NGU Report 96.060

Rock-magnetic properties, oxide mineralogy, and mineral chemistry in relation to aeromagnetic interpretation and the search for ilmenite reserves

Part I

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REPORT

Report no.: 96.060	ISSN 0800-3416	Grading: ÅPEN

Title:

Rock-magnetic properties, oxide mineralogy, and mineral chemistry in relation to aeromagnetic interpretation and the search for ilmenite reserves

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County: Rogaland	Commune: Sokndal
Map-sheet name (M=1:250.000) Mandal	Map-sheet no. and -name (M=1:50.000) 1311-IV Sokndal
Deposit name and grid-reference:	Number of pages: 281 Price (NOK): Kr. 645,- Map enclosures: 2

Fieldwork carried out:	Date of report:	Project no.:	Person responsible:
July-August 1995	29.05.1996	2663.00	[signature]

Summary:

The understanding of the rock-magnetic properties of the various oxide ores and country rocks in the vicinity of the Tellnes Deposit is a first step toward a successful interpretation of the aeromagnetic maps (NGU Report 96.059). Specifically it has been made obvious that the region contains rocks with very high magnetic susceptibility and low remanence giving rise to large positive induced aeromagnetic anomalies, and it also contains rocks with very strong reversed remanent magnetization giving rise to large negative magnetic anomalies. Measured Q values in the region range from 0.1 to 159, supporting the interpretation that both remanent and induced aeromagnetic anomalies were recorded in the region. Samples from selected anomalies were further measured to characterize their rock magnetic properties and to aid in identifying the magnetic minerals in the different rock bodies that are attributed to creating the magnetic anomalies. In selected samples detailed reflected-light microscopy was performed to identify the magnetic minerals. A subset of these samples was chosen for microproble analyses. The chemical compositions of the samples were correlated with the mineral phases, exsolution and oxidation-exsolution phases.

Oxide Mineral Correlation with Magnetic Sources:

1) Hemo-ilmenite: There is a very strong correlation between a remanence controlled aeromagnetic signatures and the presence of hematite exsolution in the ilmenite if there is no coexisting magnetite; if only hemo-ilmenite is present in the rock, as has been observed in some Åna Sira anorthosite samples, then the aeromagnetic signature is negative. If ilmenite with hematite exsolution is coexisting with magnetite then the magnetite tends to partially or completely dominant the aeromagnetic signature.
2) Magnetite: When magnetite is the dominant oxide and the ilmenite lacks hematite exsolution lamellae the magnetic response is strongly positive representing a strong induced signature parallel to the present day earth's magnetic field.
3) Magnetite-Ilmenite and Hematite-Ilmenite Exsolution in Silicates: An understanding of the role of magnetite-ilmenite and ilmenite-hematite exsolution in the silicates is fundamental to an accurate aeromagnetic interpretation to this region. It appears that when there are abundant magnetite-ilmenite exsolution in the silicates, these very fine lamellae are the dominant contributors to the aeromagnetic signature. If we can find a good correlation between the norite bodies which contain exsolution in the pyroxenes and in addition are rich in ilmenite than this will become a very important geophysical and petrological exploration tool.

Keywords: geofysikk	magnetitt	mineralforekomst
petrofysikk	kjemisk analyse	
ilmenitt	mikrosondeanalyse	fagrapport

CONTENTS

ROCK-MAGNETIC PROPERTIES, OXIDE MINERALOGY, AND MINERAL CHEMISTRY IN RELATION TO AEROMAGNETIC INTERPRETATION AND THE SEARCH FOR ILMENITE RESERVES

1. INTRODUCTION

Previous reports (Bruckshaw, 1956; McEnroe, 1995) have pointed to the necessity of understanding the rock-magnetic properties of the various oxide ores and country rocks in the vicinity of the Tellnes Deposit as a first step toward a successful interpretation of aeromagnetic maps. Specifically, it has been made obvious that the region contains rocks with very high magnetic susceptibility and low remanence giving rise to large positive induced aeromagnetic anomalies, and it also contains rocks with very strong reversed remanent magnetization giving rise to large negative magnetic anomalies. A preliminary geologic interpretation of the new aeromagnetic map (NGU-report 95.120) was given by McEnroe, 1995, and is partly reproduced here.

