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Mineralogy Report

Client Contact:	Hans Matthews
GL Job Number:	07-0499
Test Group:	SEM-101
Date:	April 9, 2008

Sample Prep: Thin sections were carbon coated prior to SEM analysis. A minimum of two representative fields of view were selected for mineral identification on each thin section, focusing primarily on the garnets and their inclusions.

SEM Analysis: Each sample thin section was examined under SEM backscatter imaging for unusual features. The representative fields of view of each sample thin section were analyzed with SEM backscatter imaging and energy dispersive (ED) X-ray data collection for mineral identification. Energy dispersive (ED) X-ray data was also used to determine the chemistry of the garnets associates with each sample.

Summary Plot: An almandine-grossular-pyrope ternary plot is included in Appendix 1 to aid in distinguishing between the various populations of garnets observed in the samples.

Quality Control: The analytical performance of the energy dispersive (ED) routine used in this study is presented in Appendix 2.

Client ID: GT01B1

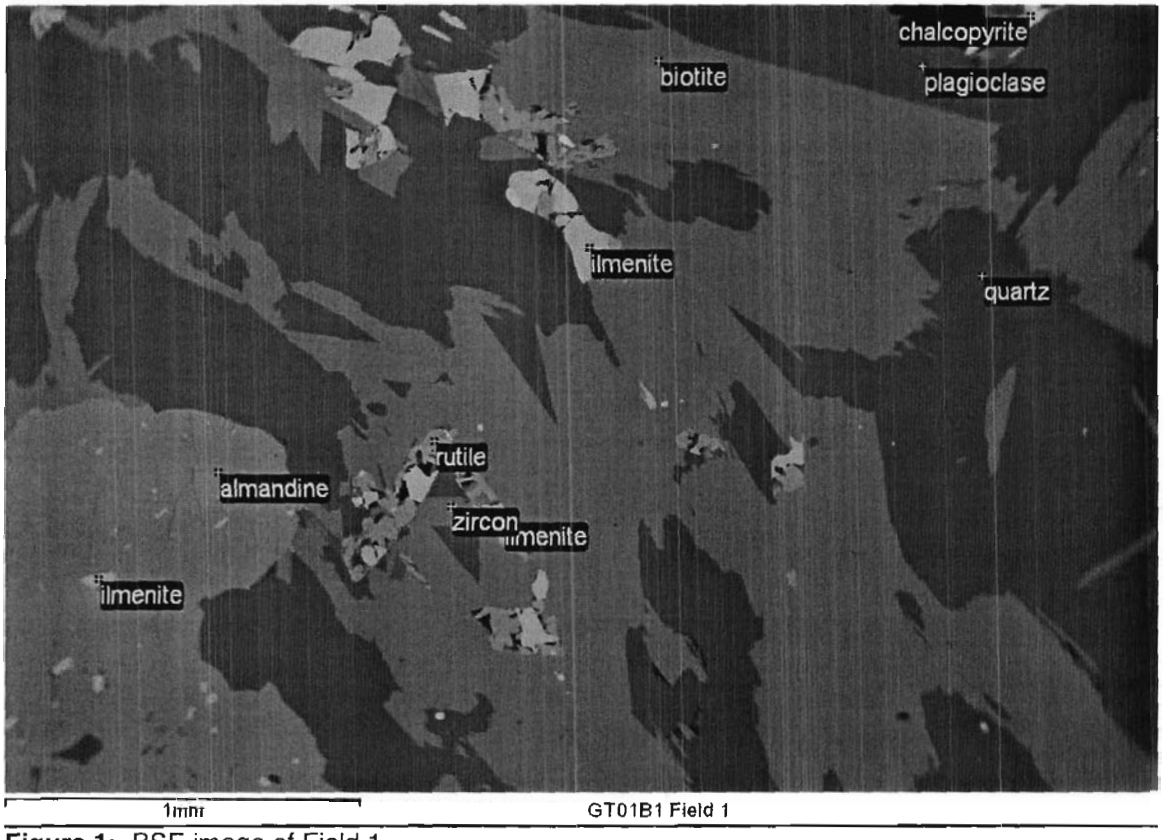


Figure 1: BSE image of Field 1.

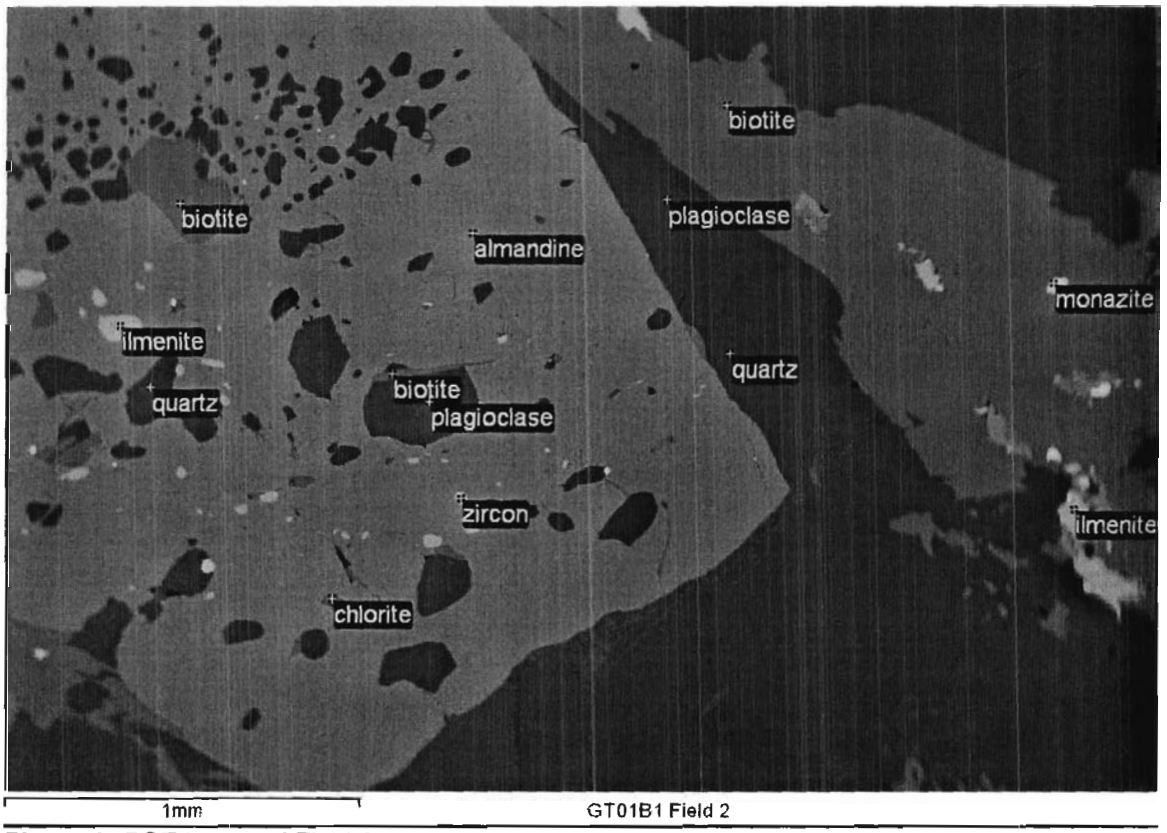


Figure 2: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 1 and Figure 2). The sample consists of a quartz-plagioclase matrix, interspersed by bands of biotite and grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, rutile, zircon, monazite, pyrite, and chalcopyrite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, and ilmenite, but also containing biotite and smaller inclusions of zircon and rare chlorite and monazite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 1).

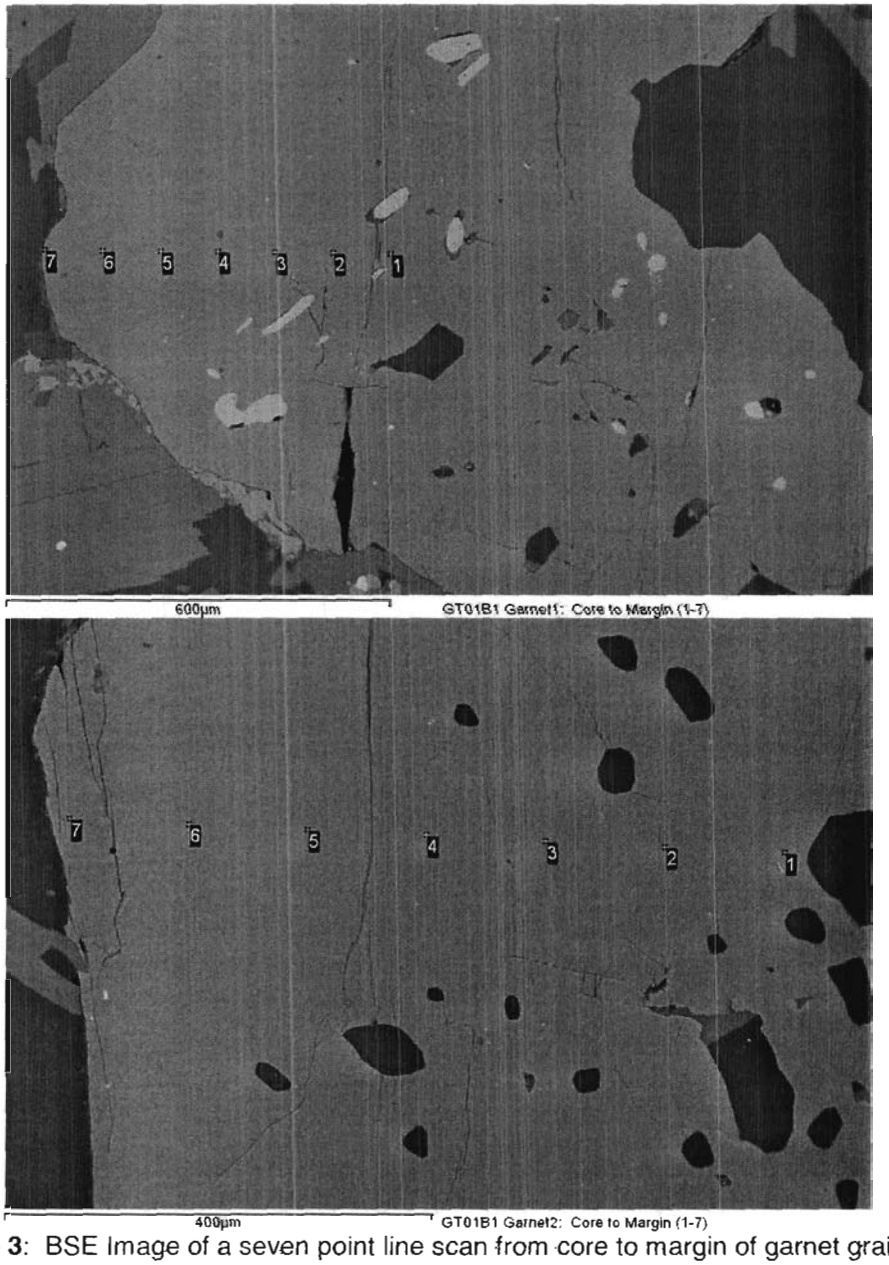


Figure 3: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 3). This data is shown in Table 1. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 1: Oxide weight percent data collected from two garnet grains in thin section GT01B1.

GT01B1 Garnet 1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	3.58	20.67	36.99	0.00	1.37	0.00	0.00	0.58	36.30	99.50
2		0.00	3.47	20.61	36.80	0.00	1.53	0.00	0.00	0.59	36.09	99.08
3		0.23	3.42	20.80	36.99	0.00	1.47	0.00	0.00	0.54	36.19	99.64
4		0.00	3.50	20.60	36.67	0.00	1.50	0.00	0.00	0.49	36.28	99.03
5		0.00	3.27	20.78	36.75	0.00	1.62	0.00	0.00	0.59	36.16	99.18
6		0.23	3.18	20.56	36.41	0.00	1.27	0.00	0.00	0.52	36.81	98.98
7	margin	0.00	2.32	20.65	36.82	0.00	1.22	0.00	0.00	0.77	37.91	99.70

GT01B1 Garnet 2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	3.57	20.82	36.86	0.00	1.23	0.00	0.00	0.49	36.42	99.39
2		0.28	3.45	20.82	36.41	0.00	1.25	0.00	0.00	0.56	36.03	98.80
3		0.00	3.58	20.39	37.03	0.00	1.27	0.00	0.00	0.54	36.30	99.12
4		0.00	3.50	20.50	36.78	0.00	1.32	0.00	0.00	0.53	36.54	99.16
5		0.00	3.40	20.63	36.84	0.00	1.27	0.00	0.00	0.50	36.48	99.13
6		0.00	3.25	20.52	37.78	0.00	1.19	0.00	0.00	0.56	36.05	99.34
7	margin	0.00	2.60	20.63	36.92	0.00	1.25	0.00	0.00	0.58	37.86	99.85

Client ID: GT01B2

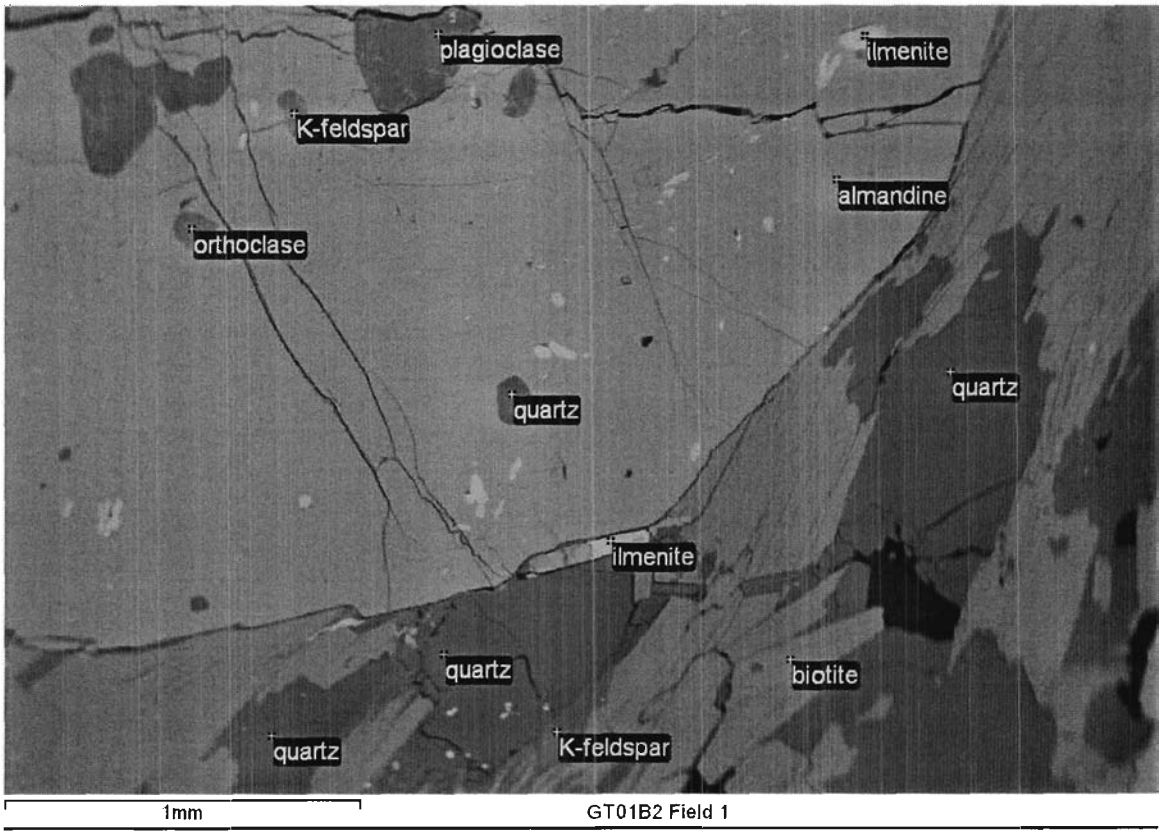


Figure 4: BSE image of Field 1.

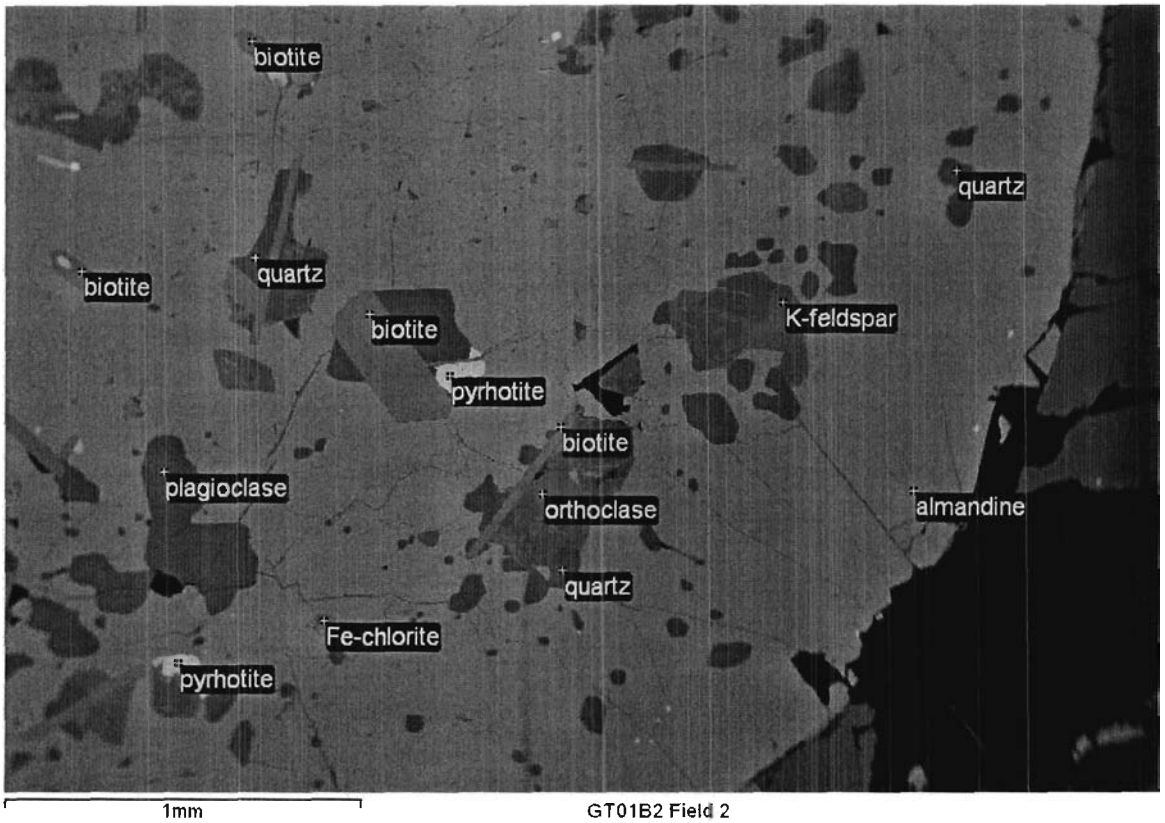


Figure 5: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 4 and Figure 5). The sample consists of a quartz-plagioclase matrix, interspersed by bands of biotite and grains of almandine garnet. Disseminated within the matrix are grains of K-feldspar, ilmenite, rutile, zircon, monazite, and pyrhotite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, K-feldspar, and ilmenite, but also containing biotite and smaller inclusions of rare chlorite and pyrhotite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 2).

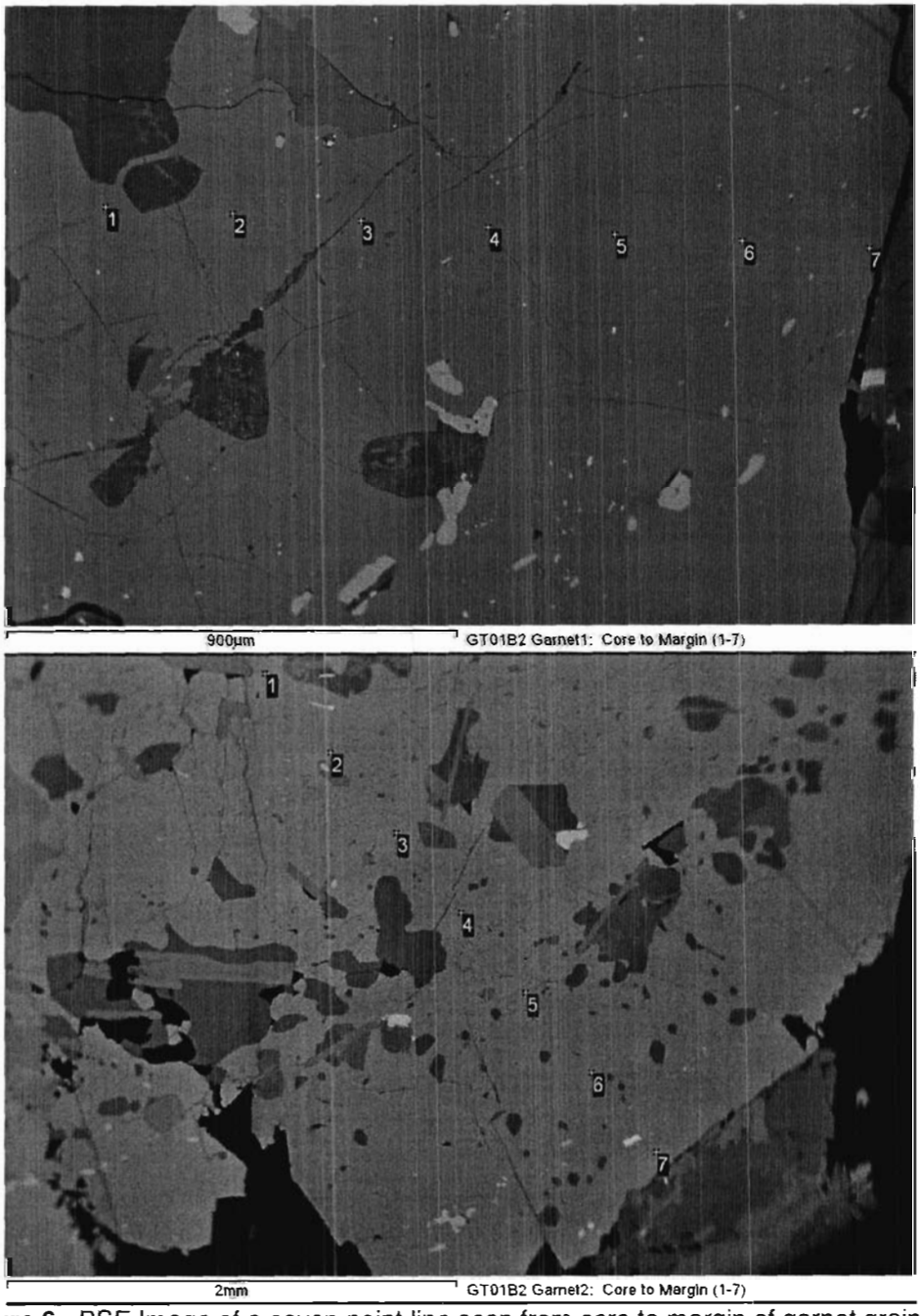


Figure 6: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 6). This data is shown in Table 2. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 2: Oxide weight percent data collected from two garnet grains in thin section GT01B2.

GT01B2 Garnet1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	3.73	20.27	36.82	0.00	1.37	0.00	0.00	0.50	36.30	99.00
2		0.00	3.50	20.52	36.75	0.00	1.54	0.00	0.00	0.46	36.29	99.07
3		0.00	3.27	20.48	36.67	0.00	1.43	0.00	0.00	0.40	36.45	98.69
4		0.00	3.60	20.54	36.33	0.00	1.47	0.00	0.00	0.41	36.19	98.53
5		0.00	3.76	20.63	37.07	0.00	1.57	0.00	0.00	0.36	35.47	98.87
6		0.00	3.63	20.77	36.54	0.00	1.53	0.00	0.00	0.45	35.82	98.73
7	margin	0.00	2.90	20.46	36.78	0.00	1.34	0.00	0.00	0.68	36.46	98.63

GT01B2 Garnet2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	3.50	20.50	36.50	0.30	1.23	0.00	0.00	0.61	36.29	98.93
2		0.00	3.52	20.44	37.01	0.00	1.37	0.00	0.00	0.54	36.05	98.93
3		0.00	3.57	20.50	36.71	0.00	1.27	0.00	0.00	0.62	35.93	98.60
4		0.00	4.25	20.20	35.62	0.00	1.15	0.00	0.00	0.57	35.70	97.48
5		0.00	3.68	20.82	36.73	0.00	1.37	0.00	0.00	0.62	35.55	98.77
6		0.00	3.58	20.46	36.39	0.00	1.46	0.00	0.00	0.54	35.35	97.78
7	margin	0.00	3.17	20.84	36.33	0.00	1.27	0.00	0.00	0.72	35.80	98.13

Client ID: GT01B3

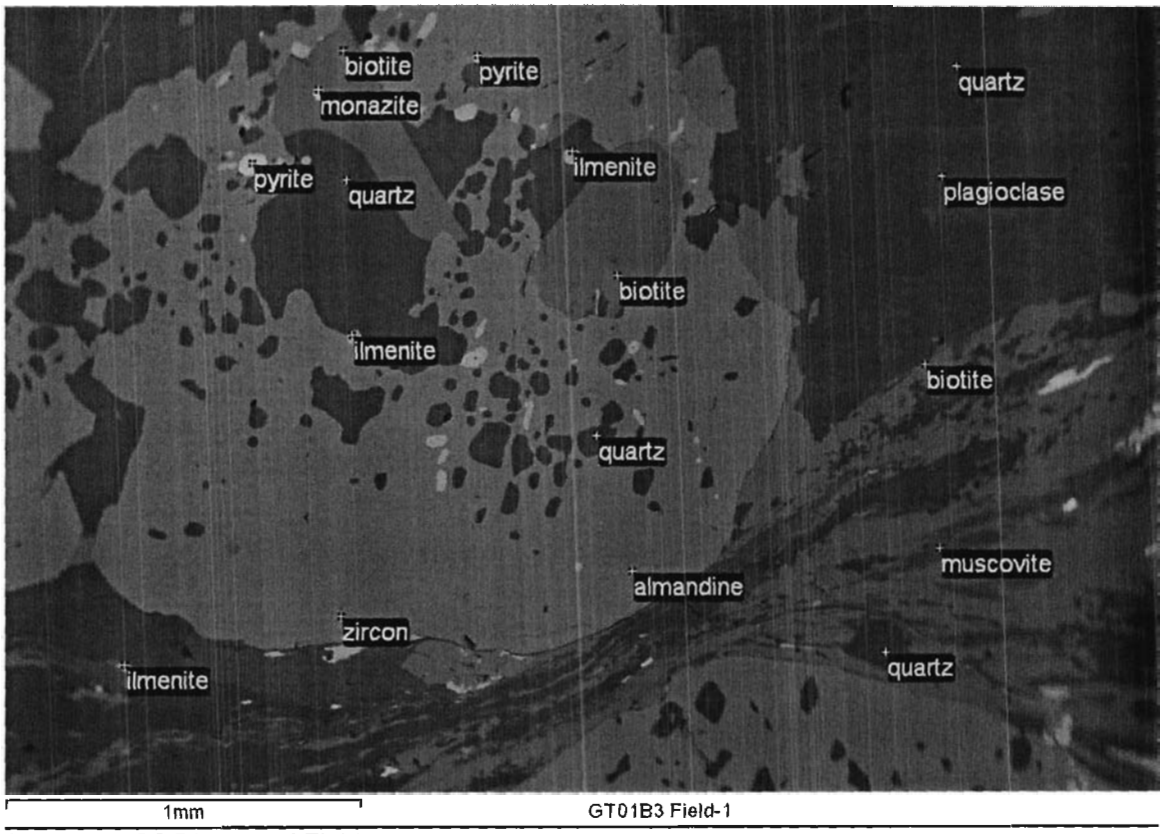


Figure 7: BSE image of Field 1.

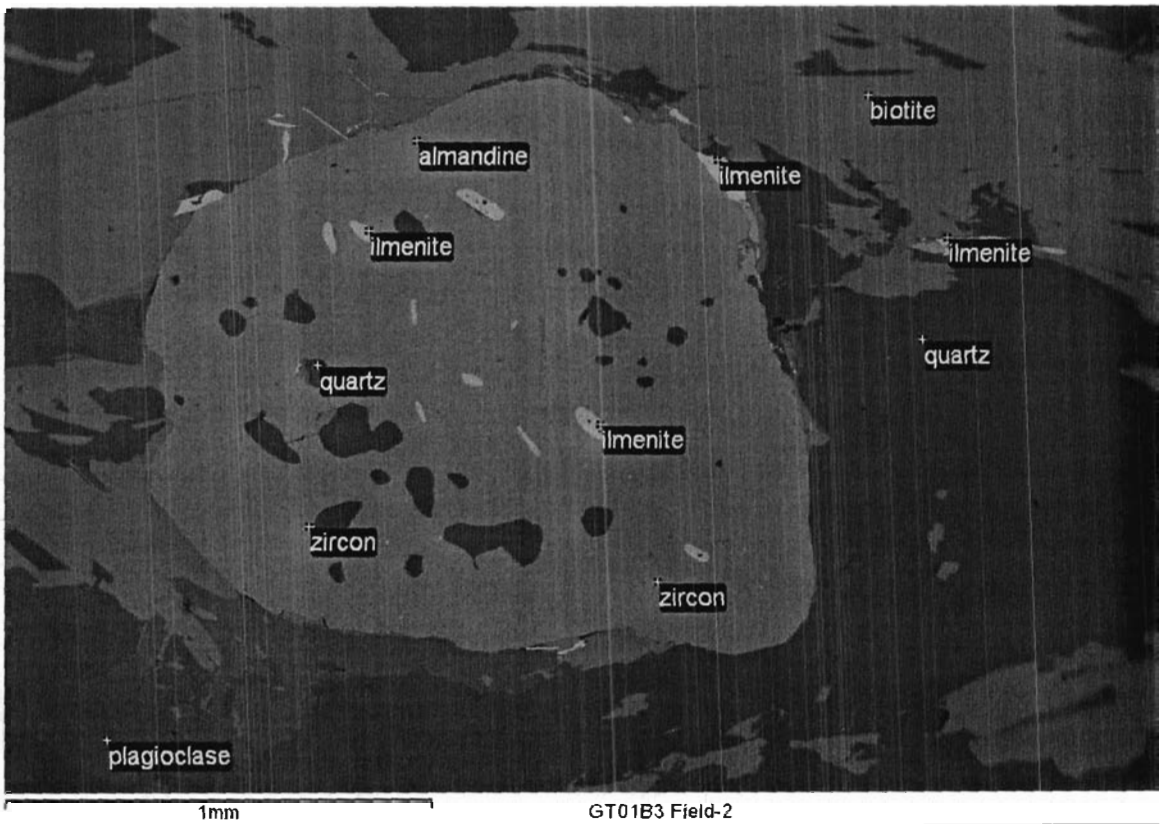


Figure 8: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 7 and Figure 8). The sample consists of a quartz-plagioclase matrix, interspersed by bands of biotite and grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, rutile, zircon, as well as small bands of muscovite within the biotite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, and ilmenite, but also containing biotite, pyrite, and smaller inclusions of rare monazite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 3).

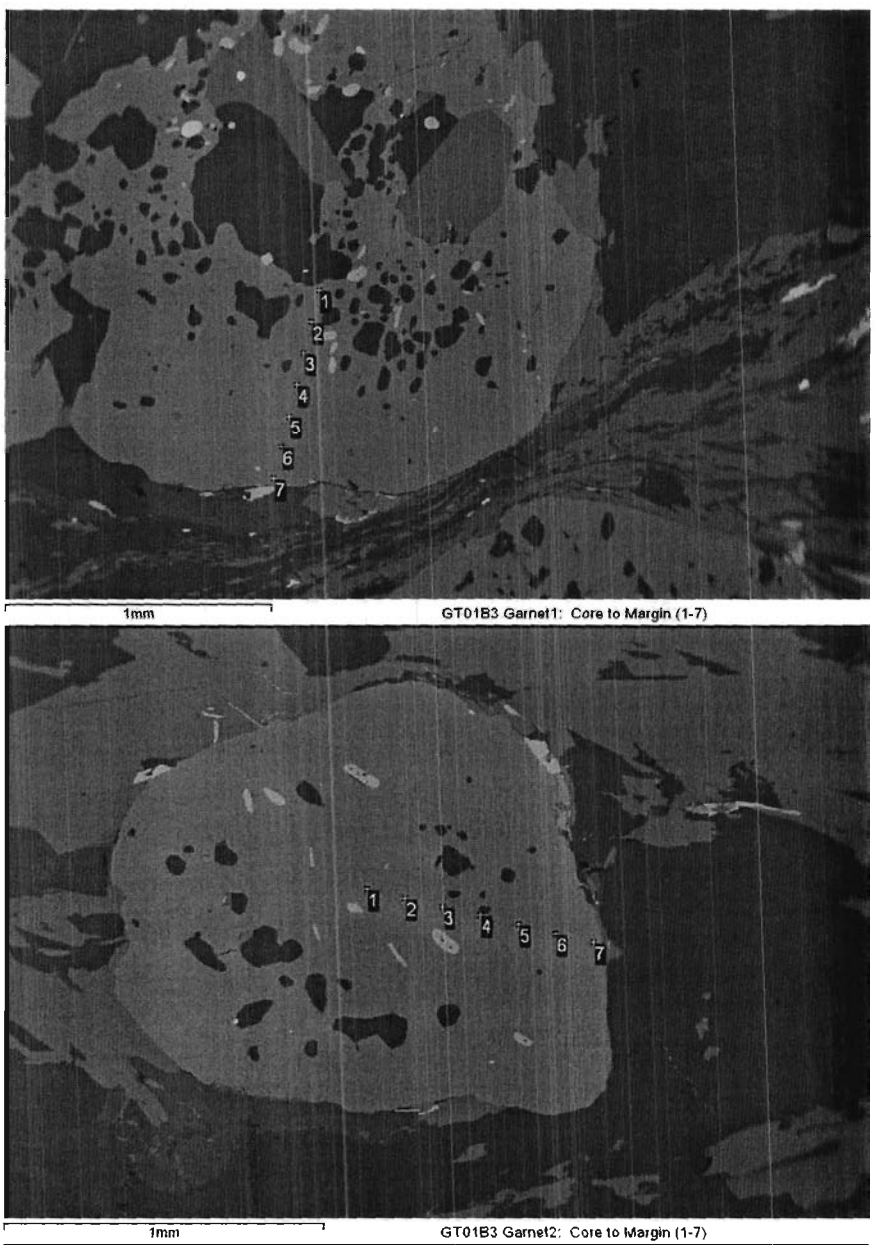


Figure 9: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 9). This data is shown in Table 3. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 3: Oxide weight percent data collected from two garnet grains in thin section GT01B3.

GT01B3 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.12	20.61	36.48	0.00	1.64	0.00	0.00	0.54	36.54	98.92
2	0.00	3.08	20.56	36.54	0.00	1.65	0.00	0.00	0.56	36.21	98.60
3	0.00	2.94	20.41	36.86	0.00	1.71	0.00	0.00	0.63	36.61	99.16
4	0.00	3.03	20.75	36.63	0.00	1.62	0.00	0.00	0.62	36.43	99.08
5	0.00	3.05	20.48	36.80	0.00	1.57	0.00	0.00	0.65	36.50	99.04
6	0.00	2.80	20.69	36.65	0.00	1.82	0.00	0.00	0.50	36.28	98.74
7 margin	0.00	2.27	20.67	36.48	0.00	1.60	0.00	0.00	0.56	37.04	98.61

GT01B3 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.00	20.46	36.67	0.00	1.80	0.00	0.00	0.56	36.50	98.99
2	0.00	2.79	21.01	36.41	0.00	1.57	0.00	0.00	0.66	36.00	98.43
3	0.00	2.79	20.43	36.90	0.00	1.72	0.00	0.00	0.56	36.96	99.35
4	0.00	2.59	20.29	36.75	0.00	1.68	0.00	0.00	0.62	36.75	98.69
5	0.00	2.57	20.78	36.37	0.00	1.72	0.00	0.00	0.63	37.01	99.09
6	0.00	2.62	20.69	36.78	0.00	1.51	0.00	0.00	0.62	36.77	98.98
7 margin	0.00	2.12	20.65	36.58	0.00	1.65	0.00	0.00	0.68	37.13	98.82

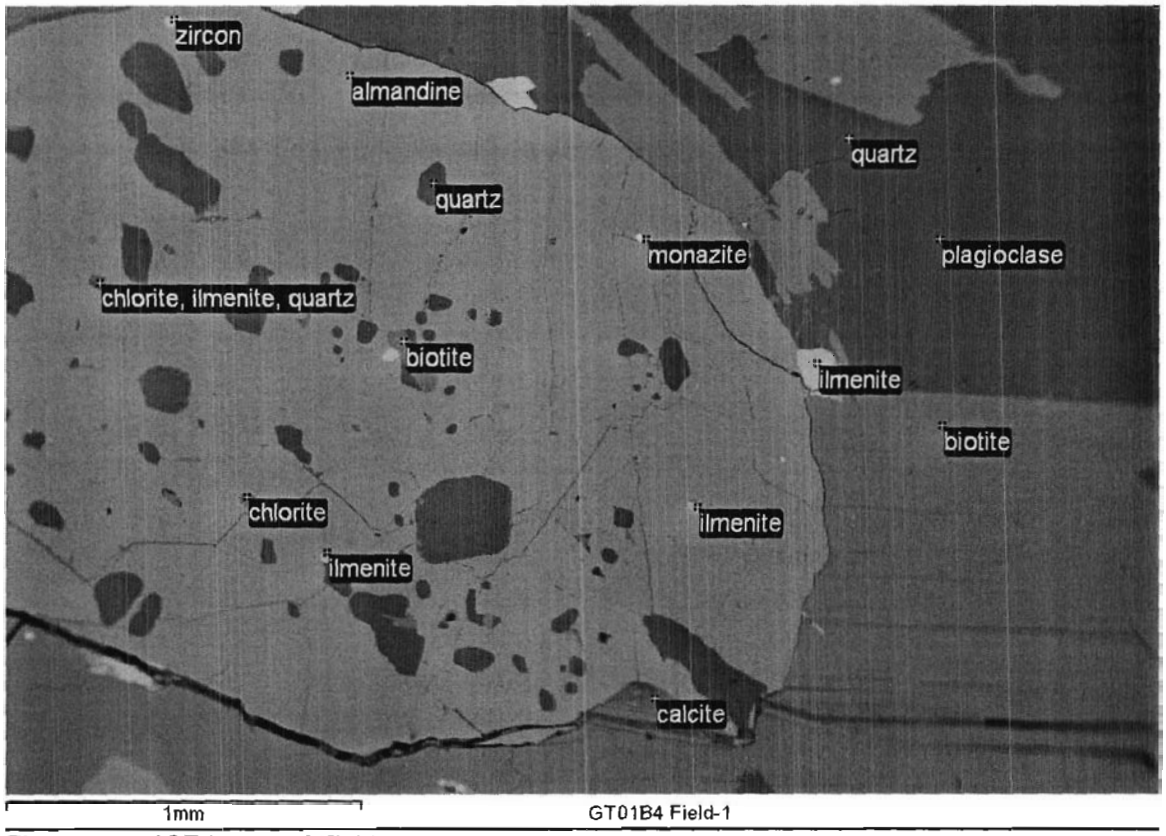


Figure 10: BSE image of Field 1.

