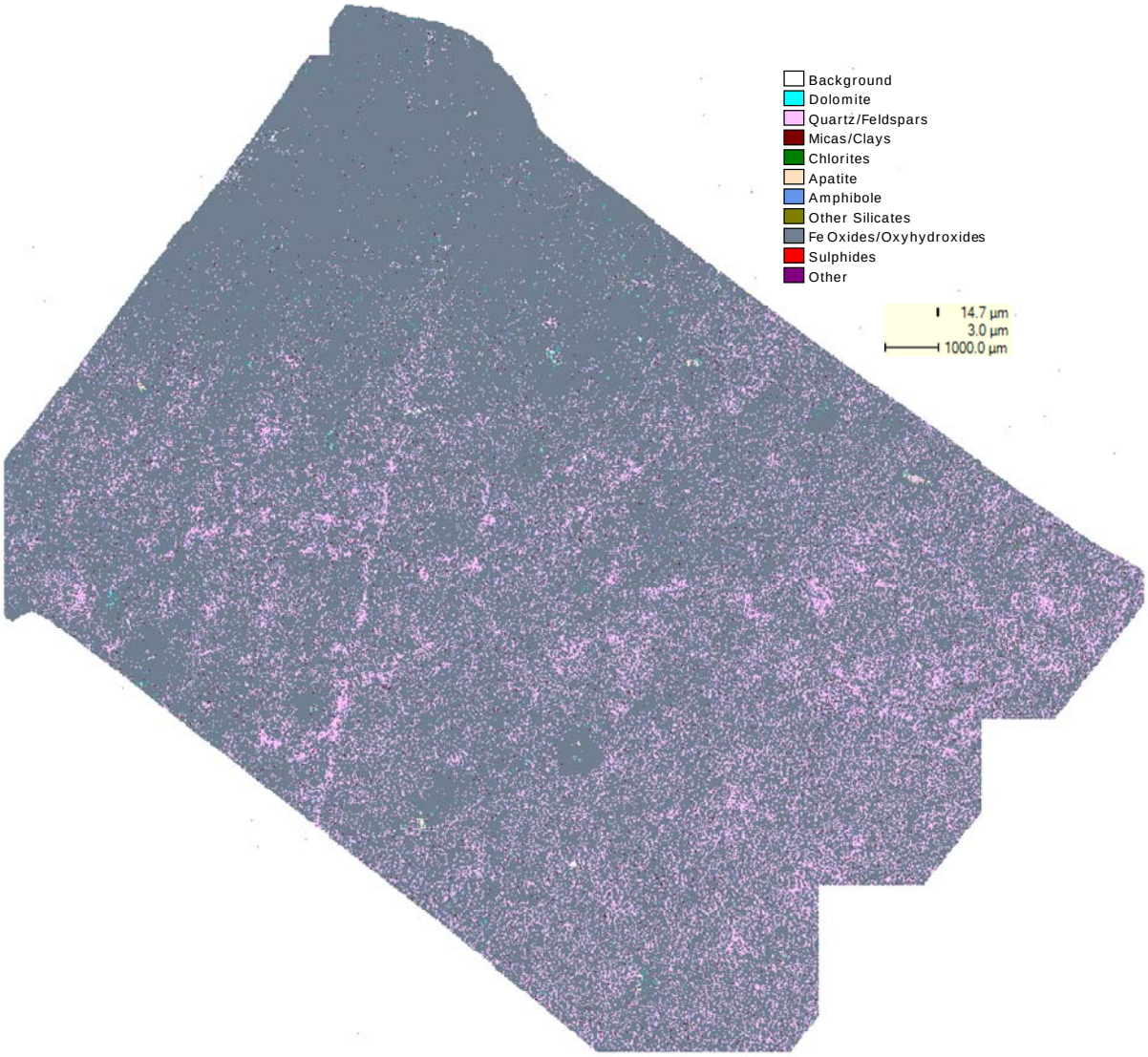


Figure 1: QEMSCAN Pseudo Image of TM 13-6

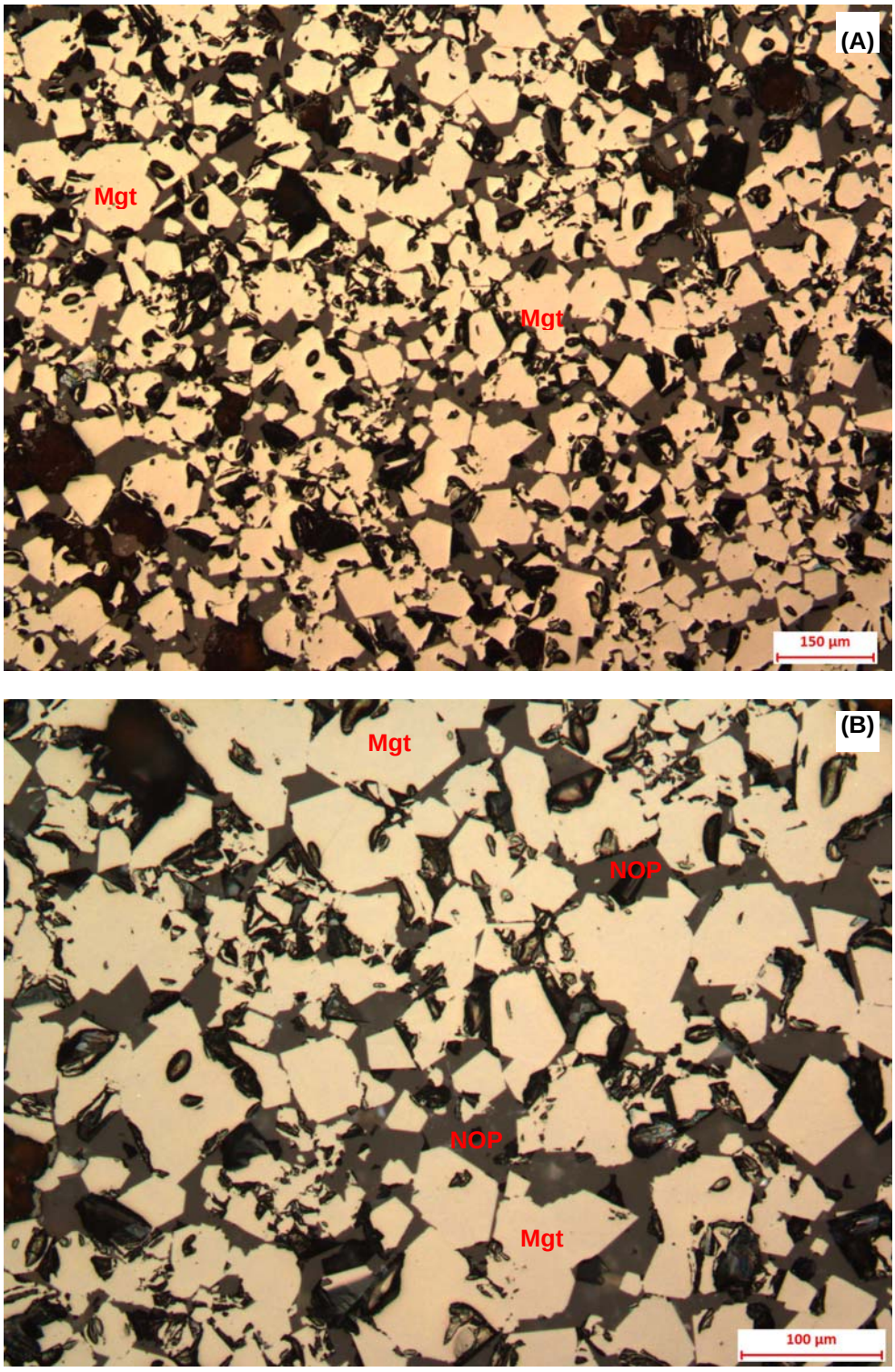


Figure 2: Optical Photomicrographs in Plane Polarized Reflected Light (PPRL) from TM 13-6

(A) Image shows fine-grained magnetite (Mgt intergrown with silicate minerals (NOP: dark grey).