1.1 Preliminary Interpretation of the Aeromagnetic Map (from McEnroe, 1995)

The aeromagnetic map (Figure 1.1) can be divided neatly into regions of high positive magnetic intensity over the norites and mangerites of the Bjerkreim-Sokndal lopolith and regions of negative magnetic intensity over the Åna-Sira and Håland anorthosites (Figure 1.2). The early work of Poorter (1972), further supported by a regional study by Stearn and Piper (1984), indicated that many of the rocks contain a reversed (negatively polarized) magnetic remanence. The rocks of the Bjerkreim-Sokndal lopolith still show a strong positive aeromagnetic anomaly as well as a strong positive correlation between magnetic intensity and topography due to the inability to drape perfectly the flight lines in this topographically steep region. This can only be explained if: 1) the field induced in the rocks by the present earth's field greatly outweighs the remanence or 2) there is a strong component of viscous remanence parallel to the earth's present day field. Such an easily induced field is usually explained by an abundance of coarse multi-domain magnetite, which is consistent with the known mineralogy

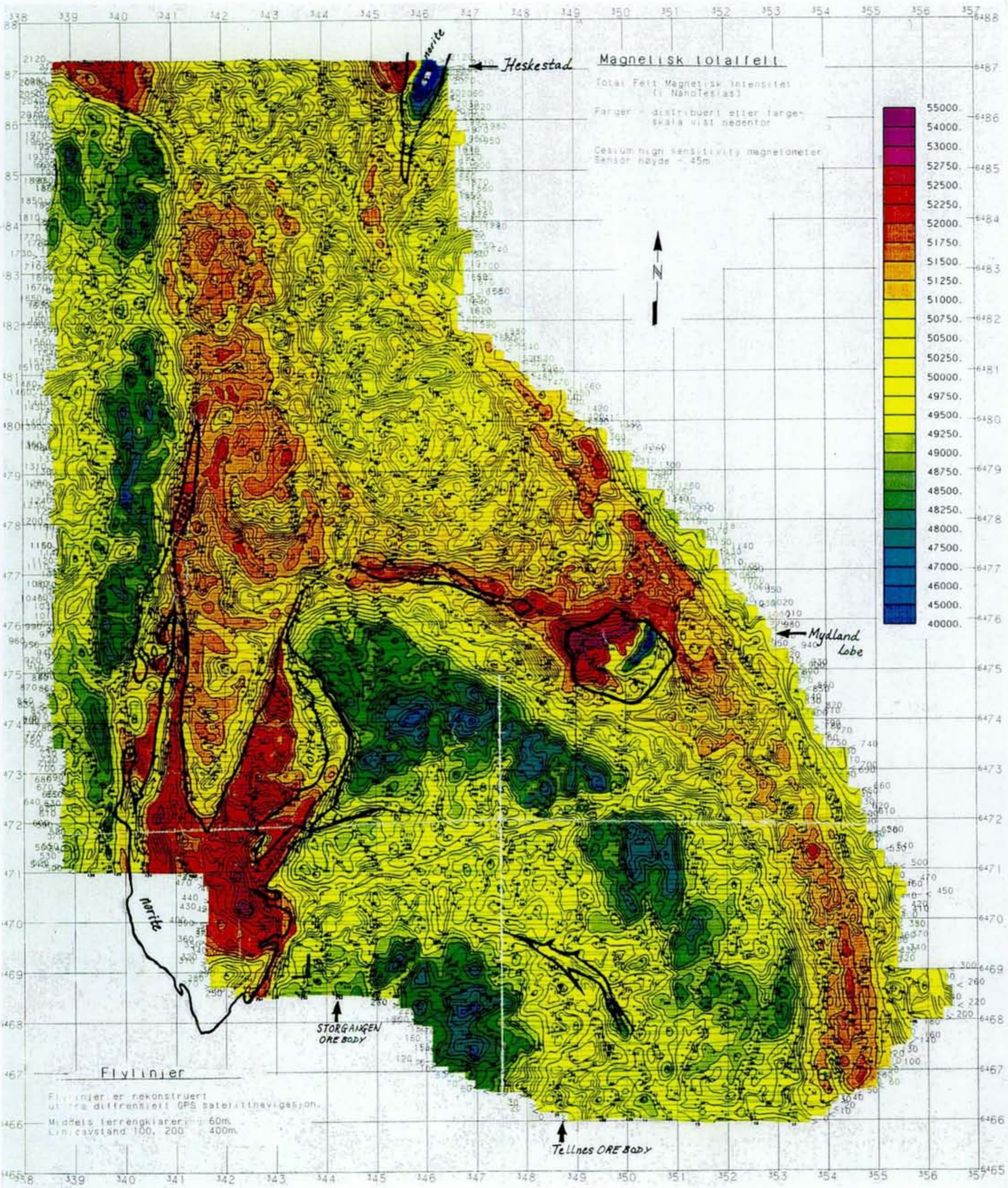


Figure 1.1 Aeromagnetic map of the Sokndal region. Details are described in NGU report 95.120.