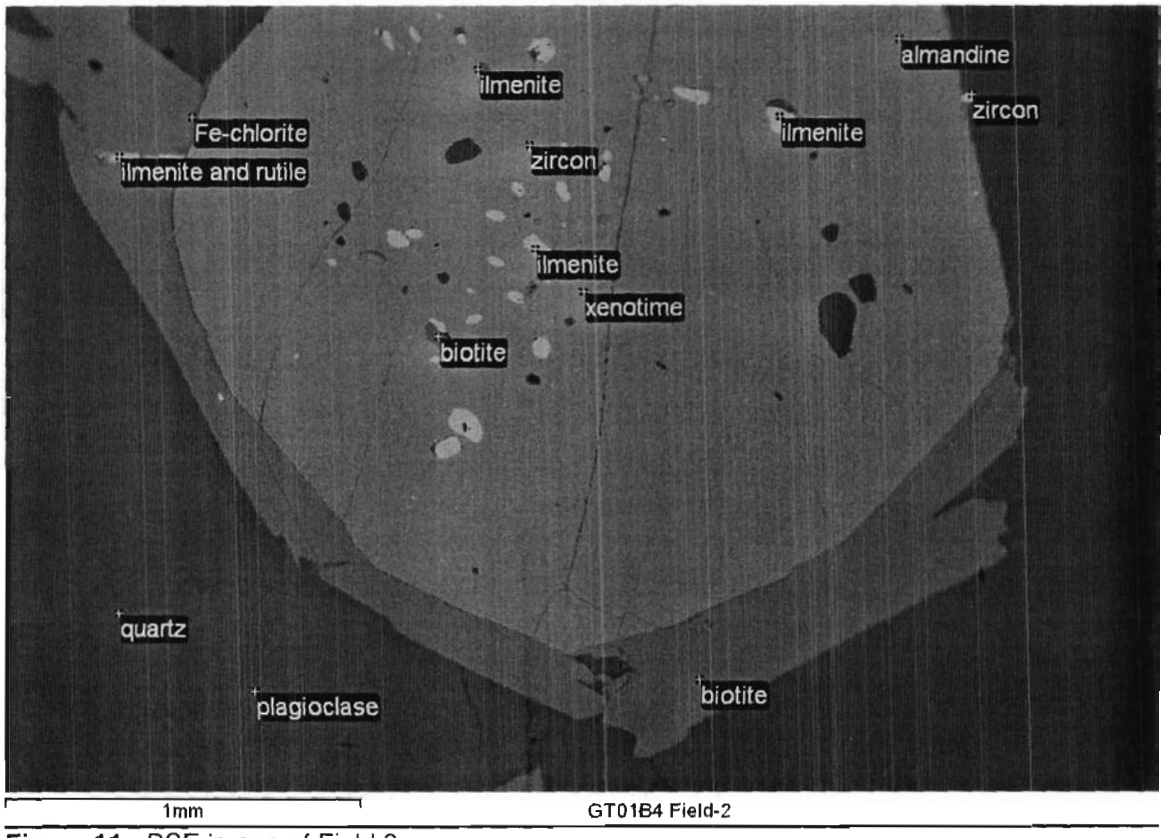


Figure 11: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 10 and Figure 11). The sample consists of a quartz-plagioclase matrix, interspersed by bands of biotite and grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, rutile, and zircon. A small area of calcite was noted in proximity to the garnet grain. The garnets appear to be associated with the mica foliation within the sample.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, and ilmenite, but also containing biotite and smaller inclusions of zircon and rare chlorite, monazite, and xenotime. A few of the garnets within this section exhibited small veins of chlorite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 4).

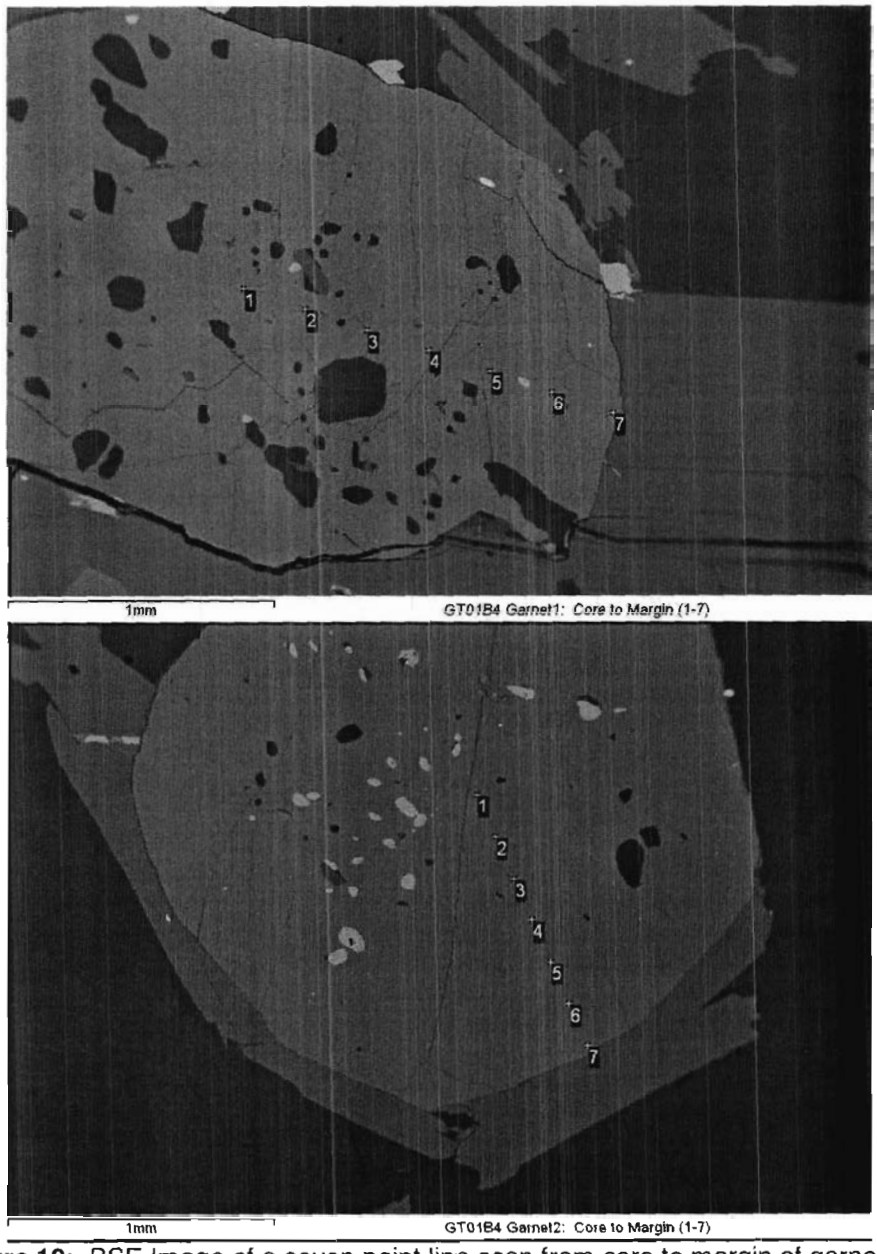


Figure 12: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 12). This data is shown in Table 4. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 4: Oxide weight percent data collected from two garnet grains in thin section GT01B4.

GT01B4 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	4.31	21.07	37.80	0.00	0.99	0.00	0.00	0.45	36.39	101.02
2	0.00	4.18	20.84	38.06	0.00	0.92	0.00	0.00	0.43	35.94	100.37
3	0.00	4.31	20.90	37.70	0.00	0.95	0.00	0.00	0.43	35.93	100.21
4	0.00	4.38	21.09	37.80	0.00	1.04	0.00	0.00	0.44	35.70	100.44
5	0.00	4.31	21.01	37.76	0.00	1.02	0.00	0.00	0.39	35.85	100.34
6	0.00	4.20	21.14	37.35	0.00	1.12	0.00	0.00	0.52	35.94	100.27
7 margin	0.00	3.48	20.84	37.50	0.00	1.15	0.00	0.00	0.54	36.30	99.82

GT01B4 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	4.18	21.05	37.80	0.00	1.25	0.00	0.00	0.32	35.88	100.48
2	0.00	4.33	21.28	37.95	0.00	1.15	0.00	0.00	0.28	35.55	100.53
3	0.00	4.38	21.07	37.89	0.00	1.32	0.00	0.00	0.35	35.73	100.72
4	0.00	4.20	21.18	37.95	0.00	1.18	0.00	0.00	0.35	35.46	100.31
5	0.00	4.21	21.18	37.82	0.00	1.26	0.00	0.00	0.40	35.83	100.70
6	0.00	4.20	20.97	37.82	0.00	1.29	0.00	0.00	0.41	36.06	100.75
7 margin	0.00	3.30	20.99	37.84	0.00	1.09	0.00	0.00	0.52	36.91	100.65

Client ID GT041:

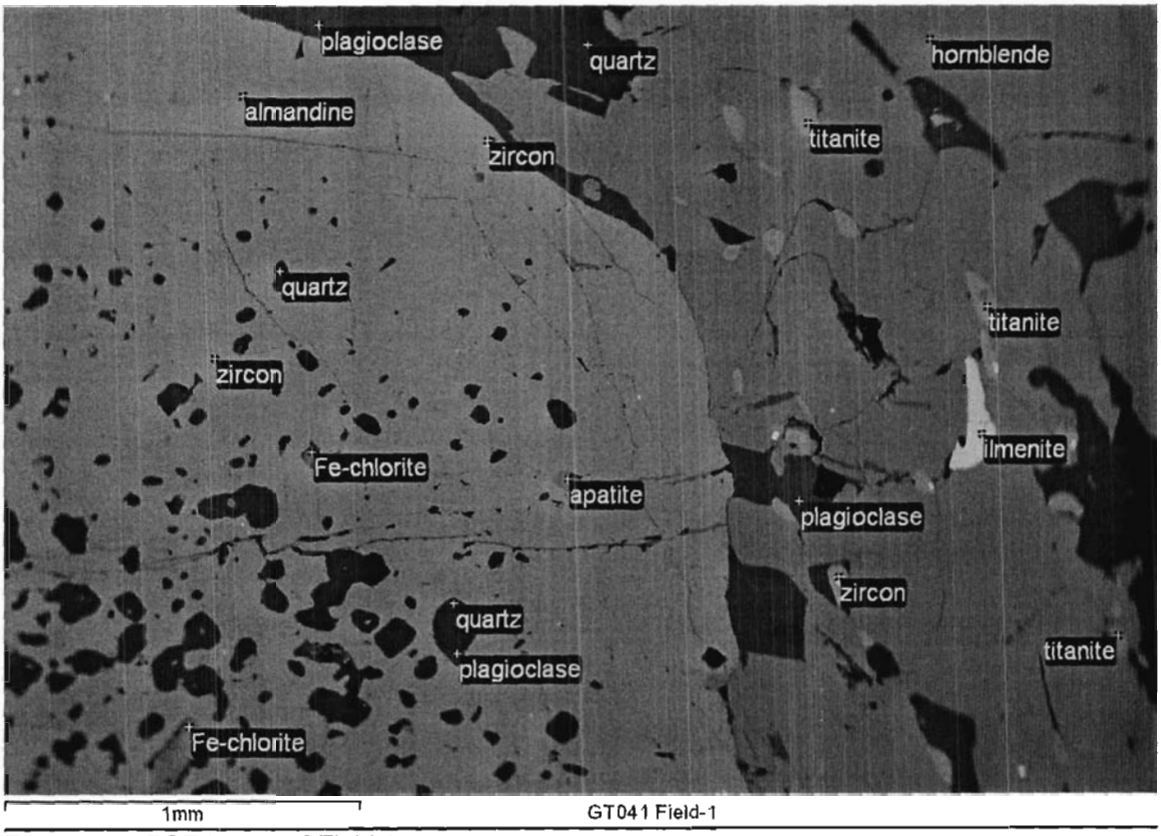


Figure 13: BSE image of Field 1.

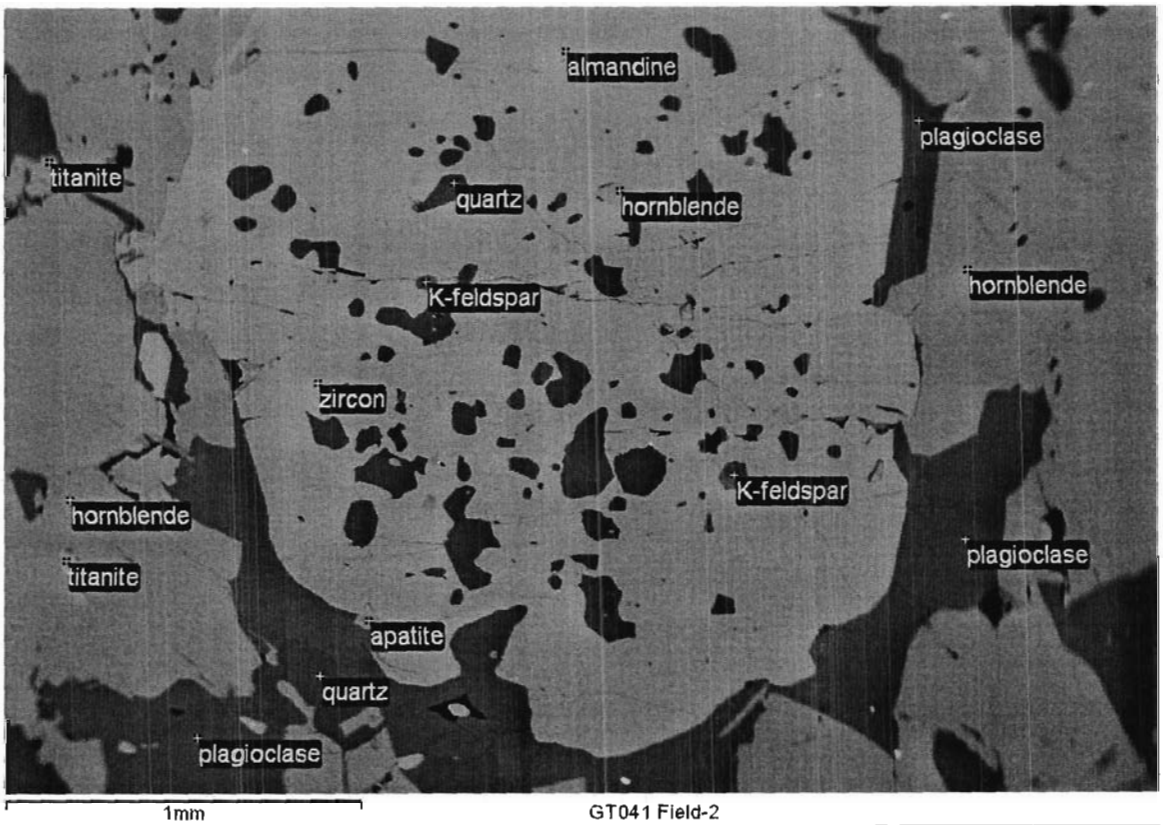


Figure 14: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 13 and Figure 14). The sample consists of a quartz, plagioclase, K-feldspar, and hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, titanite, and zircon.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, K-feldspar, but also containing hornblende and smaller inclusions of Fe-chlorite, zircon and apatite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 5).

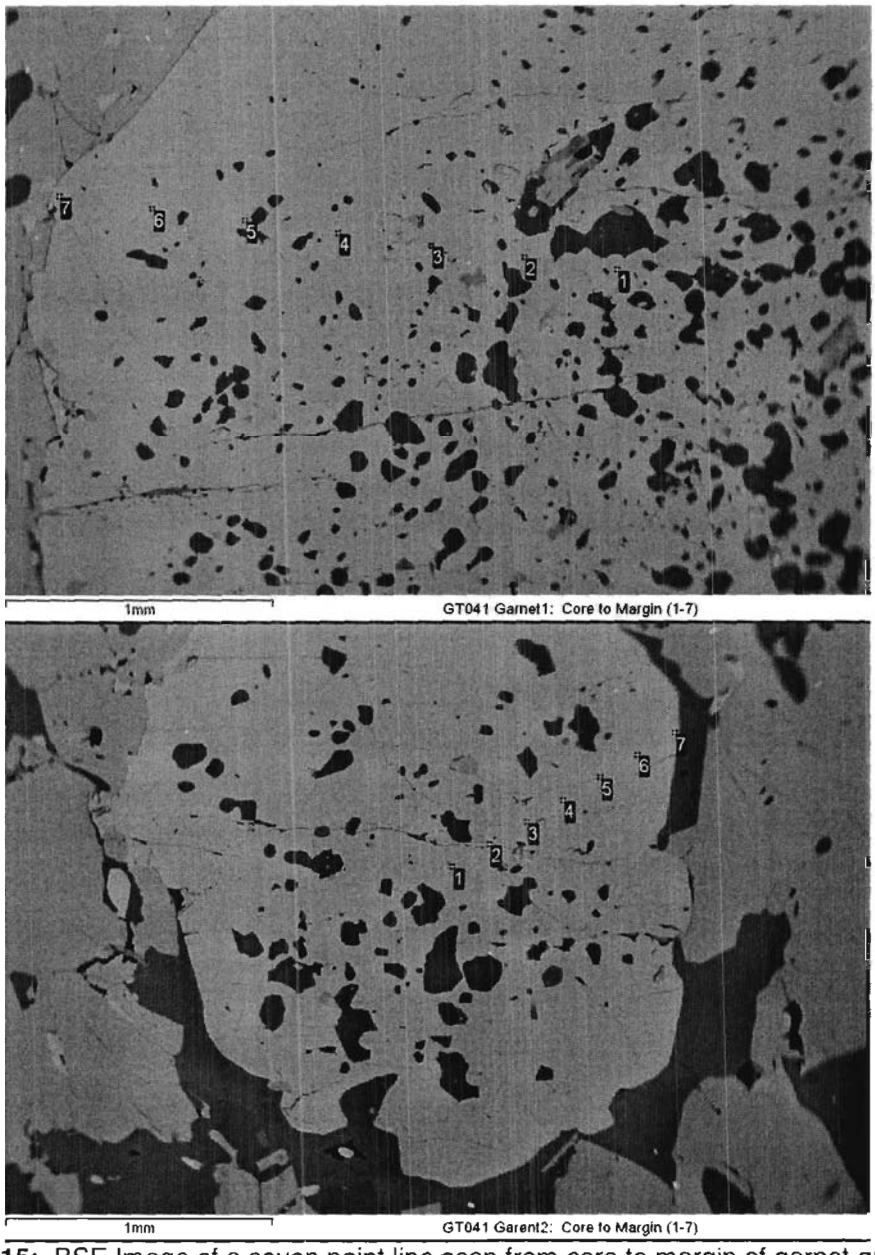


Figure 15: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 15). This data is shown in Table 5. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 5: Oxide weight percent data collected from two garnet grains in thin section GT041.

GT041 Garnet1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	1.24	20.18	37.07	0.00	11.08	0.00	0.00	2.50	26.00	98.08
2		0.00	1.11	20.33	37.10	0.00	11.64	0.00	0.00	2.57	25.42	98.17
3		0.00	1.16	20.24	37.20	0.00	11.88	0.00	0.00	2.83	25.25	98.56
4		0.00	0.90	19.93	37.14	0.00	12.09	0.00	0.00	2.63	25.40	98.09
5		0.00	0.93	20.35	37.10	0.00	12.05	0.00	0.00	2.43	25.72	98.57
6		0.00	1.18	20.18	36.92	0.00	12.05	0.00	0.00	1.73	26.45	98.51
7	margin	0.00	1.33	20.31	36.97	0.00	11.22	0.00	0.00	1.43	27.34	98.60

GT041 Garnet2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	0.86	20.37	37.46	0.00	12.06	0.00	0.00	2.38	25.72	98.84
2		0.00	1.01	20.41	37.12	0.00	11.92	0.00	0.00	2.53	25.34	98.33
3		0.00	1.03	20.10	36.88	0.00	11.92	0.00	0.00	2.34	25.51	97.78
4		0.00	0.96	20.37	37.01	0.00	11.64	0.00	0.00	2.27	25.83	98.09
5		0.00	1.64	20.18	36.65	0.00	11.60	0.00	0.00	1.98	25.47	97.52
6		0.00	1.48	20.16	36.92	0.00	9.92	0.00	0.00	1.50	27.67	97.65
7	margin	0.00	1.41	20.48	36.45	0.00	10.05	0.00	0.00	1.68	27.60	97.67

Client ID GT042:

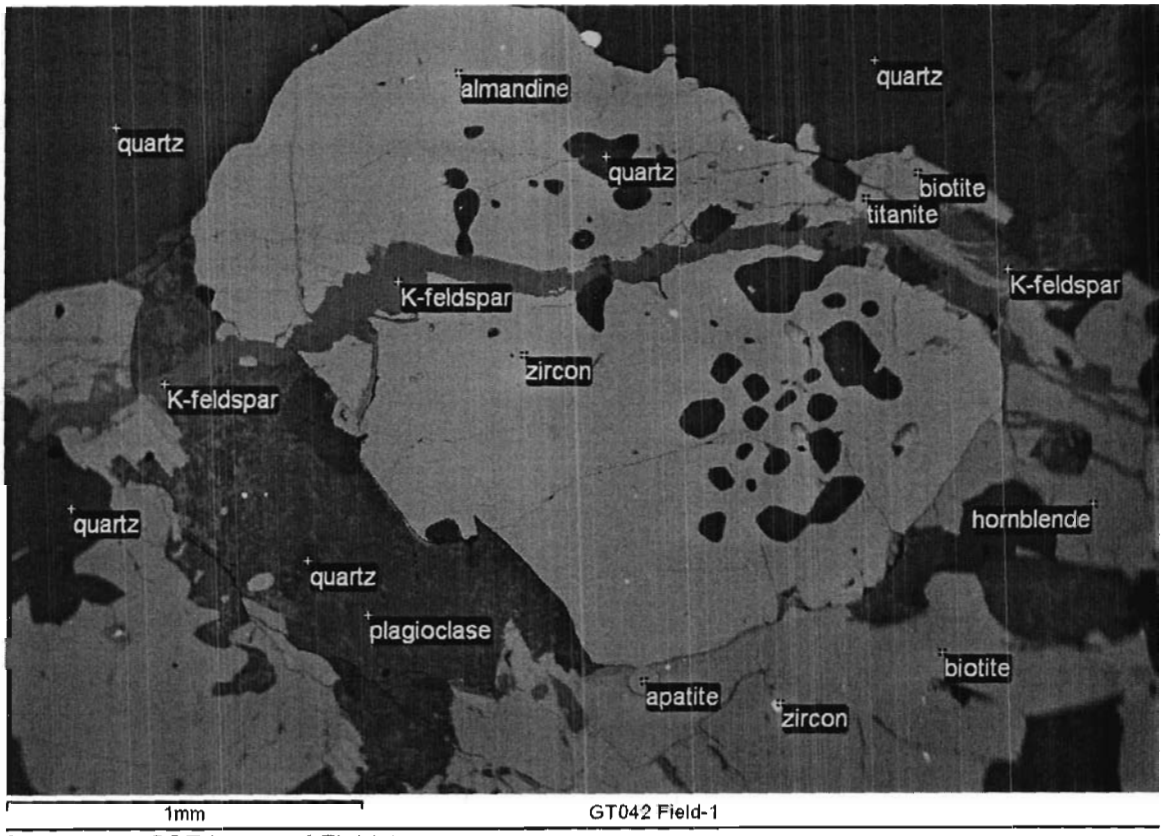


Figure 16: BSE image of Field 1.

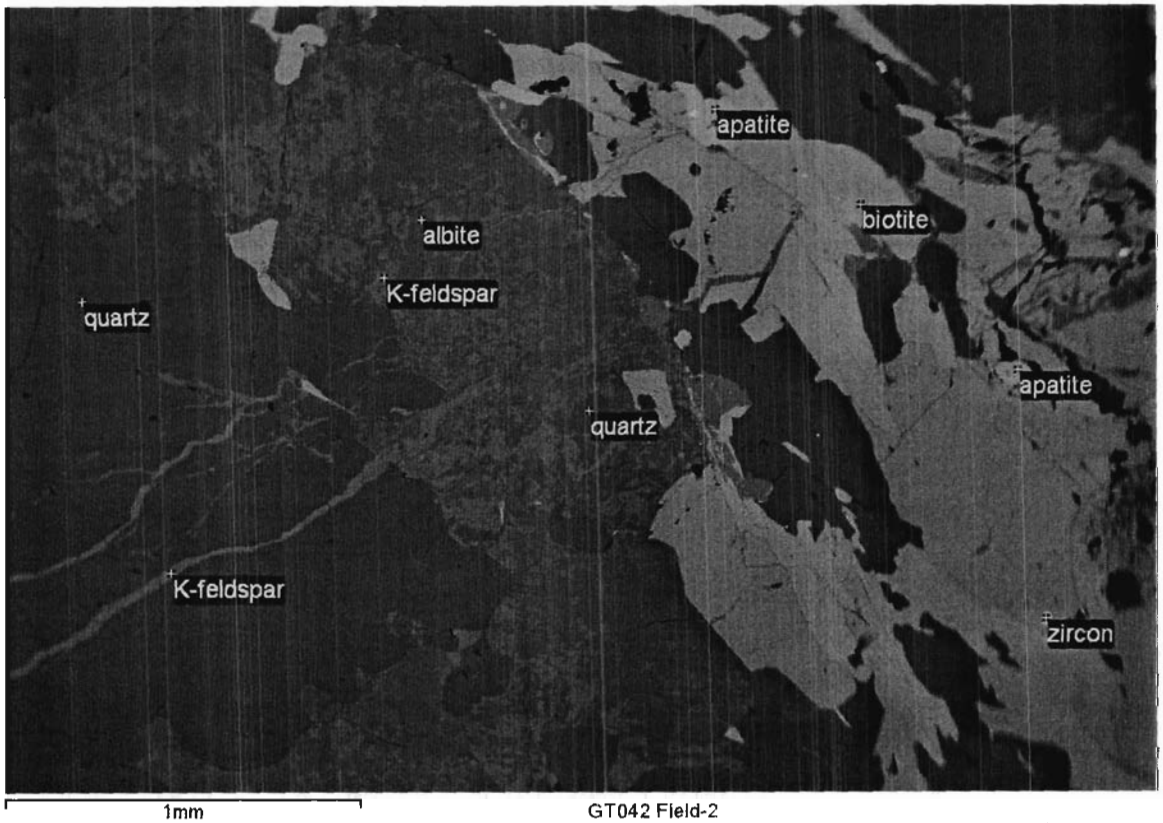


Figure 17: BSE image of Field 2, noting the K-feldspar vein.

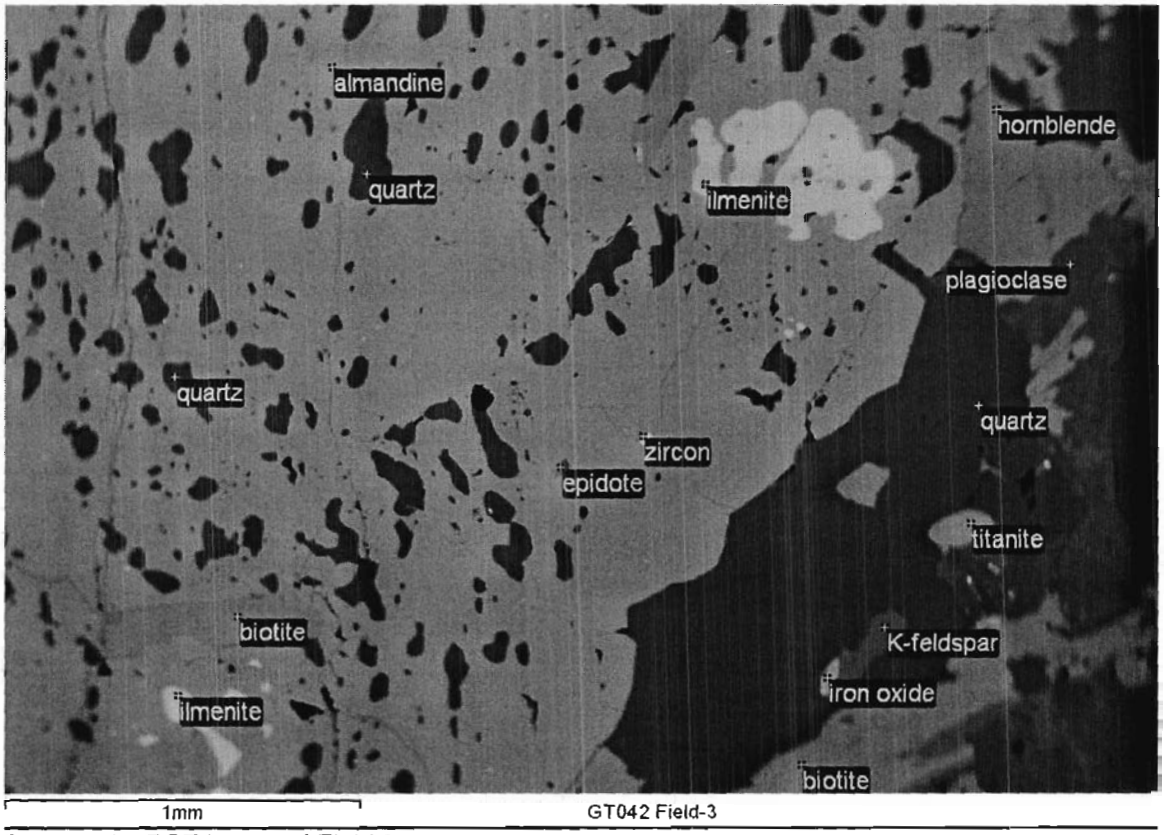


Figure 18: BSE image of Field 3.

Sample Description:

Three representative fields of view were chosen (Figure 16, Figure 17, and Figure 18). The sample consists of a quartz, plagioclase, K-feldspar, and hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, titanite, apatite, zircon, and rare iron oxide. Several late-stage veins of K-feldspar were noted, transecting the garnets and surrounding matrix. The veins appear to connect with large feldspar grains consisting of albite and K-feldspar intergrowths.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, and ilmenite, but also containing biotite and smaller inclusions of zircon and rare epidote. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 6).

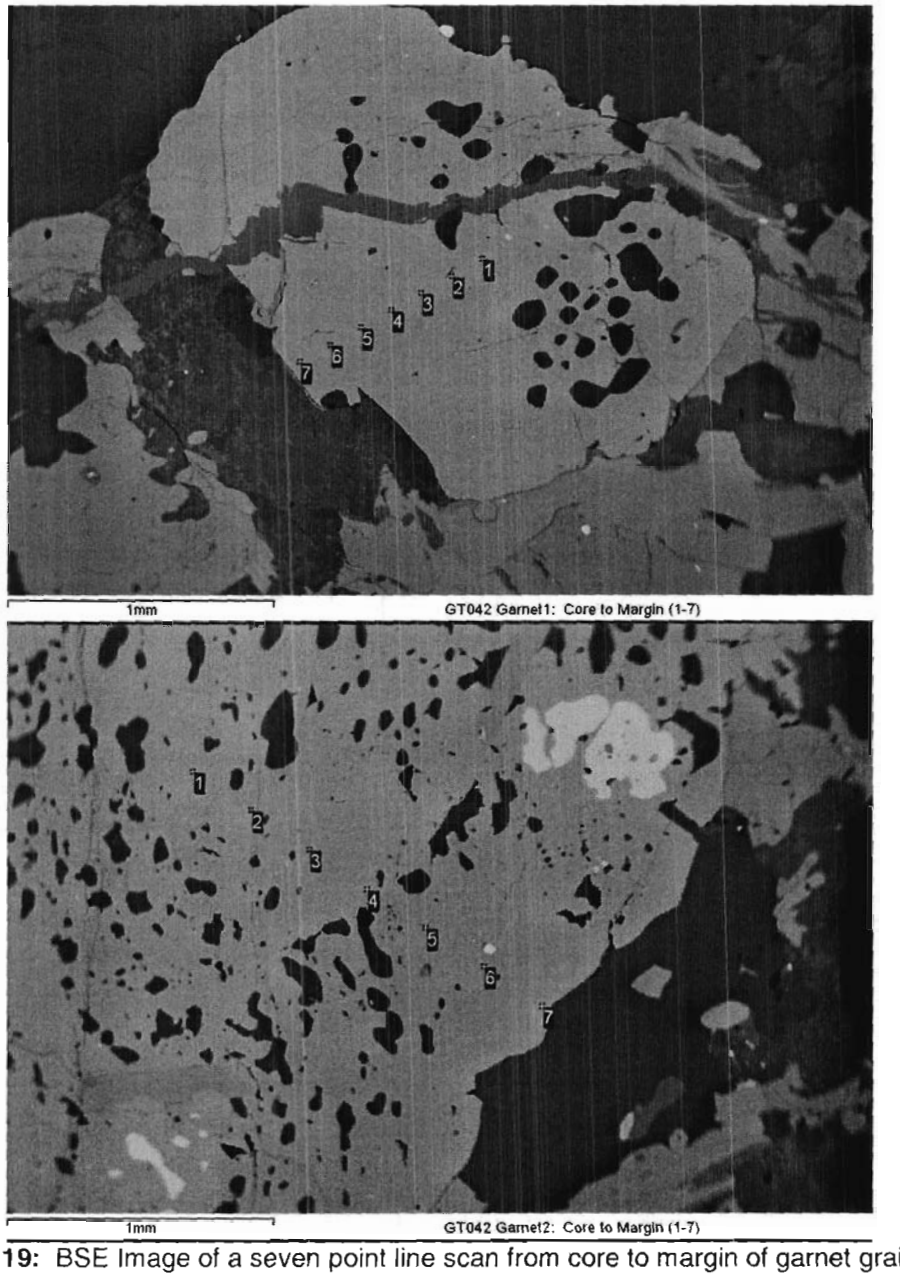


Figure 19: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 19). This data is shown in Table 6. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 6: Oxide weight percent data collected from two garnet grains in thin section GT042.

GT042 Garnet1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	1.43	20.63	36.99	0.00	10.59	0.00	0.00	1.58	27.40	98.62
2		0.00	1.31	19.69	35.90	0.00	11.42	0.00	0.00	1.50	31.16	100.97
3		0.00	1.38	20.16	37.05	0.00	10.42	0.00	0.00	1.63	27.94	98.58
4		0.00	1.29	20.35	36.86	0.00	10.45	0.00	0.00	0.98	28.39	98.33
5		0.00	2.06	18.69	37.57	0.66	8.48	0.00	0.00	0.94	29.41	97.80
6		0.00	1.46	20.56	36.80	0.00	10.31	0.00	0.00	1.03	28.57	98.73
7	margin	0.00	1.54	20.63	37.05	0.00	10.38	0.00	0.00	1.46	27.99	99.06

GT042 Garnet2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	1.23	20.44	37.10	0.00	9.49	0.00	0.00	3.74	26.68	98.68
2		0.00	1.14	20.73	37.12	0.00	9.49	0.00	0.00	4.20	26.73	99.41
3		0.00	1.09	20.35	36.97	0.00	9.33	0.00	0.00	4.39	26.48	98.61
4		0.00	1.48	20.77	36.92	0.00	9.89	0.00	0.00	1.79	27.90	98.76
5		0.00	1.54	20.54	37.72	0.00	10.38	0.00	0.00	1.47	27.36	99.01
6		0.00	1.44	20.61	37.10	0.00	10.72	0.00	0.00	1.46	27.04	98.37
7	margin	0.00	1.61	20.12	36.84	0.00	9.95	0.00	0.00	1.52	27.76	97.81

Client ID GT043:

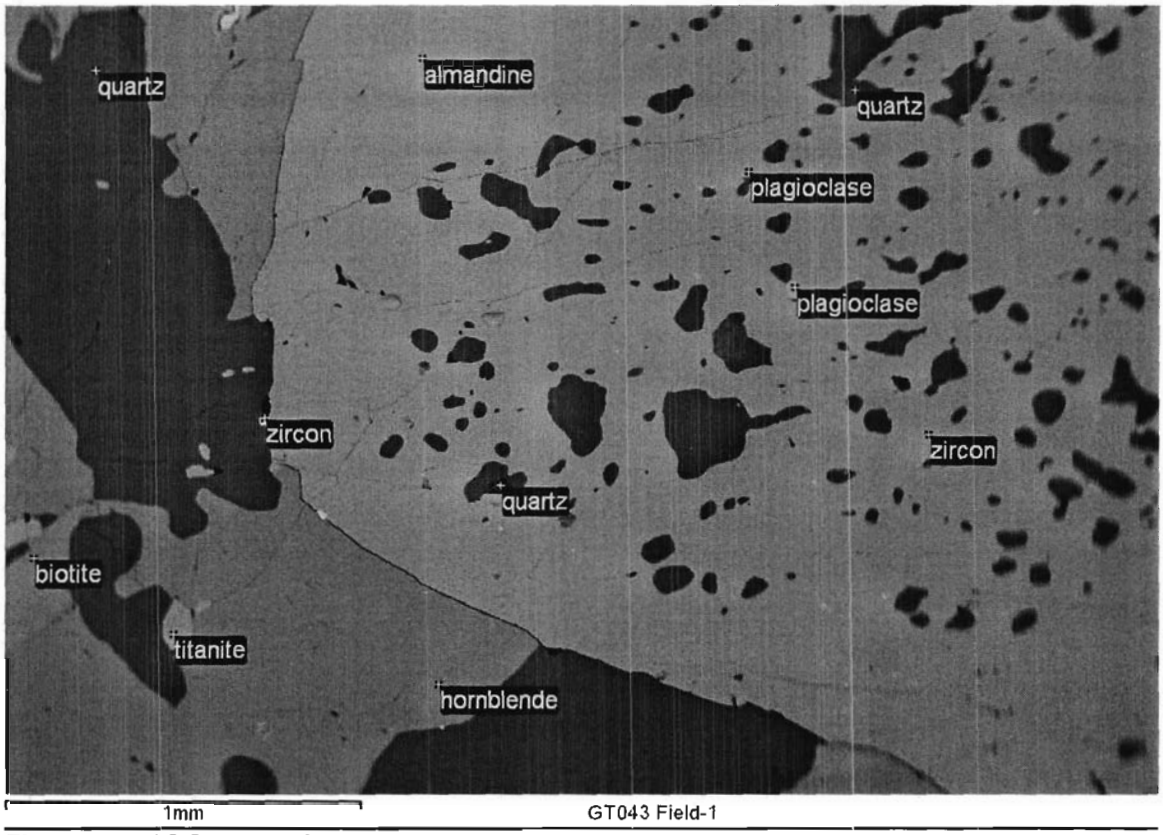


Figure 20: BSE image of Field 1.

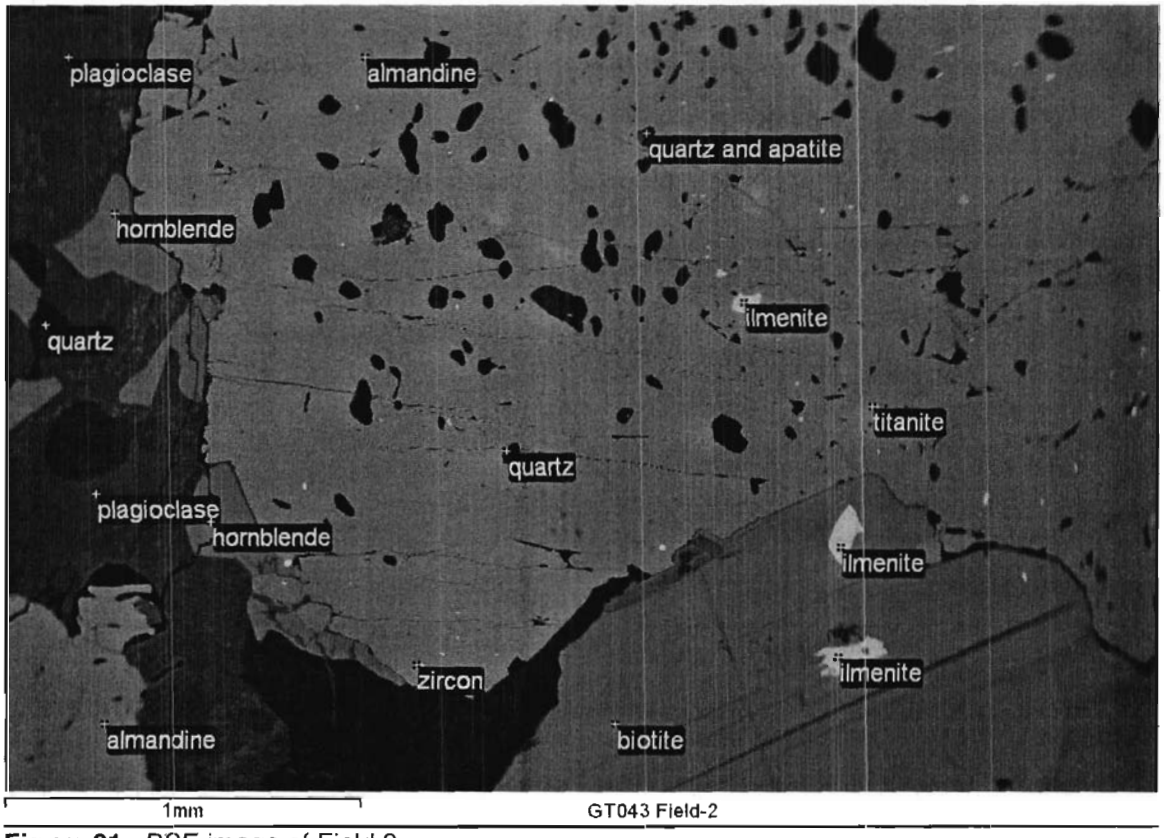


Figure 21: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 20 and Figure 21). The sample consists of a quartz, plagioclase, K-feldspar, biotite, and hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, titanite, and zircon.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, and ilmenite, but also containing smaller inclusions of titanite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 7).