(B) Image shows higher magnification magnetite and silicate minerals.

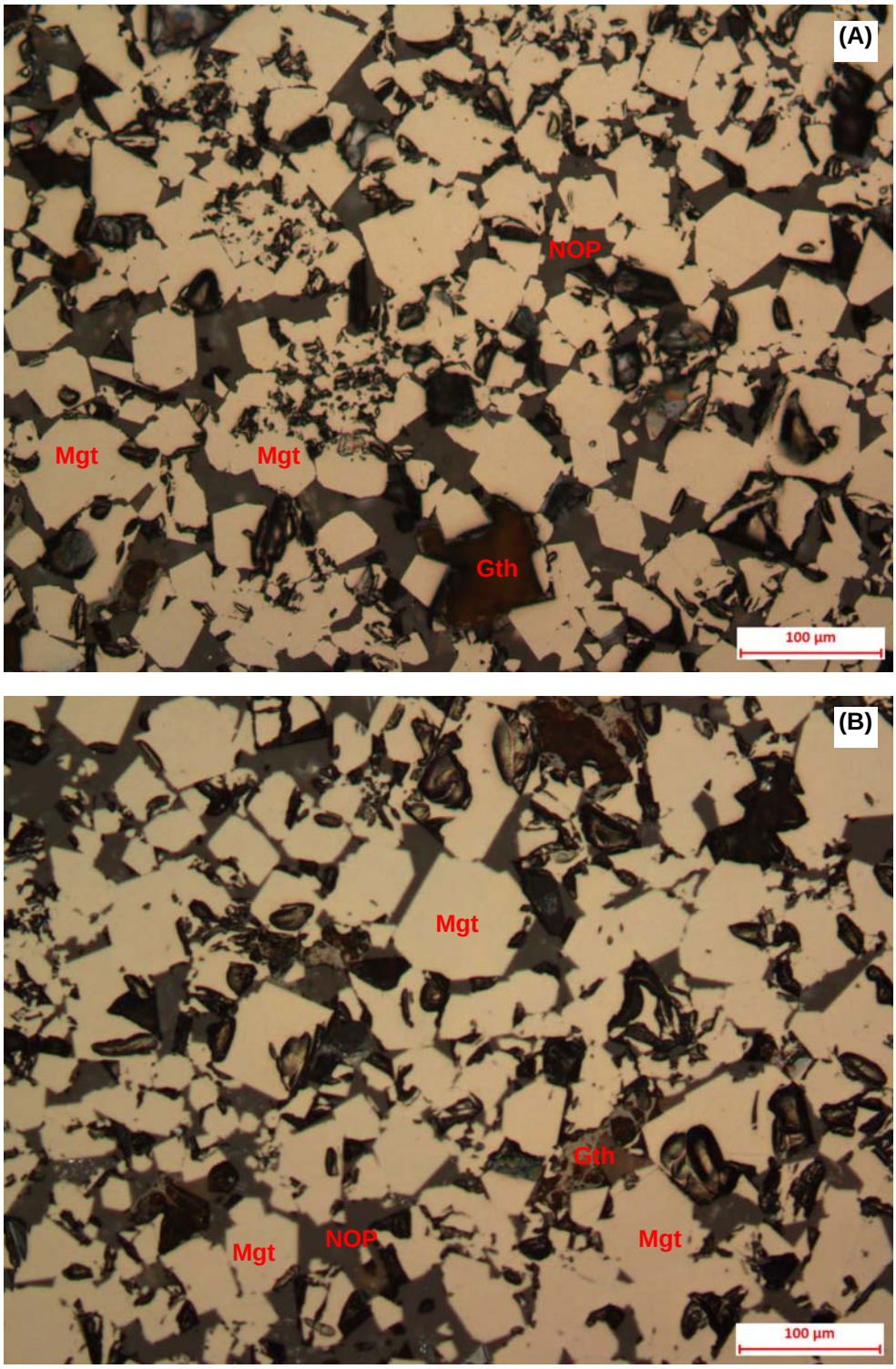


Figure 3: Optical Photomicrographs in PPRL from Sample TM 13-6

(A) and (B) Images show fine-grained magnetite (Mgt) associated with silicate minerals (NOP) and goethite (Gth).