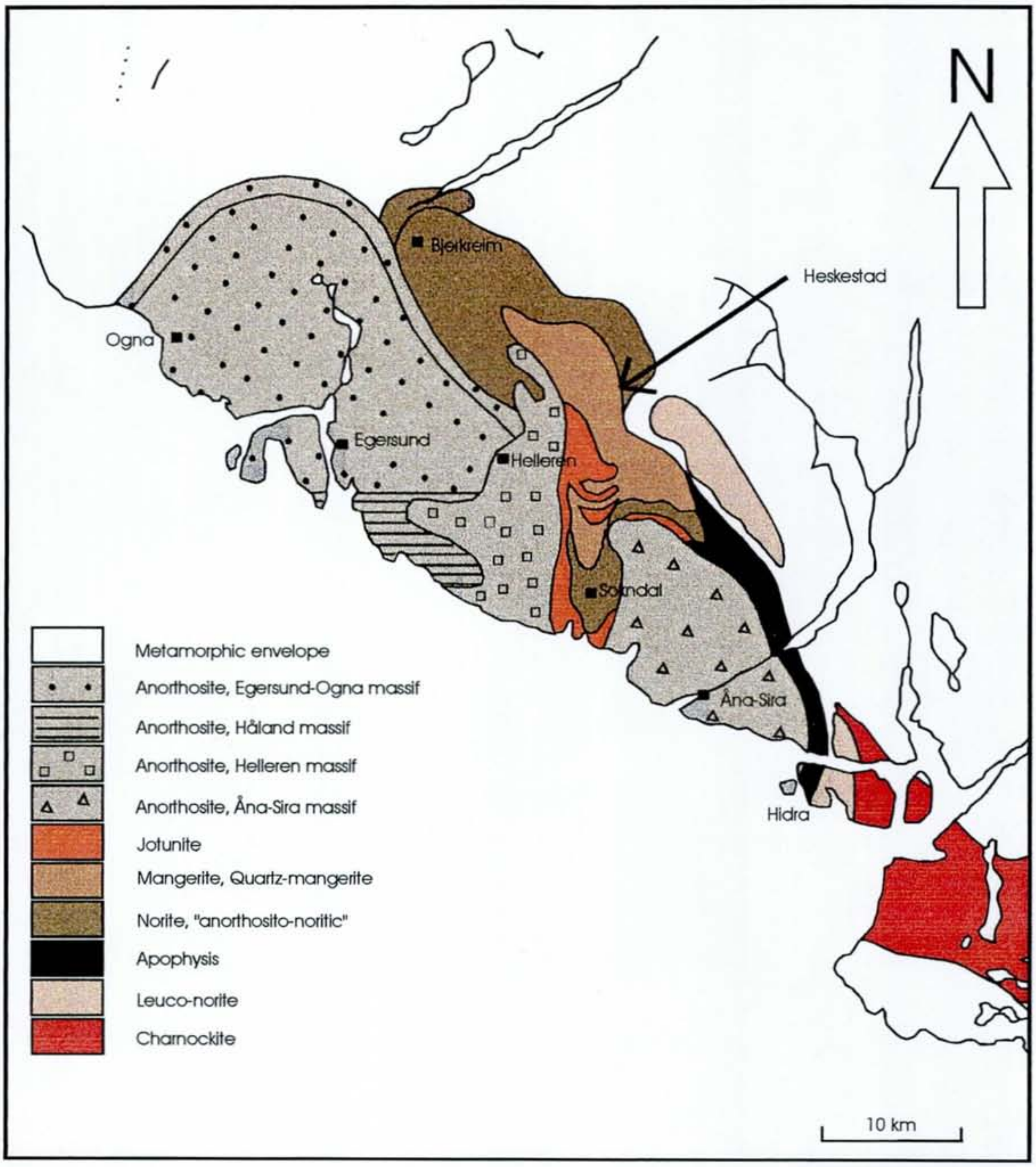


Figure 1.2 Simplified geological map from NGU report 96.059 (modified from Duschene & Michot, 1987).