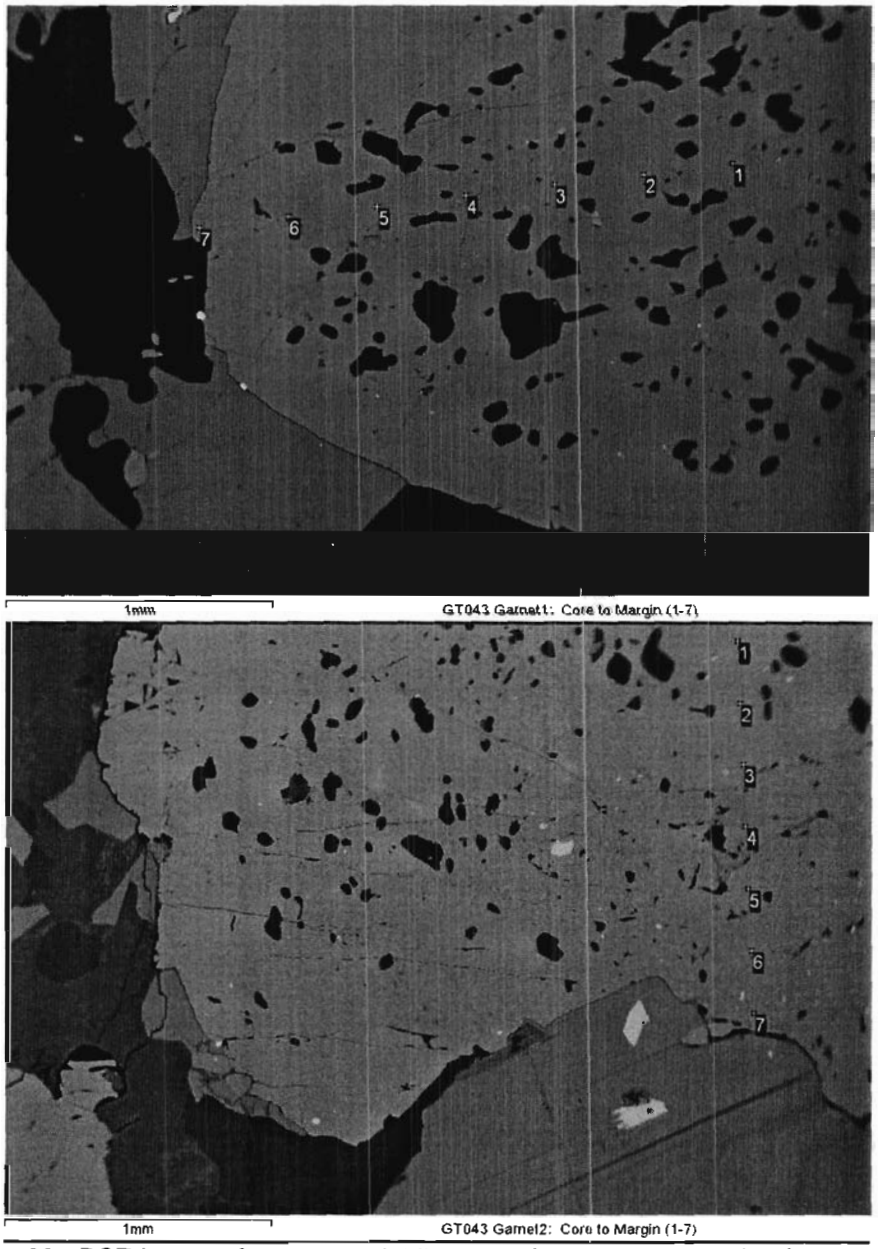


Figure 22: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 22). This data is shown in Table 7. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 7: Oxide weight percent data collected from two garnet grains in thin section GT043.

GT043 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.43	20.92	36.95	0.00	10.65	0.00	0.00	0.65	27.67	98.25
2	0.00	1.41	20.73	37.05	0.00	10.63	0.00	0.00	0.67	27.69	98.18
3	0.00	1.34	20.67	36.97	0.00	11.07	0.00	0.00	0.50	27.70	98.25
4	0.00	1.31	20.65	36.97	0.00	10.83	0.00	0.00	0.45	27.94	98.15
5	0.00	1.36	20.77	37.20	0.00	10.80	0.00	0.00	0.00	28.39	98.52
6	0.00	1.51	20.73	37.05	0.00	11.14	0.00	0.00	0.39	28.37	99.18
7 margin	0.00	1.97	20.44	37.57	0.00	10.84	0.00	0.00	0.56	27.42	98.80

GT043 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.48	20.58	37.20	0.00	10.84	0.00	0.00	0.59	27.87	98.56
2	0.00	1.63	20.39	37.33	0.00	10.65	0.00	0.00	0.39	27.76	98.14
3	0.00	1.67	20.63	37.33	0.00	10.38	0.00	0.00	0.46	27.96	98.44
4	0.00	1.58	20.60	37.07	0.00	10.51	0.00	0.00	0.45	27.66	97.86
5	0.00	1.63	20.77	37.31	0.00	10.68	0.00	0.00	0.43	27.65	98.45
6	0.00	1.49	20.69	37.33	0.00	10.96	0.00	0.00	0.25	27.88	98.59
7 margin	0.00	1.77	20.52	37.14	0.00	10.89	0.00	0.00	0.30	27.53	98.15

Client ID GT044:

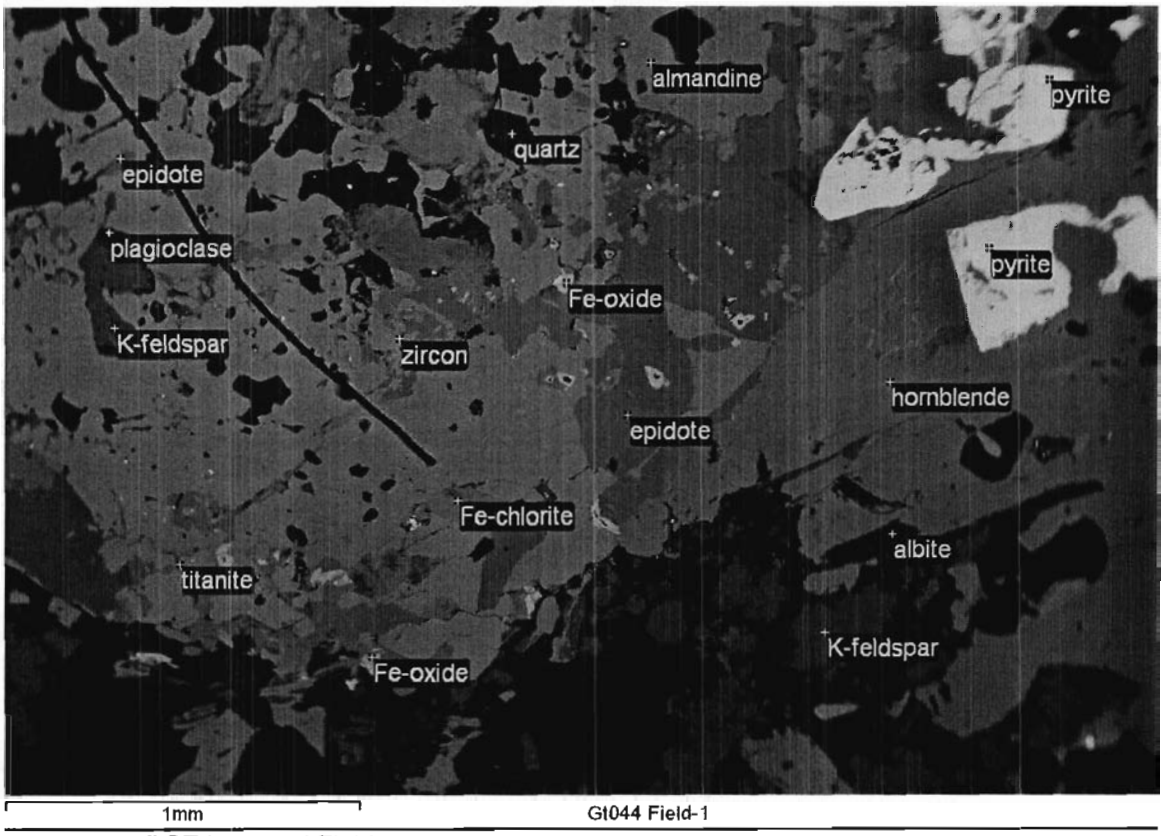


Figure 23: BSE image of Field 1.

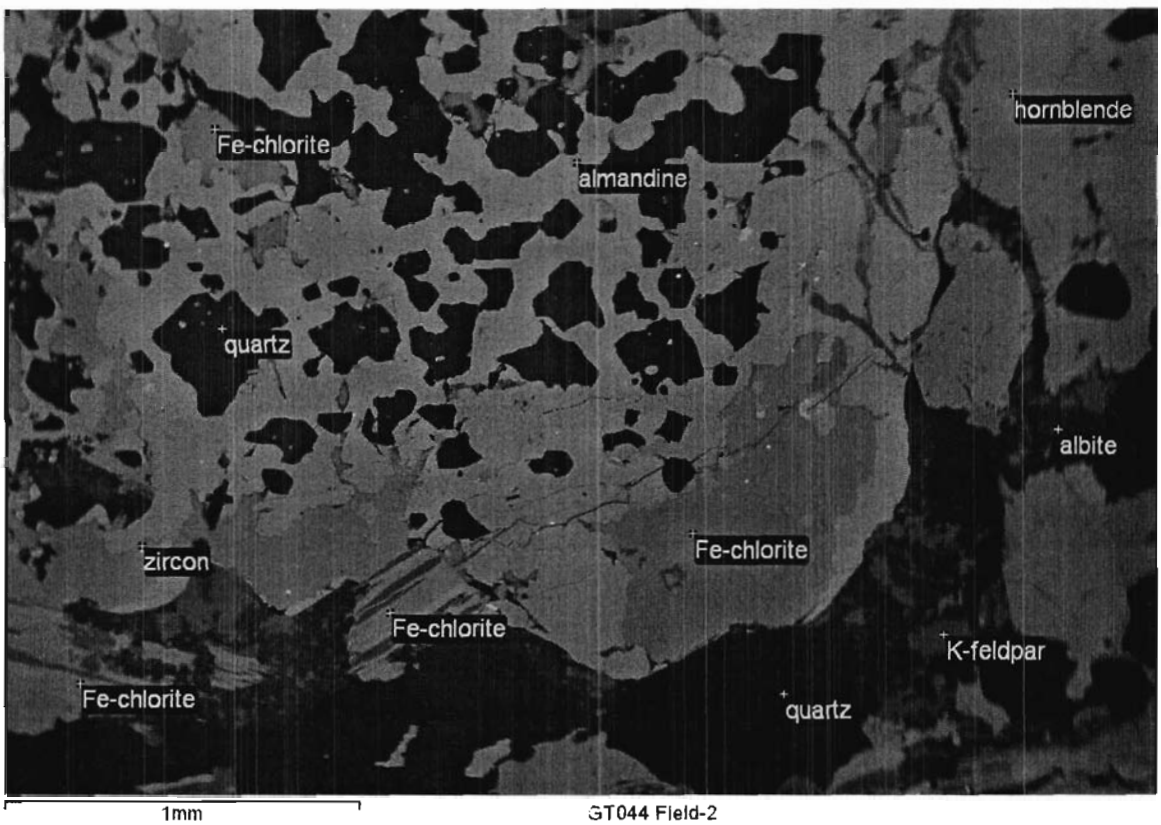


Figure 24: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 23 and Figure 24). The sample consists of a quartz, K-feldspar, Fe-chlorite, and hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of titanite, pyrite, and zircon.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, K-feldspar, and Fe-chlorite, but also containing biotite and smaller inclusions of zircon and rare epidote. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 8).

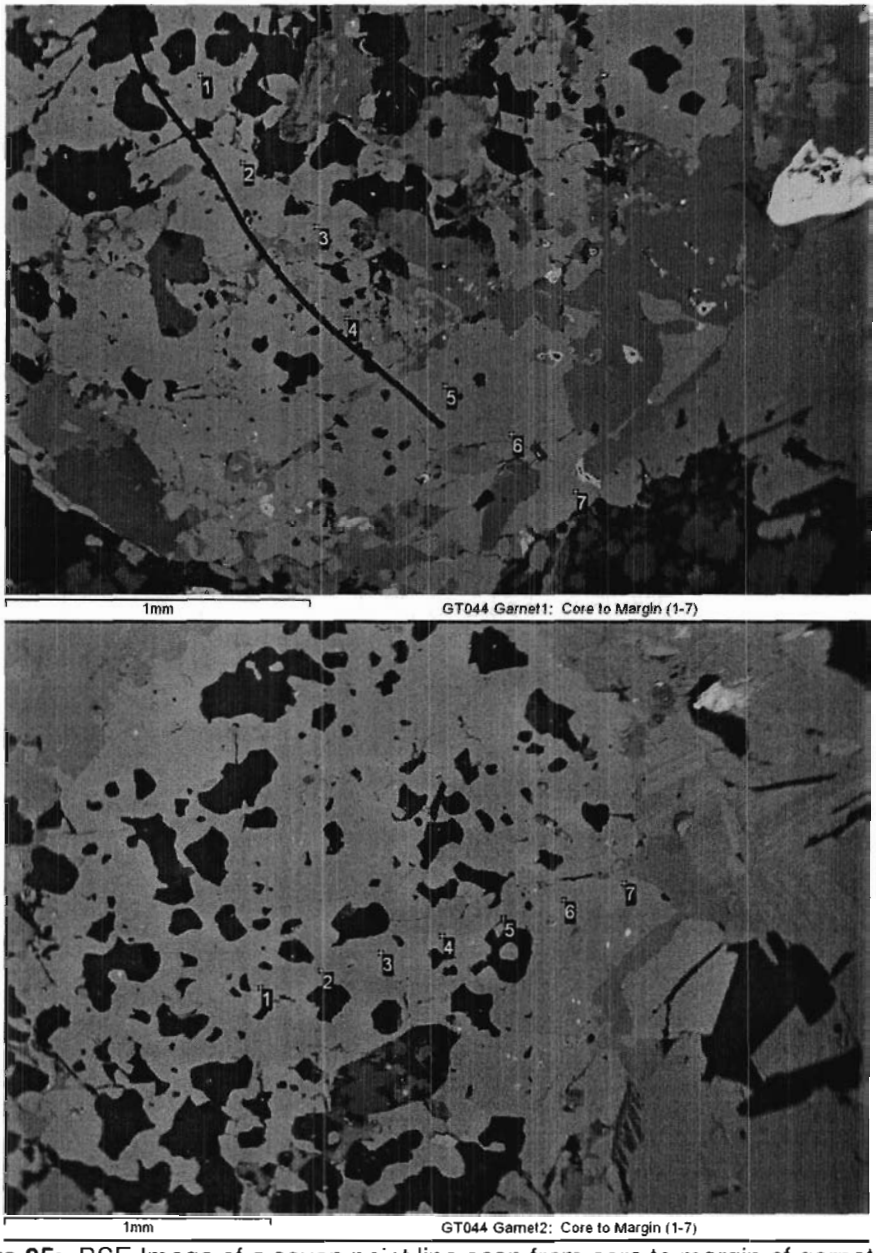


Figure 25: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 25). This data is shown in Table 8. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 8: Oxide weight percent data collected from two garnet grains in thin section GT044.

GT044 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.01	19.99	36.86	0.00	11.77	0.00	0.00	2.49	26.27	98.39
2	0.00	0.93	20.35	37.18	0.00	12.10	0.00	0.00	2.43	26.09	99.08
3	0.00	0.85	20.35	37.37	0.00	13.25	0.00	0.00	2.34	24.71	98.87
4	0.00	0.95	20.14	36.82	0.00	13.03	0.00	0.00	2.44	24.80	98.18
5	0.00	0.80	20.31	37.55	0.00	12.75	0.00	0.00	2.54	24.98	98.93
6	0.00	0.93	20.14	37.14	0.00	12.90	0.00	0.00	1.95	25.27	98.33
7 margin	0.00	1.23	20.16	36.88	0.00	11.46	0.00	0.00	1.78	26.27	97.78

GT044 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	0.85	20.14	36.97	0.00	11.84	0.00	0.00	2.53	25.82	98.14
2	0.00	0.98	20.29	36.92	0.00	11.91	0.00	0.00	2.81	26.06	98.98
3	0.00	1.01	19.80	37.05	0.00	12.03	0.00	0.00	2.56	25.37	97.83
4	0.00	0.95	20.31	37.52	0.00	12.62	0.00	0.00	2.62	24.80	98.83
5	0.00	1.03	19.91	37.07	0.00	11.95	0.00	0.00	2.56	25.68	98.20
6	0.00	0.70	20.37	37.18	0.00	13.64	0.00	0.00	2.76	23.85	98.50
7 margin	0.00	0.86	19.91	37.22	0.00	12.86	0.00	0.00	2.03	25.22	98.10

Client ID GT045:

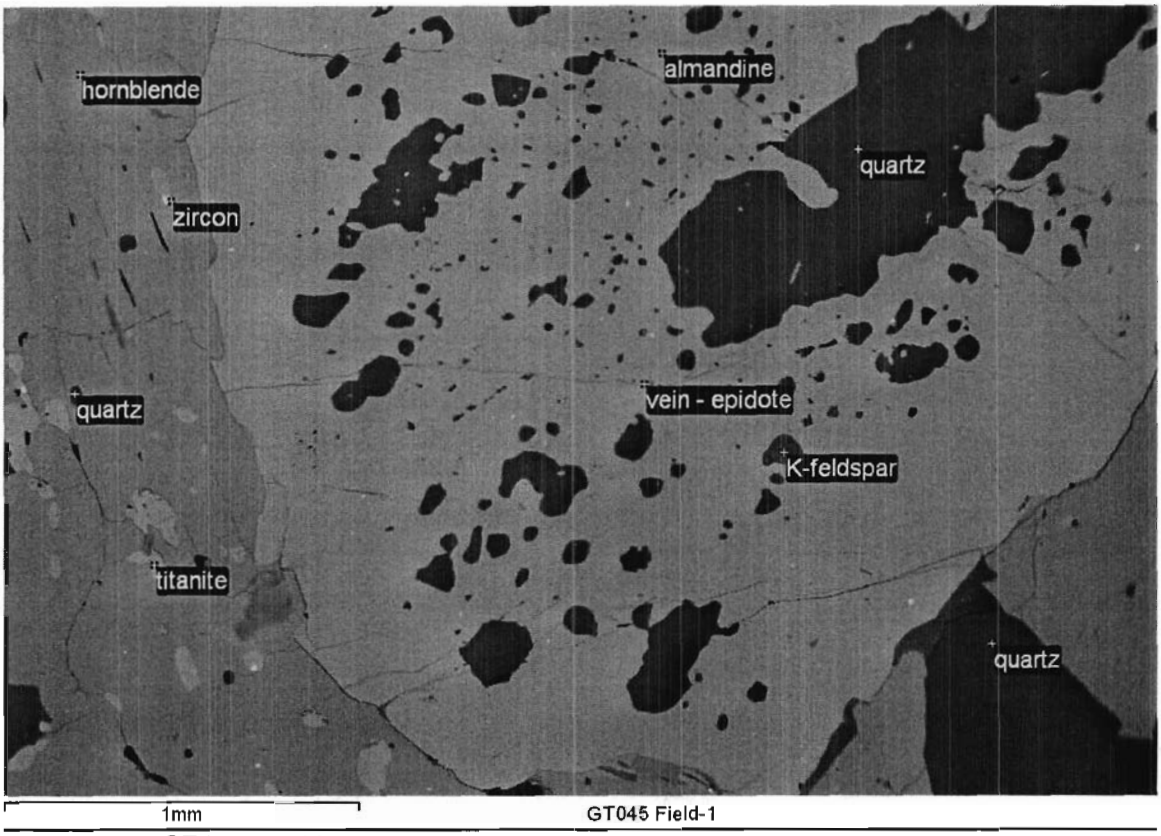


Figure 26: BSE image of Field 1.

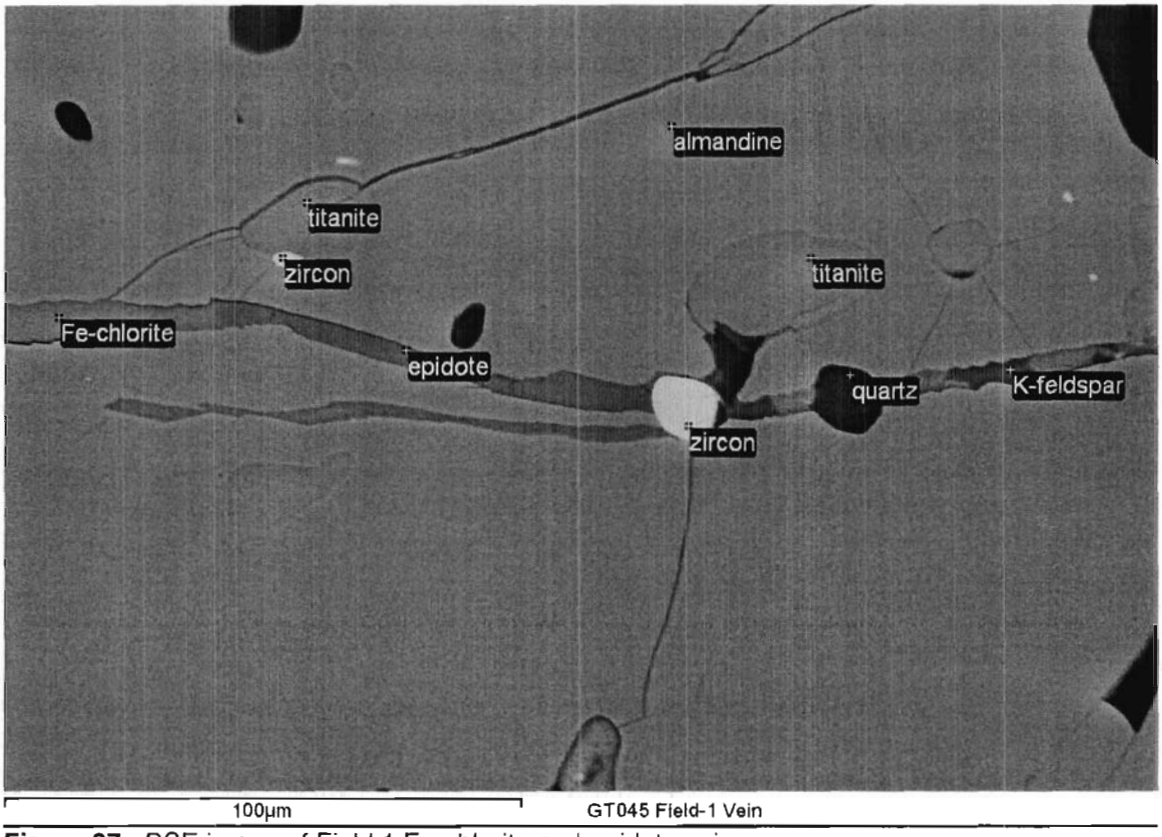


Figure 27: BSE image of Field 1 Fe-chlorite and epidote vein.

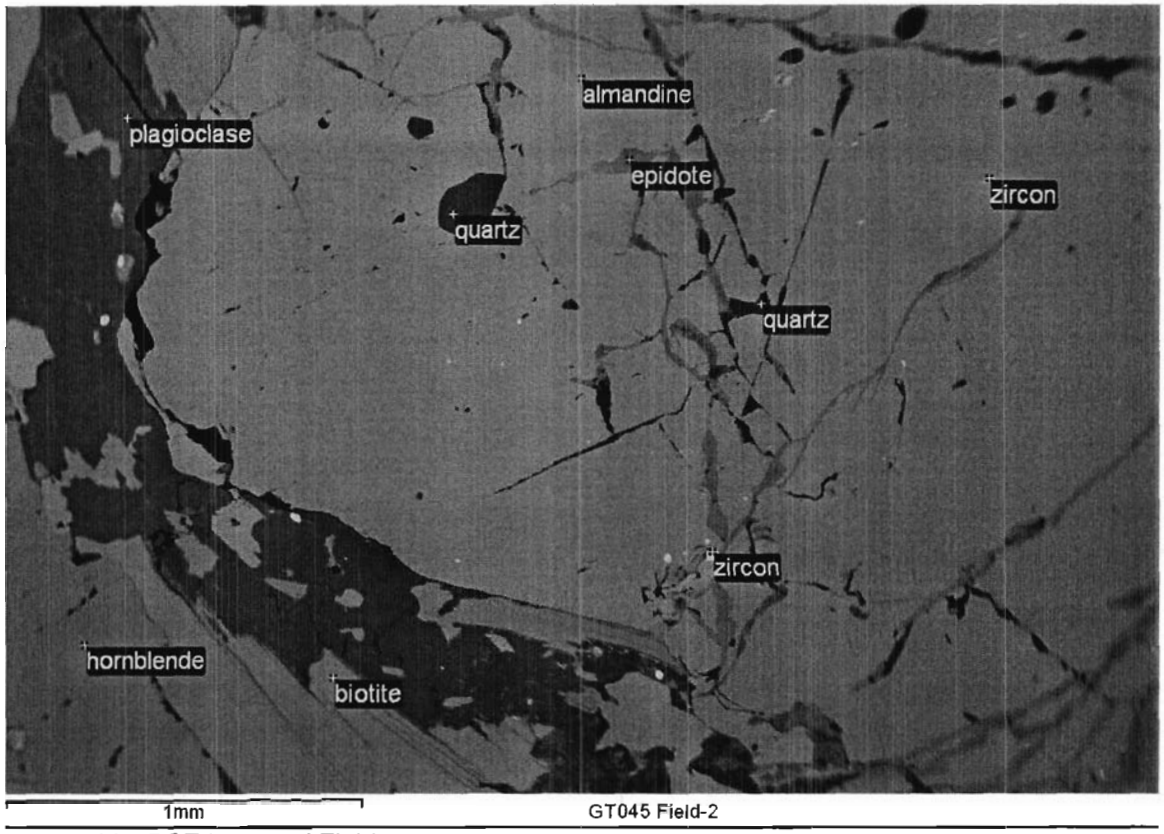


Figure 28: BSE image of Field 2.

Sample Description:

Three representative fields of view were chosen (Figure 26, Figure 27, and Figure 28). The sample consists of a quartz, plagioclase, biotite, hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite and zircon. Several late-stage veins of Fe-chlorite, epidote, and rare K-feldspar were noted, transecting the garnets and surrounding matrix.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz and K-feldspar, but also containing titanite, zircon, and epidote. Numerous Fe-chlorite and epidote veins transected the garnets. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 9).

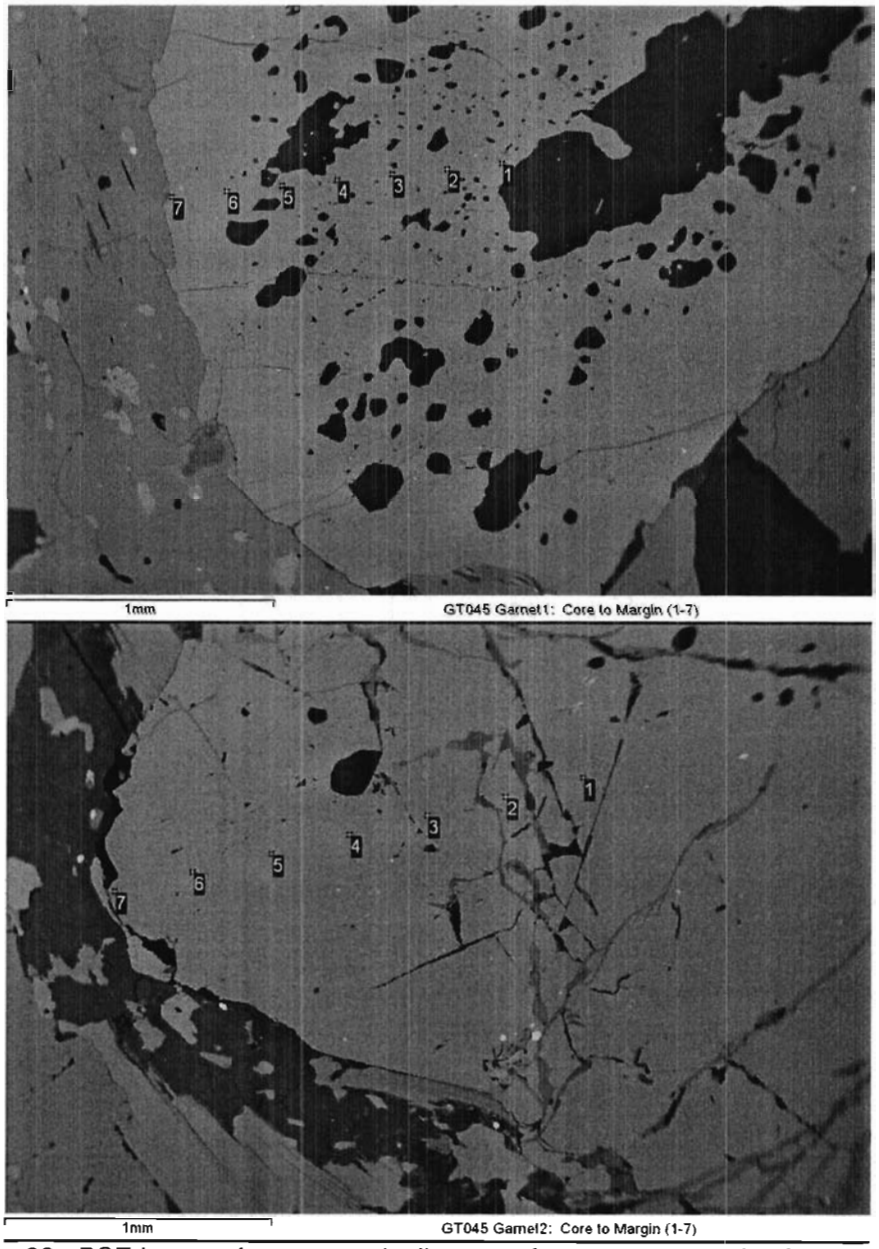


Figure 29: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 29). This data is shown in Table 9. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 9: Oxide weight percent data collected from two garnet grains in thin section GT045.

GT045 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.54	20.46	37.29	0.00	11.42	0.00	0.00	0.81	26.48	98.00
2	0.00	1.39	20.75	36.73	0.00	11.74	0.00	0.00	1.02	26.32	97.95
3	0.00	1.28	20.73	37.27	0.00	11.73	0.00	0.00	1.24	26.50	98.74
4	0.00	1.44	20.54	37.25	0.00	11.61	0.00	0.00	0.94	26.62	98.40
5	0.00	1.48	20.58	37.27	0.00	11.84	0.00	0.00	0.85	26.64	98.65
6	0.00	1.43	20.48	37.05	0.00	12.33	0.00	0.00	0.83	26.19	98.31
7 margin	0.00	1.34	20.61	37.29	0.00	13.10	0.00	0.00	0.52	26.23	99.09

GT045 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.51	20.69	37.48	0.00	12.05	0.00	0.00	0.61	26.32	98.66
2	0.00	1.44	20.52	37.48	0.00	12.19	0.00	0.00	0.61	26.39	98.62
3	0.00	1.33	20.94	37.35	0.00	12.26	0.00	0.00	0.52	26.64	99.03
4	0.00	1.31	20.69	37.40	0.00	12.23	0.00	0.00	0.44	26.80	98.86
5	0.00	1.43	20.80	37.57	0.00	12.73	0.00	0.00	0.56	26.04	99.12
6	0.00	1.59	20.71	37.07	0.00	12.09	0.00	0.00	0.46	26.86	98.79
7 margin	0.00	1.71	20.54	37.29	0.00	10.86	0.00	0.00	0.75	27.88	99.02

Client ID GT071:

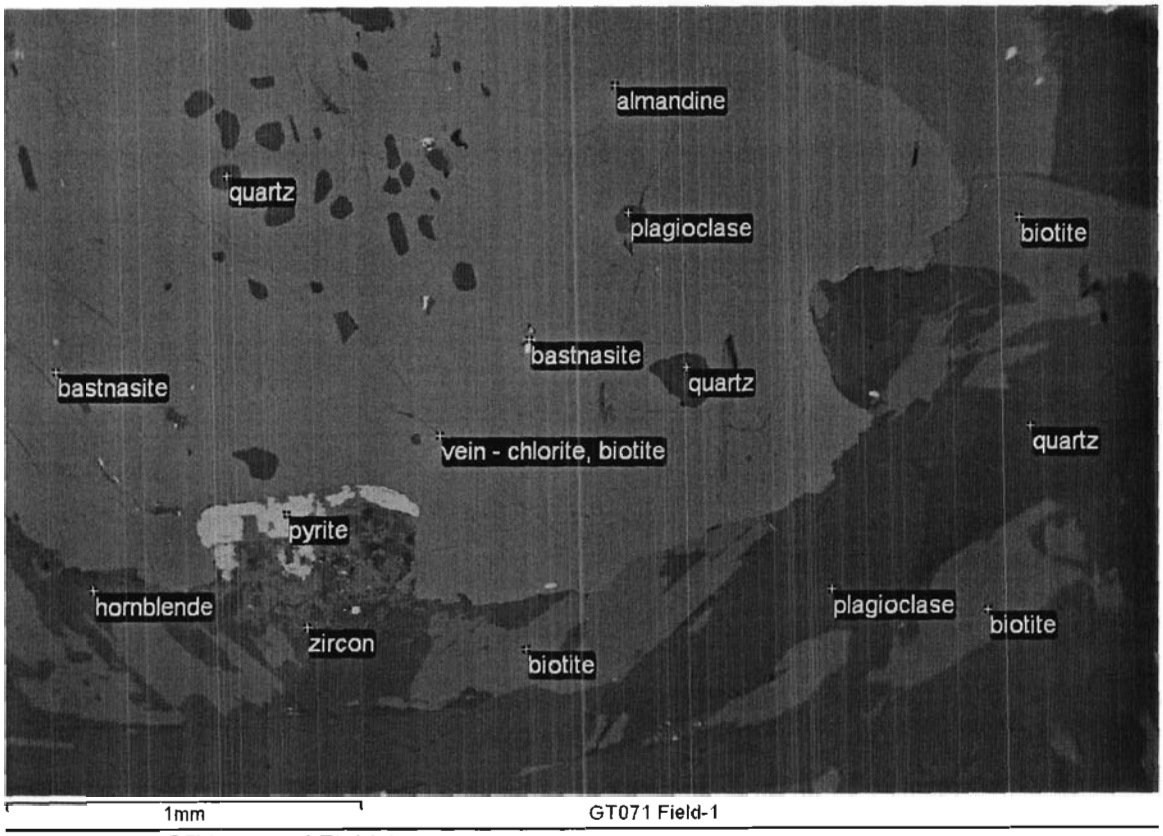


Figure 30: BSE image of Field 1.

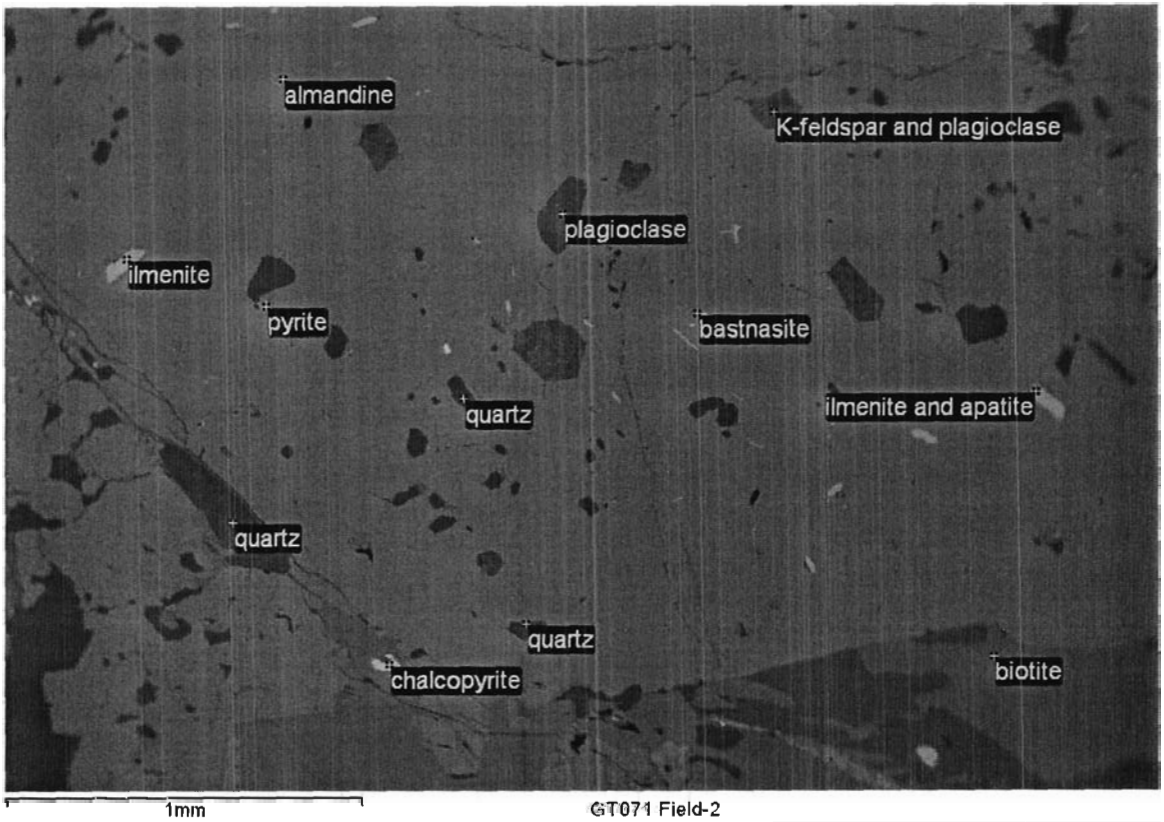


Figure 31: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 30 and Figure 31). The sample consists of a quartz, plagioclase, biotite, and hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of zircon, pyrite, and chalcopyrite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, K-feldspar, and ilmenite, but also containing smaller inclusions of zircon, pyrite, and bastnasite (REE-carbonate). A few late-stage veins of Fe-chlorite and biotite transected a few of the garnets. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 10).