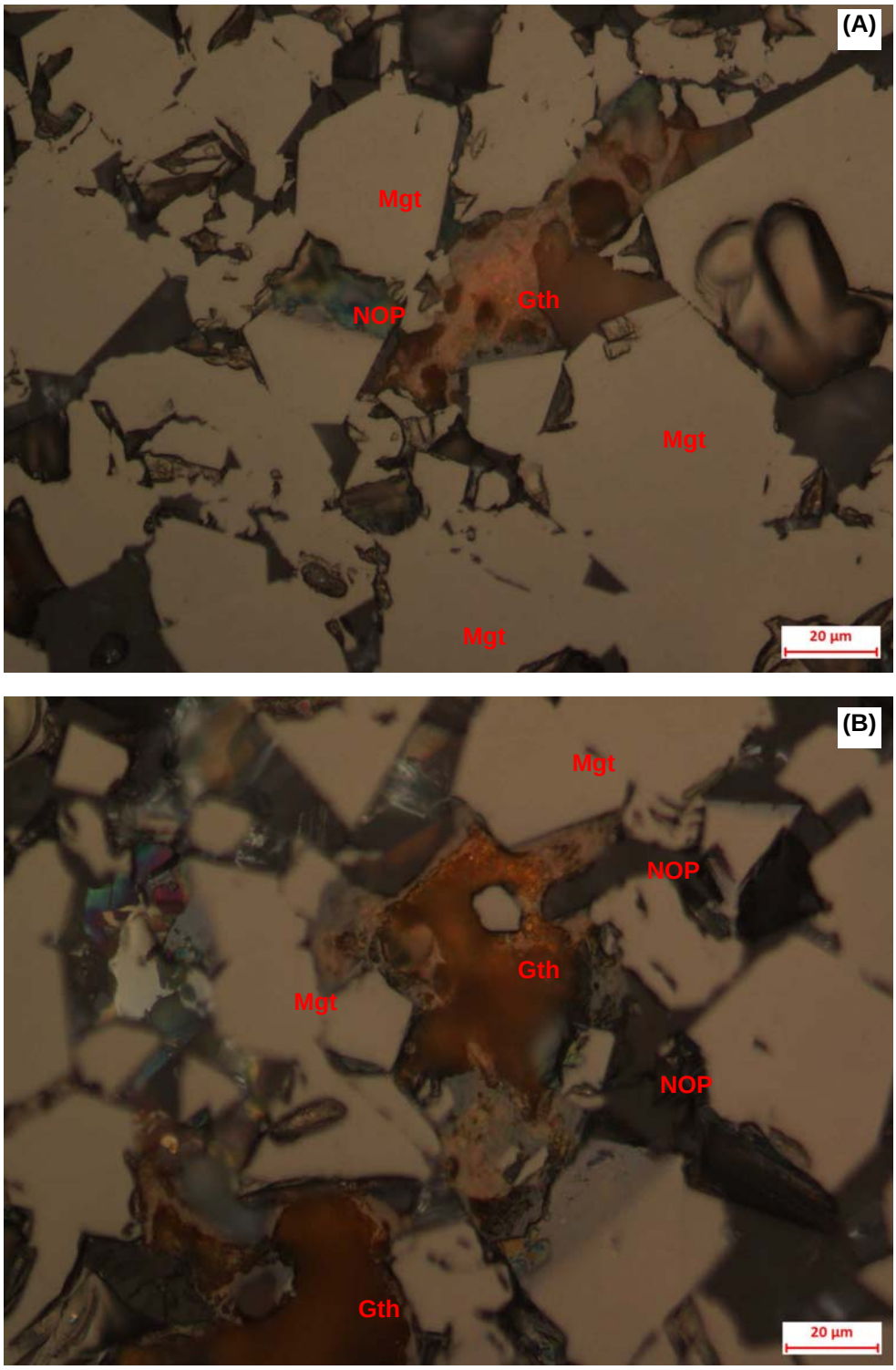


Figure 4: Optical Photomicrographs in PPRL from Sample TM 13-6

(A) and (B) Images show fine-grained magnetite (Mgt) associated with silicate minerals (NOP) and goethite (Gth).

5.2. Sample TM 13-3

The sample is fine-grained and consists mainly of amphiboles and chlorite with trace amounts of talc and other minerals (Table 7). A Tescan scanning electron microscope (SEM) equipped with a X-ray energy dispersive spectrometer (EDS) was used to examine the sample. Representative back scattered electron (BSE) images from the electron microscope and semi-quantitative analyses are shown in Figure 6 to Figure 13. They illustrate typical mineralogical characteristics of the sample.

Table 7: Mineral Abundance by QEMSCAN and Characteristics for Sample TM 13-3

Survey	**Name**	
	Id	MI5007-JUL13
Sample	**Name**	**TM-13-3**
	Min Size (µm)	3.00
	Max Size (µm)	1000.00
	Total Mass	100.00
Mineral Mass(%)	Chlorites	28.6
	Amphibole	66.1
	Talc	1.8
	Quartz/Feldspars	2.8
	Carbonates	0.0
	Micas/Clays	0.3
	Other Silicates	0.0
	Fe Oxides/Oxyhydroxides	0.0
	Apatite	0.1
	Sulphides	0.0
	Titanite	0.3
	Total	100.0
Calculated ESD Size	Chlorites	85
	Amphibole	151
	Talc	30
	Quartz/Feldspars	27
	Carbonates	24
	Micas/Clays	23
	Other Silicates	22
	Fe Oxides/Oxyhydroxides	25
	Apatite	26
	Sulphides	25
	Titanite	23

Note: The size of the minerals as shown in the table below is calculated statistically from the length of all the horizontal intercepts through each particle. It uses an assumption of random sectioning of spherical particles having uniform size, to obtain an estimate of the stereologically-corrected grain size in microns. The size calculation is a statistical property, which means that it is only valid when applied to a population of particles, and its accuracy increases as the population size increases. The accuracy of the size calculation is extremely low if applied to just a single cross-section.