and petrography of the lopolith, particularly the oxide-rich cumulate horizons in the norites which stand out strongly even in contrast with the mangerites. Within the lopolith region two special strong positive anomalies stand out, one at Mydland and one at Heskestad (Figure 1.1). Each of these positive anomalies is accompanied by a strong negative anomaly to the southeast, whereas for normal induced anomalies in the northern hemisphere, the low is usually to the north. These two regions were targeted for special study to determine to what extent the anomalies are influenced by the shape of the norite bodies and to what extent by a combination of induced magnetization and remanence.

The areas of anorthosites stand out as areas of moderate to strong negative anomalies, and furthermore show a remarkable negative correlation between magnetic intensity and topography, i. e. hills commonly show up as regions of more negative magnetic intensity, and valleys as areas of higher magnetic intensity, a sure sign that magnetic remanence is playing a dominant role. In that the rocks of this negative anomaly region appear to be dominated by members of the hematite-ilmenite series, a mineralogical explanation of the strong remanence (high coercivity) involving ilmenite is to be sought, though the exact mechanism by which ilmenite holds a strong remanence is still not understood. Within the large areas of anorthosite there are regions of particularly strong negative anomaly, including a central region near Jøssingfjord in the Åna-Sira massif, and broad regions not far from the northeast and north margins of the Åna-Sira massif and east margin of the Håland massif. At present there are no known petrographic differences in the anorthosite to explain these magnetic differences. One possibility, for the slightly less negative anomalies in anorthosite areas is small mafic dikes within anorthosite. Though on average the anorthosite has a very large Q value, the susceptibility is very low and a small percent of multi-domain magnetite in mafic dikes could overwhelm the contribution of remanence from high-coercivity hematite or hemo-ilmenite in anorthosite. Another possibility is a weak normal polarity NRM component in this part of the anorthosite.

Within the larger picture, the magnetic anomalies associated with the Tellnes ilmenite norite are only obvious on close observation (Figure 1.1). The anomaly over the present open-pit mine is mainly a slight positive one over the northern and central portions and might be ascribed to low topography. From the southeast end of the open pit southeastward to the end of the ilmenite norite the anomaly is a sharp negative one, standing out from the normal magnetic low of the immediately surrounding anorthosite, but not so negative as the broad marginal negative anomalies over the anorthosite. Clearly the search for additional deposits such as the Tellnes requires an understanding of the details of the magnetic polarity and shape of the currently mined body, the relationships between mineralogy and remanence in different parts of the norite, and calculation of a magnetic response that fits all the facts.

1.2 Program of Rock-Magnetic Research

In the quest for a better understanding of the aeromagnetic anomalies, a rock-magnetic and paleomagnetic sampling program was initiated in July 1995 and completed in August 1995. The samples were studied by Suzanne McEnroe to obtain the following kinds of information:

1) Magnetic susceptibility,
2) Natural remanent magnetization;
3) Q value, the ratio between natural remanent magnetization and induced magnetization that determines whether induced or remanent magnetization will dominate the aeromagnetic signature;
4) Orientation of remanent magnetization both before and during progressive AF or thermal demagnetization that reflects on the aeromagnetic signature as well as the nature of magnetic carriers;
5) Measurements of isothermal remanent magnetization (IRM) and demagnetization of isothermal remanent magnetization (IRM Demag) that assist in identifying magnetic carriers;
6) Reflected-light microscopy on polished thin sections to characterize the magnetic mineralogy including grain size and exsolution features likely to effect the magnetic character;

7) Electron probe analyses of oxides and silicates in selected samples to attempt to understand the relations between mineral compositions and magnetic properties. In the case of the Tellnes Deposit itself, these analyses also can be used to help understand the relation between magnetic properties and the grade of the ore, including such components in ilmenite as MgO, Cr_2O_3 and V_2O_3.

1.3 Sample Collection

Rock-magnetic and paleomagnetic sampling was initiated in July 1995 by Suzanne McEnroe and Peter Robinson and completed in the August of 1995 up by Lars Petter Nilsson and Henrik Schiellerup. A series of sixty-three oriented blocks were collected to determine the orientation of magnetic remanence and various rock-magnetic properties. The locations of those samples on which detailed studies are included in this report are given in Figure 1.3.