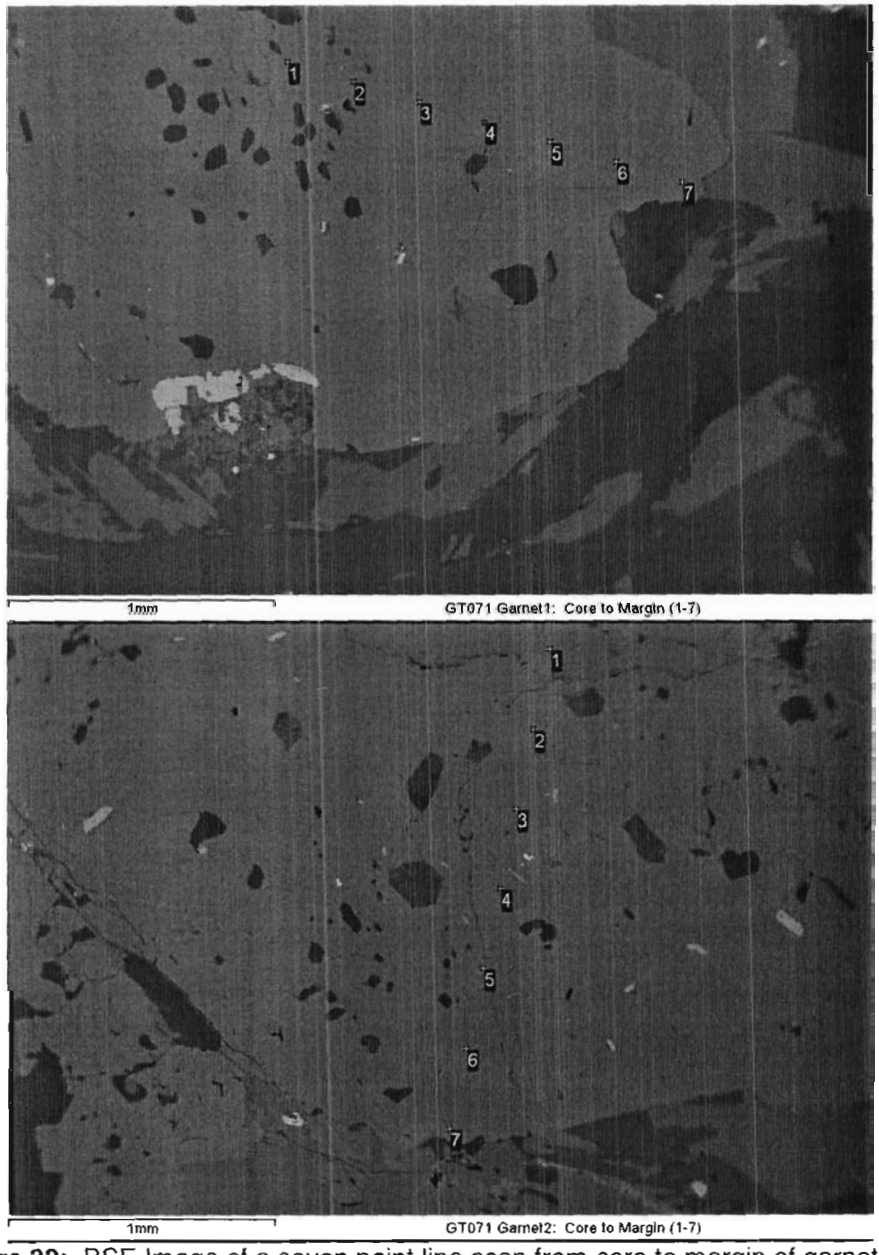


Figure 32: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 32). This data is shown in Table 10. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 10: Oxide weight percent data collected from two garnet grains in thin section GT071.

GT071 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.30	20.73	36.73	0.00	5.19	0.00	0.00	0.34	32.41	98.69
2	0.00	2.64	20.67	36.95	0.00	6.17	0.00	0.00	0.45	32.12	99.00
3	0.00	2.40	20.61	37.29	0.00	7.14	0.00	0.00	0.36	30.75	98.55
4	0.00	2.55	20.52	36.97	0.00	5.88	0.00	0.00	0.48	31.90	98.30
5	0.00	2.69	20.84	36.95	0.00	5.36	0.00	0.00	0.57	32.52	98.92
6	0.00	2.79	20.69	36.90	0.00	4.87	0.00	0.00	0.63	32.77	98.65
7 margin	0.00	2.50	20.58	36.95	0.00	4.73	0.00	0.00	0.61	32.92	98.28

GT071 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.77	20.63	37.33	0.00	6.74	0.00	0.00	0.23	32.59	99.30
2	0.00	0.96	20.56	36.97	0.00	7.32	0.00	0.00	0.00	32.77	98.57
3	Electron beam intersected with an ilmenite grain										
4	0.00	1.34	20.44	36.88	0.00	7.37	0.00	0.00	0.23	32.68	98.95
5	0.00	1.63	20.73	36.95	0.00	7.16	0.00	0.00	0.00	32.61	99.08
6	0.00	2.21	20.48	37.07	0.00	6.11	0.00	0.00	0.34	32.05	98.26
7 margin	0.00	2.59	20.65	37.12	0.00	4.65	0.00	0.00	0.54	33.82	99.37

Client ID GT072:

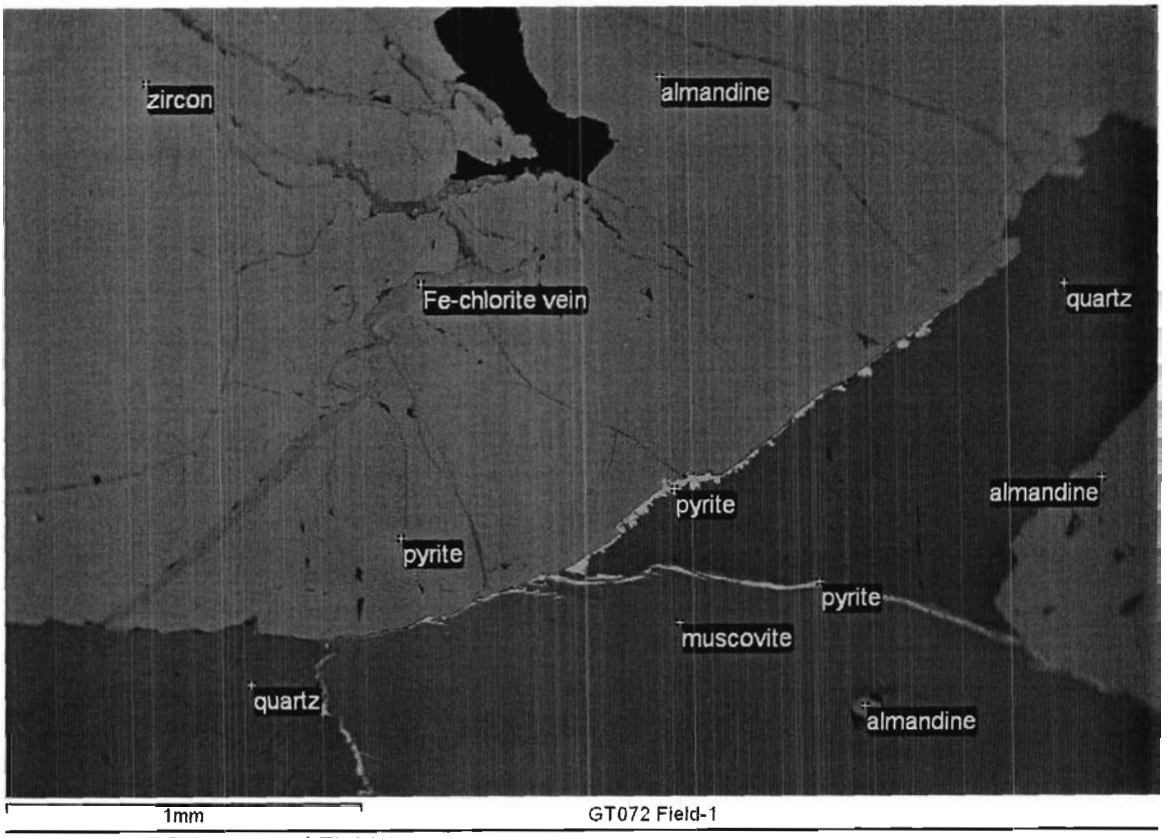


Figure 33: BSE image of Field 1.

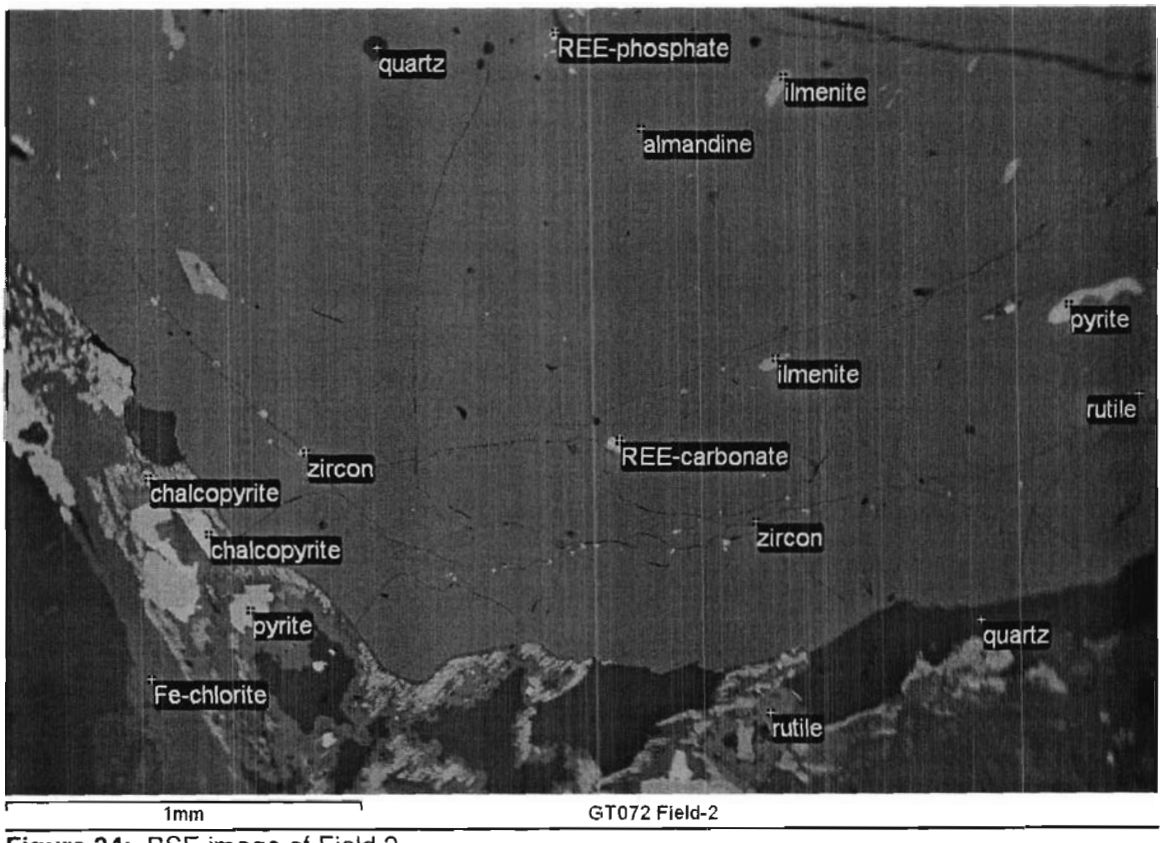


Figure 34: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 33 and Figure 34). The sample consists of a quartz, muscovite, Fe-chlorite, and hornblende matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of rutile, pyrite, and chalcopyrite. In Field-1, the pyrite formed a rim around part of the garnet and mica.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, zircon, pyrite, rutile, REE-phosphate, and REE-carbonate inclusions. Fe-chlorite veins were apparent in some of the garnets. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 11).

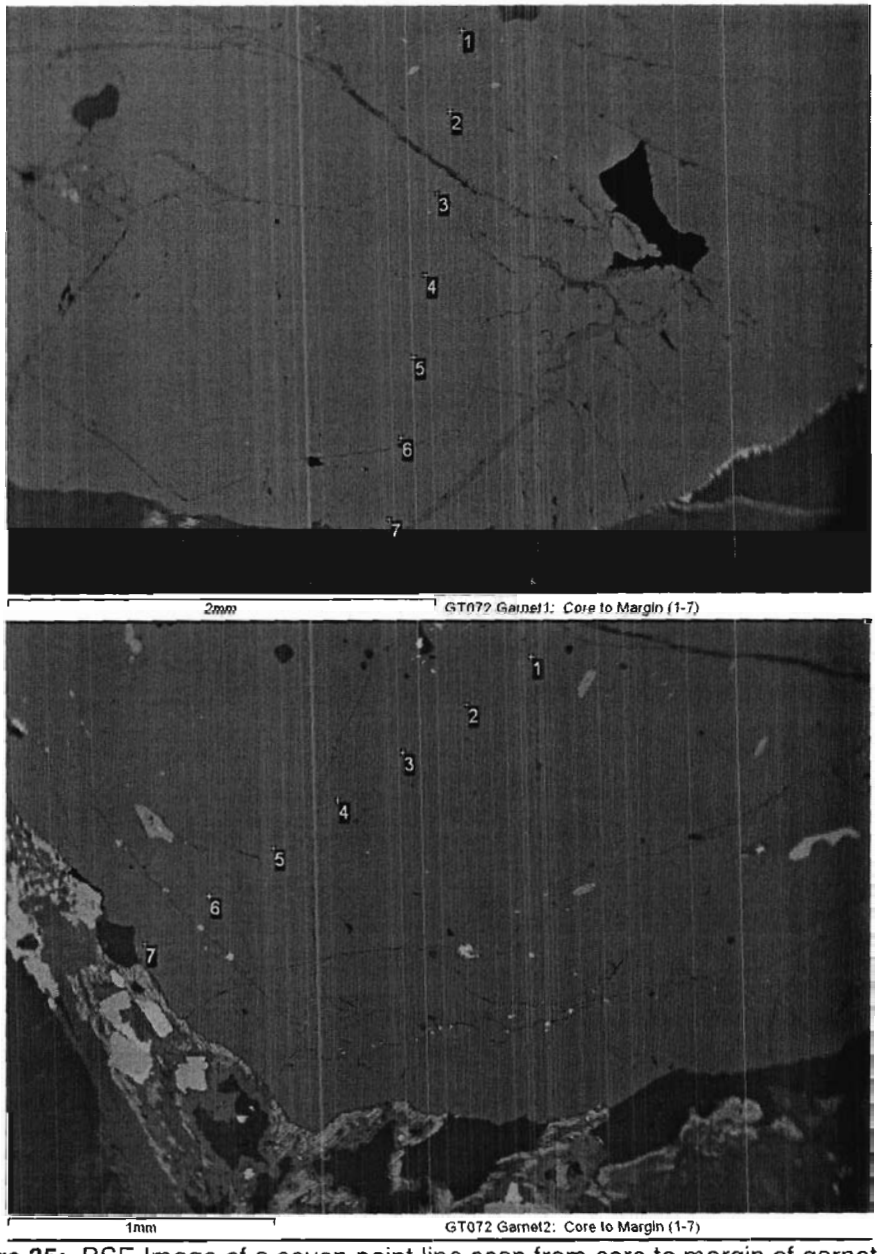


Figure 35: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 35). This data is shown in Table 1. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 11: Oxide weight percent data collected from two garnet grains in thin section GT072.

GT072 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	2.84	20.52	36.65	0.00	2.63	0.00	0.00	0.41	35.47	98.51
2	0.00	2.62	20.39	36.73	0.00	2.70	0.00	0.00	0.34	35.93	98.71
3	0.00	2.67	20.67	36.92	0.00	2.63	0.00	0.00	0.50	35.91	99.31
4	0.00	2.85	20.82	36.58	0.00	2.43	0.00	0.00	0.41	35.55	98.65
5	0.00	3.12	20.63	36.78	0.00	2.48	0.00	0.00	0.54	35.38	98.92
6	0.00	3.33	20.78	37.07	0.00	2.43	0.00	0.00	0.52	35.11	99.25
7 margin	0.00	3.43	20.77	36.80	0.00	2.81	0.00	0.00	0.57	34.16	98.53

GT072 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	1.77	20.37	36.43	0.00	2.34	0.00	0.00	0.34	36.91	98.16
2	0.00	1.81	20.46	36.33	0.00	2.52	0.00	0.00	0.36	37.01	98.49
3	0.00	1.99	20.84	37.12	0.00	2.66	0.00	0.00	0.36	37.59	100.56
4	0.00	2.34	20.63	37.07	0.00	2.81	0.00	0.00	0.53	36.69	100.08
5	0.00	2.79	21.03	36.90	0.00	3.15	0.00	0.00	0.63	35.30	99.80
6	0.00	3.25	20.88	37.16	0.00	2.83	0.00	0.00	0.62	34.57	99.30
7 margin	0.00	3.32	20.90	36.73	0.00	2.92	0.00	0.00	0.65	34.50	99.02

Client ID GT073:

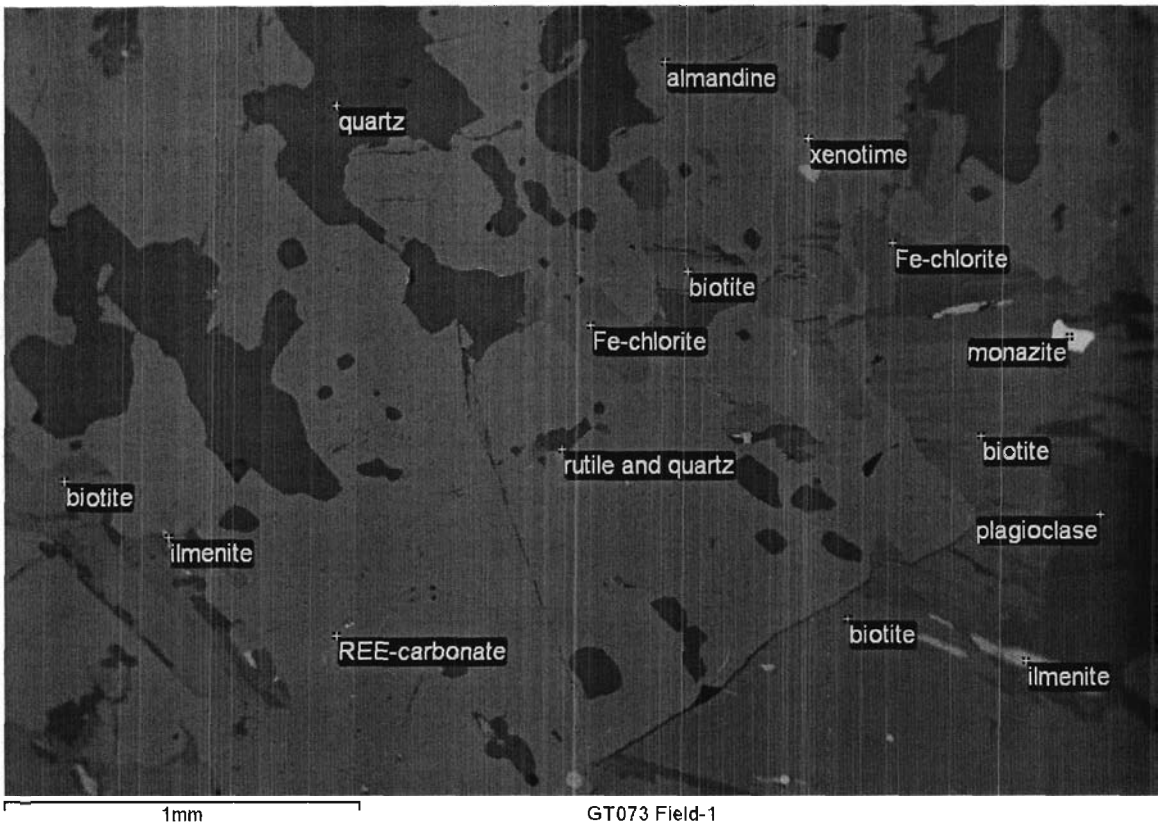


Figure 36: BSE image of Field 1.

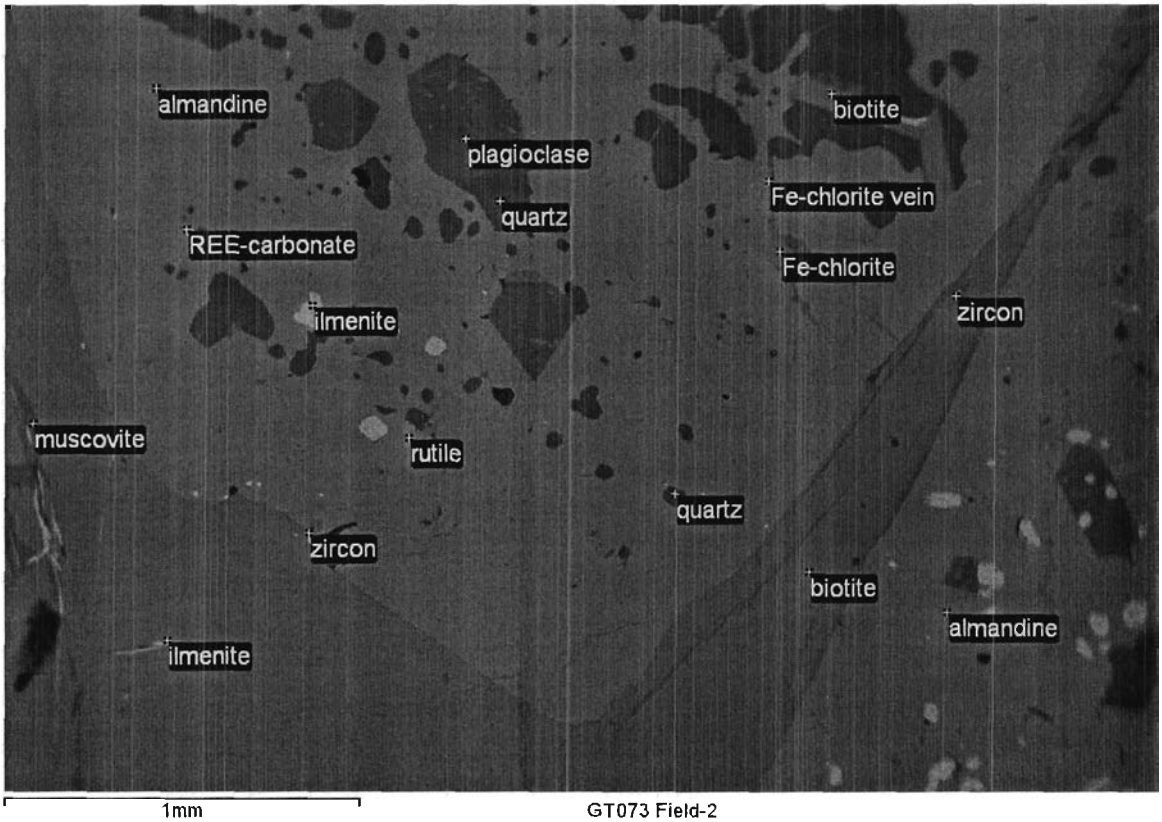


Figure 37: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 36 and Figure 37). The sample consists of a quartz, plagioclase, biotite and muscovite matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite and rare monazite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, biotite, and ilmenite, but also containing smaller inclusions of zircon, rutile, xenotime, and REE-carbonate. Several late-stage veins of Fe-chlorite were noted, transecting the garnets. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 12).

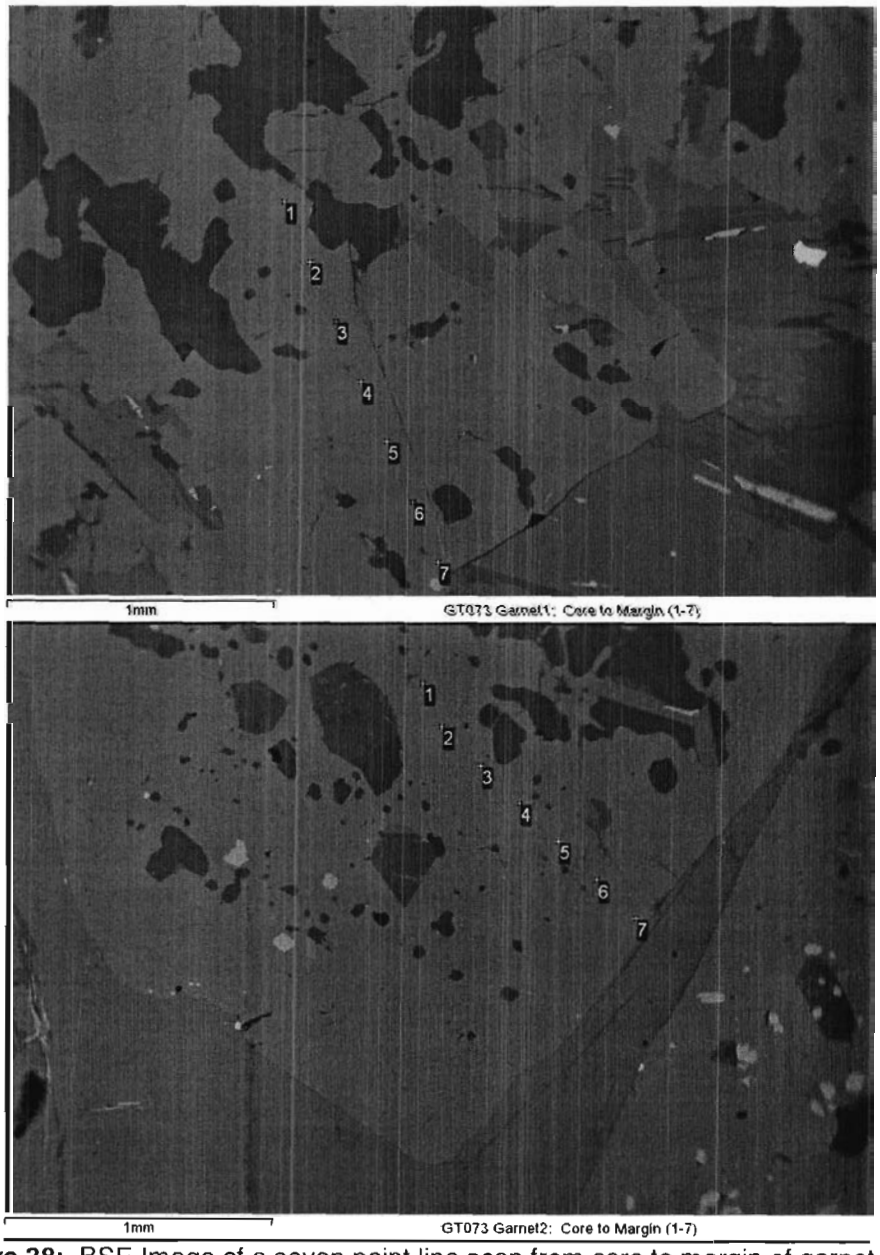


Figure 38: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 38). This data is shown in Table 12. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 12: Oxide weight percent data collected from two garnet grains in thin section GT073.

GT073 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.33	20.29	37.07	0.00	3.58	0.00	0.00	0.68	33.64	98.61
2	0.00	3.32	20.48	37.03	0.00	3.58	0.00	0.00	0.67	33.58	98.66
3	0.00	3.45	20.48	36.92	0.00	3.88	0.00	0.00	0.65	33.08	98.45
4	0.00	3.37	21.12	37.37	0.00	3.95	0.00	0.00	0.50	33.02	99.34
5	0.00	3.33	20.69	36.58	0.00	4.06	0.00	0.00	0.43	32.90	97.98
6	0.00	3.40	20.56	37.18	0.00	3.93	0.00	0.00	0.50	32.91	98.48
7 margin	0.00	3.22	20.69	36.97	0.00	3.99	0.00	0.00	0.39	33.29	98.54

GT073 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.35	20.95	37.40	0.00	3.75	0.00	0.00	0.58	33.54	99.57
2	0.00	3.42	20.77	37.22	0.00	3.78	0.00	0.00	0.54	33.62	99.34
3	0.00	3.35	20.84	37.12	0.00	3.86	0.00	0.00	0.41	33.29	98.88
4	0.00	3.40	20.97	37.12	0.00	3.90	0.00	0.00	0.49	33.10	98.99
5	0.00	3.28	20.86	36.84	0.00	4.04	0.00	0.00	0.44	33.10	98.57
6	0.00	3.28	21.16	36.88	0.00	4.06	0.00	0.00	0.46	33.13	98.98
7 margin	0.00	3.23	21.12	36.97	0.00	3.60	0.00	0.00	0.54	33.50	98.96

Client ID GT074:

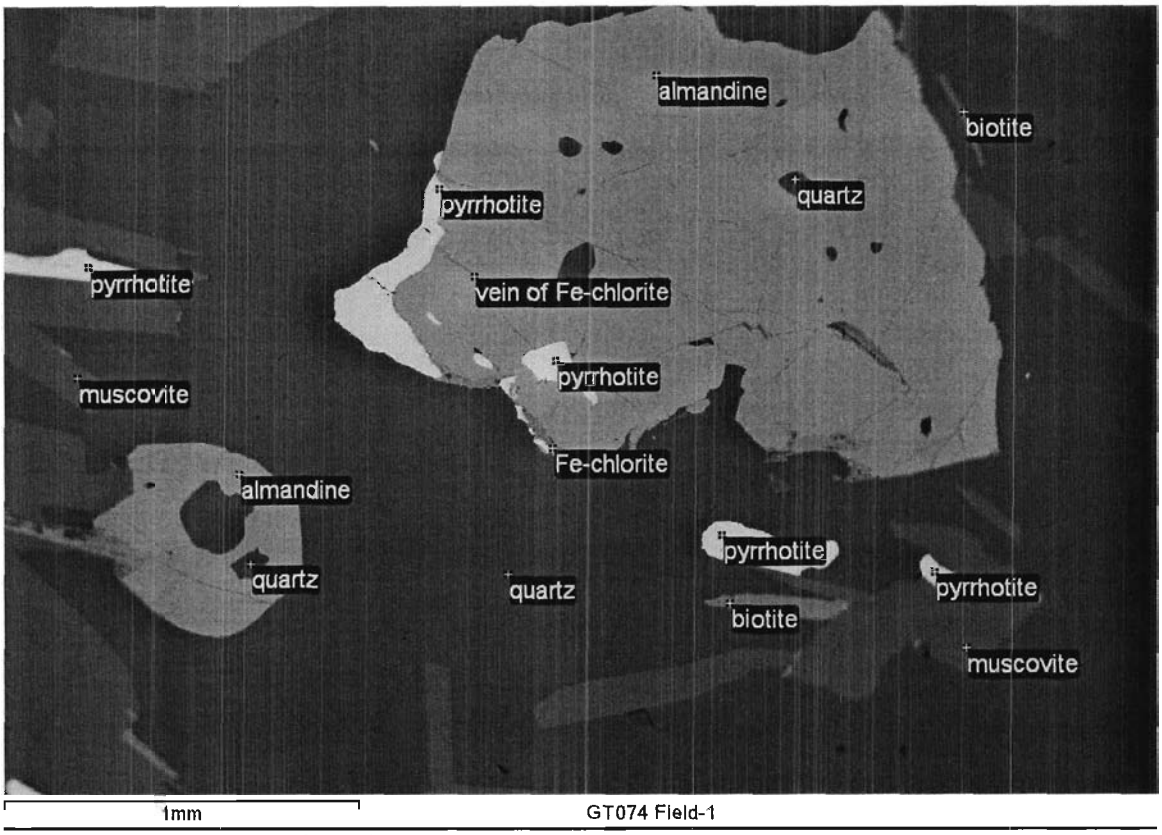


Figure 39: BSE image of Field 1.

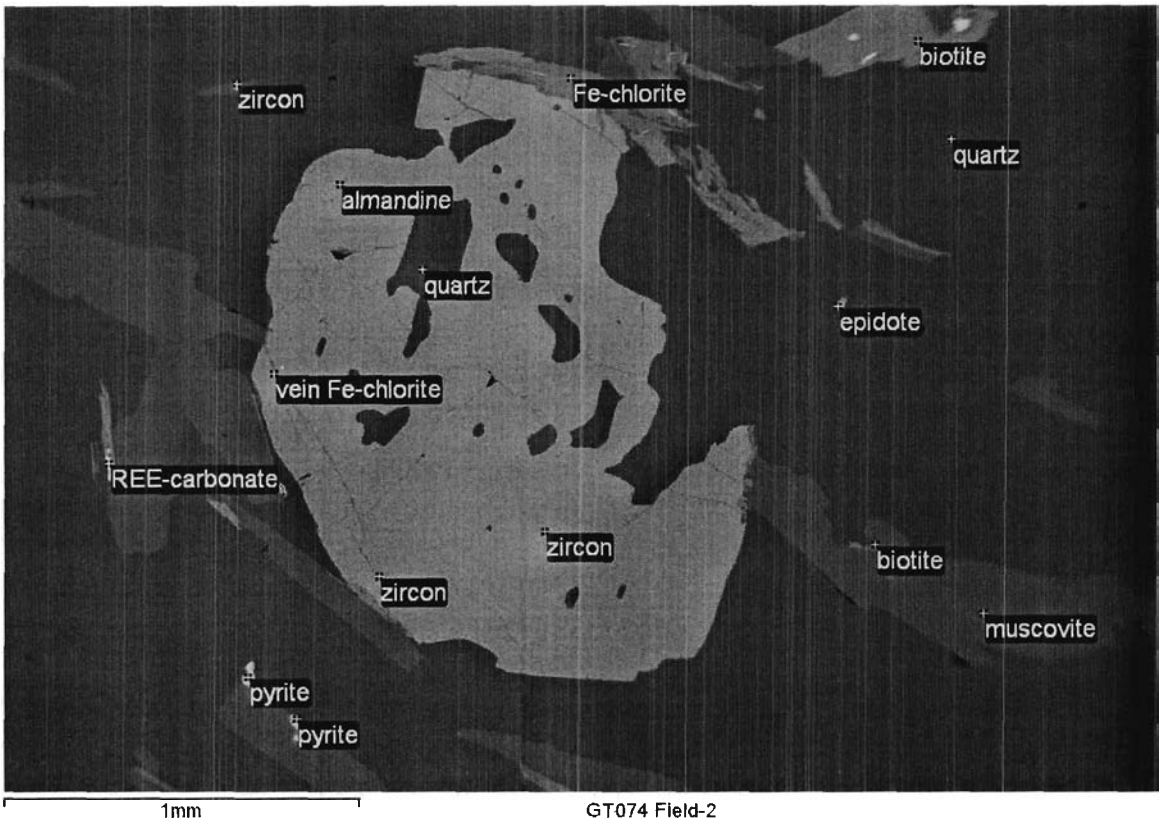


Figure 40: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 39 and Figure 40). The sample consists of a quartz, biotite, and muscovite matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of Fe-chlorite, zircon, pyrite, pyrrhotite, and rare epidote.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, but also containing Fe-chlorite, pyrrhotite, and smaller inclusions of zircon. Numerous small veins containing Fe-chlorite transected the garnet grains. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 13).

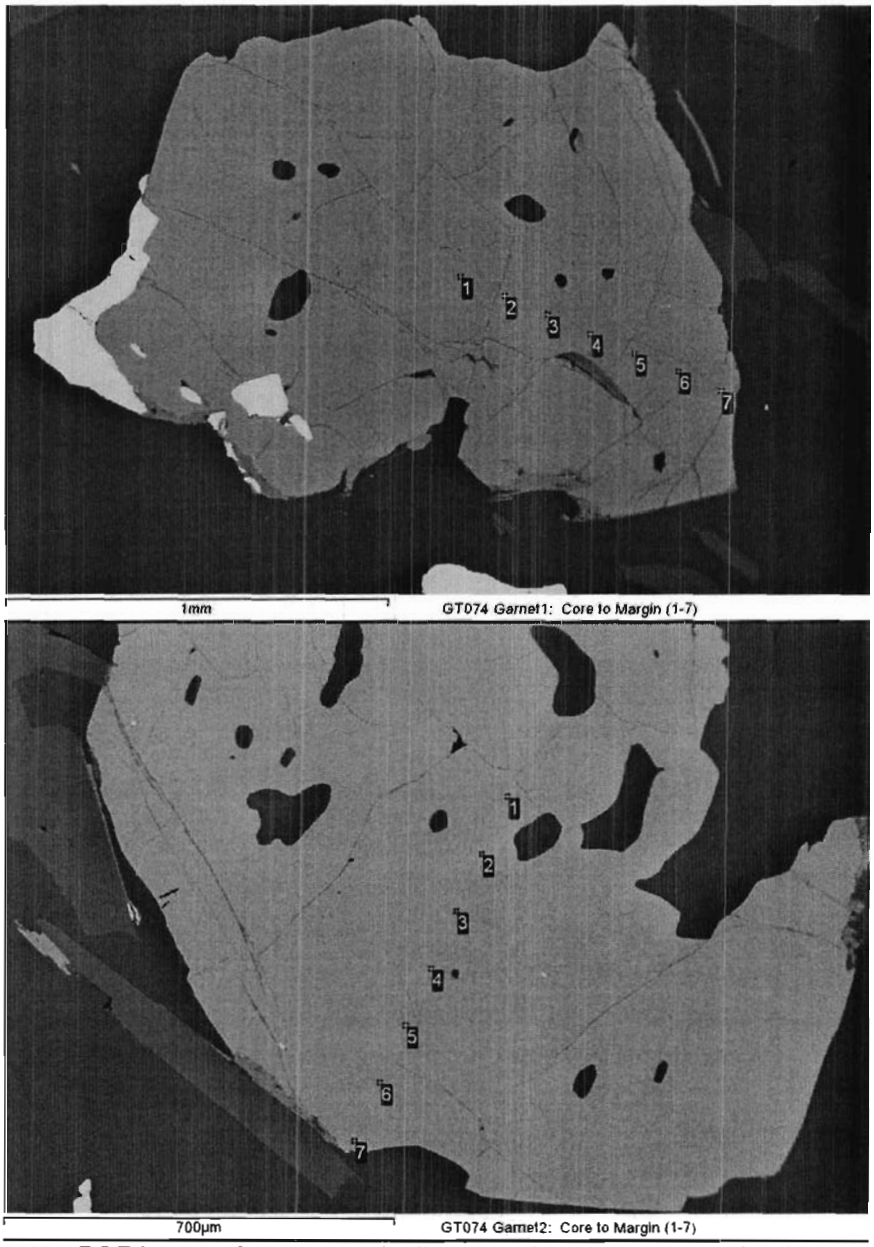


Figure 41: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 41). This data is shown in (Table 13). The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client. Additionally, the small size of the garnets and the relatively low number of inclusions allowed for a complete transect of the Garnet 1 (Figure 42)

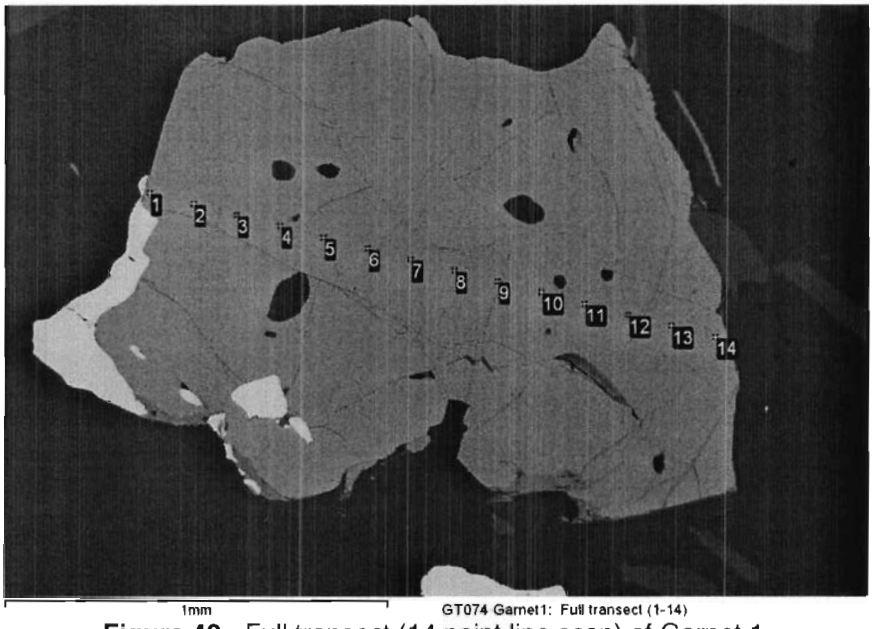


Figure 42: Full transect (14 point line scan) of Garnet 1.