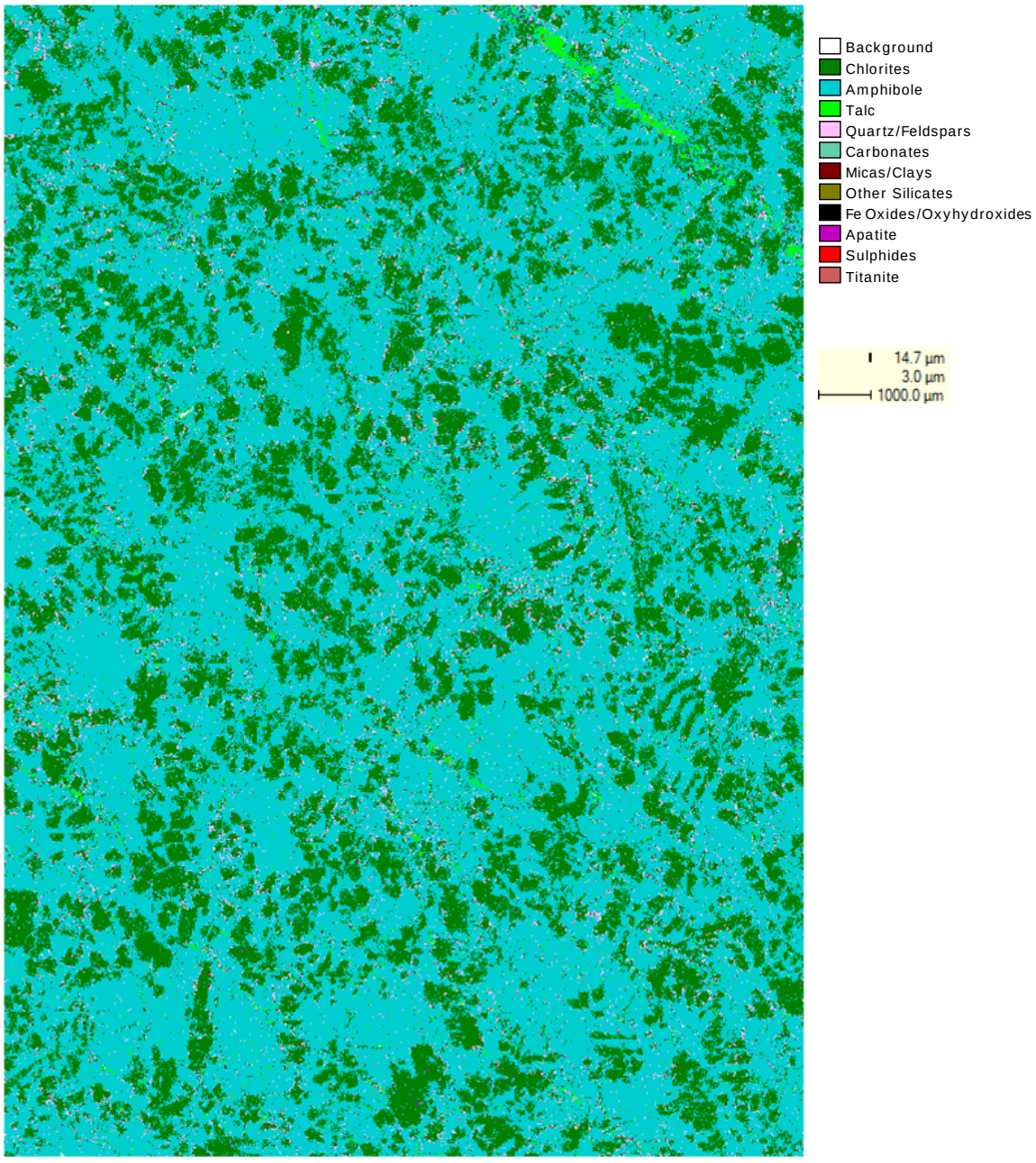
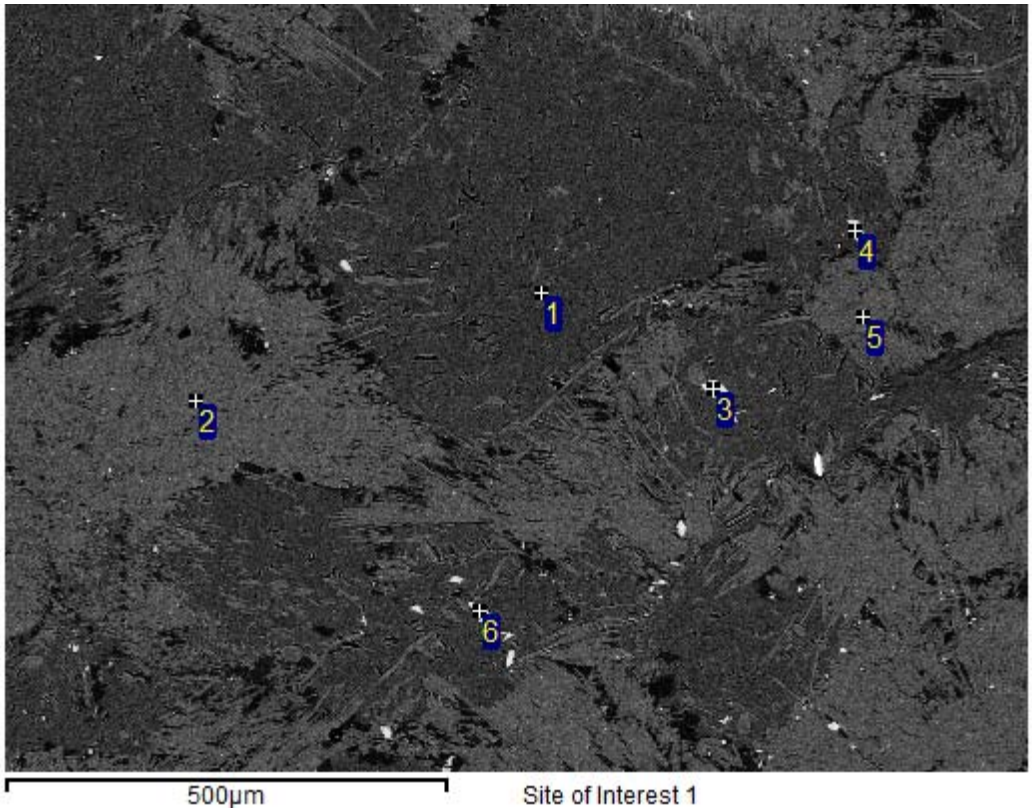


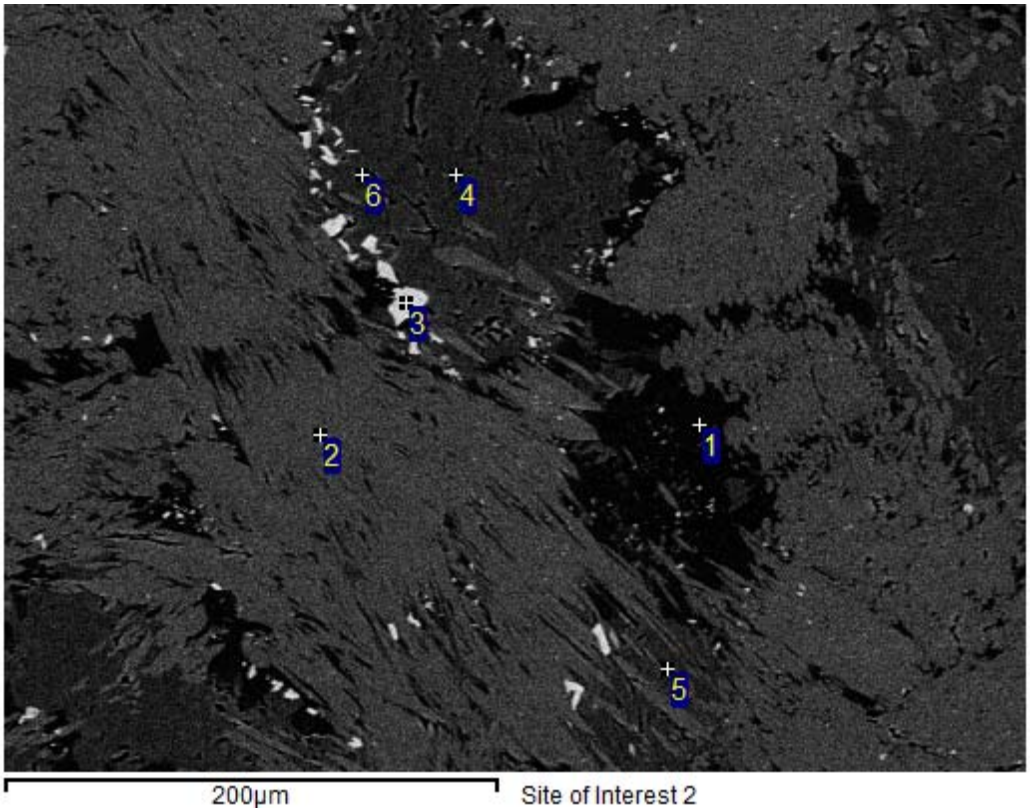
Figure 5: QEMSCAN Pseudo Image of TM-13-3