There were three main objectives: 1) To obtain a spectrum of samples from the lopolith and related bodies, in which it is suspected that the induced magnetization completely overwhelms the remanence; 2) To obtain a broad spectrum of negatively polarized anorthosites in which it is believed that remanence is greatly dominant, both from the normal magnetic lows and the extreme magnetic lows. 3) To obtain a spectrum of samples from the Tellnes ilmenite norite. The open pit mine was well sampled, including ilmenite norite, the surrounding anorthosite, and a later diabase dike. Each sample was located as accurately as possible on the mine map by Kari Berge and will be surveyed in later so that the samples can be placed in a three-dimensional context along with other petrologic and chemical characteristics (Kullerud, 1996). We also sampled southeast of the open pit at a somewhat weathered exposure at the extreme southeast end and most negative part of the ilmenite norite. Here an oriented sample was obtained about 3m from the collar of one the diamond drill holes. In this connection it would be of interest to sample the old drill cores for measurements of susceptibility and remanence.

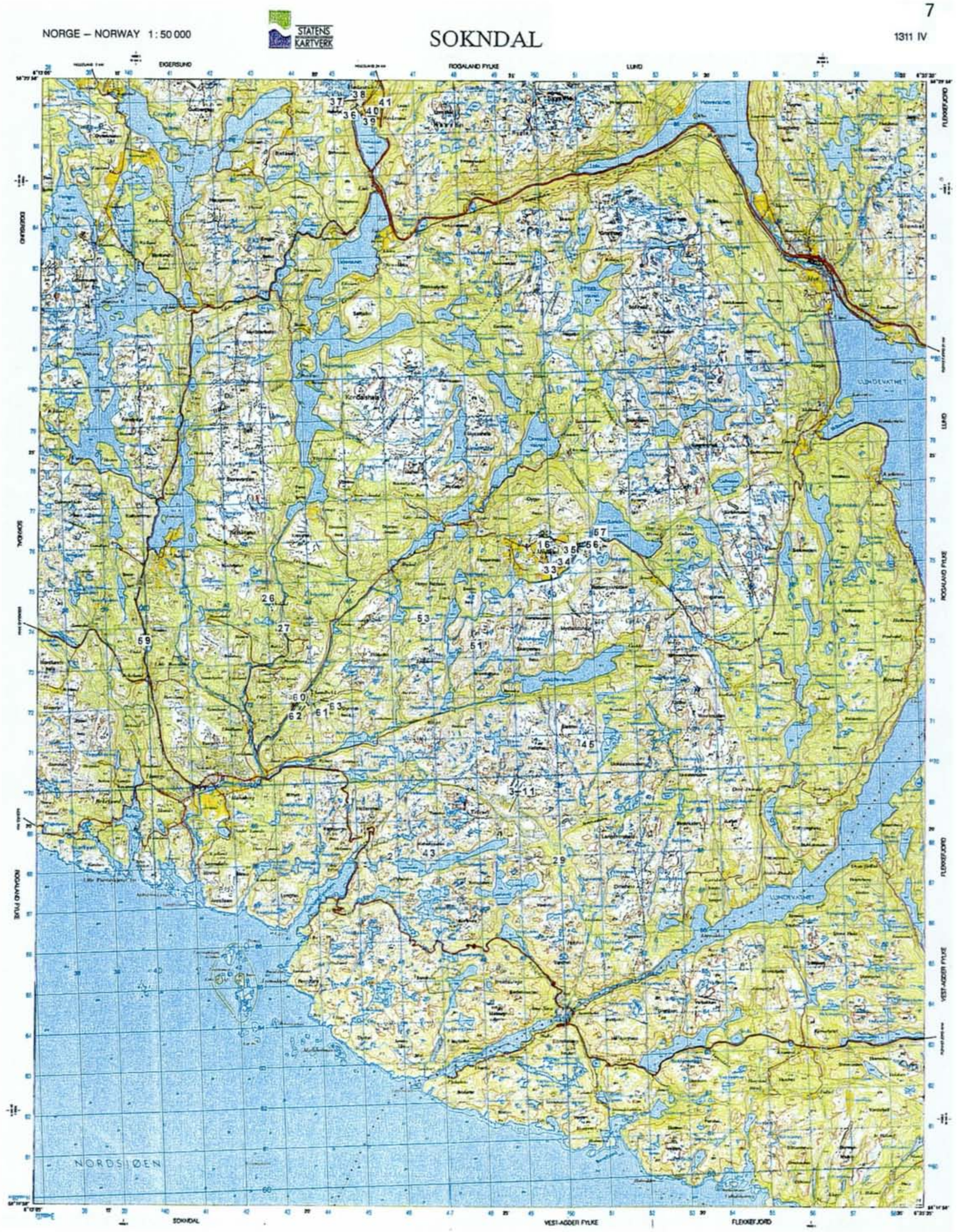


Figure 1.3. Topographic base of the Sokndal map sheet (13114) with sample localities that are discussed in detail in this report.

2. LABORATORY MEASUREMENTS OF ROCK-MAGNETIC PROPERTIES

A brief overview of typical magnetic measurements is given here. Listed in Table 3.1 are magnetic susceptibility (k) and natural remanent magnetization (D, I and J) measurements and Q Value (Koningsberger ratio) determinations.

2.1 Magnetic Susceptibility (k)

Magnetic susceptibility is the capacity of the sample to acquire magnetization. The magnetization is induced by the applied field (geomagnetic field). The induced magnetization of a rock primarily depends on its susceptibility.

2.2 Natural Remanent Magnetization