Table 13: Oxide weight percent data collected from two garnet grains in thin section GT074.

GT074 Garnet1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	3.62	21.01	37.07	0.00	3.90	0.00	0.00	0.45	32.86	98.91
2		0.00	3.57	21.05	37.57	0.00	4.14	0.00	0.00	0.43	33.08	99.82
3		0.00	3.81	20.95	37.27	0.00	3.65	0.00	0.00	0.37	33.20	99.27
4		0.00	3.53	20.88	36.95	0.00	3.72	0.00	0.00	0.45	32.91	98.44
5		0.00	3.47	20.82	37.03	0.00	3.90	0.00	0.00	0.50	32.90	98.62
6		0.00	3.30	20.77	36.97	0.00	4.30	0.00	0.00	0.48	32.70	98.51
7	margin	0.00	3.55	20.58	36.26	0.42	3.86	0.00	0.00	0.52	32.32	97.50

GT074 Garnet2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	3.42	20.77	37.27	0.00	4.70	0.00	0.00	0.53	32.18	98.85
2		0.00	3.18	20.92	37.01	0.00	4.48	0.00	0.00	0.44	32.79	98.82
3		0.00	3.27	20.78	36.95	0.00	4.74	0.00	0.00	0.45	32.23	98.42
4		0.00	3.57	20.95	37.12	0.00	3.74	0.00	0.00	0.41	33.01	98.80
5		0.00	3.52	20.97	37.12	0.00	4.21	0.00	0.00	0.46	32.52	98.80
6		0.00	3.38	20.48	36.84	0.00	4.21	0.00	0.00	0.52	32.72	98.15
7	margin	0.00	2.95	20.75	37.03	0.00	4.17	0.00	0.00	0.53	33.40	98.83

GT074 Garnet1 full transect		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	margin left	0.00	2.95	20.69	36.78	0.00	4.48	0.00	0.00	0.53	33.33	98.76
2		0.00	3.35	20.99	36.80	0.00	4.35	0.00	0.00	0.45	32.86	98.80
3		0.00	3.42	20.73	37.18	0.00	4.32	0.00	0.00	0.44	32.69	98.78
4		0.00	3.66	20.61	36.80	0.00	4.02	0.00	0.00	0.45	32.90	98.44
5		0.00	3.62	20.60	36.75	0.00	3.86	0.00	0.00	0.43	32.79	98.04
6		0.00	3.50	21.03	36.82	0.00	4.32	0.00	0.00	0.45	32.68	98.80
7		0.00	3.43	20.77	36.88	0.00	4.28	0.00	0.00	0.37	32.63	98.36
8		0.00	3.52	20.86	36.97	0.00	4.03	0.00	0.00	0.48	32.52	98.37
9		0.00	3.45	20.95	36.67	0.00	4.13	0.00	0.00	0.48	32.78	98.46
10		0.00	3.53	20.94	36.80	0.00	4.04	0.00	0.00	0.52	32.59	98.41
11		0.00	3.58	21.03	37.18	0.00	3.62	0.00	0.00	0.40	33.14	98.96
12		0.00	3.68	21.26	38.32	0.00	4.04	0.00	0.00	0.45	33.49	101.24
13		0.00	3.22	20.92	37.07	0.00	4.38	0.00	0.00	0.48	32.16	98.23
14	margin right	0.00	2.92	20.77	36.99	0.00	4.38	0.00	0.00	0.48	32.96	98.49

Client ID GT075:

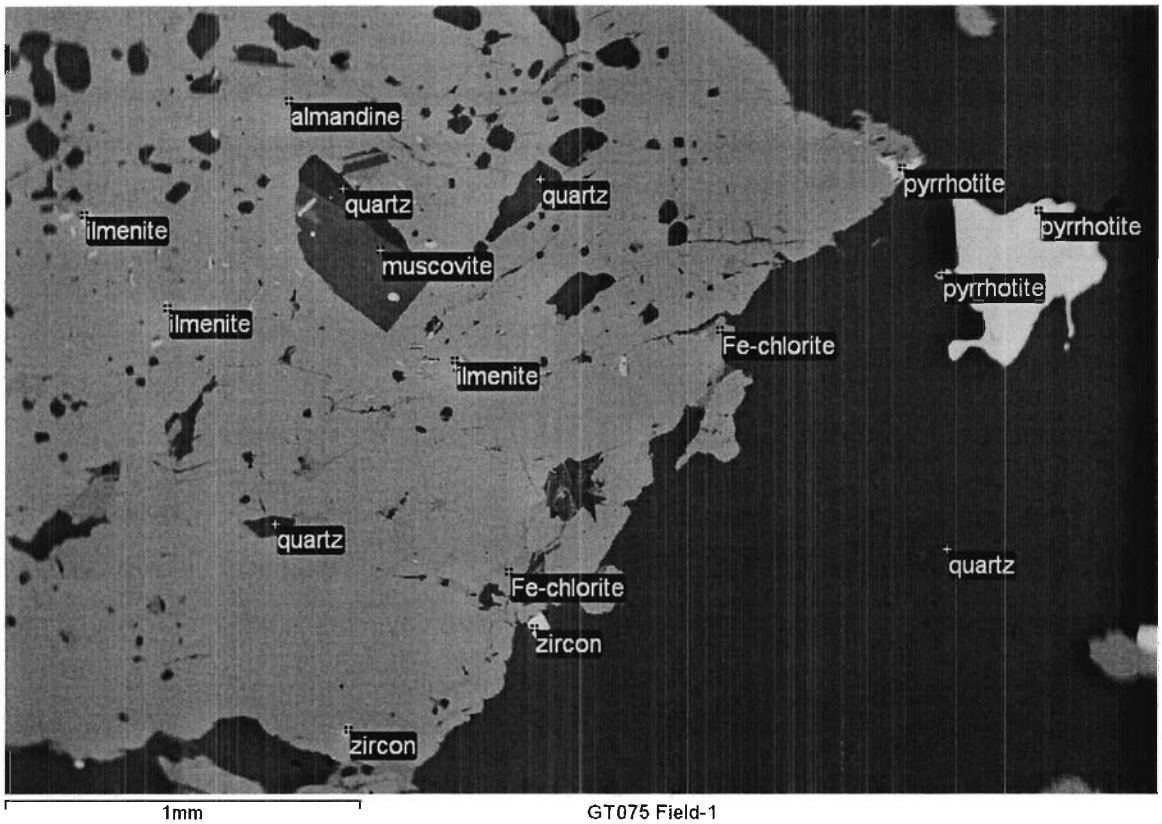


Figure 43: BSE image of Field 1.

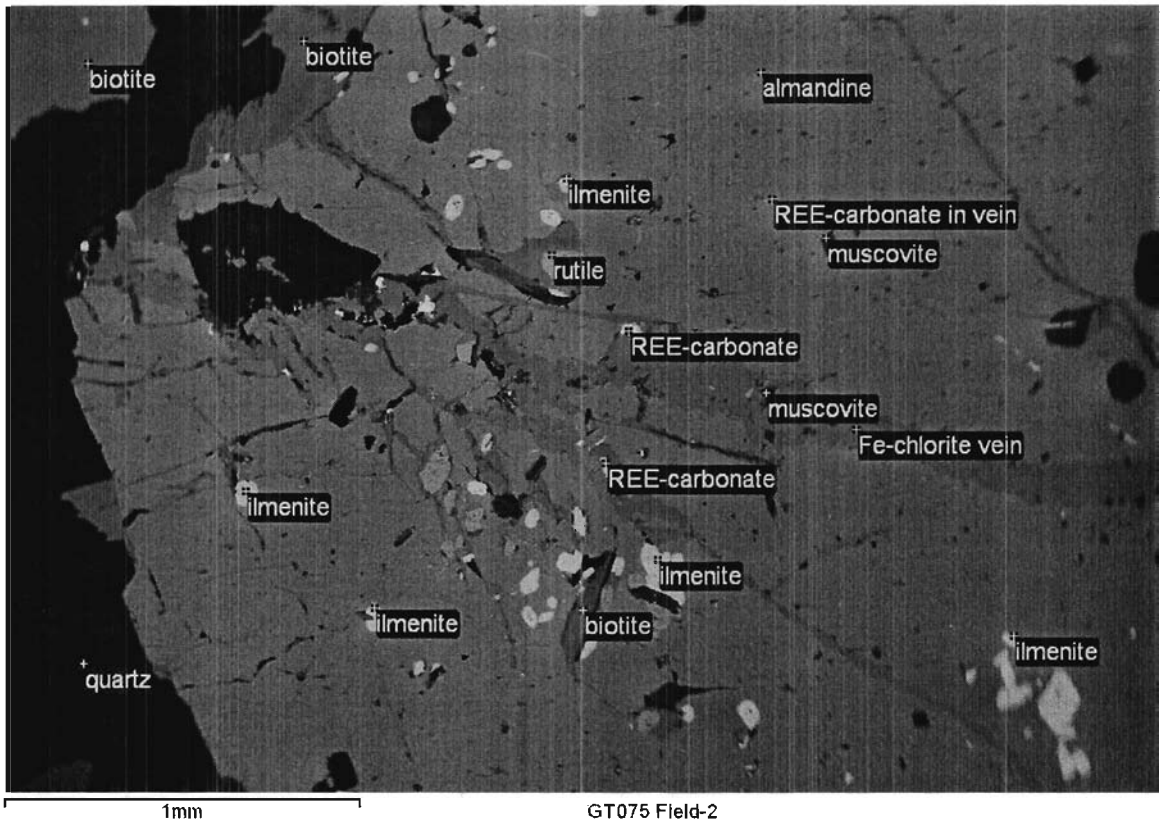


Figure 44: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 43 and Figure 44). The sample consists of a quartz and biotite matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of Fe-chlorite, zircon, and pyrrhotite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, ilmenite, rutile, biotite, and muscovite, but also containing biotite and smaller inclusions of zircon and rare REE-carbonate. Numerous veins of Fe-chlorite transected the garnets. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 14).

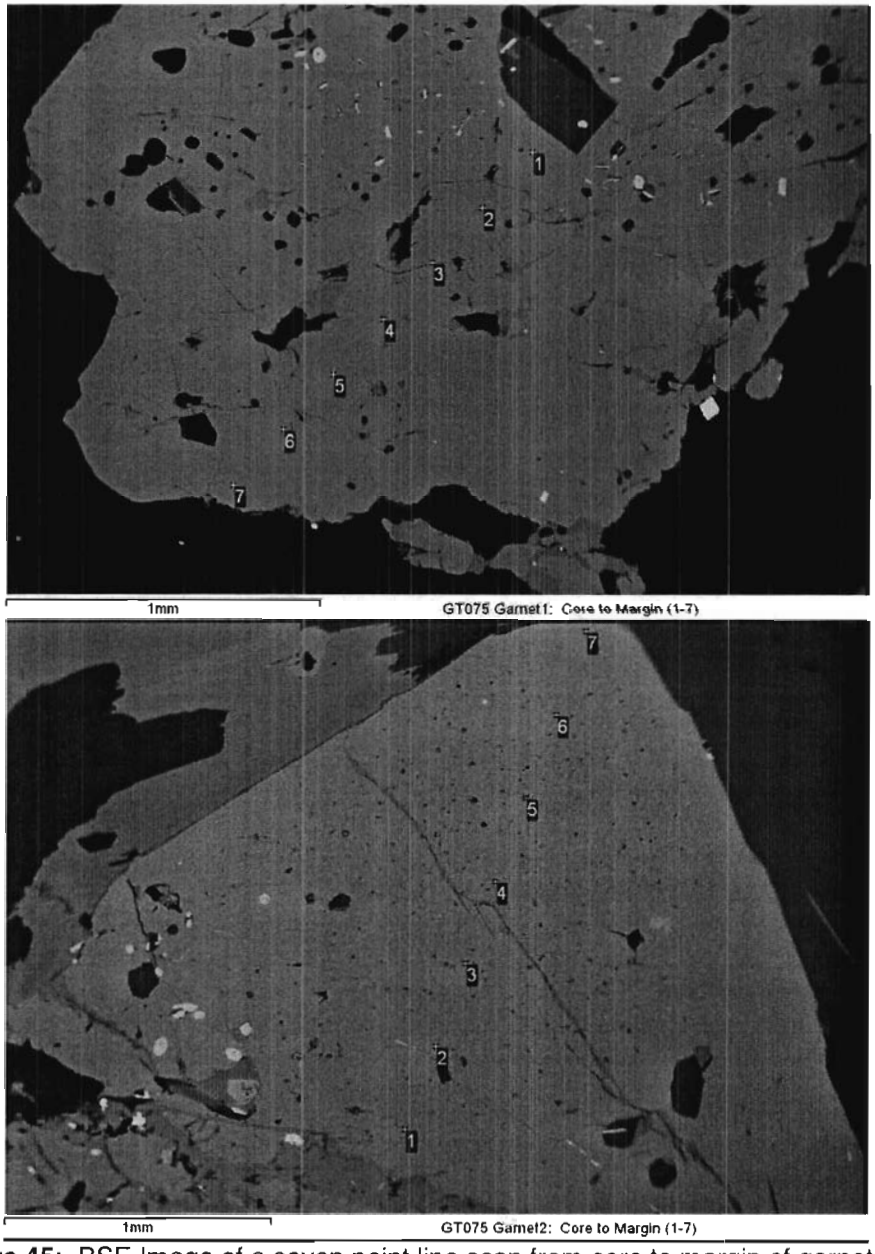


Figure 45: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 45). This data is shown in Table 14. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 14: Oxide weight percent data collected from two garnet grains in thin section GT075.

GT075 Garnet1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.33	20.58	36.54	0.00	3.33	0.00	0.00	0.72	33.67	98.17
2	0.00	3.42	20.80	36.92	0.00	3.43	0.00	0.00	0.66	33.45	98.68
3	0.00	3.57	20.44	36.52	0.00	2.91	0.00	0.00	0.70	33.78	97.92
4	0.00	3.37	20.35	36.84	0.00	3.44	0.00	0.00	0.72	33.68	98.40
5	0.00	3.35	20.35	36.97	0.00	3.44	0.00	0.00	0.53	33.54	98.18
6	0.00	3.33	20.92	36.65	0.00	3.30	0.00	0.00	0.72	33.60	98.52
7 margin	0.00	3.30	20.46	36.75	0.00	3.39	0.00	0.00	0.58	34.16	98.64

GT075 Garnet2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	2.37	20.71	36.95	0.00	5.28	0.00	0.00	0.43	33.33	99.06
2	0.00	2.54	20.77	36.97	0.00	4.90	0.00	0.00	0.32	33.62	99.11
3	0.00	2.54	20.73	36.67	0.00	4.76	0.00	0.00	0.50	33.27	98.46
4	0.00	2.82	20.58	37.05	0.00	4.52	0.00	0.00	0.49	33.44	98.89
5	0.00	2.65	20.35	36.90	0.00	4.35	0.00	0.00	0.46	33.55	98.27
6	0.00	3.13	20.73	36.80	0.00	3.95	0.00	0.00	0.56	33.17	98.32
7 margin	0.00	3.07	20.41	37.05	0.00	3.47	0.00	0.00	0.65	33.86	98.50

Client ID G31:

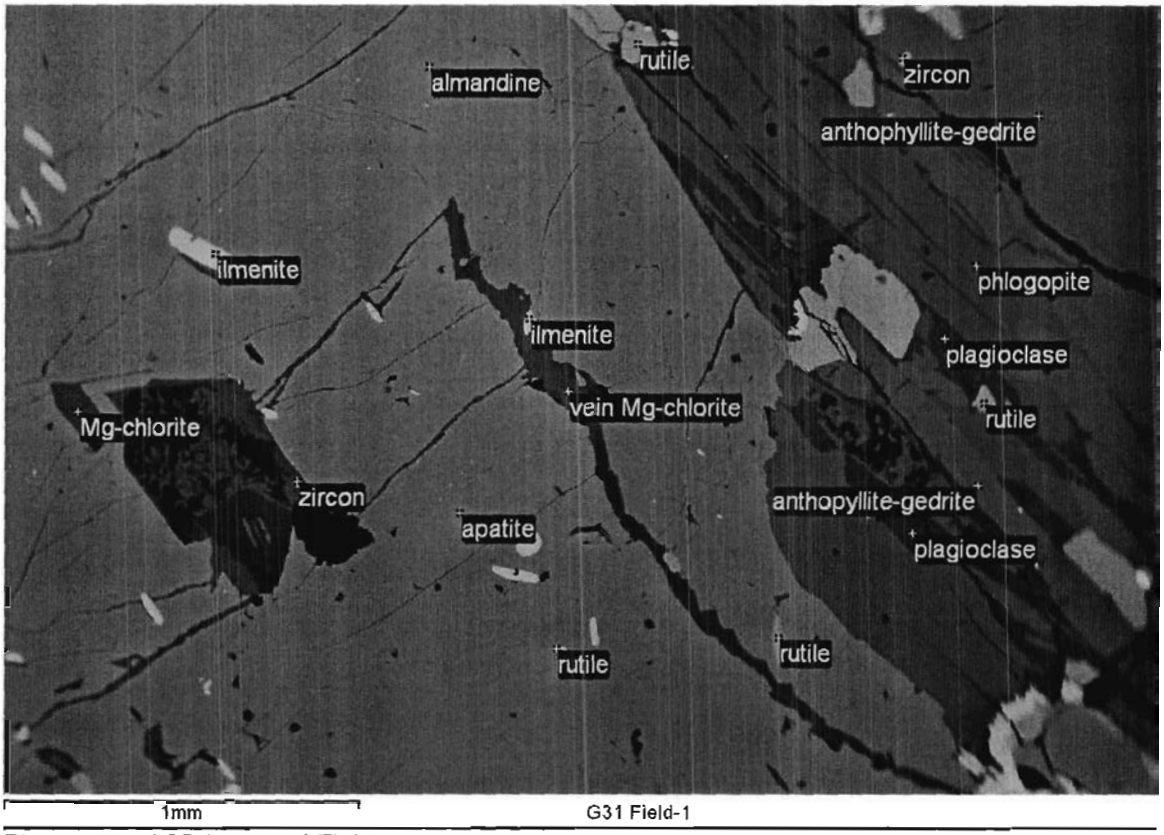


Figure 46: BSE image of Field 1.

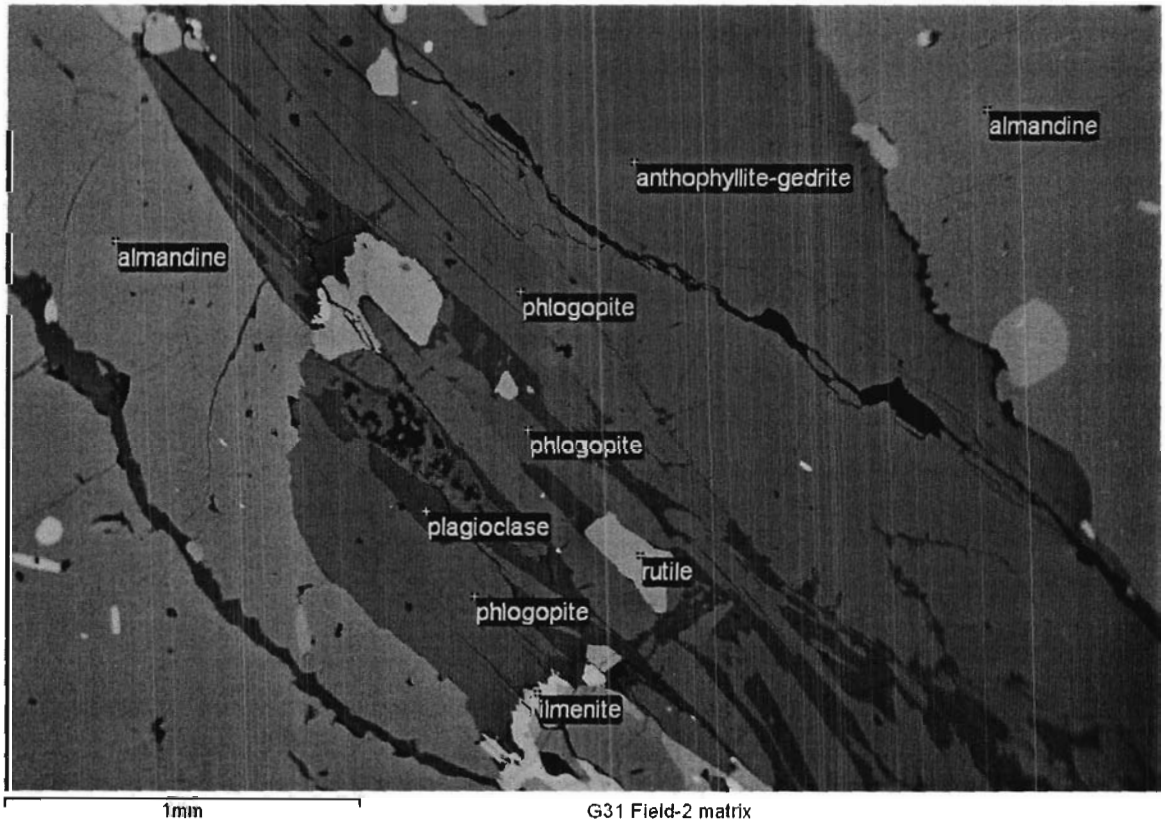


Figure 47: BSE image of Field 2.

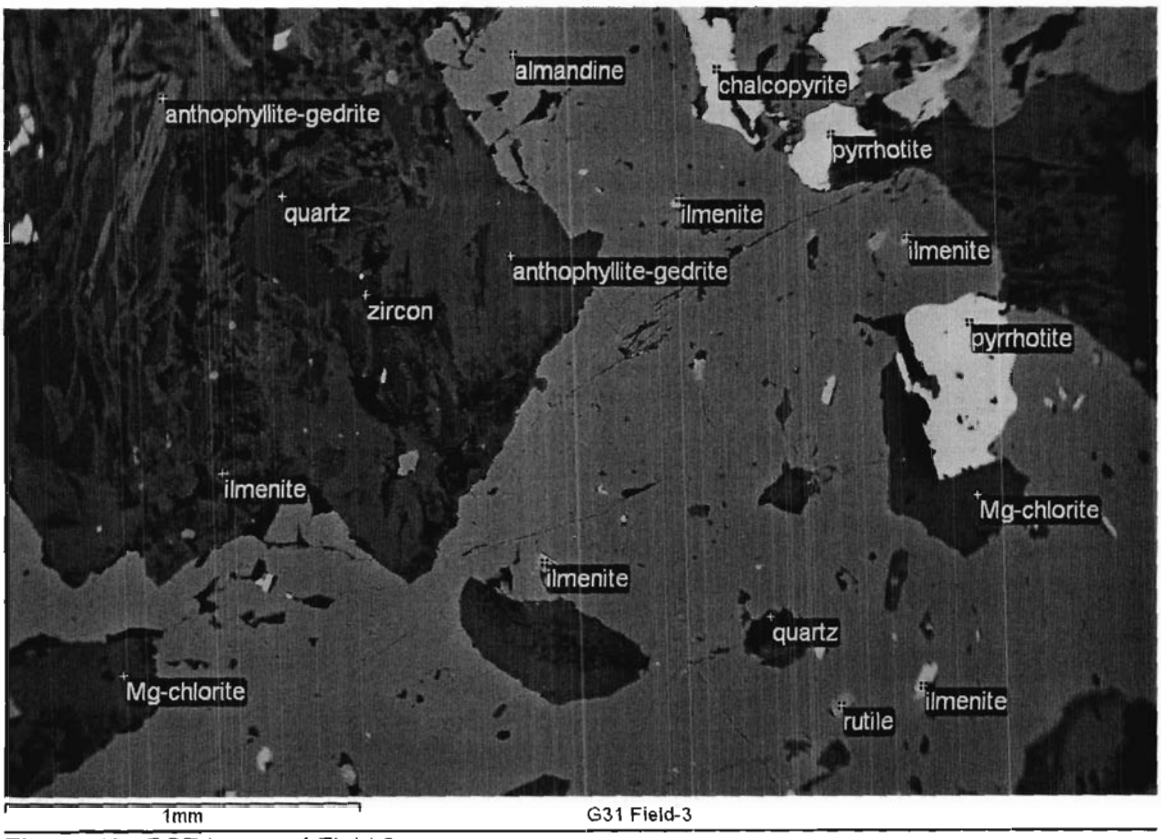


Figure 48: BSE image of Field 3.

Sample Description:

Three representative fields of view were chosen (Figure 46, Figure 47, and Figure 48). The sample consists of an anthopyllite-gedrite, quartz, plagioclase, phlogopite, Mg-chlorite matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, rutile, zircon, pyrite, and chalcopyrite. Quantitative data for the amphibole (identified as the anthopyllite-gedrite series) is given in Table 15.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, ilmenite, rutile, and Mg-chlorite, but also containing rare apatite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 15).

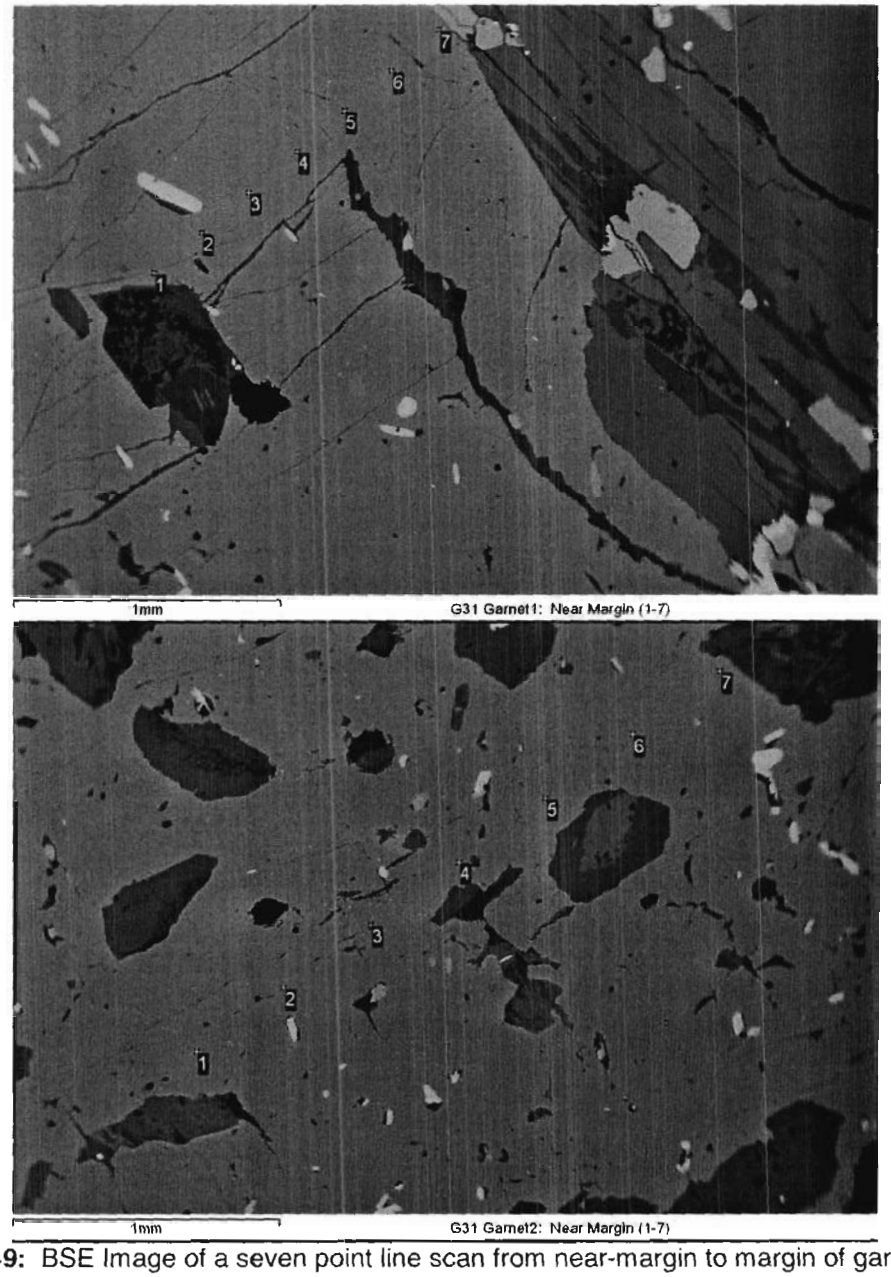


Figure 49: BSE Image of a seven point line scan from near-margin to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 49). This data is shown in Table 15. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client. Also included in Table 15 ED X-ray data for the amphibole and phlogopite.

Table 15: Oxide weight percent data collected from two garnet grains in thin section G31.

G31 Garnet 1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	near margin	0.00	6.42	21.16	37.48	0.00	2.62	0.00	0.00	0.53	31.34	99.55
2		0.00	7.21	21.12	37.76	0.00	2.39	0.00	0.00	0.44	29.80	98.72
3		0.00	7.23	21.39	38.12	0.00	2.48	0.00	0.00	0.27	29.67	99.16
4		0.00	7.03	21.16	37.78	0.00	2.43	0.00	0.00	0.39	30.00	98.80
5		0.00	7.06	21.41	37.74	0.00	2.43	0.00	0.00	0.41	30.22	99.28
6		0.00	7.45	21.01	38.04	0.00	2.35	0.00	0.00	0.40	29.82	99.07
7	margin	0.00	6.52	21.05	37.37	0.00	2.38	0.00	0.00	0.53	30.66	98.50

G31 Garnet 2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	near margin	0.00	7.55	21.45	38.08	0.00	2.24	0.00	0.00	0.50	29.55	99.36
2		0.00	7.16	21.39	37.57	0.00	2.38	0.00	0.00	0.43	29.96	98.89
3		0.00	6.60	21.58	37.57	0.00	2.24	0.00	0.00	0.57	30.31	98.86
4		0.00	7.50	20.97	37.87	0.00	2.43	0.00	0.00	0.53	29.51	98.81
5		0.00	7.23	21.03	38.10	0.00	2.52	0.00	0.00	0.45	28.88	98.21
6		0.00	7.69	21.41	38.27	0.00	2.46	0.00	0.00	0.48	29.07	99.39
7	margin	0.00	7.11	21.50	38.89	0.00	2.55	0.00	0.00	0.34	29.96	100.35

G31 Field-2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
anthophyllite-gedrite	1.01	17.10	9.96	47.69	0.00	0.60	0.40	0.00	0.00	19.71	96.46
phlogopite	0.50	16.68	17.67	38.38	8.81	0.00	1.50	0.00	0.00	11.87	95.41

Client ID G32:

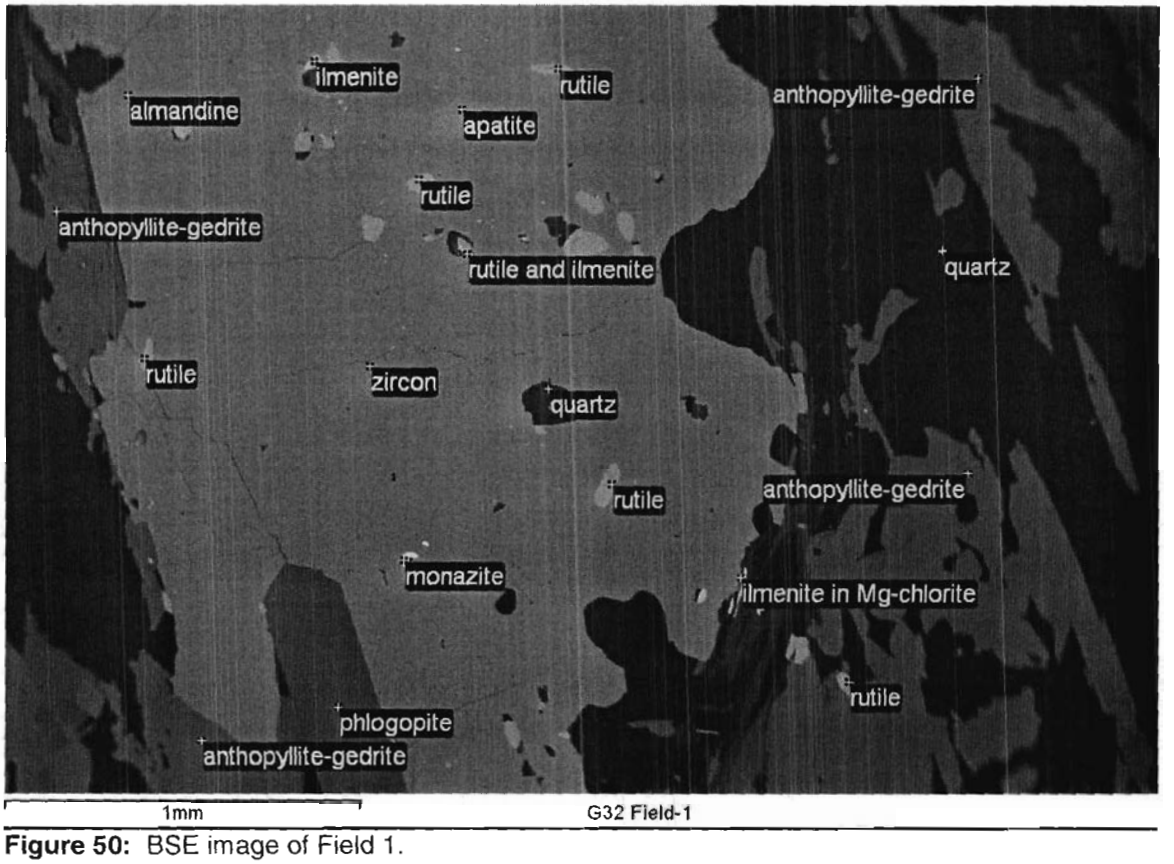


Figure 50: BSE image of Field 1.

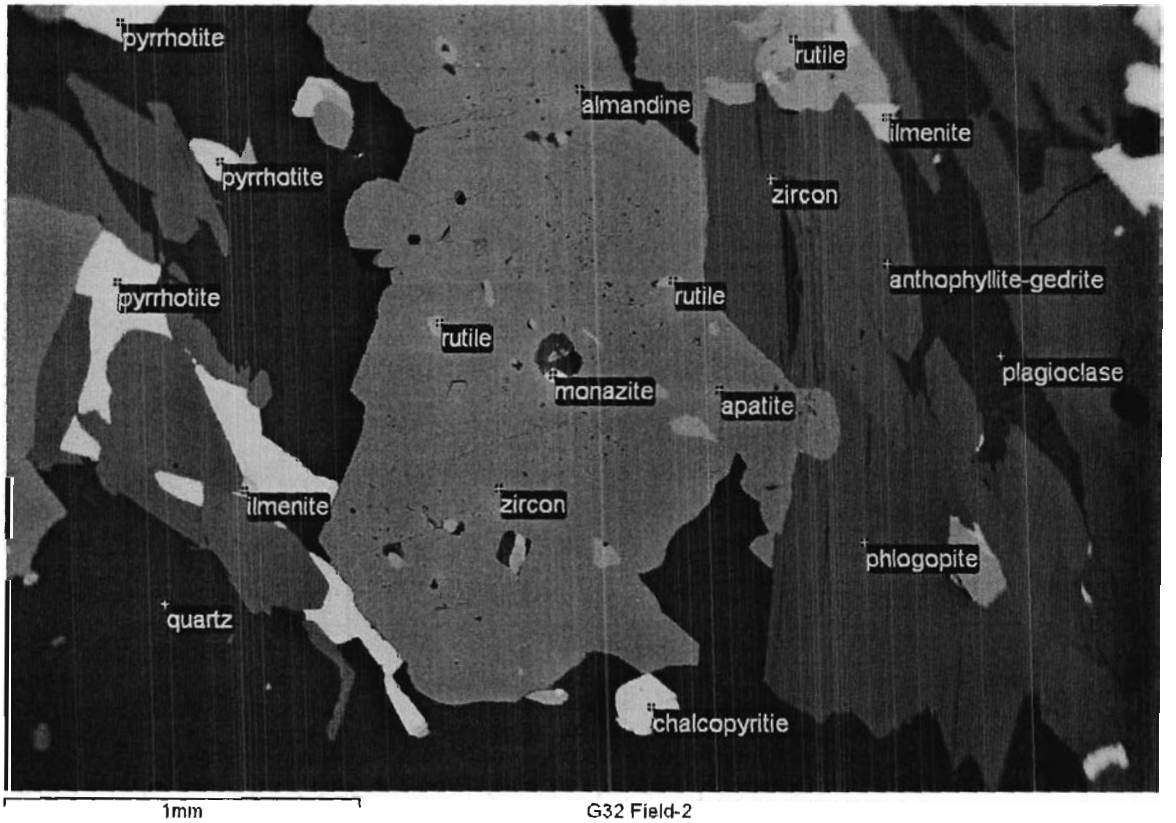


Figure 51: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 50 and Figure 51). The sample consists of an anthopyllite-gedrite, quartz, plagioclase, phlogopite, Mg-chlorite matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, rutile, zircon, and pyrrhotite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, ilmenite, and rutile, but also containing apatite, zircon, and rare monazite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 16).

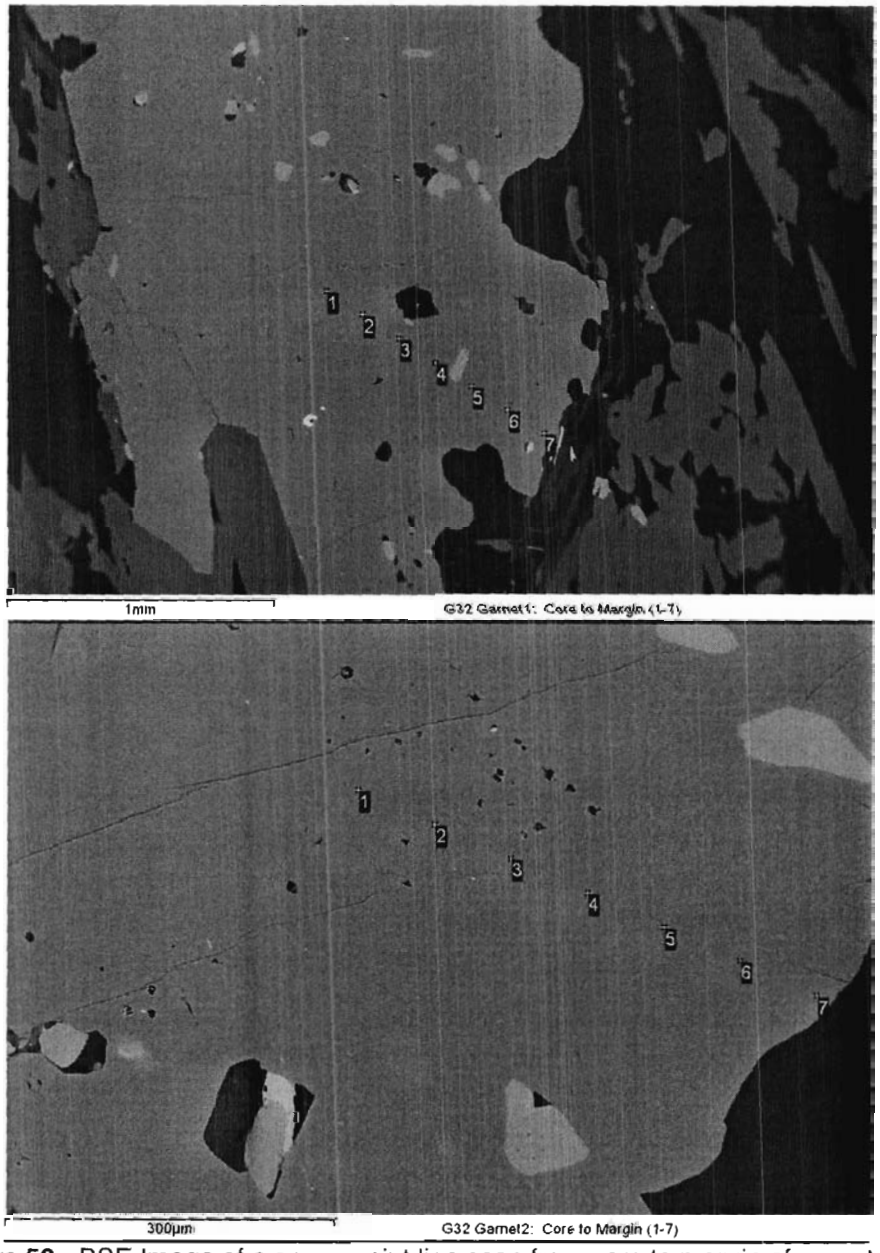


Figure 52: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 52). This data is shown in Table 16. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 16: Oxide weight percent data collected from two garnet grains in thin section G32.