Spectrum	O	Mg	Al	Si	P	Ca	Ti	Cr	Fe	Total	Mineral ID
1	39.0	14.1	9.8	15.4				0.8	20.8	100.0	Chlorite
2	45.5	11.4		27.7		9.4			6.0	100.0	Amphibole
3	40.2			14.3		20.9	24.6			100.0	Titanite
4	50.0	12.6	8.5	12.2	2.1	3.1		0.4	11.0	100.0	Chlorite/Amp
5	45.5	11.4		27.7		9.4			6.0	100.0	Amphibole
6	38.4	6.0	4.4	18.4		11.1	12.6	0.7	8.4	100.0	Titanite

Figure 6: Back Scattered Electron (BSE) Image from the Electron Microscope from TM 13-3

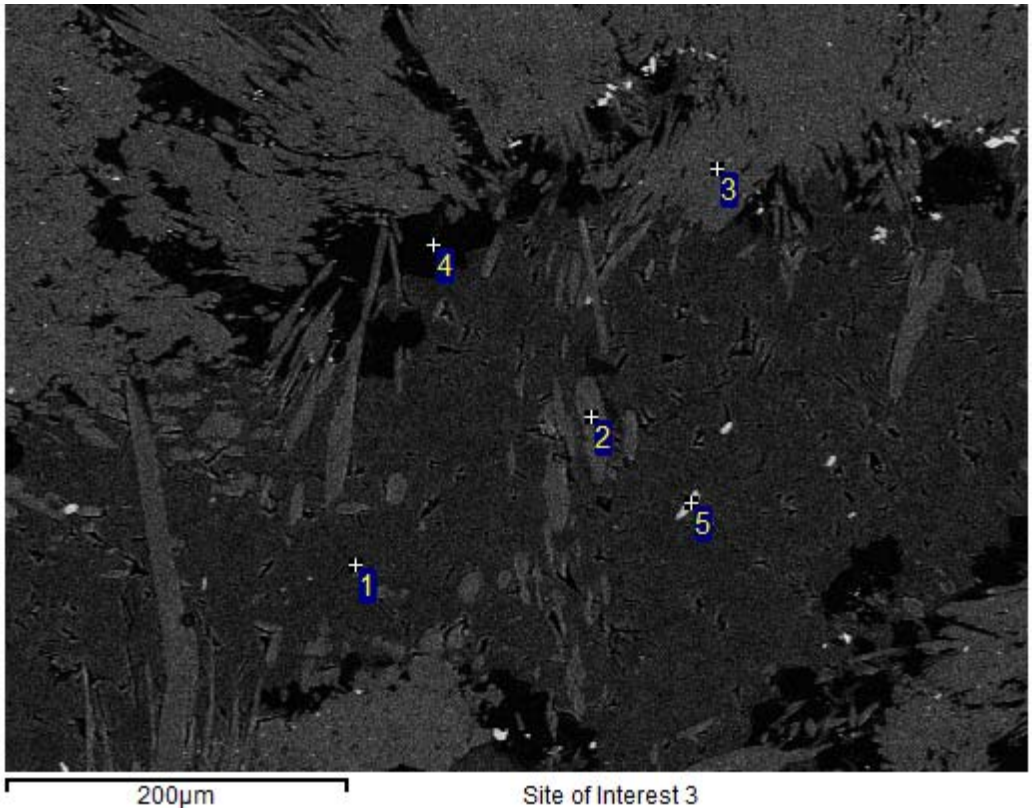
The image shows aggregates of amphibole and chlorite and titanite (bright white grains).



Spectrum	O	Na	Mg	Al	Si	Ca	Ti	Cr	Fe	Total	Mineral ID
1	48.1	8.2		10.1	33.6					100.0	Albite
2	44.7		11.6		28.2	9.1			6.4	100.0	Amphibole
3	41.6			0.4	15.2	19.8	23.0			100.0	Titanite
4	49.3		14.7	9.0	14.8			0.4	11.9	100.0	Chlorite
5	49.8		14.1	8.2	15.7	1.2			11.1	100.0	Chlorite
6	46.9		15.2	9.0	15.5				13.5	100.0	Chlorite

Figure 7: BSE Image from the Electron Microscope from TM 13-3

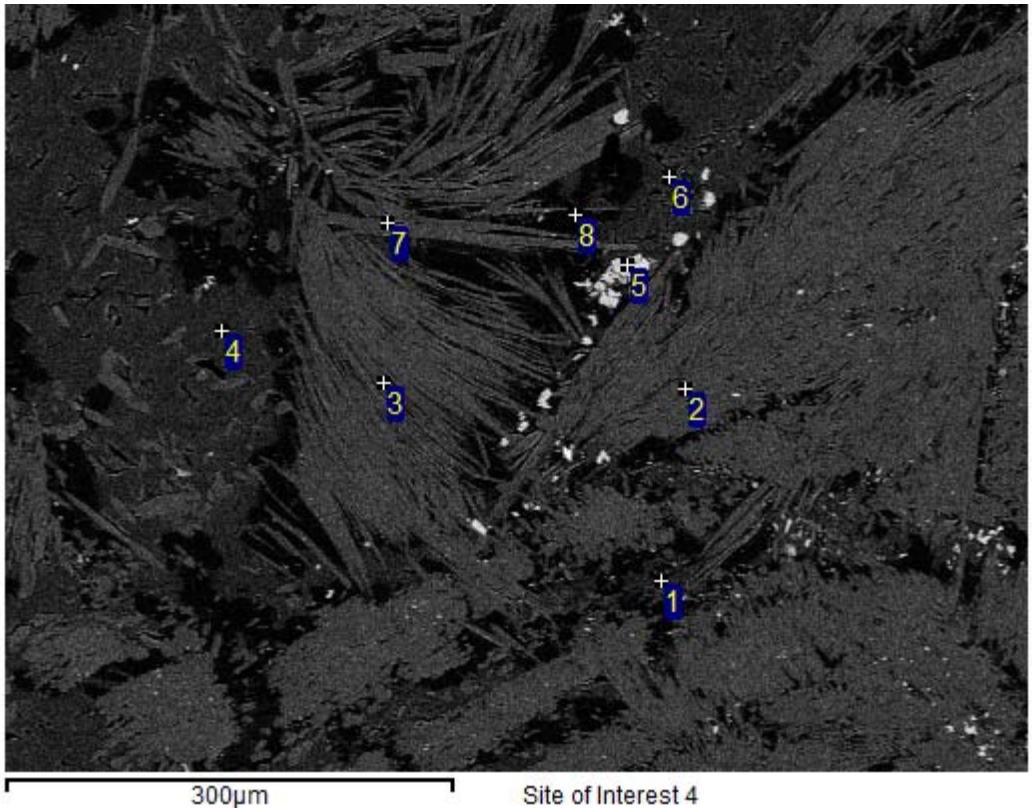
The image shows aggregates of amphibole and chlorite and titanite (bright white grains).