The natural remanent magnetization (NRM) is the summation of all the components of magnetization acquired, both primary and secondary. The declination, as measured in a sample, is the angle between true north and the horizontal component of the magnetic field vector. The inclination is the angle from the horizontal plane to the magnetic vector as measured in the vertical plane. The intensity of magnetization J, is the measure of pole strength per unit area ($Am/m^2 = A/m$).

The NRM directions were determined for each core using a Molspin fluxgate magnetometer at the University of Massachusetts Paleomagnetic Laboratory. For the analysis of the stability of magnetization, samples are subjected to a series of experiments in relationship to applied field (alternating field demagnetization) and increasing temperature (thermal demagnetization).

Table 3.1 Remanence, Susceptibility Measurements and Calculated Q Values

Area	Sample	D	I	J (A/M)	$K*10^{-3}$	Q
Tellnes Mine	TE3-1	224	-10	10.1	45.4	5.6
	TE3-2	241	-77	6.8	32.8	5.3
	TE3-3	332	-81	6.8	37.7	4.6
	TE3-4	286	-70	7.9	35.0	5.7
	TE3-5	245	-45	6.4	38.4	4.2
	TE3-6	253	-52	6.4	35.2	4.6
	TE3-7	304	-78	8.2	41.0	5.1
	TE3-8	290	-80	6.4	30.1	5.4
	TE3-9	287	-79	5.7	39.0	3.7
	TE3-10	343	-77	6.9	74.3	2.4
	TE4-1	335	-86	3.3	28.8	2.9
	TE4-2	251	-86	4.8	31.3	3.9
	TE4-3	326	-79	3.7	31.5	3.0
	TE4-4	306	-80	4.6	30.0	3.9
	TE4-5	322	-74	4.1	31.1	3.3
	TE4-6	232	-84	4.1	30.4	3.4
	TE4-7	249	-49	3.7	30.8	3.1
	TE4-8	161	-81	5.1	29.9	4.3
	TE4-9	198	-77	5.7	21.5	6.7
	TE4-10	224	-64	3.1	25.6	3.1
	TE11-1	337	-11	5.2	17.9	7.4
	TE11-2	323	-8	18.1	15.3	31.0
	TE11-3	296	-74	18.6	18.3	26.2
	TE11-4	260	-79	16.7	16.2	26.1
	TE11-5	326	-8	6.3	15.1	10.6
	TE11-6	320	-6	8.3	18.0	11.7
	TE11-7	298	-5	3.8	14.5	6.7
	TE11-8	306	-6	7.6	1.6	11.4
	TE11-9	320	-9	3.3	14.0	6.0
Southern end of mine, not part of active mine						
	TE29-1	278	-63	19.4	104	4.7
	TE29-2	285	-64	20.2	95	5.4
	TE29-3	309	-66	19.6	110	4.5
	TE29-4	61	-67	14.7	95	3.9

Table 3.1 (continued)