G32 Garnet 1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	7.36	21.35	38.04	0.00	2.25	0.00	0.00	0.43	29.47	98.90
2		0.00	7.51	21.22	37.89	0.00	2.20	0.00	0.00	0.48	29.70	99.00
3		0.00	7.33	21.14	38.32	0.00	2.29	0.00	0.00	0.41	29.34	98.84
4		0.00	7.46	21.29	38.14	0.00	2.27	0.00	0.00	0.34	29.52	99.03
5		0.00	7.45	21.41	38.25	0.00	2.35	0.00	0.00	0.35	29.59	99.39
6		0.00	7.26	21.20	38.04	0.00	2.28	0.00	0.00	0.36	29.68	98.82
7	margin	0.00	6.47	21.14	37.89	0.00	2.39	0.00	0.00	0.56	30.36	98.81

G32 Garnet 2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	7.38	21.22	38.23	0.00	2.31	0.00	0.00	0.52	29.90	99.55
2		0.00	7.16	21.03	38.02	0.00	2.34	0.00	0.00	0.44	29.89	98.87
3		0.00	7.10	20.78	37.80	0.00	2.34	0.00	0.00	0.46	29.72	98.20
4		0.00	6.63	21.43	37.93	0.00	2.38	0.00	0.00	0.36	30.25	98.98
5		0.00	6.83	21.69	38.12	0.00	2.29	0.00	0.00	0.37	30.19	99.51
6		0.00	6.92	21.26	38.10	0.00	2.41	0.00	0.00	0.49	30.18	99.35
7	margin	0.00	6.55	21.11	37.63	0.00	2.35	0.00	0.00	0.53	30.43	98.59

Client ID G33:

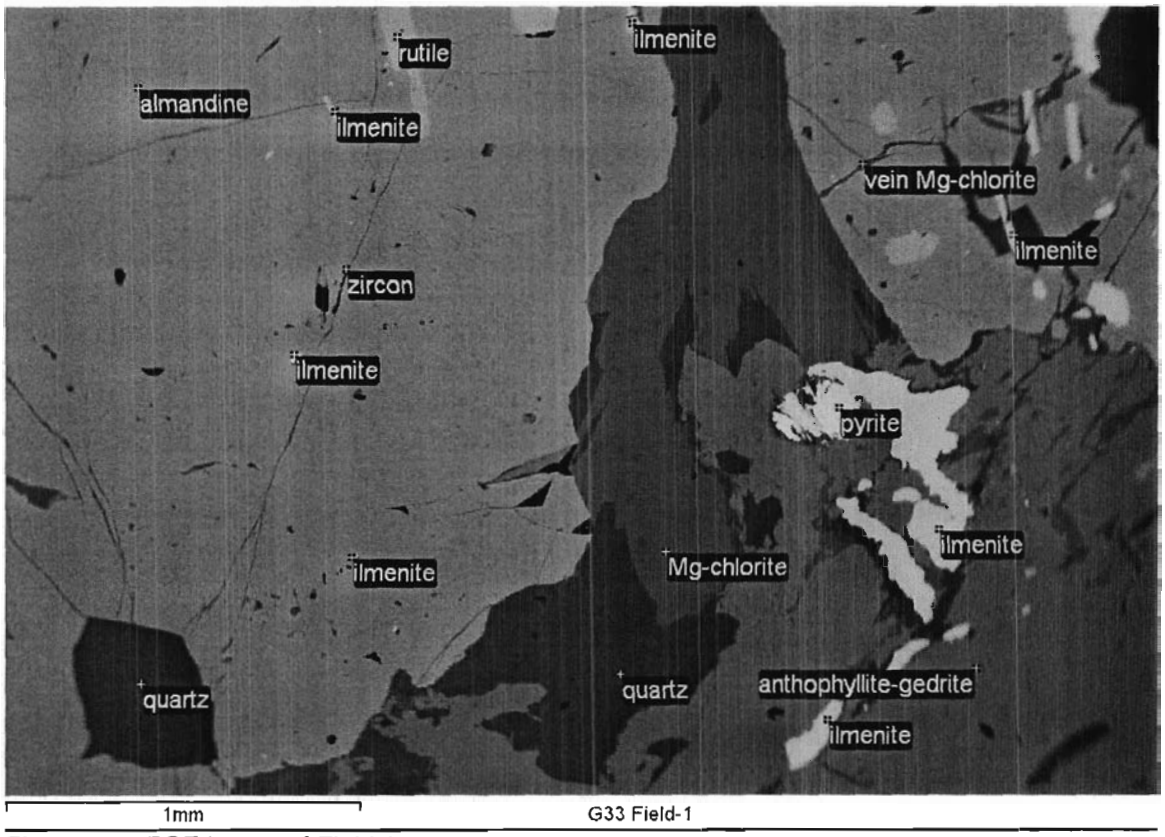


Figure 53: BSE image of Field 1.

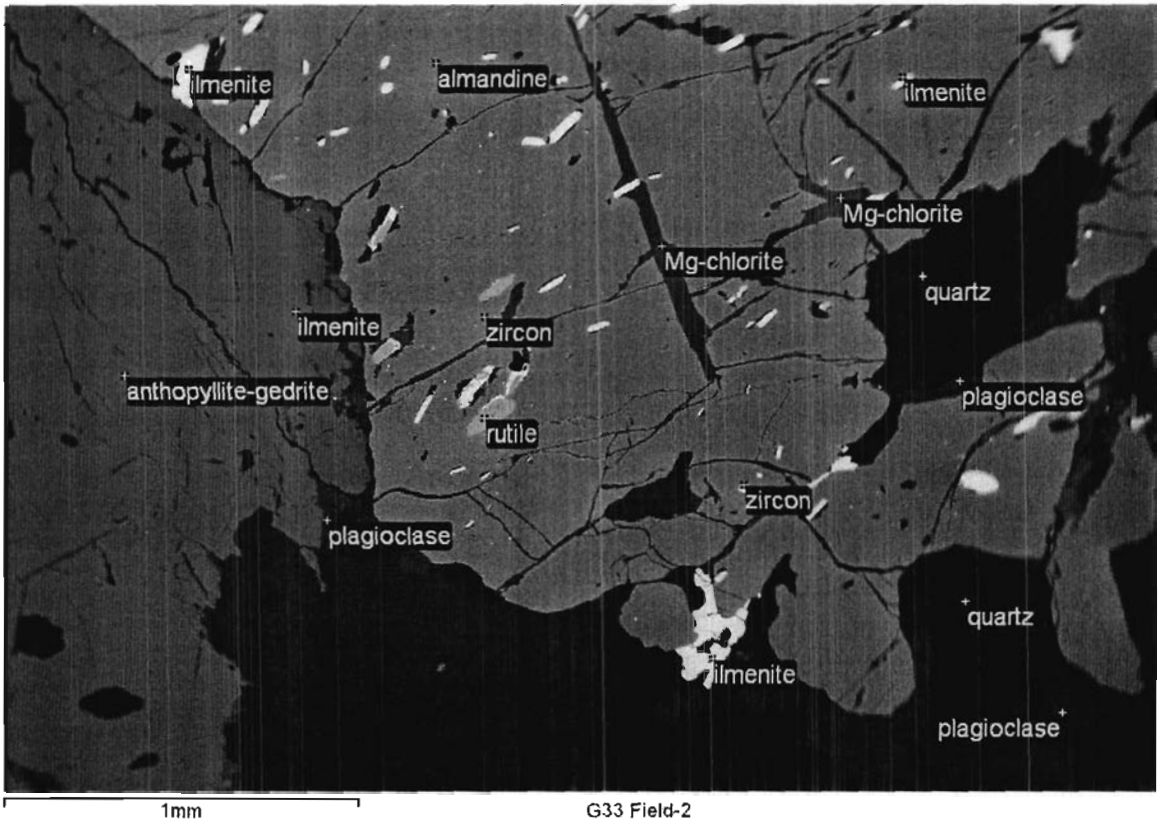


Figure 54: BSE image of Field 2.

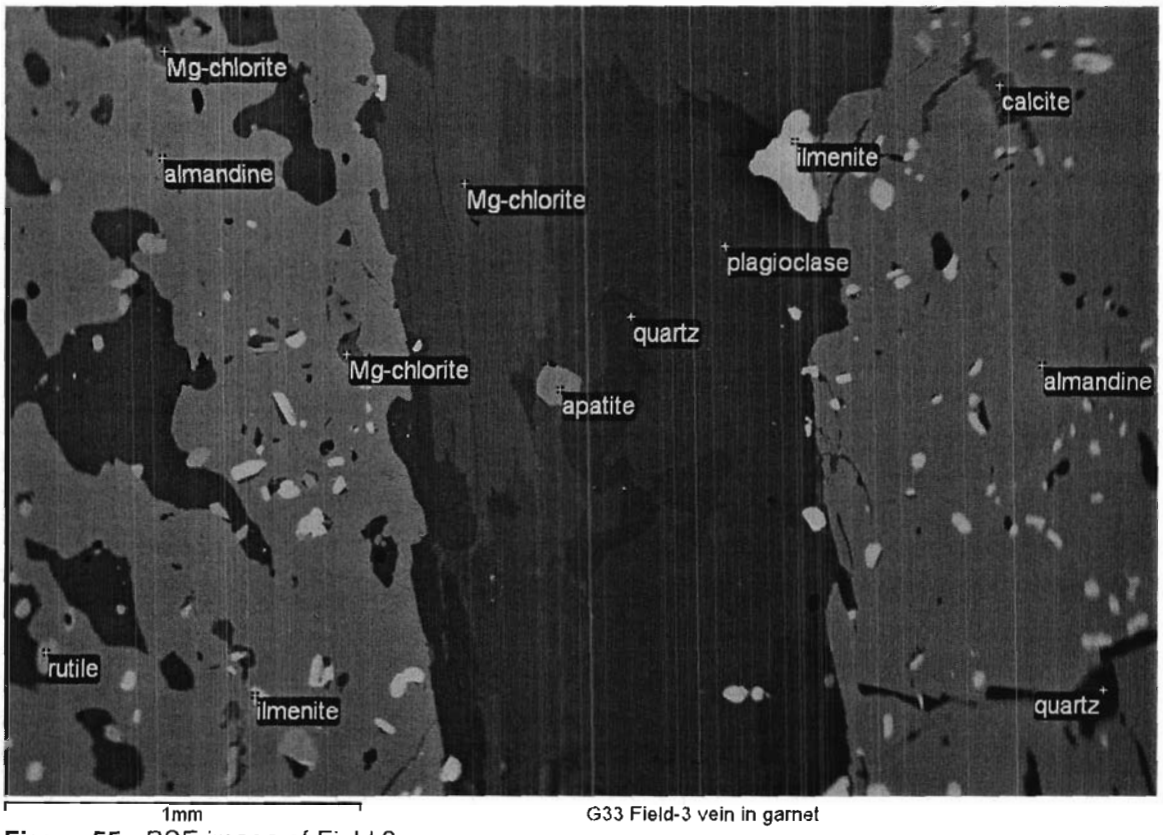


Figure 55: BSE image of Field 3.

Sample Description:

Three representative fields of view were chosen (Figure 53, Figure 54, and Figure 55). The sample consists of a quartz, plagioclase, anthopyllite-gedrite, and Mg-chlorite, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of ilmenite, apatite, and pyrite. A few areas of disseminated iron oxides (magnetite) were noted in the thin section (not shown).

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, ilmenite, and rutile, but also containing smaller inclusions of zircon. Several late-stage veins of Mg-chlorite were noted transecting the garnets. The larger veins (Figure 55) also contained Mg-chlorite, quartz, plagioclase, and rare calcite and apatite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 17).

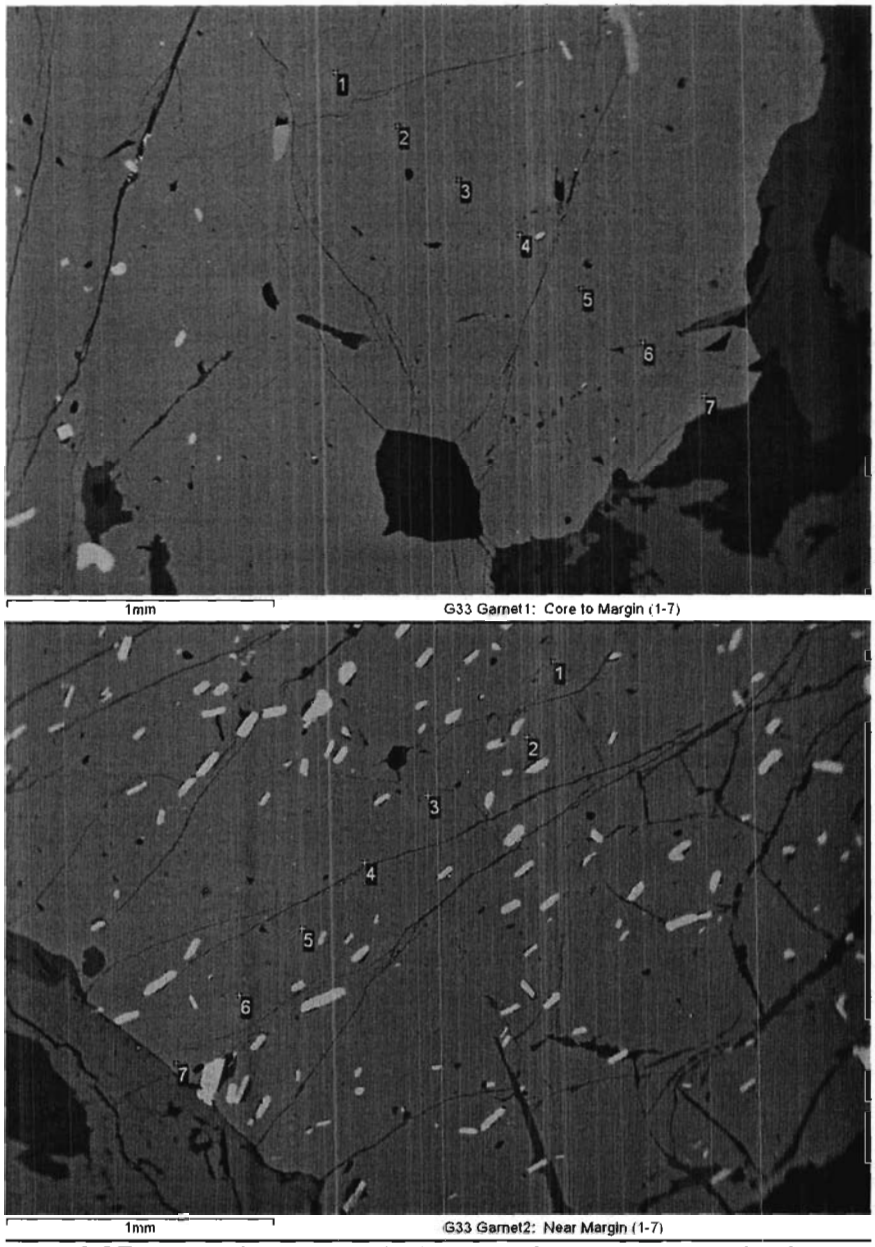


Figure 56: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 56). This data is shown in Table 17. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 17: Oxide weight percent data collected from two garnet grains in thin section G33.

G33 Garnet 1		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	core	0.00	6.47	20.88	37.91	0.00	2.90	0.00	0.00	0.00	30.52	98.67
2		0.00	6.45	20.99	37.42	0.00	2.90	0.00	0.00	0.00	30.40	98.16
3		0.00	6.57	21.26	37.52	0.00	3.02	0.00	0.00	0.23	29.49	98.09
4		0.00	7.16	21.14	37.65	0.00	2.83	0.00	0.00	0.40	29.25	98.44
5		0.00	7.50	21.37	37.99	0.00	2.62	0.00	0.00	0.54	29.20	99.22
6		0.00	7.43	21.20	37.89	0.00	2.45	0.00	0.00	0.54	28.59	98.09
7	margin	0.00	6.80	21.33	38.06	0.00	2.41	0.00	0.00	0.48	30.05	99.13

G33 Garnet 2		Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1	near margin	0.00	7.10	20.90	37.48	0.00	2.59	0.00	0.00	0.48	29.49	98.03
2		0.00	6.87	21.43	38.10	0.00	2.74	0.00	0.00	0.34	29.38	98.85
3		0.00	6.32	21.01	37.55	0.00	3.30	0.00	0.00	0.00	30.01	98.19
4		0.00	6.17	21.22	37.84	0.00	3.50	0.00	0.00	0.00	30.10	98.83
5		0.00	6.68	21.31	37.76	0.00	3.32	0.00	0.00	0.37	30.35	99.79
6		0.00	6.93	21.39	38.06	0.00	3.25	0.00	0.00	0.34	29.47	99.43
7	margin	0.00	6.28	21.05	37.57	0.00	2.84	0.00	0.00	0.46	30.85	99.06

Client ID G34:

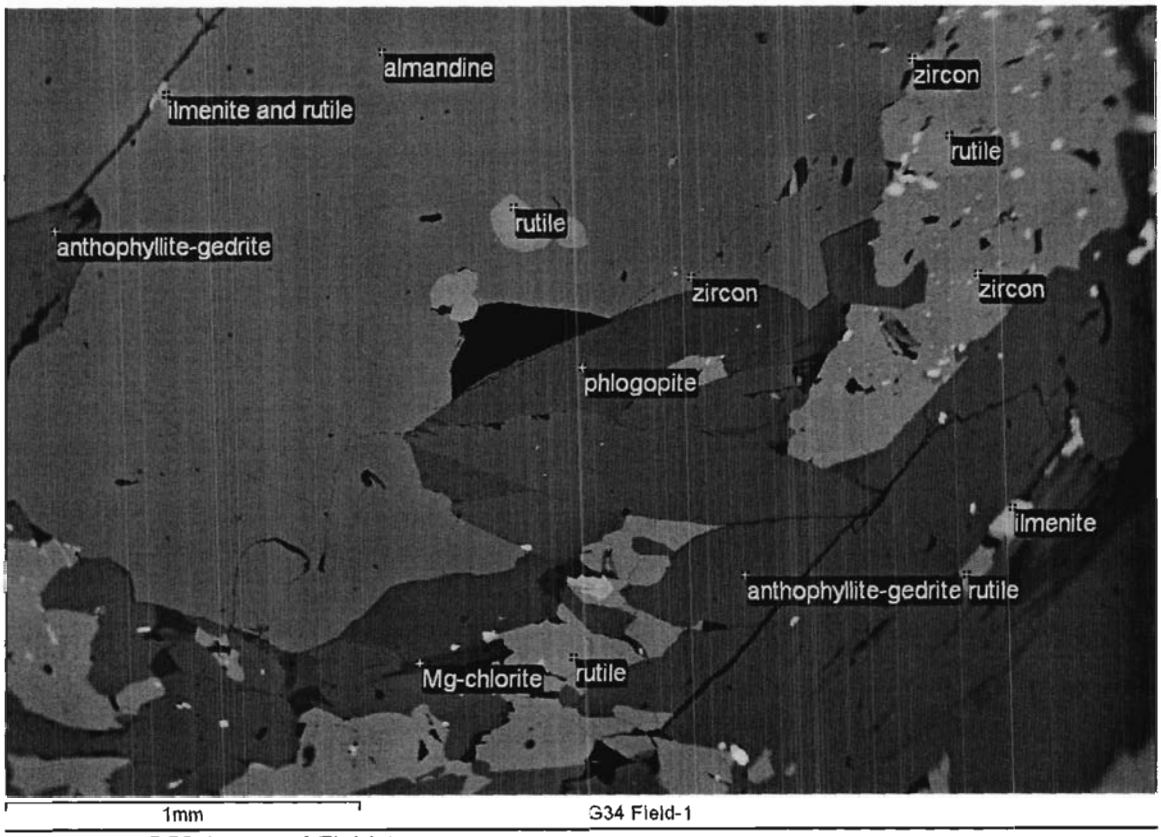


Figure 57: BSE image of Field 1.

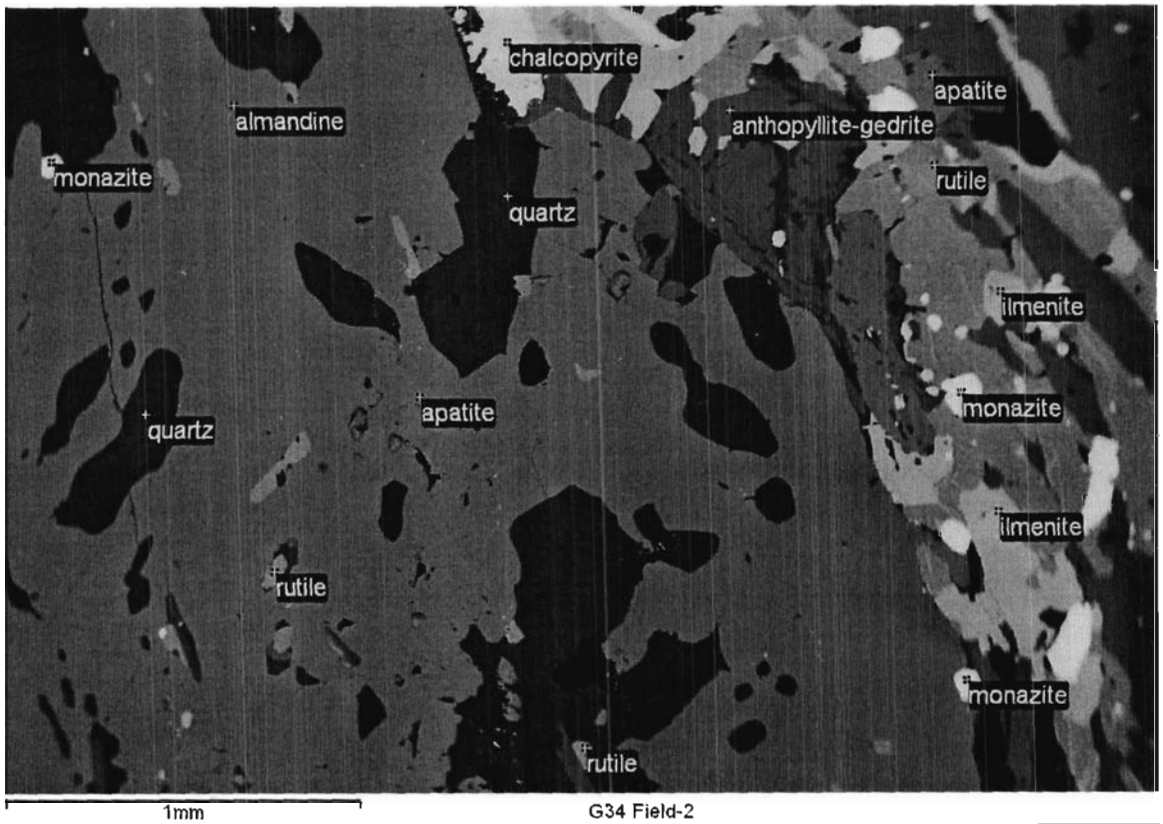


Figure 58: BSE image of Field 2.

Sample Description:

Two representative fields of view were chosen (Figure 57 and Figure 58). The sample consists of a quartz, anthopyllite-gedrite, and Mg-chlorite, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of rutile, ilmenite, titanite, apatite, zircon, and rare monazite. In comparison to the other thin sections, G33 exhibited unusually large rutile grains (up to 2.5 mm), as well as very abundant zircons and REE-bearing minerals. The largest monazite in G34 Field-2 was measured at 100 μm in diameter.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, ilmenite, and rutile, but also containing smaller inclusions of zircon and monazite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 18).

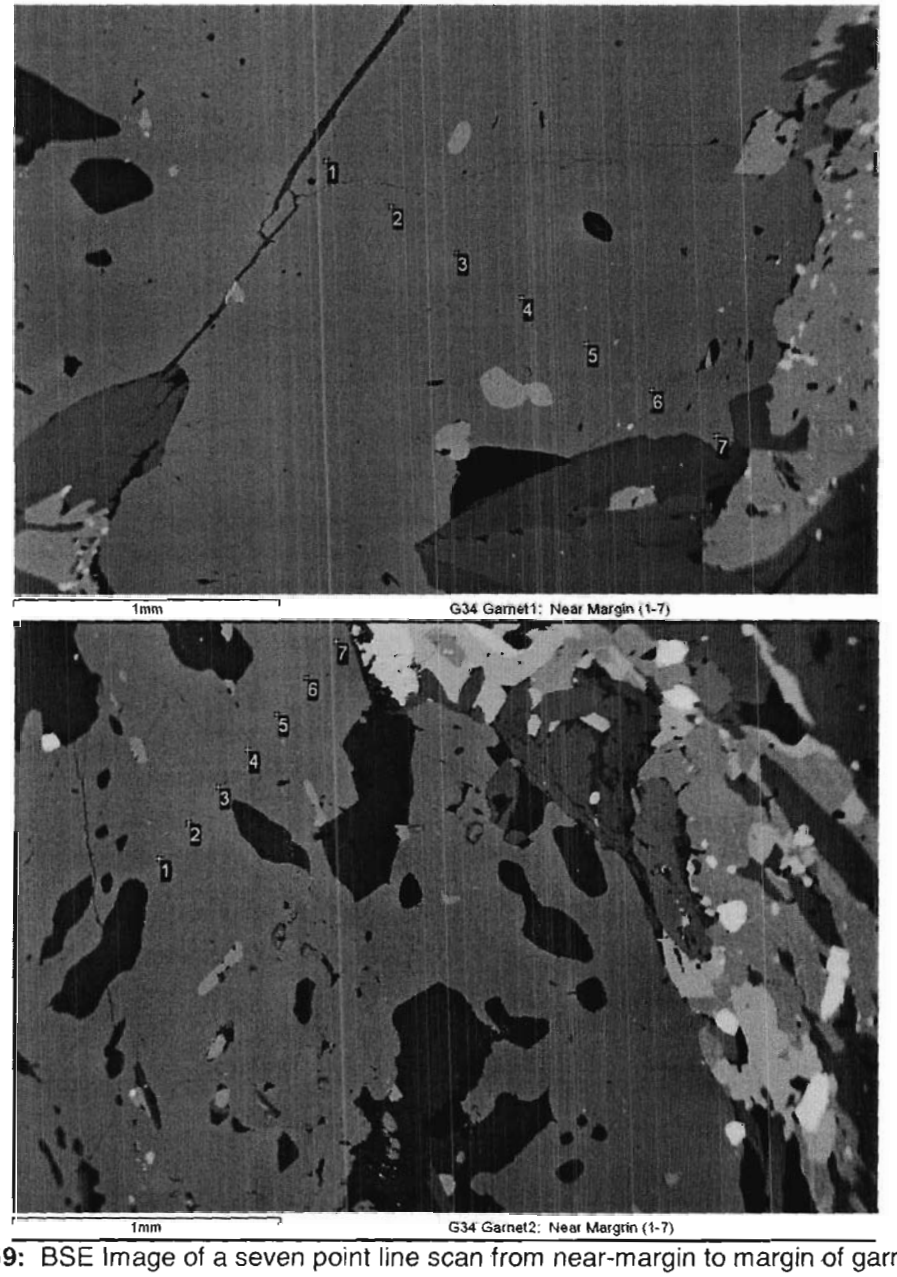


Figure 59: BSE Image of a seven point line scan from near-margin to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions Figure 59). This data is shown in Table 18. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 18: Oxide weight percent data collected from two garnet grains *in thin* section G34.

G34 Garnet 1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 near margin	0.00	7.59	21.35	38.23	0.00	2.18	0.00	0.00	0.45	29.65	99.46
2	0.00	7.58	21.14	37.93	0.00	2.07	0.00	0.00	0.35	29.47	98.54
3	0.00	7.78	21.35	38.17	0.00	2.17	0.00	0.00	0.27	28.84	98.58
4	0.00	7.93	21.50	37.91	0.00	2.13	0.00	0.00	0.30	28.64	98.40
5	0.00	8.09	21.18	37.93	0.00	2.17	0.00	0.00	0.31	28.87	98.55
6	0.00	7.89	21.24	38.04	0.00	1.97	0.00	0.00	0.27	28.69	98.10
7 margin	0.00	6.73	21.20	37.67	0.00	2.10	0.00	0.00	0.39	30.44	98.53

G34 Garnet 2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 near margin	0.00	7.93	21.28	37.95	0.00	2.14	0.00	0.00	0.35	29.16	98.81
2	0.00	7.76	21.54	37.93	0.00	2.20	0.00	0.00	0.41	29.29	99.13
3	0.00	8.06	21.35	38.21	0.00	2.17	0.00	0.00	0.37	29.33	99.49
4	0.00	7.64	21.20	38.02	0.00	2.13	0.00	0.00	0.35	29.51	98.85
5	0.00	7.41	21.07	37.67	0.00	2.03	0.00	0.00	0.40	29.80	98.38
6	0.00	7.26	21.20	37.57	0.00	2.06	0.00	0.00	0.35	29.94	98.37
7 margin	0.00	6.65	21.18	37.93	0.00	2.18	0.00	0.00	0.39	30.34	98.67

Client ID G35:

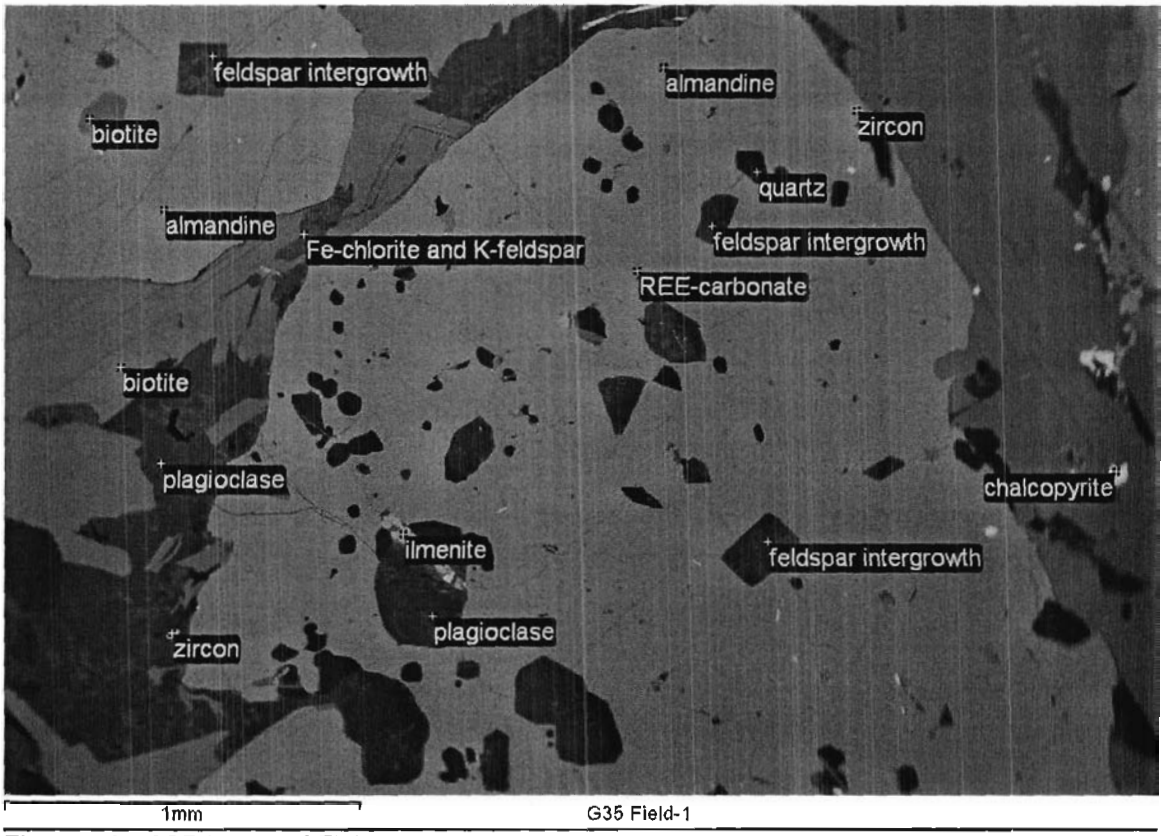


Figure 60: BSE image of Field 1.

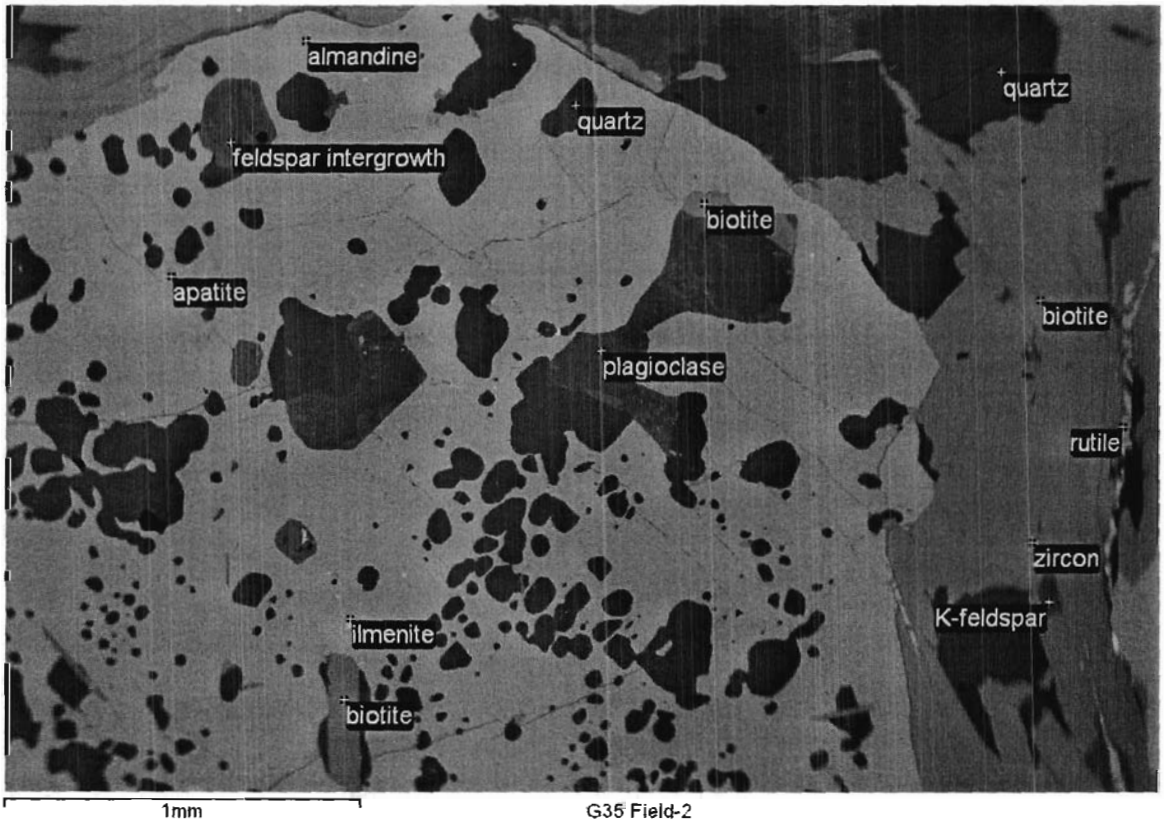


Figure 61: BSE image of Field 2.

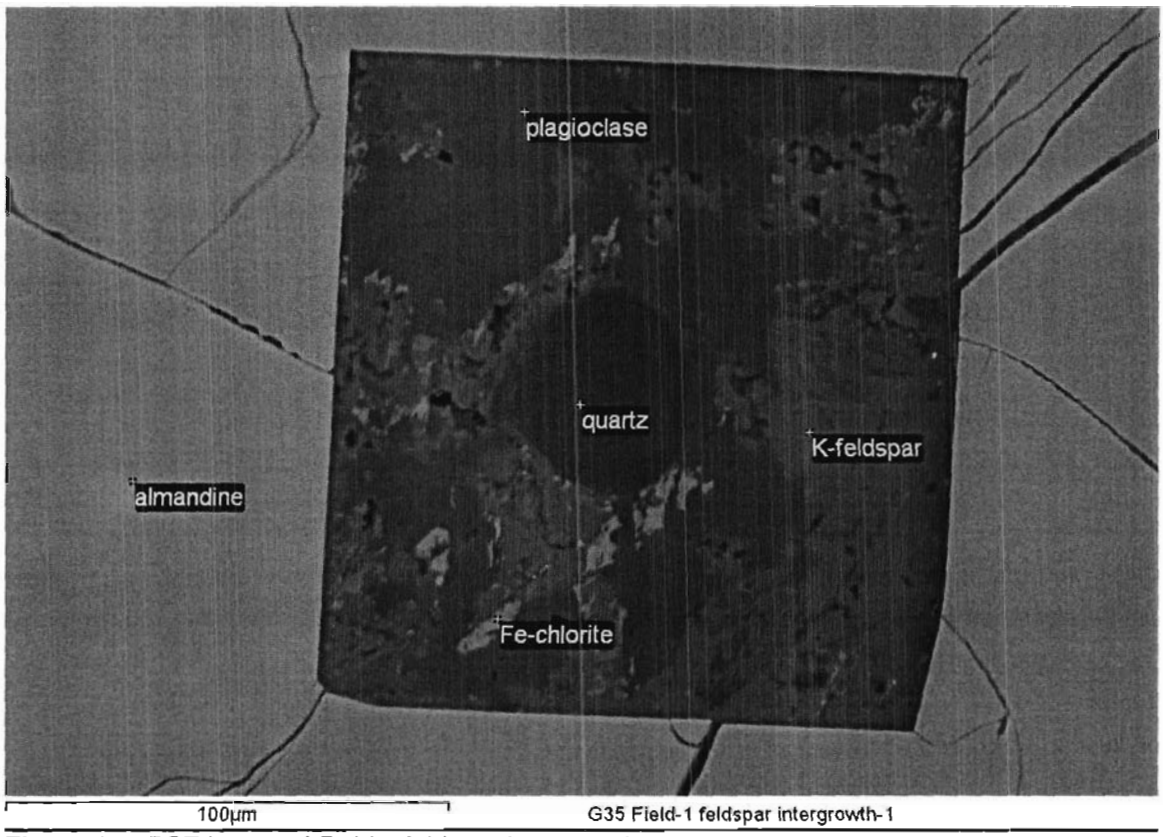


Figure 62: BSE image of Field 1 feldspar intergrowth.