Spectrum	O	Na	Mg	Al	Si	P	Ca	Fe	Total	Mineral ID
1	49.1		15.0	9.1	14.7			12.2	100.0	Chlorite
2	46.2		11.2	0.4	26.9		8.9	6.3	100.0	Amphibole
3	46.0		11.2		27.4		9.3	6.1	100.0	Amphibole
4	47.5	8.0	0.6	9.6	34.2				100.0	Albite
5	47.5		1.5	0.9	1.0	16.1	31.9	1.1	100.0	Apatite

Figure 8: BSE Image from the Electron Microscope from TM 13-3

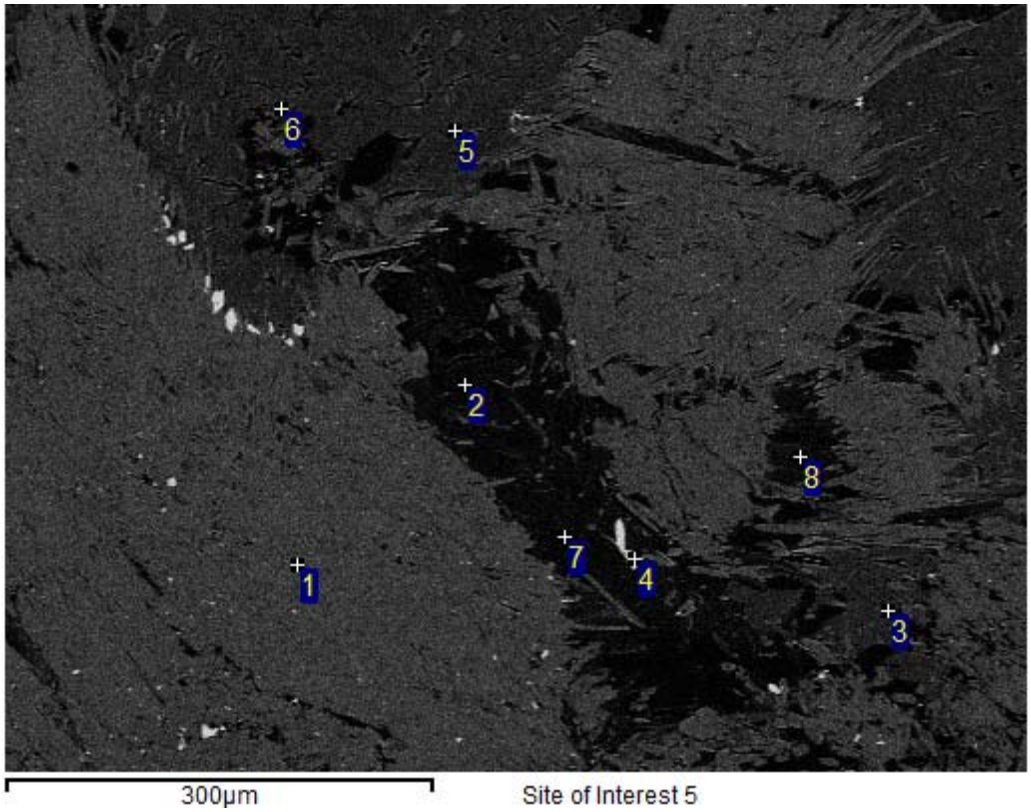
The image shows aggregates of amphibole and chlorite, apatite and feldspars.



Spectrum	O	Na	Mg	Al	Si	Ca	Ti	Cr	Mn	Fe	Total	Mineral ID
1	46.7	0.6	13.7	9.4	17.4					12.1	100.0	Chlorite
2	45.7		11.6		28.1	9.0				5.7	100.0	Amphibole
3	45.7		11.7	0.6	26.9	8.5				6.7	100.0	Amphibole
4	48.5		14.5	9.3	14.5			0.6		12.6	100.0	Chlorite
5	42.0		0.7	0.6	15.5	18.7	21.7			0.7	100.0	Titanite
6	42.3		14.5	9.7	15.1				0.6	17.7	100.0	Chlorite
7	46.7		11.3		27.1	9.0				5.9	100.0	Amphibole
8	48.1	7.8		10.1	33.9						100.0	Albite