Bjerkrem-Sokndal Lopolith, Mydland Area
Aeromagnetic High Oxide-rich Cumulate

	Sample	D	I	J (A/M)	K*10-3	Q
Mydland	TE16-1	240	20	24.6	189	0.3
	TE16-2	52	58	4.6	174	0.7
	TE16-3	31	57	4.3	116	0.9
	TE16-4	20	64	44.8	93	0.6
	TE16-5	220	5.9	88.2	185	1.2
	TE16-6	31	57	43.1	231	0.5

Aeromagnetic Low - Oxide rich Cumulate Norite

	Sample	D	I	J (A/M)	K*10-3	Q
Mydland	TE33-1a	262	-31	0.74	24.3	0.7
	TE33-1b	218	-80	5.3	17.7	7.6
	TE33-2a	193	-65	10.2	20.2	12.8
	TE33-2b	185	-64	8.5	18.2	11.8
	TE33-3a	166	-63	9.7	21.5	11.4
	TE33-3b	171	-61	8.8	23.8	9.8
	TE33-4a	192	-68	9.8	18.9	13.2
	TE33-4b	188	-70	10.8	20.9	13.1
	TE33-5a	201	-61	9.7	22.5	10.9
	TE33-5b	200	-61	10.2	18.7	13.8
	TE33-6a	192	-69	10.2	16.7	15.5
	TE33-6b	200	-72	10.4	22.4	11.8
	TE34-1a	47	-5.0	5.3	45.4	3.0
	TE34-1b	342	+8.0	4.5	41.4	2.8
	TE34-2a	164	-54	4.0	36.9	2.8
	TE34-2b	154	-56	8.1	45.7	4.5
	TE34-3	157	-55	4.5	38.5	3.0
	TE34-4	148	-57	5.2	42.5	3.1
	TE34-5	157	-56	6.9	42.7	4.1
	TE34-6	155	-59	7.5	43.6	4.4
	TE34-7	136	-80	26.7	86.7	7.8
	TE34-8	159	-56	4.6	44.6	2.6
	TE34-9	163	-59	5.0	52.2	2.3
	TE34-10	146	-55	4.5	40.8	2.8
	TE35-1	208	+80	5.2	27.3	4.8
	TE35-2	120	+6.0	0.3	17.2	0.4
	TE35-3	259	-52	0.6	28.8	0.5
	TE35-7	119	-3.9	0.2	20.8	0.2
	TE35-8	135	-65	0.3	35.0	0.2
	TE56-1	280	-2.0	10.2	47.2	5.4
	TE56-1a	276	-14	10.4	58.8	4.5
	TE57-1a	345	-14	2.8	24.1	3.0
	TE57-1b	327	-6.0	3.9	15.6	6.3

Table 3.1 (continued)

Bjerkreim Lobe Cumulates Heskestad Area
Aeromagnetic - High

Sample	D	I	J (A/M)	K*10^{-3}	Q
TE36-1	359	-68	2.8	89.9	0.8
TE36-2	164	+76	9.0	78.8	2.9
TE36-3	275	-43	7.2	76.9	2.4
TE36-4	355	-58	2.3	95.7	0.6
TE36-5	158	+75	9.2	80.7	2.9
TE36-6	325	-52	2.4	87.6	0.7
TE37-1	148	-33	1.9	50.2	1.0
TE37-2	111	-47	1.9	52.7	0.9
TE37-3a	58	-16	12.3	46.4	6.7
TE37-3b	38	-34	11.5	67.5	4.3
TE37-4a	124	-49	2.1	53.4	1.0
TE37-4b	148	-33	3.2	54.5	1.5
TE37-5	131	+4	1.6	53.9	0.8
TE37-5a	36	-83	1.3	73.0	0.5
TE38-1	189	-12	1.0	72.5	0.4
Heskestad Aeromagnetic - Low					
TE39-1a	112	-82	29.2	72.2	10.3
TE39-1b	116	-81	34.3	80.1	10.9
TE39-2a	43	-88	26.7	72.3	9.4
TE39-2b	351	-86	23.8	79.3	7.6
TE39-3	8.4	-87	30.1	88.4	8.6
TE39-4	84	-86	28.6	77.0	9.4
TE39-5	231	-67	33.0	84.5	9.9
TE39-6	40	-85	33.1	84.4	10.0
TE39-7	356	-86	19.8	63.8	7.8
TE39-8	127	-85	28.5	80.3	9.0
TE39-9	34	-87	22.9	77.4	7.5
TE40-1	353	-48	33.1	115	7.3
TE40-1a	345	-39	27.3	114	6.1
TE40-2	327	+7	20.4	90.1	5.7
TE40-3	317	+27	15.6	119	2.6
TE40-4	332	+18	15.1	79.9	4.8
TE40-6	328	+11	14.7	112	3.3
TE40-7	51	+31	17.8	120	3.8
TE40-8	298	-60	12.8	100	3.3
TE41-1a	307	+49	3.5	94.2	0.7
TE41-1b	276	+41	3.3	90.3	1.0
TE41-1c	300	+79	3.1	104	0.9
TE41-2a	102	-62	3.0	96.5	0.8
TE41-2b	185	-74	3.7	68.2	1.4