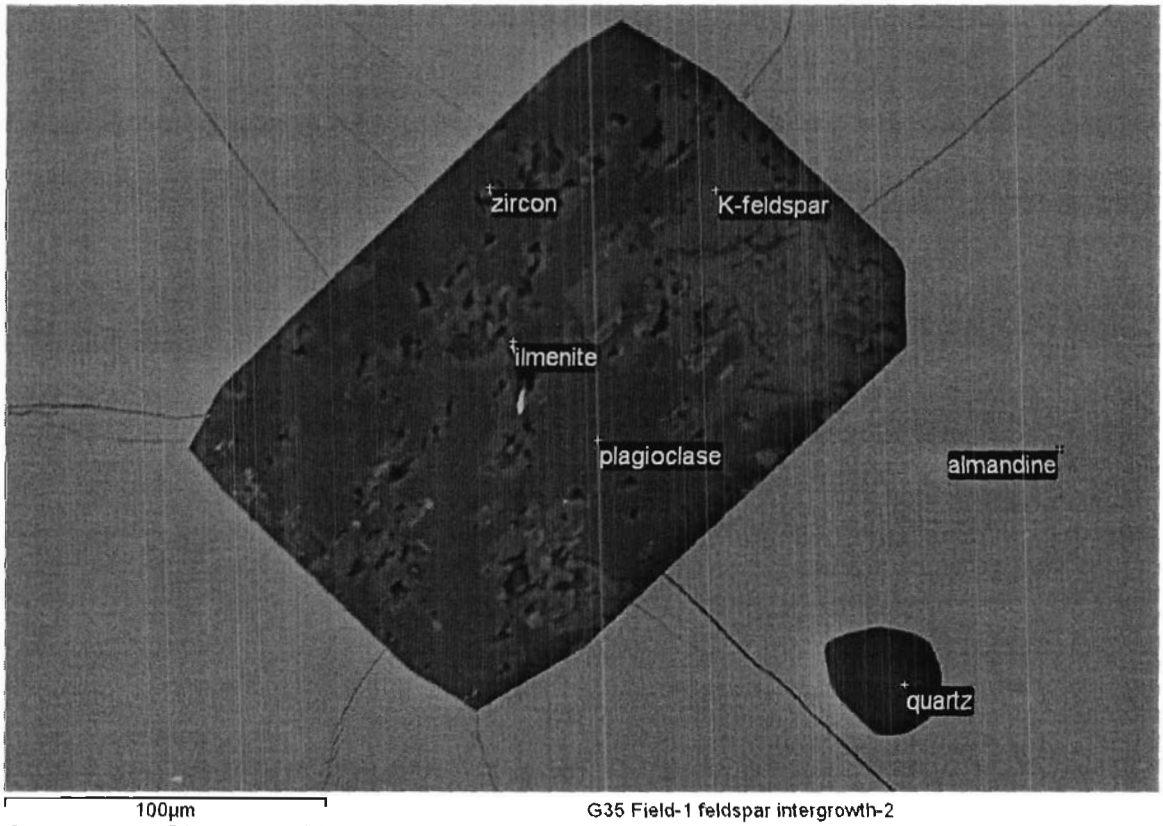


Figure 63: BSE image of Field 1 feldspar intergrowth.

Sample Description:

Two representative fields of view were chosen (Figure 60 and Figure 61). The sample consists of a quartz, plagioclase, K-feldspar, and biotite matrix, interspersed with grains of almandine garnet. Disseminated within the matrix are grains of rutile, zircon, and rare chalcopyrite.

Garnet Description:

The garnets were identified as almandine. There are numerous inclusions (~ 5-50%) in the garnets, consisting primarily of quartz, plagioclase, biotite, ilmenite, and apatite, but also containing smaller inclusions of zircon and rare REE-carbonates. Several unusual angular inclusions of feldspar intergrowths were noted in the garnets (Figure 62 and Figure 63). These inclusions appear to be late stage replacement features (garnet fractures/veins do not transect inclusions) of plagioclase and K-feldspar, along with some quartz and rare ilmenite. There was no visible indication of zonation under the SEM backscatter imaging, though a subtle chemical variation was noted using Energy Dispersive (ED) X-ray analysis (Table 19).

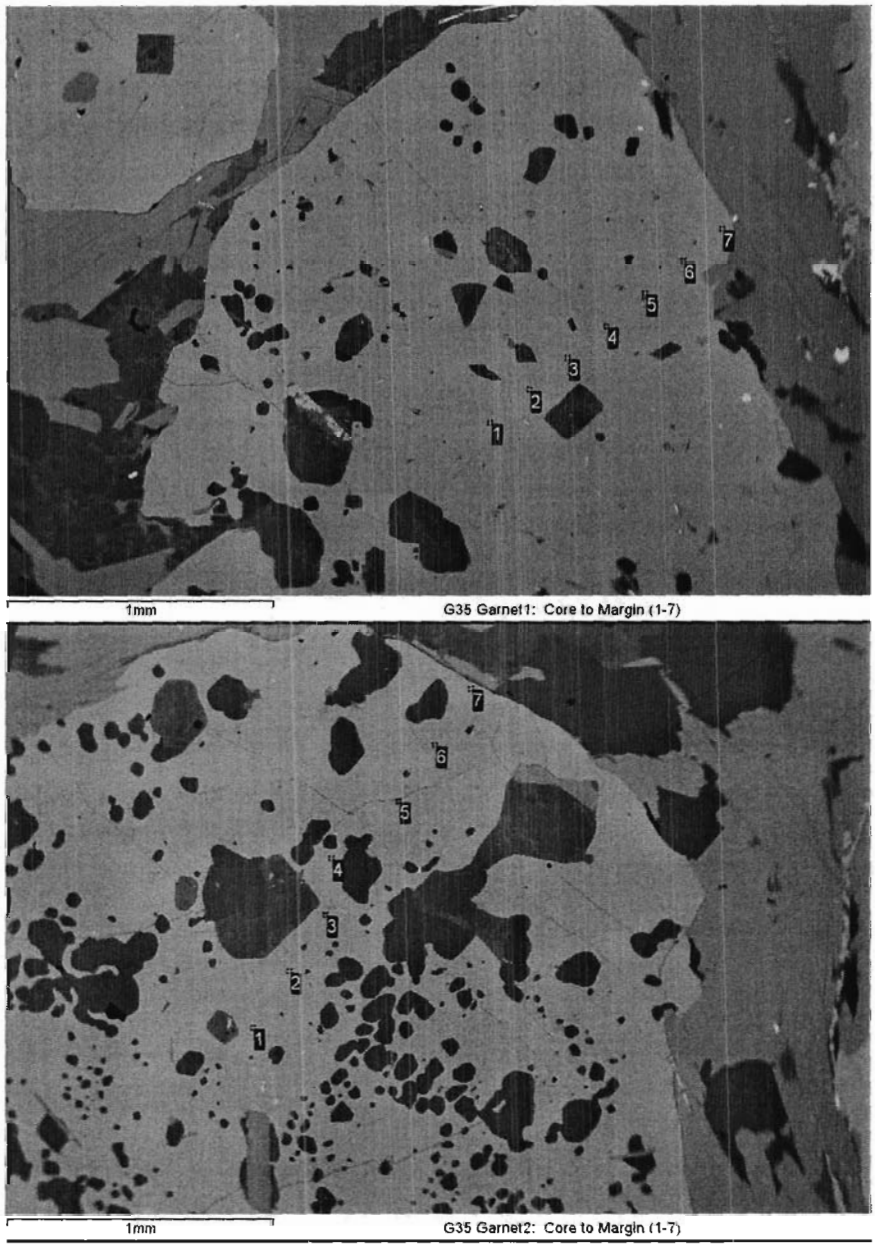


Figure 64: BSE Image of a seven point line scan from core to margin of garnet grains.

Garnet Chemistry:

Two representative garnets were chosen for line spectra analysis (7 points) from core to the margin of grain. Energy dispersive X-ray data were collected from each point, taking care to avoid inclusions (Figure 64). This data is shown in Table 19. The variation in Mg-Fe-Mn-Ca within the garnet grains may be of interest to the client.

Table 19: Oxide weight percent data collected from two garnet grains in thin section G35.

G35 Garnet 1	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.28	20.50	37.33	0.00	3.71	0.00	0.00	0.43	34.00	99.25
2	0.00	3.00	20.43	36.69	0.00	3.86	0.00	0.00	0.35	33.67	97.99
3	0.00	3.03	20.58	36.82	0.00	3.99	0.00	0.00	0.43	33.85	98.69
4	0.00	3.07	20.78	37.01	0.00	3.68	0.00	0.00	0.48	33.77	98.79
5	0.00	3.08	20.50	37.12	0.00	3.57	0.00	0.00	0.56	33.68	98.51
6	0.00	3.22	20.63	36.97	0.00	3.25	0.00	0.00	0.62	33.46	98.15
7 margin	0.00	2.95	20.61	36.56	0.00	3.06	0.00	0.00	0.84	34.23	98.26

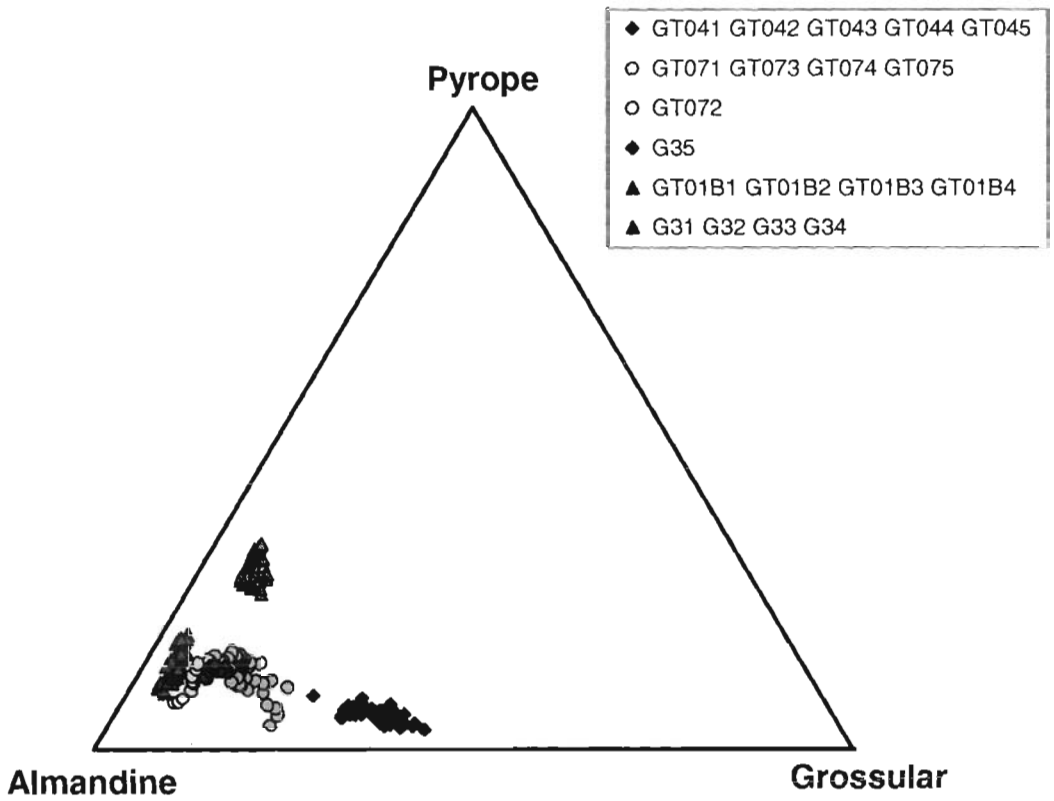
G35 Garnet 2	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO	Total
1 core	0.00	3.28	20.58	36.92	0.00	3.12	0.00	0.00	0.67	34.35	98.93
2	0.00	3.28	20.69	36.92	0.00	3.06	0.00	0.00	0.80	34.13	98.89
3	0.00	3.15	20.56	36.78	0.00	3.12	0.00	0.00	0.70	34.77	99.07
4	0.00	3.22	20.63	36.82	0.00	2.95	0.00	0.00	0.80	34.31	98.73
5	0.00	3.38	21.22	38.08	0.00	3.26	0.00	0.00	0.61	34.43	100.98
6	0.00	3.12	20.73	36.75	0.00	3.15	0.00	0.00	0.83	33.81	98.38
7 margin	0.00	2.74	20.65	36.73	0.00	3.04	0.00	0.00	0.96	34.67	98.78

Analyses by:
John Hechler
Geoscience Laboratories

Reviewed by:
Dave Crabtree
Geoscience Laboratories

Appendix 1

Ternary plot of calculated almandine-grossular-pyrope end members based on cation proportions of Fe^{2+}-Ca^{2+}-Mg^{2+}



Appendix 2.

Quality Control for ED data acquisition

QUALITY CONTROL

Analytical Conditions:	**20kV & ~ 1nA beam current, 60 second acquisition time**
Routine:	**EDS acquisition**
Instrument	**Zeiss EVO-50 equipped with Oxford INCA Energy Dispersive Spectrometer**
Correction Procedure:	**XPP with digital top hat filter and least square profile fitting**

Standard	Na2O	MgO	Al2O3	SiO2	K2O	CaO	TiO2	Cr2O3	MnO	FeO*	Sum
pyxBRN2	0.88	17.59	7.37	50.12	LOD	17.26	0.63	0.94	LOD	4.64	99.43
pyxBRN2	0.97	17.54	7.41	50.37	LOD	17.40	0.45	0.98	LOD	4.76	99.88
pyxBRN2	0.96	17.59	7.29	50.46	LOD	17.42	0.57	0.88	LOD	4.53	99.69
pyxBRN2	0.97	17.72	7.29	50.48	0.00	17.50	0.60	0.94	LOD	4.75	100.25
pyxBRN2	0.84	17.34	7.58	50.63	0.00	17.38	0.58	0.96	LOD	4.59	99.90
pyxBRN2	0.86	17.74	7.25	50.65	0.00	17.26	0.47	0.91	LOD	4.62	99.76
ampKNZ2	2.57	13.08	14.43	40.79	2.02	10.33	5.05	LOD	LOD	10.64	98.92
ampKNZ2	2.59	12.82	14.07	40.60	2.14	10.02	4.89	LOD	LOD	11.10	98.23
ampKNZ2	2.61	12.97	14.23	40.62	2.05	10.10	4.94	LOD	LOD	10.46	97.97
ampKNZ2	2.67	12.97	14.28	40.64	2.16	10.20	4.97	LOD	LOD	10.64	98.52
ampKNZ2	2.59	12.97	13.96	40.96	2.04	10.19	4.87	LOD	LOD	10.56	98.13
ampKNZ2	2.41	12.83	14.28	40.64	2.13	10.33	4.95	LOD	LOD	10.20	97.78

Standard	ampKNZ	pyxBRN	pyxBRN	pyxBRN	ampKNZ	pyxBRN	ampKNZ	pyxBRN	pyxBRN	pyxBRN
Average wt%	2.57	17.59	7.36	50.45	2.09	17.37	4.95	0.93	LOD	4.65
Expected wt% *	2.60	17.32	7.82	50.48	2.10	17.30	4.72	0.90	0.13	4.71
Accuracy % rel.	-0.98	1.55	-5.82	-0.06	-0.48	0.42	4.79	3.65	LOD	-1.28

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

QC notes

1) None of the reported values for these mineral standards are certified:" accuracy" is therefore based on available chemical data.
2) LOD = Limit of Detection defined here as 3 x standard deviation of the total accumulated b
   The L.O.D. represents the minimum value in this report where the peak - background signal exceeds 3 x standard deviation of the background signal.
3) FeO* - total Iron expressed as FeO

Report 080054 for:
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Samples: **GT01 Zone: GT01B1-GT01B4**
GT04 Zone: GT041-GT045
GT07 Zone: GT071-GT075
GT03 Zone: G31-G35

Summary:

Garnet:

Garnet grains range widely in size and abundances, sizes, and types of inclusions, both within and between samples. All garnet grains appear similar optically in thin section; they have a pale pink colour and are isotropic. Abundances of inclusions range widely, with many grains containing 5-20% inclusions. These are dominated by quartz, with lesser ilmenite/rutile and plagioclase, and minor biotite. Many garnet grains with plagioclase inclusions contain only a few inclusions. Quartz inclusions generally are spherical, whereas plagioclase inclusions generally are angular. Some garnet grains are intergrown irregularly with patches of quartz and a few are intergrown moderately with biotite; a complete gradation exists between garnet with abundant quartz inclusions and garnet intergrown with coarser patches of quartz. In some grains, ilmenite inclusions are tabular and in subparallel orientation; in one sample, ilmenite inclusions are also present in patches of quartz that are intergrown coarsely with garnet.

Anthophyllite:

Many of the samples from Zone GT03 contain abundant amphibole which is dark green in hand sample and colourless to neutral in thin section. It has parallel extinction and a positive optic sign with a large 2V. The optical properties indicate that the mineral is anthophyllite. The green colour probably is because it contains a moderately high content of iron relative to magnesium.

Samples:

Sample GT01B1 is a moderately foliated gneiss dominated by quartz and plagioclase, with bands of garnet-biotite-(muscovite), and disseminated grains and patches of ilmenite-rutile and of pyrrhotite-(chalcopyrite-pyrite-pentlandite). Sillimanite(?) forms minor lenses and patches.

Sample GT01B2 is a well banded gneiss, with major bands of plagioclase and quartz and lesser bands of garnet-biotite-muscovite. Minor minerals include apatite (with plagioclase and quartz) and ilmenite, rutile, pyrrhotite, and zircon (mainly with biotite and garnet).

Sample GT01B3 is a slightly to moderately foliated gneiss dominated by quartz, plagioclase, garnet, and biotite, with lesser muscovite and much less abundant ilmenite, pyrrhotite, and apatite, and minor chalcopyrite, pyrite, rutile, and zircon.

Sample GT01B4 is a well banded gneiss dominated by plagioclase with much less abundant quartz, garnet, and biotite, accessory ilmenite, pyrrhotite, and rutile, and minor chalcopyrite, pyrite, apatite, zircon, and chlorite. Garnet, biotite, and accessory and minor minerals are concentrated strongly in seams parallel to foliation.

Sample GT041 is a moderately foliated gneiss dominated by hornblende with lenses dominated by plagioclase and quartz. It contains much less abundant biotite and garnet and minor apatite, sphene, and zircon.

Sample GT042 is slightly foliated and is dominated by hornblende with lesser plagioclase (altered slightly to sericite) and quartz, much less abundant garnet, biotite, and sphene, and minor ilmenite and apatite. Plagioclase and quartz are concentrated strongly in a few patches up to 10 mm across. A few patches are of pyrite and a few are of chalcopyrite, both of which were altered moderately to hematite. A veinlet is of K-feldspar.

Sample GT043 is slightly foliated and dominated by hornblende, quartz, garnet, biotite, and plagioclase, with much less abundant sphene, and minor apatite and ilmenite.

Sample GT044 is a moderately foliated gneiss that is dominated by bands rich in hornblende with lesser biotite, plagioclase, quartz, and garnet; some of these bands also contain moderately abundant disseminated K-feldspar. A few bands are rich in plagioclase and quartz.

Sample GT045 is a well foliated, lensy gneiss, with bands dominated by hornblende-biotite-garnet and less abundant lenses dominated by quartz-plagioclase. Veinlets, mainly in large garnet grains, are of chlorite, with or without epidote.

Sample GT071 is a weakly foliated gneiss consisting of quartz, biotite, garnet, muscovite, and plagioclase (altered slightly to sericite), with accessory ilmenite-rutile, minor pyrite and apatite, and trace zircon, chalcopyrite, and sphene. Foliation defined by elongation of biotite and muscovite flakes is warped moderately around some garnet grains.

Sample GT072 contains abundant equant garnet grains with interstitial patches of plagioclase (altered slightly to moderately to sericite), quartz, and scattered patches of biotite, muscovite, and chlorite, with interstitial patches of ilmenite (altered partly to rutile) and pyrrhotite (altered partly to pyrite). Many garnet grains are cut by veinlets of chlorite and contain replacement patches of chlorite.

Sample GT073 is massive and contains coarse garnet grains with interstitial patches of quartz, biotite, and plagioclase, with minor chlorite, ilmenite, and pyrrhotite.

Sample GT074 is a well foliated schist dominated by quartz with lesser muscovite and minor biotite, garnet, and pyrrhotite.

Sample GT075 is a massive intergrowth of quartz, garnet, and muscovite, with much less abundant patches of biotite and of plagioclase, and minor ilmenite and pyrrhotite.

Sample G31 contains very coarse garnet grains with small inclusions of quartz, rutile, and ilmenite, and larger inclusions/interstitial patches of biotite-chlorite, quartz, ilmenite-rutile, and plagioclase. Garnet grains are intergrown coarsely with patches dominated by anthophyllite and lesser quartz and others dominated by biotite and chlorite. Sulphides, dominated by pyrrhotite with lesser chalcopyrite and pyrite, form scattered interstitial patches.

Sample G32 is dominated by quartz with lesser anthophyllite, much less garnet and biotite, and scattered patches of pyrrhotite-(chalcopyrite) and grains of rutile and lesser ilmenite. Biotite and garnet are concentrated moderately in a few bands parallel to a slightly warped foliation.

Sample G33 contains megacrysts of garnet (containing inclusions of quartz, ilmenite, and rutile) that are intergrown with patchy aggregates of quartz, plagioclase, anthophyllite (locally altered strongly to completely to chlorite-magnetite), and biotite (altered in patches to chlorite), with scattered patches of pyrrhotite-(chalcopyrite). Replacement patches and discontinuous veins in anthophyllite are of chlorite and magnetite. Braided veinlets in garnet are of chlorite with or without quartz and calcite.

Sample G34 contains megacrysts of garnet enclosed in foliated patches of anthophyllite and lesser quartz, with much less abundant patches of biotite, disseminated grains and clusters of grains of rutile, and grains of plagioclase and apatite. Garnet contains large inclusions of quartz and much less abundant smaller ones of rutile and ilmenite. Minor sulphide patches are of pyrite, chalcopyrite, and pyrrhotite.

Sample G35 is a moderately banded gneiss dominated by plagioclase with lesser quartz and garnet, much less abundant biotite, and minor rutile/ilmenite, apatite, muscovite, and pyrrhotite.

Photographic Notes:

The scanned section shows the gross textural features of the sections; these features are seen much better on the digital image than on the printed image. Photo numbers are shown in the lower left corner of the photographs. The letter in the lower right-hand corner indicates the lighting conditions: P = plane light, X = plane light in crossed nicols, R = reflected light, RP = reflected light and plane light, RX = reflected light and plane light in almost crossed nicols, and XR = reflected light in crossed nicols. Locations of photographs are shown on the scanned sections. Descriptions of the photographs are at the end of the report.

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Sample GT01B1 **Quartz-Plagioclase-Garnet-Biotite Gneiss**

The sample is a moderately foliated gneiss dominated by quartz and plagioclase, with bands of garnet-biotite-(muscovite), and disseminated grains and patches of ilmenite-rutile and of pyrrhotite-(chalcopyrite-pyrite-pentlandite). Sillimanite(?) forms minor lenses and patches.

mineral	percentage	main grain size range (mm)	
quartz	35-40%	0.5-1	(a few up to 2 mm across)
plagioclase	30-35	0.5-1	(a few up to 2 mm across)
garnet	15-17	0.5-2	
biotite	7- 8	0.3-1	
ilmenite	0.5	0.1-0.3	
rutile	0.3	0.1-0.2	
pyrrhotite	0.3	0.1-0.2	
sillimanite(?)	0.3	0.03-0.05	
pyrite	0.2	0.05-0.2	
muscovite	0.2	0.05-0.2	
apatite	0.2	0.07-0.15	(one grain 0.4 mm long)
biotite/chlorite	0.1	0.05-0.08	
chalcopyrite	minor	0.03-0.1	
zircon	minor	0.02-0.05	

Quartz and plagioclase form anhedral, slightly interlocking grains. Plagioclase is mainly fresh and locally altered slightly to sericite. A few patches of quartz were recrystallized moderately to finer subgrain aggregates with slightly to moderately variable extinction orientations.

Garnet forms equant to slightly elongate anhedral grains with a pale pink colour in thin section. It contains 5-50% inclusions, that consist of two or more of rounded quartz grains (0.05-0.1 mm), slightly elongate ilmenite grains (0.03-0.07 mm) in parallel orientation, biotite flakes (0.1-0.2 mm), and patches of pyrrhotite and minor chalcopyrite.

Biotite forms single flakes and clusters of a few flakes, in part associated with garnet. Pleochroism is from pale to medium brown and locally to slightly reddish brown. Many grains contain minor zircon inclusions (0.2-0.03 mm) with dark pleochroic halos. Locally adjacent to garnet and as inclusions in garnet, patches of biotite/chlorite are pleochroic from light to medium green.

Rutile forms elongated prismatic grains intergrown with biotite and ilmenite.

Ilmenite forms tabular to anhedral grains intergrown with biotite and rutile.

Pyrrhotite forms patches up to 0.3 mm in size, mainly intergrown with garnet and biotite. Some grains of pyrrhotite contain exsolution patches of pentlandite

Pyrite forms anhedral patches, mainly associated with pyrrhotite and chalcopyrite.

Muscovite forms scattered clusters of a few flakes intergrown coarsely with biotite along borders of garnet grains.

Sillimanite(?) forms clusters and trains up to 0.7 mm long of acicular grains, mainly along borders of quartz-plagioclase.

Apatite forms disseminated equant anhedral grains, mainly intergrown with quartz and plagioclase.

Chalcopyrite forms patches intergrown coarsely with larger patches of pyrrhotite.

Zircon forms disseminated anhedral grains, in part associated with biotite and in part intergrown with quartz and plagioclase.

Sample GT01B2 Banded Plagioclase-Quartz-Garnet-Biotite-Muscovite Gneiss

The sample is well banded, with major bands of plagioclase and quartz and lesser bands of garnet-biotite-muscovite. Minor minerals include apatite (with plagioclase and quartz) and ilmenite, rutile, pyrrhotite, and zircon (mainly with biotite and garnet).

mineral	percentage	main grain size range (mm)	
plagioclase	50-55%	0.5-3	(a few up to 8 mm long)
quartz	20-25	0.5-2	(a few up to 0.3 mm across)
garnet	10-12	0.7-3	(a few up to 5 mm across)
biotite	8-10	0.5-1.5	
muscovite	2- 3	0.5-1.5	
apatite	0.4	0.1-0.5	
ilmenite	0.2	0.03-0.07	
pyrite	0.2	0.05-0.2	
rutile	0.2	0.05-0.08	
pyrrhotite	0.1	0.05-0.15	
biotite/chlorite	0.1	0.05-0.08	
pyrrhotite	0.1	0.07-0.15	
sillimanite	0.1	0.03-0.05	
zircon	minor	0.02-0.05	(a few up to 0.12 mm long)
chalcopyrite	trace	0.03-0.07	
pentlandite	trace	0.03-0.05	

Plagioclase forms anhedral rains that range from fresh to altered slightly to locally moderately to sericite. Some grains contain irregular flakes of muscovite up to 0.5 mm in size.

Quartz forms anhedral grains intergrown coarsely with plagioclase. Many grains show slightly strained extinction.

Biotite forms clusters of subhedral flakes with pleochroism from light to medium brown and locally to medium/dark reddish brown. Locally adjacent to garnet and as inclusions in garnet, patches of biotite/chlorite are pleochroic from light to medium green.

Garnet forms clusters of equant, anhedral grains intergrown with biotite. It commonly contains from 2-7% inclusions, mainly of quartz (0.05-0.15 mm). A few grains contain up to 20% inclusions of quartz, biotite, ilmenite, and rutile, and some grains are free of inclusions. A few grains are intergrown moderately with biotite; some of these also contain inclusions of ilmenite and of rutile.

Muscovite forms slender flakes, mainly intergrown with biotite near or bordering garnet grains. Some muscovite flakes contains 2-5% slender lenses of ilmenite parallel to cleavage.

Apatite forms anhedral grains intergrown with plagioclase and quartz.

Rutile forms anhedral grains intergrown with biotite and locally forms inclusions in garnet.

Sulphide patches averaging 0.1-0.2 mm in size and a few up to 0.5 mm across occur mainly along margins of garnet grains and in part are intergrown with biotite. Sulphides are dominated by pyrite or pyrrhotite with generally much less abundant chalcopyrite and pentlandite, the latter as exsolution patches in pyrrhotite.

Sillimanite(?) forms clusters of acicular grains in a few lenses up to 0.5 mm long in plagioclase grains associated with patches of muscovite.

Zircon forms anhedral to subhedral prismatic grains mainly as inclusions in biotite; most grains are surrounded by dark pleochroic halos.

Sample GT01B3 Quartz-Plagioclase-Garnet-Biotite-Muscovite Gneiss

The sample is a slightly to moderately foliated gneiss dominated by quartz, plagioclase, garnet, and biotite, with lesser muscovite and much less abundant ilmenite, pyrrhotite, and apatite, and minor chalcopyrite, pyrite, rutile, and zircon.

mineral	percentage	main grain size range (mm)	
quartz	30-35%	0.3-1	
plagioclase	20-25	0.3-1.5	
garnet	20-25	0.8-2	
biotite	12-15	0.5-1.5	
muscovite	3- 4	0.5-1.5	(a few up to 2.2 mm long)
ilmenite	0.5	0.05-0.1	
pyrrhotite	0.3	0.05-0.2	
apatite	0.3	0.1-0.2	
chalcopyrite	0.1	0.03-0.1	
pyrite	0.1	0.05-0.3	
rutile	minor	0.03-0.05	
zircon	minor	0.02-0.05	

Quartz forms anhedral grains and patches of grains, many of which have slightly strained extinction.

Plagioclase forms anhedral grains intergrown coarsely with quartz. Most grains are fresh and a few are altered very slightly to sericite.

Garnet forms anhedral, equant grains, most of which contain 3-15% inclusions (0.05-0.15 mm) dominated by quartz with lesser plagioclase, biotite, and ilmenite. A few grains contain 20-50% inclusions (0.02-0.2 mm) of the same minerals in similar proportions. A few grains are relatively free of inclusions. A few grains contain 10% biotite inclusions (0.2-1 mm).

Biotite is concentrated moderately in seams parallel to foliation and commonly is intergrown coarsely with biotite. Pleochroism is from light to medium or dark brown.

Muscovite forms flakes and clusters of flakes that are intergrown coarsely with biotite; some occur along borders of garnet grains.

Apatite forms anhedral grains mainly included in quartz and plagioclase.

Ilmenite forms anhedral to tabular inclusions in garnet, elongate grains intergrown along cleavage planes of biotite and muscovite, and a few stubby tabular grains in quartz.

Sulphides form irregular patches up to 0.5 mm long intergrown with biotite and locally included in garnet. Most are dominated by pyrrhotite with minor to locally moderately abundant chalcopyrite. A few patches are dominated by pyrite with much less abundant chalcopyrite. Pyrite commonly contains abundant non-reflective inclusions (0.002-0.02 mm).

Rutile forms scattered equant anhedral grains, mainly intergrown coarsely with ilmenite and possibly formed by replacement of ilmenite.

Zircon forms anhedral to subhedral, equant to prismatic grains, mainly included in biotite; most grains in biotite have dark pleochroic halos.

Sample GT01B4 Banded Plagioclase-Quartz-Garnet-Biotite Gneiss

The sample is a well banded gneiss dominated by plagioclase with much less abundant quartz, garnet, and biotite, accessory ilmenite, pyrrhotite, and rutile, and minor chalcopyrite, pyrite, apatite, zircon, and chlorite. Garnet, biotite, and accessory and minor minerals are concentrated strongly in seams parallel to foliation.

mineral	percentage	main grain size range (mm)	
plagioclase	60-65%	0.7-2	
quartz	12-15	0.3-1	(a few up to 1.7 mm across)
garnet	10-12	0.5-2.5	(a few up to 3.5 mm across)
biotite	10-12	0.5-1.5	
ilmenite	0.5	0.05-0.3	(a few grains up to 1 mm long)
pyrrhotite	0.4	0.05-0.3	
rutile	0.2	0.05-0.15	
chalcopyrite	0.1	0.05-0.15	
pyrite	0.1	0.05-0.1	(a few up to 0.3 mm)
apatite	minor	0.1-0.2	
zircon	minor	0.03-0.07	(one grain 0.15 mm long)
pentlandite	trace	0.02-0.03	(a few up to 0.05 mm long)
chlorite	trace	0.05-0.08	

Plagioclase forms anhedral grains that range from fresh to altered very slightly to sericite.

Quartz forms anhedral grains and patches interstitial to plagioclase. Some grains have slightly strained extinction.

Garnet forms equant, anhedral grains that are concentrated in trains parallel to foliation and commonly is associated with biotite. The abundance of inclusions ranges widely from some grains with less than 2% inclusions to others with over 30% inclusions. Inclusions are mainly quartz with lesser ilmenite, plagioclase, and biotite.

Biotite is concentrated moderately to strongly in seams parallel to foliation, and commonly is associated with garnet. Pleochroism is from light to medium/dark, slightly reddish brown.

Ilmenite forms anhedral to subhedral tabular grains that are concentrated with biotite and garnet, and are abundant along contacts of these minerals. Some garnet grains contain 1-2% ilmenite inclusions. Rutile forms anhedral grains intergrown coarsely with ilmenite and possibly formed by replacement of ilmenite.

Sulphides form irregular patches up to 1 mm in size, mainly along margins of garnet and biotite and commonly associated with ilmenite. Pyrrhotite forms patches alone or with lesser chalcopyrite and minor pyrite; a few pyrrhotite grains contain exsolution lenses and patches up to 0.05 mm in size of pentlandite. Pyrite forms subhedral grains and also forms irregular patches intergrown with minor to moderately abundant chalcopyrite and in places containing dusty non-reflective inclusions.

Apatite forms anhedral, equant grains, mainly intergrown with plagioclase and quartz.

Zircon forms anhedral to subhedral stubby prismatic grains, mainly enclosed in biotite and mainly with a dark pleochroic halo.

Chlorite forms a few grains included in garnet; it is pleochroic from light to medium green.

Sample GT041 Hornblende-Plagioclase-Quartz-(Garnet-Biotite-Sphene) Gneiss

The sample is a moderately foliated gneiss dominated by hornblende with lenses dominated by plagioclase and quartz. It contains much less abundant biotite and garnet and minor apatite, sphene, and zircon.

mineral	percentage	main grain size range (mm)	
hornblende	55-60%	0.5-1.5	
plagioclase	17-20	0.5-1.5	
quartz	15-17	0.5-1	
garnet	3- 4	2- 3	(one grain 5 mm across)
biotite	2- 3	0.5-1	
sphene	1- 2	0.02-0.04	(a few up to 0.07 mm)
ilmenite	0.3	0.1-0.4	
apatite	0.2	0.05-0.1	
zircon	0.1	0.02-0.05	(a few up to 0.08 mm long)
K-feldspar	minor	0.03-0.07	
chalcopyrite	trace	0.02-0.05	(two from 0.07-0.1 mm)
pyrrhotite	trace	0.02-0.03	
bornite	trace	0.02	

Hornblende forms anhedral, equant to slightly elongate grains with pleochroism from light to medium/dark green. A few grains contain abundant inclusions of sphene.

Plagioclase and quartz form anhedral grains that are interstitial to hornblende and are concentrated moderately in lenses up to several mm long and a few mm across. Most plagioclase grains are fresh, whereas a few are altered very slightly to slightly to disseminated flakes of sericite. Quartz also forms abundant inclusions in garnet.

Biotite forms disseminated, commonly elongate flakes, mainly intergrown with hornblende. Pleochroism is from light to medium brown to orangish brown.

Garnet forms anhedral equant grains that contain 5-30% inclusions of quartz (0.03-0.08 mm with a few up to 0.15 mm), sphene (0.01-0.05 mm), and locally hornblende (0.05-0.08 mm with a few up to 0.15 mm). Some garnet grains are intergrown with patches from 0.2-2 mm across of quartz and/or plagioclase. The abundance of inclusions varies widely within and between garnet grains; inclusions commonly are more abundant in broad cores of grains, whereas narrow rims commonly have much fewer inclusions.

Sphene also forms disseminated, mainly anhedral grains included in hornblende and clusters of similar to subhedral grains associated with hornblende and biotite.

Ilmenite forms anhedral grains, mainly associated with hornblende and in part included in hornblende grains.

Apatite forms anhedral to subhedral grains intergrown mainly with plagioclase and quartz.

Zircon forms anhedral to subhedral grains, mainly disseminated in hornblende. Most grains have small dark pleochroic halos.

K-feldspar forms a few patches up to 0.3 mm in size interstitial to hornblende and associated with plagioclase and quartz; it may be a replacement of plagioclase.

Chalcopyrite forms a few patches up to 0.1 mm in size, in part included in garnet and in part in quartz and plagioclase; some of the patches were altered moderately inwards from their margins to red hematite. One patch 0.05 mm across in quartz is half of chalcopyrite and half of bornite. A few rounded patches of pyrrhotite and minor chalcopyrite occur in plagioclase and quartz.

Sample GT042 **Patchy Hornblende-Plagioclase-Quartz-Garnet-(Biotite-Sphene) Gneiss Veinlet: K-feldspar**

The sample is slightly foliated and is dominated by hornblende with lesser plagioclase (altered slightly to sericite) and quartz, much less abundant garnet, biotite, and sphene, and minor ilmenite and apatite. Plagioclase and quartz are concentrated strongly in a few patches up to 10 mm across. A few patches are of pyrite and a few are of chalcopyrite, both of which were altered moderately to hematite. A veinlet is of K-feldspar.

mineral	**percentage**	**main grain size range (mm)**	
hornblende	45-50%	0.5-1.5	
plagioclase	17-20	0.5-1.5	
quartz	17-20	0.3-1.5	
garnet	4- 5	1- 4	
biotite	4- 5	0.5-1.5	
sphene	2	0.05-0.2	(a few up to 0.3 mm)
ilmenite	0.2	0.02-0.05	
apatite	0.2	0.07-0.15	(a few up to 0.25 mm)
pyrite	minor	0.05-0.2	
chalcopyrite	minor	0.05-0.2	
zircon	minor	0.02-0.05	(a few up to 0.07 mm)
veinlet			
K-feldspar	1- 2	0.03-0.05	

Hornblende forms anhedral equant to slightly elongate grains with pleochroism from light to medium/dark, slightly brownish green.

Plagioclase forms anhedral grains that were altered slightly to locally moderately to sericite and dusty hematite. Plagioclase and quartz are concentrated strongly in lenses up to 2 cm long by 0.7 cm wide. Quartz forms anhedral grains intergrown slightly to moderately with plagioclase and also forms abundant inclusions in garnet.

Garnet forms anhedral, equant grains that contain 15-40% inclusions, mainly of quartz (0.05-0.2 mm), with much less abundant ones of sphene (0.03-0.1 mm) and scattered ones of biotite and of hornblende. One grain contains a few proximal clusters up to 0.4 mm in size of anhedral sphene grains with inclusions of ilmenite.

Biotite forms disseminated flakes with pleochroism from light to medium/dark brownish red. A few grains are altered along one side to pseudomorphic muscovite with abundant tabular inclusions of ilmenite along cleavage.

Sphene forms anhedral equant grains and clusters of grains, many of which have cores of ilmenite.

Apatite forms anhedral equant grains mainly intergrown with plagioclase and quartz. It forms a few open clusters of much finer anhedral grains included in a few quartz and plagioclase grains.

Pyrite forms a few patches up to 0.5 mm long that were altered moderately to strongly inwards from their margins to deep reddish brown hematite.

Chalcopyrite forms a few patches up to 0.3 mm across; some were altered moderately inwards from their margins to opaque hematite.

Zircon forms disseminated anhedral to subhedral grains included in hornblende; most have weak dark pleochroic halos.

An irregular veinlet 0.1-0.5 mm wide is of slightly interlocking anhedral grains of K-feldspar.

Sample GT043 Hornblende-Quartz-Garnet-Biotite-Plagioclase-Gneiss

The sample is slightly foliated and dominated by hornblende, quartz, garnet, biotite, and plagioclase, with much less abundant sphene, and minor apatite and ilmenite.

mineral	percentage	main grain size range (mm)	
hornblende	25-30%	0.5-1.5	(a few up to 2 mm long)
quartz	20-25	0.5-1	
garnet	15-17	2- 5	
biotite	15-17	0.5-2	(a few up to 2.5 mm long)
plagioclase	10-12	0.5-1.5	(a few up to 3.5 mm long)
sphene	2- 3	0.05-0.2	(a few up to 0.3 mm long)
ilmenite	0.2	0.05-0.1	
apatite	0.2	0.05-0.1	(a few up to 0.25 mm)
pyrite	minor	0.05-0.3	
zircon	minor	0.02-0.07	

Hornblende forms anhedral, commonly submosaic grains with pleochroism from light to medium/dark slightly brownish green.

Quartz forms anhedral grains intergrown coarsely with plagioclase and also forms inclusions in garnet.

Garnet forms anhedral, equant grains, most of which contain 5-15% inclusions of quartz, minor to moderately abundant inclusions of sphene, and generally minor inclusions of hornblende and biotite. A few garnet grains contain less than 5% inclusions dominated by quartz and a few contain up to 40% inclusions, including coarser grains of quartz and clusters of quartz and minor ones of plagioclase. Commonly cores of garnet grains contain more abundant inclusions than rims.