Figure 9: BSE Image from the Electron Microscope from TM 13-3

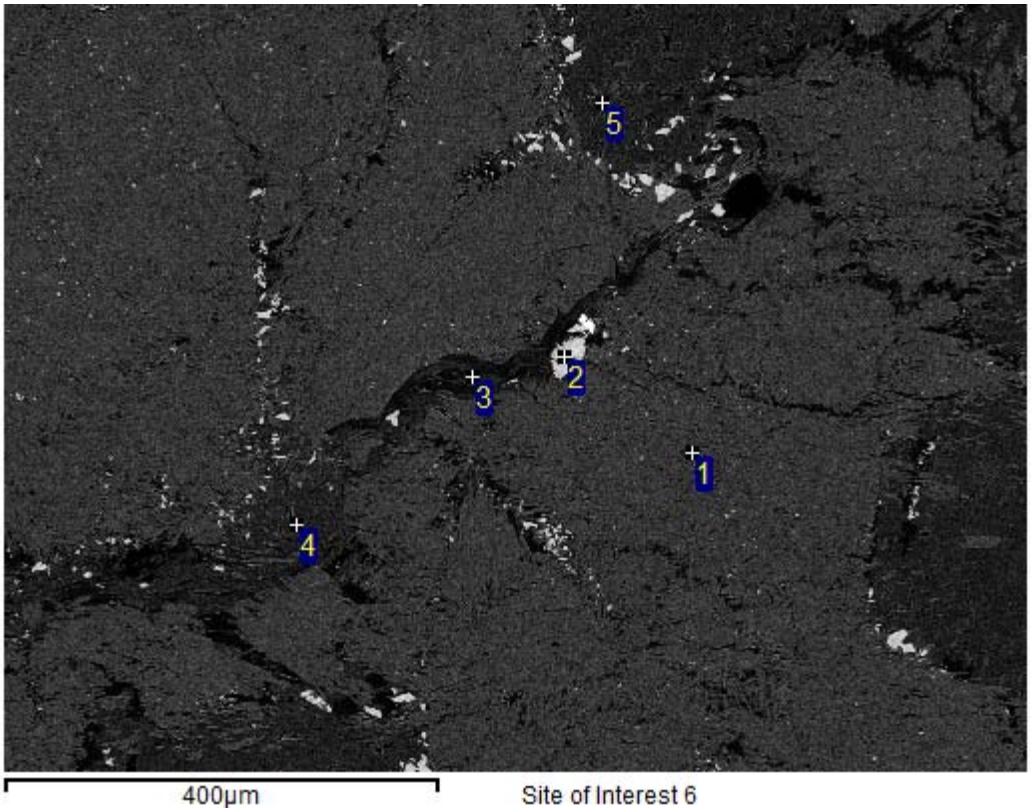
The image shows aggregates of amphibole and chlorite, titanite and albite.



Spectrum	O	Mg	Al	Si	Ca	Ti	Cr	Fe	Total	Mineral ID
1	46.1	11.4	1.7	26.3	7.7			6.8	100.0	Amphibole
2	48.8	16.6		30.3				4.3	100.0	Talc
3	48.1	14.2	9.5	14.7			0.6	12.9	100.0	Chlorite
4	40.2			15.2	20.2	24.4			100.0	Titanite
5	48.2	14.6	9.5	14.2			0.6	13.0	100.0	Chlorite
6	30.3	13.8	8.7	18.1			0.9	28.2	100.0	Chlorite
7	45.2	17.1	0.9	31.1				5.7	100.0	Talc
8	47.4	16.3		31.2				5.1	100.0	Talc

Figure 10: BSE Image from the Electron Microscope from TM 13-3

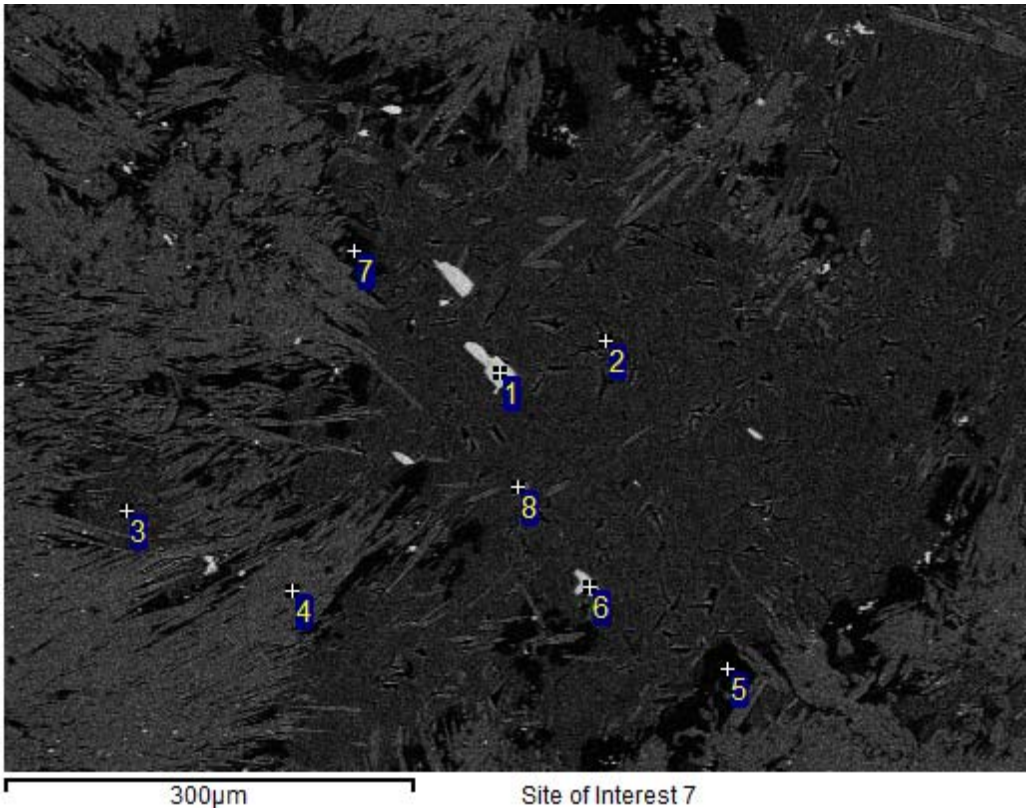
The image shows aggregates of amphibole, chlorite, titanite and talc.



Spectrum	O	Mg	Al	Si	Ca	Ti	Cr	Fe	Total	Mineral ID
1	44.9	13.6	5.0	21.3	3.6		1.2	10.4	100.0	Amphibole
2	41.5			14.7	19.9	23.8			100.0	Titanite
3	44.3	14.5	7.5	18.1			1.1	14.6	100.0	Chlorite
4	51.8	13.9	9.1	13.7			0.4	11.1	100.0	Chlorite
5	28.4	14.5	8.8	17.6			0.9	29.9	100.0	Chlorite

Figure 11: BSE Image from the Electron Microscope from TM 13-3

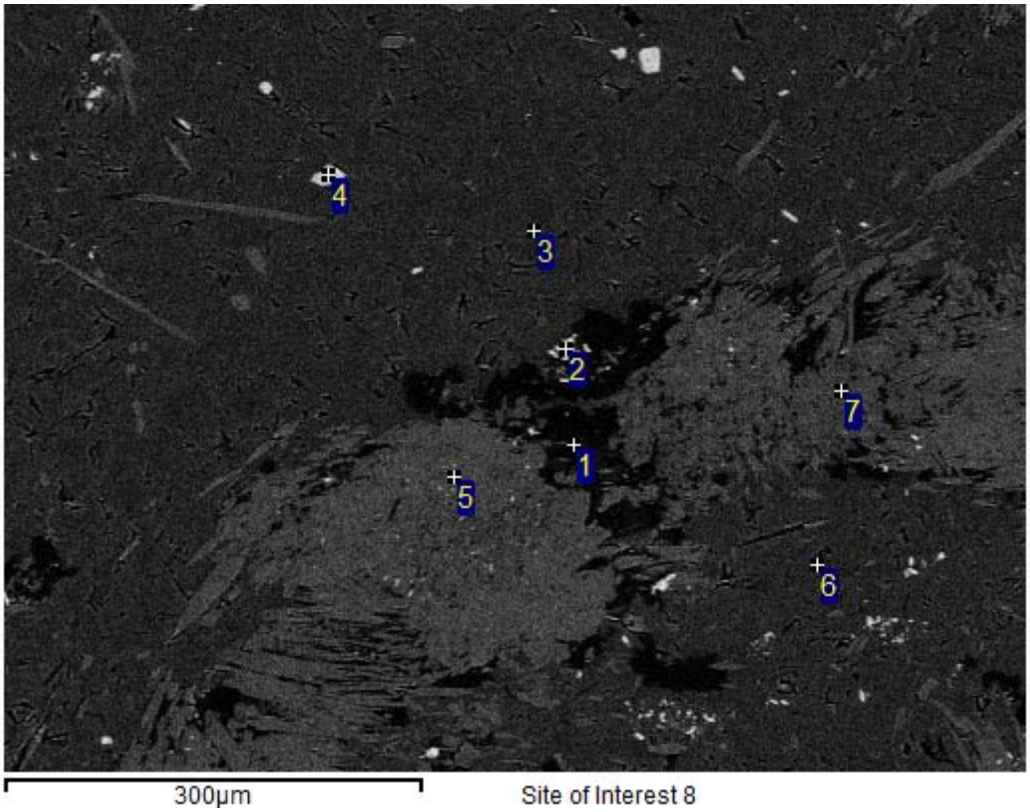
The image shows aggregates of amphibole, chlorite and titanite.



Spectrum	O	F	Na	Mg	Al	Si	P	Ca	Cr	Fe	Total	Mineral ID
1	37.8	2.8					19.7	39.7			100.0	Apatite
2	47.6			14.2	9.8	14.3			0.5	13.6	100.0	Chlorite
3	46.9			14.6	8.9	14.4			1.0	14.2	100.0	Chlorite
4	45.2		2.6	8.2	2.7	28.3		7.7		5.3	100.0	Amphibole
5	49.4		8.4		10.0	32.2					100.0	Albite
6	39.7						19.7	40.6			100.0	Apatite
7	47.4		8.3		10.1	34.1					100.0	Albite
8	49.1			12.7	7.0	16.4		2.6	0.7	11.4	100.0	Chloriote

Figure 12: BSE Image from the Electron Microscope from TM 13-3

The image shows aggregates of amphibole, chlorite, apatite, and albite.



Spectrum	O	Mg	Al	Si	P	Ca	Ti	Cr	Fe	Total	Mineral ID
1	43.0	14.9		32.5		3.4			6.2	100.0	Amphibole
2	50.3	7.0	4.2	13.0		9.1	10.7		5.8	100.0	Titn/Amph
3	48.8	14.0	9.7	14.3				0.5	12.8	100.0	Chlorite
4	39.2				20.4	40.4				100.0	Apatite
5	46.2	6.4		21.3		12.7	9.6		3.8	100.0	Titn/Amph
6	48.2	14.6	8.6	14.9					13.6	100.0	Chlorite
7	45.3	11.5		28.4		8.9			5.8	100.0	Amphibole

Figure 13: BSE Image from the Electron Microscope from TM 13-3

The image shows aggregates of amphibole, chlorite, titanite and apatite.

Appendix A – Certificate of Analysis

SGS Canada Inc.
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Phone: 705-652-2000 FAX: 705-652-6365

Mineralogy
Attn : Tassos Grammatikopoulos / Elaine Glover

July 24, 2013

Date Rec. : 19 July 2013
LR Report : **CA02867-JUL13**
Client Ref : MI5007-JUL13

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %
1: TM-13-3	44.6	8.18	11.5	20.1	7.77	0.70	0.02
2: TM-13-4	65.0	0.55	27.5	0.66	0.16	0.01	0.04
3: TM-13-5	52.7	0.12	46.9	0.27	0.43	0.01	< 0.01
4: TM-13-6	12.9	0.14	88.5	0.10	0.17	0.01	< 0.01
5: TM-13-7	42.6	0.22	56.3	0.14	0.03	0.02	0.02

Sample ID	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %	Fe %
1: TM-13-3	0.41	0.04	0.17	0.29	0.02	7.10	101.0	8.04
2: TM-13-4	0.04	0.09	0.90	0.01	< 0.01	5.66	100.6	19.2
3: TM-13-5	< 0.01	0.13	0.02	0.02	< 0.01	-0.58	100.1	32.8
4: TM-13-6	< 0.01	0.16	0.02	0.01	< 0.01	-2.08	99.9	61.9
5: TM-13-7	< 0.01	0.14	0.03	0.01	< 0.01	0.59	100.1	39.4

Control Quality Assay
Not Suitable for Commercial Exchange

Tom Watt
Project Coordinator

SGS Canada Inc.
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Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Mineralogy
Attn : Tassos Grammatikopoulos / Nicole Martin / Tracy Gill

August 22, 2013

Date Rec. : 29 July 2013
LR Report : **CA03273-JUL13**
Client Ref : MI5007

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
1: TM-13-5 Mag	30.5	0.19	70.9	0.15	0.14	0.05	0.02	< 0.01	0.08	< 0.01	0.03	< 0.01	-1.85	100.3
2: TM-13-5 Non Mag	92.3	0.43	4.42	0.39	0.75	0.15	0.06	< 0.01	0.16	0.02	0.11	< 0.01	0.99	99.8
3: TM-13-6 Mag	6.59	0.09	95.6	0.06	0.05	0.04	0.01	< 0.01	0.06	0.02	< 0.01	< 0.01	-2.12	100.4
4: TM-13-6 Non Mag	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss	---nss

Control Quality Assay
Not Suitable for Commercial Exchange

Tom Watt
Project Coordinator

ONLINE LIMS

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Mineralogy
Attn : Tassos Grammatikopoulos / Elaine Glover

July 24, 2013

Date Rec. : 19 July 2013
LR Report : **CA02868-JUL13**
Client Ref : MI5007-JUL13

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Fe %
1: TM-13-5	33.39
2: TM-13-6	62.49

Control Quality Assay
Not Suitable for Commercial Exchange

Tom Watt
Project Coordinator