Biotite forms anhedral to subhedral flakes mainly intergrown with hornblende; pleochroism is from light to dark brownish red to reddish brown. A few grains were altered along one side to intergrowths of quartz and wispy patches and seams of Ti-oxide/leucoxene.

Plagioclase forms anhedral grains that are concentrated slightly in lenses parallel to foliation. Grains range from fresh to altered very slightly to sericite.

Sphene forms anhedral grains intergrown mainly with hornblende and much less abundant inclusions in garnet. It forms several clusters up to 0.9 mm across in and bordering one garnet grain. Many sphene grains have a subrounded core of ilmenite.

Apatite forms anhedral equant grains intergrown with plagioclase and quartz and also with hornblende and biotite.

Pyrite forms scattered anhedral to subhedral patches up to 0.5 mm in size that were altered slightly to strongly to hematite along their margins.

Zircon forms anhedral grains disseminated in hornblende; most have weak halos in which hornblende is slightly darker in color than further away.

Sample GT044 Foliated Hornblende-Quartz-Biotite-Plagioclase-K-feldspar-Garnet-Gneiss

The sample is moderately foliated, and is dominated by bands rich in hornblende with lesser biotite, plagioclase, quartz, and garnet; some of these bands also contain moderately abundant disseminated K-feldspar. A few bands are rich in plagioclase and quartz.

mineral	percentage	main grain size range (mm)	
hornblende	30-35%	0.5-1.5	
plagioclase	17-20	0.5-2	(a few up to 3 mm)
quartz	17-20	0.5-1.5	(a few up to 2 mm)
biotite	10-12	0.5-1	
K-feldspar	8-10	0.2-0.5	
garnet	2- 3	0.7-2	
epidote	2- 3	0.1-0.5	
sphene	1	0.05-0.2	
pyrite	0.5	0.05-0.3	
apatite	0.2	0.05-0.15	
zircon	minor	0.02-0.05	
chalcopyrite	minor	0.01-0.05	

Hornblende forms anhedral equant to elongate grains, with the latter commonly oriented parallel to foliation. Pleochroism is from light to medium/dark slightly brownish green.

Plagioclase forms anhedral grains intergrown coarsely with hornblende. Alteration is moderate to dusty to extremely fine grained disseminated flakes of sericite, irregular patches of epidote (0.02-0.07 mm), and dusty hematite.

Quartz forms anhedral grains intergrown coarsely with plagioclase and hornblende.

Biotite forms equant to moderately elongate flakes intergrown mainly with hornblende. Pleochroism is mainly from light to dark brown to slightly reddish brown. Some grains are pleochroic from light to medium green. Some grains were altered moderately to completely to pseudomorphic chlorite and coarse patches of epidote. Some rains were altered partly to lenses of quartz with disseminated wispy patches and lenses of Ti-oxide.

K-feldspar forms anhedral grains mainly intergrown moderately to finely with plagioclase. It contains minor dusty hematite that gives it a pale brown colour. It is concentrated moderately in one half of the section.

Garnet forms disseminated grains that contain 5-20% inclusions of quartz and minor inclusions of biotite and hornblende. A few grains contain patches of chlorite up to 0.5 mm in size. One grain was altered in patches to epidote, pyrite, and biotite.

Sphene forms anhedral grains mainly interstitial to hornblende.

Pyrite forms anhedral to subhedral patches up to 0.9 mm in size. It is concentrated in one open cluster bordering and within one altered garnet grain. Some grains contain minor inclusions of chalcopyrite. Some were altered slightly along their margins to hematite.

Apatite forms anhedral equant grains, mainly intergrown with plagioclase and quartz.

Zircon forms anhedral to subhedral, equant to stubby prismatic grains, mainly included in hornblende. Most have weak dark pleochroic alteration halos.

Chalcopyrite forms a few anhedral grains associated with one or more of epidote, pyrite, and biotite and a few are in hornblende; some were altered slightly to hematite.

Sample GT045 Foliated Hornblende-Plagioclase-Quartz-Garnet-Biotite Gneiss

The sample is a well foliated, lensy gneiss, with bands dominated by hornblende-biotite-garnet and less abundant lenses dominated by quartz-plagioclase. Veinlets, mainly in large garnet grains, are of chlorite, with or without epidote.

mineral	**percentage**	**main grain size range (mm)**	
hornblende	25-30%	0.5-2	(a few up to 5 mm long)
quartz	20-25	0.5-1.5	(a few up to 2.5 mm)
plagioclase	17-20	0.5-2	
biotite	10-12	0.5-1.5	
garnet	12-15	1- 5 (one grain 7 mm across)	
sphene	2	0.05-0.1	(with hornblende); 0.01-0.03 (in garnet)
pyrite	0.3	0.05-0.5	
apatite	0.2	0.05-0.15	
chalcopyrite	trace	0.05-0.08	
veinlets			
chlorite-epidote	0.3	0.02-0.05	

Hornblende forms equant to prismatic grains with pleochroism from light to medium/dark, slightly brownish green.

Plagioclase forms anhedral grains that range from fresh to altered moderately to sericite and locally slightly to moderately to disseminated patches of epidote.

Quartz forms anhedral grains intergrown coarsely with plagioclase and hornblende.

Garnet forms equant anhedral grains that contain 5-25% inclusions, mainly of quartz (0.05-0.2 mm, locally up to 0.5 mm) with minor to locally very abundant sphene (0.01-0.03 mm), and locally minor biotite and hornblende. In several grains, inclusions are more abundant in cores of than towards the rims. Some large grains were cut by a few branching subparallel veinlets of chlorite and lesser chlorite-epidote up to 0.03 mm wide.

Biotite forms equant to moderately elongate flakes with pleochroism from light to dark brown to reddish brown.

Sphene forms anhedral grains intergrown with hornblende and locally abundant inclusions in garnet.

Pyrite forms disseminated patches that were altered moderately along borders and abundant fractures to hematite.

Apatite forms anhedral grains mainly intergrown with plagioclase and quartz.

Chalcopyrite forms minor grains that were altered moderately inwards from their margins to hematite.

Some large garnet grains are cut by sets of subparallel, braided veinlets of chlorite or chlorite-epidote. A few discontinuous veinlets up to 0.07 mm wide of epidote cut garnet grains. A few veinlets up to 0.05 mm wide of epidote-chlorite cut hornblende grains.

Sample GT071 Quartz-Biotite-Garnet-Muscovite-Plagioclase Gneiss

The sample is a weakly foliated gneiss consisting of quartz, biotite, garnet, muscovite, and plagioclase (altered slightly to sericite), with accessory ilmenite-rutile, minor pyrite and apatite, and trace zircon, chalcopyrite, and sphene. Foliation defined by elongation of biotite and muscovite flakes is warped moderately around some garnet grains.

mineral	percentage	main grain size range (mm)	
quartz	25-30%	0.3-1.56	
biotite	17-20	0.5-2	
garnet	17-20	1-5	(a few up to 7 mm)
muscovite	15-17	0.7-1.5	
plagioclase	15-17	0.5-1.5	
ilmenite/rutile	1	0.07-0.5	
pyrite	0.5	0.07-0.5	
apatite	0.4	0.05-0.15	(a few up to 0.3 mm long)
chlorite	0.1	0.01-0.03	
zircon	0.1	0.05-0.1	
chalcopyrite	0.1	0.02-0.05	
sphene	minor	0.01-0.03	

Quartz forms anhedral grains.

Plagioclase forms anhedral grains that range from fresh to altered moderately to pale green-brown chlorite/sericite.

Biotite forms subhedral flakes with pleochroism from light brown to dark brownish red to red.

Garnet forms disseminated, anhedral to subhedral, equant to irregular grains that commonly contain 3-10% inclusions of quartz and locally 2-5% inclusions of one or more of biotite, ilmenite, and sphene. A few patches consist of clusters of subhedral garnet grains (0.07-0.5 mm) with interstitial patches of quartz and locally abundant biotite. A few grains contain 15-25% inclusions of quartz. A few grains contain minor inclusions of medium green chlorite.

Muscovite forms clusters of flakes, in part intergrown with biotite.

Ilmenite and much less abundant rutile occur together in elongate lenses up to 1 mm long, in part intergrown along cleavage planes of muscovite and of biotite. Probably rutile is secondary after ilmenite.

Pyrite forms disseminated anhedral grains and clusters of grains, the largest being a patch 0.7 mm long intergrown coarsely with biotite. .

Apatite forms disseminated anhedral equant grains and clusters of a few grains, intergrown with biotite, plagioclase, and quartz.

A few patches from 0.3-0.5 mm long are of equant grains of chlorite (0.02 mm) with lesser pyrite and minor chalcopyrite.

Zircon forms anhedral to subhedral grains in biotite; many grains are metamict.

Chalcopyrite forms anhedral grains intergrown with pyrite and a few patches up to 0.3 mm across.

Sphene forms 2-5% inclusions in a few garnet grains.

Sample GT072 Massive Garnet-Plagioclase-Biotite-Muscovite-Quartz-Ilmenite

The sample contains abundant equant garnet grains with interstitial patches of plagioclase (altered slightly to moderately to sericite), quartz, and scattered patches of biotite, muscovite, and chlorite, with interstitial patches of ilmenite (altered partly to rutile) and pyrrhotite (altered partly to pyrite). Many garnet grains are cut by veinlets of chlorite and contain replacement patches of chlorite.

mineral	**percentage**	**main grain size range (mm)**	
garnet	50-55%	1.5-5	
plagioclase	20-25	0.5-2	
quartz	10-12	0.3-0.8	
biotite	2- 3	0.5-2	(a few up to 3 mm long)
chlorite	2- 3	0.3-1.5	
ilmenite	2- 3	0.3-0.7	
muscovite	1	0.7-2	(a few up to 3 mm long)
pyrrhotite	1	0.05-0.3	(altered slightly to moderately to pyrite)
rutile	0.7	0.05-0.08	
pyrite	0.3	0.03-0.1	
marcasite	0.1	0.1-0.15	
chalcopyrite	minor	0.03-0.1	
veinlets, replacement patches			
chlorite	2- 3	0.05-0.1	

Garnet forms equant anhedral grains from 1-5 mm in size. These generally contain 2-7% inclusions of quartz and some contain patches with moderately abundant inclusions of ilmenite. It also forms clusters up to 1.5 mm in size of commonly subhedral grains (0.07-0.3 mm) with interstitial patches of one or more of quartz, biotite-muscovite, chlorite, and ilmenite.

Plagioclase forms anhedral grains that are interstitial to garnet and that were altered very slightly to slightly to sericite. Locally adjacent to ilmenite, plagioclase was altered strongly to medium brownish grey chlorite(?).

Quartz forms anhedral patches interstitial to garnet; some patches consist of very fine grains with slightly to moderately sutured grain borders, suggesting they were recrystallized from coarser grains.

Biotite forms scattered flakes and clusters of flakes with pleochroism from light to dark brown. Several flakes were altered completely to pseudomorphic chlorite and lenses of Ti-oxide. A few flakes were replaced along their margins to pseudomorphic light green chlorite.

Chlorite forms clusters up to a few mm across of anhedral grains with pleochroism from pale to light green.

Muscovite forms subhedral flakes in part associated with biotite.

Ilmenite forms patches up to a few mm across interstitial to garnet. Many of these were replaced slightly to moderately by very fine grained aggregates of rutile.

Pyrrhotite forms patches up to 1 mm in size of anhedral grains, many of which were altered to secondary pyrite with dusty non-reflective inclusions.

Pyrite forms scattered patches, in part along margins of larger pyrrhotite patches. It also forms a few wispy veinlets up to 0.02 mm wide along cleavage planes of biotite flakes.

Marcasite forms a few patches up to 1 mm in size of anhedral, equant grains; it probably is secondary after pyrrhotite.

Chalcopyrite forms anhedral patches, mainly associated with pyrrhotite.

Many garnet grains were cut by veinlets up to 0.05 mm wide and a few contain replacement patches up to 1 mm across of chlorite. One veinlet up to 0.1 mm wide is of chlorite with a few flakes of muscovite (0.3-0.4 mm).

Sample GT073 Massive Garnet-Quartz-Plagioclase-Biotite Rock

The sample contains coarse garnet grains with interstitial patches of quartz, biotite, and plagioclase, with minor chlorite, ilmenite, and pyrrhotite.

mineral	percentage	main grain size range (mm)	
garnet	40-45%	2- 7	
quartz	20-25	0.2-2	(a few up to 3 mm)
biotite	12-15	0.5-2	
plagioclase	12-15	0.5-1.5	
chlorite	1- 2	0.1-0.5	
ilmenite	1- 2	0.05-0.2	(a few up to 0.5 mm)
pyrrhotite	0.5	0.05-0.1	
rutile	0.3	0.1-0.5	(a few up to 0.9 mm long)
pyrite	0.2	0.05-0.1	
ankerite	0.1	0.05-0.2	
zircon	minor	0.01-0.03	
chalcopyrite	minor	0.03-0.1	
pentlandite	trace	0.02-0.03	

Garnet forms anhedral to subhedral, equant grains with widely variable abundances and mineralogy of inclusions. Most inclusions are of quartz, but some grains also contain inclusions of one or more of plagioclase, chlorite, biotite, and ilmenite. Some grains are cut by irregular veinlets up to 0.05 mm wide of chlorite and lesser biotite.

Quartz forms anhedral grains interstitial to garnet; many large quartz grains are skeletal. Many grains have slightly strained extinction.

Biotite forms clusters of flakes with pleochroism from light to dark reddish brown to brownish red.

Plagioclase forms anhedral grains interstitial to garnet; most are fresh and a few were altered very slightly to sericite. Inclusions in garnet (0.05-0.2 mm) are mainly altered slightly to moderately to sericite.

Muscovite forms clusters of flakes intergrown coarsely with biotite; most muscovite flakes contain 2-5% tabular inclusions of ilmenite along cleavage planes, suggesting that muscovite is secondary after biotite.

Ilmenite forms anhedral, equant patches up to 0.7 mm in size, many of which are rimmed by rutile. Some garnet grains contain 1-5% inclusions of ilmenite (0.03-0.05 mm). Rutile forms subhedral to euhedral grains in part associated with ilmenite and in part away from ilmenite.

Pyrrhotite forms anhedral patches up to 0.5 mm in size of anhedral grains. Some patches contain minor exsolution lenses of pentlandite.

Ankerite is concentrated in a few clusters up to 0.6 mm in size of anhedral grains that contain abundant tiny, in part elongate inclusions of pyrrhotite (0.015-0.01 mm long).

Pyrite forms anhedral grains associated with several large patches of pyrrhotite. Many patches of pyrite contain abundant dusty non-reflective inclusions, suggesting that these patches were formed by replacement of pyrrhotite.

Zircon forms disseminated grains included in biotite. Many are metamict. Most have small dark pleochroic halos.

Chalcopyrite forms minor interstitial patches up to 0.2 mm in size away from pyrrhotite and patches up to 0.1 mm in size intergrown coarsely with pyrrhotite.

Sample GT074 Quartz-Muscovite-(Biotite-Garnet-Pyrrhotite) Schist

The sample is a well foliated schist dominated by quartz with lesser muscovite and minor biotite, garnet, and pyrrhotite.

mineral	percentage	main grain size range (mm)	
quartz	78-82%	0.4-1.5	(a few up to 2.5 mm long)
muscovite	15-17	0.4-1.2	(a few up to 2.5 mm long)
biotite	1- 2	0.2-0.5	
garnet	1- 2	0.3-0.8	(a few up to 1.2 mm)
pyrrhotite	0.3	0.07-0.3	(a few up to 0.5 mm long)
pyrite	minor	0.02-0.03	
chalcopyrite	minor	0.02-0.05	(one 0.1 mm across)

Quartz forms anhedral grains with moderately sutured grain borders. Some coarser grains have slightly strained extinction and some are oriented parallel to foliation. Finer grains probably were recrystallized from coarser grains during metamorphism.

Muscovite forms disseminated flakes, most of which are elongate parallel to foliation. One large grain is oriented perpendicular to foliation.

Biotite forms flakes with a preferred orientation parallel to foliation. It is concentrated slightly to moderately in a few seams parallel to foliation. Pleochroism is from light to dark slightly reddish brown. A few flakes were altered completely to pseudomorphic greyish green chlorite.

Garnet forms equant, mainly anhedral, commonly irregular grains intergrown with quartz. Some grains are skeletal in outline and are intergrown intimately with quartz. A few grains have subhedral outlines. Grains are fractured coarsely. A few contain 2-3% rounded inclusions of quartz (0.01-0.015 mm).

Pyrrhotite forms disseminated lenses up to 0.5 m long, many of which are elongated parallel to foliation. Most are associated with muscovite and/or biotite.

Pyrite forms clusters up to 0.3 mm across of anhedral to subhedral grains, some of which contain abundant non-reflective inclusions. These generally are away from biotite and muscovite.

Chalcopyrite forms anhedral grains, mainly associated with patches of pyrrhotite.

Sample GT075 Massive Quartz-Muscovite-Garnet-(Biotite-Plagioclase-Ilmenite)

The sample is a massive intergrowth of quartz, garnet, and muscovite, with much less abundant patches of biotite and of plagioclase, and minor ilmenite and pyrrhotite.

mineral	percentage	main grain size range (mm)	
quartz	30-35%	0.3-1.5; 0.05-0.15 (inclusions in garnet)	
garnet	25-30	0.5-4	
muscovite	25-30	0.7-3	
biotite	4- 5	0.7-1.5	
plagioclase	2- 3	0.3-1; 0.1-0.2 (inclusions in garnet)	
ilmenite	0.7	0.3-0.7; 0.05-0.15 (inclusions in garnet)	
pyrrhotite	0.4	0.07-0.3	
chlorite	0.1	0.01-0.015	
chalcopyrite	0.1	0.05-0.1	(a few up to 0.4 mm)
rutile	minor	0.05-0.1	
zircon	trace	0.03-0.08	
pyrite	trace	0.02-0.05	
pentlandite	trace	0.02-0.05	

Quartz forms anhedral grains, many of which have slightly strained extinction.

Muscovite forms subhedral flakes and clusters of flakes.

Garnet forms anhedral, equant grains that contain a wide variety of inclusions. Many grains contain inclusions of quartz and minor ilmenite. Some grains contain 3-5% subhedral to euhedral inclusions of plagioclase (0.1-0.2 mm), that was altered slightly to moderately to sericite. Some grains contain replacement patches of chlorite and some contain minor to abundant irregular veinlets mainly from 0.07-0.2 mm wide and one veinlet up to 0.7 mm wide of chlorite.

Biotite forms scattered flakes, mainly intergrown with muscovite. Pleochroism is from light straw to medium/dark brownish red. Bordering a few patches of biotite are irregular patches up to 0.2 mm across of equant flakes of chlorite.

Plagioclase is concentrated strongly in a few patches up to 2 mm across, mainly interstitial to garnet. Plagioclase was altered slightly to moderately to pale green to pale brown chlorite-sericite; some strongly altered patches are adjacent to patches of pyrrhotite-chalcopyrite.

Ilmenite forms anhedral patches up to 0.7 mm in size. Associated with some of these are patches of rutile, some of which at least which may have formed by replacement of ilmenite. It also forms 1-3% inclusions in some garnet grains.

Pyrrhotite and much less chalcopyrite form irregular interstitial patches up to 1.2 mm in size. A few grains contain minor exsolution patches and lenses of pentlandite.

Chalcopyrite forms anhedral patches, mainly intergrown with pyrrhotite.

Zircon forms disseminated, anhedral to subhedral stubby prismatic grains included in biotite; it is rimmed by thin dark pleochroic halos.

Pyrite forms scattered patches up to 0.1 mm in size associated with small patches of pyrrhotite and lesser chalcopyrite.

Sample G31 Garnet-Anthophyllite-Quartz-Biotite-Chlorite Schist

The sample contains very coarse garnet grains with small inclusions of quartz, rutile, and ilmenite, and larger inclusions/interstitial patches of biotite-chlorite, quartz, ilmenite-rutile, and plagioclase. Garnet grains are intergrown coarsely with patches dominated by anthophyllite and lesser quartz and others dominated by biotite and chlorite. Sulphides, dominated by pyrrhotite with lesser chalcopyrite and pyrite, form scattered interstitial patches.

mineral	percentage	main grain size range (mm)	
garnet	65-70%	30-50	
anthophyllite	12-15	1- 3	(a few up to 12 mm long)
quartz	7- 8	0.5-1.5	
biotite	3- 4	0.5-2	(a few up to 4 mm long)
chlorite	3- 4	0.5-1	
rutile	1- 2	0.1-0.3	
plagioclase	1- 2	0.5-1	
ilmenite	1- 2	0.1-0.5	
pyrrhotite	0.3	0.1-0.5	
pyrite	0.1	0.3-0.7	
marcasite	0.1	0.01-0.03	
chalcopyrite	0.1	0.02-0.05	(a few up to 0.2 mm)
pentlandite	trace	0.03-0.05	
zircon	trace	0.01-0.02	
apatite	trace	0.1-0.2	

Garnet forms anhedral megacrysts that contain 3-5% inclusions (0.05-0.1 mm) of quartz, rutile, and ilmenite, and scattered zones of coarser inclusions or intergrowths of biotite, chlorite, quartz, and minor plagioclase. Garnet is cut by moderately abundant chlorite veinlets up to 0.05 mm wide.

Away from garnet grains, much of the rock is dominated by an intergrowth of prismatic anthophyllite and interstitial quartz. Anthophyllite is colourless and has parallel extinction.

Biotite forms clusters of flakes with pleochroism from pale to medium brown. Chlorite forms clusters of flakes with pleochroism from pale to light green. Some biotite grains were altered moderately to strongly to chlorite.

Rutile and ilmenite commonly occur together in patches up to 1 mm in size. In several patches, rutile grains are surrounded by ilmenite. Rutile also forms abundant disseminated grains away from ilmenite.

Several sulphide patches up to 1.5 mm in size are dominated by pyrrhotite with lesser chalcopyrite. A few pyrrhotite patches contain minor exsolution lenses and patches of pentlandite. A few coarser grained patches of chalcopyrite (up to 0.7 mm) are associated with pyrrhotite and chlorite (after hornblende), and one patch 0.5 mm across is interstitial to chlorite.

One patch 1.5 mm long consists of pyrite and patches of marcasite (after pyrrhotite), with minor chalcopyrite.

Zircon, surrounded by dark pleochroic halos, forms a few equant grains within biotite flakes.

Apatite forms scattered equant anhedral grains associated with mafic minerals.

Sample G32 Foliated Quartz-Anthophyllite-Garnet-(Biotite-Pyrrhotite) Schist

The sample is dominated by quartz with lesser anthophyllite, much less garnet and biotite, and scattered patches of pyrrhotite-(chalcopyrite) and grains of rutile and lesser ilmenite. Biotite and garnet are concentrated moderately in a few bands parallel to a slightly warped foliation.

mineral	percentage	main grain size range (mm)	
quartz	70-75%	0.5-1.5	(a few up to 2.5 mm)
anthophyllite	17-20	1- 3	
garnet	5- 7	1- 3	
biotite	2- 3	0.5-1.5	(a few up to 2 mm long)
pyrrhotite	0.3	0.2-0.5	
rutile	0.3	0.2-0.3	
ilmenite	0.2	0.2-0.5	
chalcopyrite	0.1	0.1-0.2	(a few up to 0.5 mm long)
apatite	minor	0.1-0.25	
pyrite	minor	0.04-0.1	
zircon	trace	0.03-0.06	

Quartz forms anhedral grains that have slightly strained extinction and slightly sutured grain borders.

Anthophyllite forms elongate prismatic grains, mainly parallel to foliation. It is colourless and has parallel extinction.

Garnet forms anhedral, in part skeletal grains, in part elongated parallel to foliation. Most are intergrown coarsely to moderately with quartz. Most grains contain 2-5% inclusions of ilmenite-rutile and quartz.

Biotite forms disseminated flakes that are mainly oriented parallel to foliation. Pleochroism is from pale to medium brown.

Rutile forms disseminated anhedral to subhedral grains and a few lenses parallel to foliation, commonly intergrown with ilmenite and commonly associated with anthophyllite. Some rutile grains were altered along their margins to ilmenite.

Pyrrhotite forms disseminated patches 0.3-0.9 mm in size that commonly are associated with anthophyllite and commonly are elongate parallel to foliation.

Chalcopyrite forms anhedral grains, mainly intergrown coarsely with pyrrhotite.

Pyrite forms anhedral grains in a few patches of pyrrhotite-chalcopyrite and also forms inclusions in a few patches of chalcopyrite.

Apatite forms anhedral equant grains disseminated in quartz.

Zircon forms disseminated equant to slightly prismatic grains included in biotite; many grains are metamict and many have dark pleochroic halos.

Sample G33 **Patchy Garnet-Quartz-Plagioclase-Anthophyllite-Biotite/Chlorite Schist Veins, Replacement: Chlorite-Magnetite; Chlorite-Quartz-Calcite**

Megacrysts of garnet (containing inclusions of quartz, ilmenite, and rutile) are intergrown with patchy aggregates of quartz, plagioclase, anthophyllite (locally altered strongly to completely to chlorite-magnetite), and biotite (altered in patches to chlorite), with scattered patches of pyrrhotite-(chalcopyrite). Replacement patches and discontinuous veins in anthophyllite are of chlorite and magnetite. Braided veinlets in garnet are of chlorite with or without quartz and calcite.

mineral	**percentage**	**main grain size range (mm)**	
garnet	50-55%	10-40	
quartz	15-17	0.7- 2	
plagioclase	15-17	0.7-1.5	(a few grains up to 2.5 mm long)
anthophyllite	5- 7	1- 3	
biotite	2- 3	1- 2	
ilmenite	0.7	0.05-0.3	(a few up to 0.7 mm)
rutile	0.3	0.05-0.3	
chlorite	0.3	0.1-0.7	
pyrrhotite	0.2	0.2-0.5	
calcite	minor	0.03-0.1	
chalcopyrite	minor	0.07-0.2	(a few up to 0.3 mm across)
pyrite	minor	0.05-0.1	
veins, veinlets, replacement			
1) chlorite-magnetite	4- 5	0.02-0.03 (cl), 0.1-0.15 (mt)	
2) chlorite-quartz-calcite	0.5	0.02-0.07	

Garnet forms subrounded megacrysts that contain 5-15% inclusions of quartz, rutile, and ilmenite, and minor ones of biotite. In a few places, ilmenite inclusions occur in both garnet and adjacent quartz grains and some cross the border between the two host minerals. In one garnet grain, larger quartz inclusions are oriented in broad arcs (see scanned section).

Quartz forms anhedral grains in patches up to several mm across in some of which it is intergrown coarsely with plagioclase. Some quartz grains have slightly strained extinction.

Plagioclase forms anhedral grains intergrown coarsely with quartz. Alteration ranges from absent to very weak to sericite.

Anthophyllite is concentrated strongly in a band up to a few mm wide along one side of the section where it forms subparallel, elongate prismatic grains. It was replaced by patches and veinlike zones by intergrowths of chlorite and disseminated grains and clusters of a few subhedral to euhedral grains of magnetite (0.03-0.07 mm), with scattered anhedral grains and clusters of grains of quartz and of calcite (0.1-0.3 mm) and minor pyrite (probably after pyrrhotite).

Biotite forms disseminated flakes and clusters of a few flakes, commonly intergrown with garnet. Pleochroism is from light to medium brown. A few grains were altered moderately towards muscovite and are pleochroic from colourless to pale/light brown.

Ilmenite and rutile form disseminated grains in garnet. Ilmenite also forms scattered coarser grains intergrown with quartz.

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Most sulphide patches are from 0.1-0.5 mm in size and are dominated by pyrrhotite with minor to abundant chalcopyrite. One patch 1 mm across is a very fine intergrowth of pyrite and chalcopyrite, on one side of which is an intimate intergrowth of chlorite and chalcopyrite.

Chlorite, with or without much less abundant calcite, occurs in interstitial patches up to 2 mm in size, some of which consist of fan-textured flakes.

Some garnet grains are cut by braided veinlets up to 0.1 mm wide of chlorite with or without quartz and calcite. One of these contains a few patches of pyrrhotite and chalcopyrite.

Sample G34 Anthophyllite-Garnet-Quartz-(Biotite-Rutile-Plagioclase) Schist

Megacrysts of garnet are enclosed in foliated patches of anthophyllite and lesser quartz, with much less abundant patches of biotite, disseminated grains and clusters of grains of rutile, and grains of plagioclase and apatite. Garnet contains large inclusions of quartz and much less abundant smaller ones of rutile and ilmenite. Minor sulphide patches are of pyrite, chalcopyrite, and pyrrhotite.

mineral	percentage	grain size (mm)		percentage	grain size
anthophyllite	35-40%	0.7-3	apatite	0.7	0.3-0.5
garnet	30-35	5-25	ilmenite	0.4	0.05-0.15
quartz	15-17	0.5-3	zircon	0.1	0.1-0.3
biotite	4- 5	0.5-2	pyrite	0.1	1.5
rutile	2- 3	0.15-0.5	chalcopyrite	0.1	0.2-0.5
plagioclase	1- 2	0.5-1	pyrrhotite	minor	0.15-0.3

Garnet forms anhedral megacrysts that contain 5-10% inclusions of quartz (0.1-0.7 mm), 1-3% inclusions of rutile (0.1-0.2 mm), and up to 1% inclusions of ilmenite.

Anthophyllite forms bands of elongate prismatic grains in subparallel orientation that are wrapped around the large garnet grains. A few clusters are of equant grains averaging 0.05-0.1 mm across; these clusters probably are subperpendicular to the elongation of the grains. A few patches up to 2 mm across and several mm long are of fibrous intergrowths of subparallel grains (0.1-0.3 mm). Anthophyllite is colourless with parallel extinction and typical amphibole cross-sections. The optic sign is positive with a large 2V angle.

Quartz forms anhedral, equant grains with slightly strained extinction. It occurs in quartz-rich patches with minor anthophyllite, interstitial to anthophyllite in anthophyllite-quartz patches, and as irregular inclusions in garnet.

Biotite forms disseminated flakes and a few clusters of flakes, commonly bordering patches of anthophyllite and grains of garnet. Pleochroism is from pale to medium brown. A few grains were altered in lenses parallel to cleavage planes to quartz.

Plagioclase forms anhedral interstitial grains, some of which contain subhedral to euhedral grains of anthophyllite and biotite. Plagioclase is fresh.

Rutile forms disseminated grains included in garnet and interstitial to anthophyllite. It also forms several patches from 1.5-3.5 mm long of equant grains intergrown coarsely with anthophyllite and much less abundant ilmenite and quartz.

Apatite forms a few equant to prismatic, anhedral grains and clusters of up to several grains, mainly intergrown with anthophyllite and rutile. It is concentrated in bands of anthophyllite near margins of garnet grains.

Ilmenite forms anhedral, in part elongate grains intergrown with large patches of rutile as well as disseminated small inclusions in garnet.

Zircon forms anhedral to locally subhedral prismatic grains that commonly are associated with rutile and anthophyllite. Some have thin poorly developed pleochroic halos in surrounding anthophyllite grains.

Minor sulphide patches are up to 2 mm in size. The largest patch contains an elongate subhedral grain of pyrite, smaller patches of chalcopyrite, a patch of pyrrhotite with irregular veinlike patches of chalcopyrite and minor pyrite. Smaller patches are dominated by pyrrhotite and lesser chalcopyrite.

Sample G35 **Foliated Plagioclase-Quartz-Garnet-Biotite Gneiss**

The sample is a moderately banded gneiss dominated by plagioclase with lesser quartz and garnet, much less abundant biotite, and minor rutile/ilmenite, apatite, muscovite, and pyrrhotite.

mineral	percentage	main grain size range (mm)
plagioclase	40-45%	0.5-1.5; 0.05-0.2 (inclusions in garnet)
quartz	25-30	0.3-1.5 (a few up to 3 mm); 0.05-0.2 (inclusions in garnet)
garnet	17-20	0.5-3
biotite	7- 8	0.5-1
rutile/ilmenite	0.5	0.05-0.2
apatite	0.3	0.1-0.3
muscovite	0.1	0.2-0.5
pyrite	0.2	0.05-0.1
pyrrhotite	minor	0.05-0.1
chalcopyrite	minor	0.03-0.05
zircon	trace	0.01-0.03

Plagioclase forms anhedral grains intergrown coarsely with quartz. Grains range from fresh to altered slightly to sericite and locally to light greenish brown chlorite/sericite(?). Some garnet grains contain 2-5% subhedral to anhedral inclusions of plagioclase that were altered slightly to moderately to sericite. Scattered patches up to 0.3 mm in size are of ragged flakes and aggregates of muscovite; these probably are secondary after plagioclase.

Quartz forms anhedral grains intergrown coarsely with plagioclase. It also forms inclusions in garnet grains.

Garnet forms equant anhedral grains with widely varying abundances and mineralogy of inclusions, both between grains and within grains. Some grains are relatively free of inclusions (<2%). Some grains contain up to 30% rounded inclusions of quartz (0.05-0.15 mm). Some grains contain up to 5% subangular inclusions of plagioclase (altered slightly to sericite). Some grains contain 1-2% disseminated inclusions of ilmenite/rutile (0.03-0.05 mm). A few grains are intergrown coarsely with biotite.

Biotite is concentrated in clusters of several flakes and in trains parallel to foliation. Pleochroism is from light brown to medium brownish red.

Rutile and ilmenite occur together as disseminated patches up to 0.2 mm in size.

Apatite forms anhedral equant to elongate grains, mainly intergrown with biotite.

Muscovite forms scattered flakes and clusters of a few flakes, mainly intergrown with biotite.

Sulphide patches from 0.1-0.5 mm in size are dominated by anhedral to subhedral pyrite with lesser chalcopyrite. Many pyrite patches contain interstitial zones of non-reflective material, suggesting that at least some of it is secondary after pyrrhotite. A few patches consist of intergrowths of extremely fine grained marcasite and non-reflective material, a typical alteration product of pyrrhotite.

Zircon forms equant anhedral grains included in biotite and surrounded by dark pleochroic halos. Many grains are metamict.

List of Photographs

photo	section	description
01	GT01B1	garnet porphyroblasts with inclusions of quartz, ilmenite, and minor plagioclase; seam of ilmenite-rutile-pyrrhotite-chalcopyrite-(pyrite) between two garnet grains; grains of quartz, plagioclase, and biotite on margins of garnet.
02	GT01B2	to the left: biotite (with inclusions of apatite and zircon, the latter surrounded by dark pleochroic halos), intergrown with patches of muscovite, rutile, apatite, and quartz; to the right: garnet grain with scattered inclusions of quartz and minor ones of ilmenite.
03	GT01B3	rounded garnet grains with scattered inclusions of quartz enclosed in groundmass dominated by biotite and muscovite with lesser quartz and disseminated patches of ilmenite (some along cleavage planes of muscovite); one grain of apatite; several dark pleochroic halos in biotite (bordering zircon grains outside the section); lower left: quartz-rich band with a grain of apatite and a minor seam of biotite.
04	GT01B4	above: garnet with a large inclusion of plagioclase-quartz-(biotite) and a few small inclusions of quartz; in the middle: band of biotite containing patches of sulphides, mainly pyrrhotite (with exsolution patches of pentlandite) and pyrite, with lesser chalcopyrite; below: intergrowth of plagioclase and lesser quartz with minor ilmenite and rutile.
05	GT041	garnet grain with abundant inclusions of quartz and mainly smaller ones of sphene, with lesser inclusions towards the outer margin. In the core of the garnet grain is a coarse patch of quartz (top left of photo). Bordering garnet is an intergrowth of hornblende and plagioclase with lesser quartz and biotite and moderately abundant sphene (mainly included in hornblende).
06	GT042	garnet grain with clusters of sphene (with cores of ilmenite), equant, subrounded to subangular inclusions of quartz, and one flake of biotite.
07	GT043	garnet grain containing abundant inclusions of quartz and minor ones of sphene and ilmenite; intergrown with quartz, hornblende, and biotite, with minor sphene.
08	GT044	garnet grain intergrown with quartz and plagioclase and replaced in patches by epidote, pyrite, and biotite with minor chalcopyrite included in pyrite and in one patch of biotite); bordered by hornblende, chlorite, K-feldspar, and quartz.
09	GT045	to the left: garnet grain with a core containing abundant inclusions of sphene and lesser ones of quartz and minor ones of ilmenite; and a rim (to the right)

with much fewer inclusions; garnet is cut by a few subparallel branching veinlets of chlorite; to the right: biotite containing minor inclusions of zircon with weak dark pleochroic halos and minor inclusions of quartz.

List of Photographs

photo	section	description
10	GT071	to the left: cluster of subhedral garnet grains with interstitial patches of quartz and locally abundant biotite; to the right: muscovite, plagioclase (altered moderately to pale brown chlorite/sericite) quartz, and minor biotite.
11	GT072	garnet grains (with few inclusions of quartz and minor ilmenite) with interstitial patches of ilmenite-rutile, plagioclase (altered in patches strongly to brown chlorite-sericite(?), and quartz; veinlets of chlorite cut garnet grains.
12	GT072	fine to very fine grained garnet with interstitial biotite and muscovite (with lenses of ilmenite parallel to cleavage and irregular patches of rutile).
13	GT073	to the left: garnet grain with abundant inclusions of ilmenite and quartz and interstitial patches of chlorite; to the right: garnet grain with much less abundant inclusions of ilmenite, quartz, and altered plagioclase; at the bottom: interstitial patches of quartz and biotite-muscovite.
14	GT074	moderately foliated intergrowth of quartz, biotite, and muscovite, with ragged, coarsely fractured grains of garnet, minor grains of rutile, and trace chalcopyrite.
15	G31	to the left: garnet with abundant small inclusions of ilmenite and a few larger inclusions/interstitial patches of quartz, biotite-chlorite, ilmenite, and minor apatite; to the right: cluster of subparallel anthophyllite grains.
16	G31	garnet grains with disseminated inclusions of ilmenite-(rutile) and quartz; interstitial patches of biotite, chlorite, ilmenite-rutile, quartz, and sulphides (dominated by pyrrhotite with much less abundant chalcopyrite and pyrite).
17	G32	intergrowth of garnet with numerous small inclusions of rutile-(ilmenite) and a few small and large inclusions of quartz, quartz, elongate prismatic grains of anthophyllite, a few patches of biotite-(chlorite) (mainly associated with anthophyllite), and a patch of pyrrhotite.
18	G33	garnet grain with interstitial quartz grains, both with lensy to equant inclusions of ilmenite; veinlet of quartz-chlorite.
19	G33	bottom 2/3 of photo: parallel aggregate of prismatic anthophyllite grains replaced by veinlike zone of finer grained chlorite with disseminated patches of magnetite and

		minor pyrite and calcite, also anthophyllite replaced in irregular patches on either side of the vein by chlorite and magnetite with scattered grains of quartz; upper 1/3 of photo: quartz which shows no indication of a crosscutting vein.
20	G34	top right: garnet grain with coarse inclusions of quartz; lower left: prismatic grains of anthophyllite in parallel orientation with irregular patches rutile, a large grain of apatite, and a subhedral grain of zircon.

List of Photographs

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photo	**section**	**description**
21	G34	to the upper left: large garnet grain with interstitial patch of quartz with minor ilmenite, rutile, and biotite; garnet is cut by a veinlet of chlorite; lower right: intergrowth of prismatic anthophyllite with a large patch of rutile and smaller patches of ilmenite, with minor biotite.
22	G35	lower right: biotite with abundant tiny inclusions of zircon with dark pleochroic halos; lower right: anhedral garnet grain with abundant inclusions of quartz that are unevenly distributed; upper area: intergrowth of plagioclase and quartz with scattered biotite flakes; between biotite and garnet is a thin zone of plagioclase and quartz with a few elongate grains of ilmenite.
23	G35	garnet grain with a few large inclusions of plagioclase and a few small ones of quartz, one large patch of biotite and a small biotite flake, and a small grain of ilmenite; surrounded by an intergrowth of plagioclase, biotite, and quartz, with minor muscovite (in biotite).