Table 3.1 (continued)

Heskestad Aeromagnentic-Low (continued)

	Sample	D	I	J (A/M)	K*10-3	Q
Heskestad	TE41-3a	176	-51	4.2	104	1.0
	TE41-3b	171	-62	4.8	117	0.6
	TE41-4a	199	-67	3.7	86.5	1.1
	TE41-4b	179	-66	3.4	110	0.8
	TE41-5a	358	-49	23.4	93.5	6.4
	TE41-5b	13	-34	23.1	85.0	6.9
	TE41-6	261	-58	20.3	97.6	5.3
Urdal	TE59-1a	95	+24	15.7	93.9	4.2
	TE59-1b	159	+32	21.0	114	4.7
Sandbekk	TE60-1a	61	+27	7.1	117	1.5
	TE60-1b	42	+15	7.3	159	1.2
	TE60-2a	317	+67	30.4	104	7.4
	TE60-2b	353	+79	28.7	157	4.6
	TE60-2c	320	+63	3.6	185	0.5
	TE60-3a	13	+10	1.9	83.6	0.6
	TE60-3b	24	+8	5.0	47.3	2.7
	TE60-4a	41	+8	4.3	150	0.7
	TE60-4b	33	+29	9.3	96.0	2.5
	TE60-4c	45	+13	112.2	134	21.2
	TE61-1a	215	-45	6.2	194	0.8
	TE61-1b	209	-47	7.4	245	0.8
	TE61-2	223	+40	110.5	326	8.6
	TE62-1	232	-68	70.7	257	6.9
	Te62-1a	38	-71	100.4	313	8.3
	TE62-2a	284	-50	71.7	251	7.4
	TE62-2b	287	-48	92.1	232	10.1
	TE62-3	31	+25	25.5	409	1.6
	TE62-4	26	+39	14.8	292	1.3
	TE62-5	27	+39	21.8	436	1.3
	TE63-1a	69	+4	87.3	256	8.7
	TE63-1b	72	+8	70.6	167	10.7
	TE63-2a	188	-26	4.0	164	0.6
	TE63-2b	181	-30	3.3	162	0.5
	TE63-3	359	+29	16.7	283	1.5
	TE63-4a	172	+62	90.4	267	8.6
	TE63-4b	209	+54	73.0	264	7.0

Table 3.1 (continued)

Bjerkrem-Sokndal Lopolith Oxide-rich Cumulate, Bakke Area

	Sample	D	I	J(A/M)	$K*10^{-3}$	Q
Norite	TE26-1	124	+32	10.2	371	0.7
	TE26-2	2	-34	8.1	370	0.6
	TE26-3	278	+29	15.7	372	1.0
	TE26-4	278	+29	15.7	397	1.0
	TE26-5	112	+45	10.4	373	0.7
	TE26-6	209	+7	9.7	378	0.6
Norite	TE27-1	209	+5	10.6	224	1.2
	TE27-2	44	-7	9.4	225	1.1
	TE27-3	226	-5	10.3	171	1.5
	TE27-4	211	+9	9.5	213	1.1
	TE27-4a	221	+0	7.8	192	1.0
	TE27-5	209	+7	9.2	224	1.0
	TE27-6	209	+7	91.7	224	1.1
	TE27-7	221	-5	12.4	208	1.2
	TE27-8	102	+42	51.6	268	0.5
	TE27-9	211	+9	7.8	192	1.0
Åna Sira Anorthosite						
	TE2-1	298	-59	6.9	1.1	159
	TE2-2	295	-68	5.1	1.2	108
	TE2-3	247	-72	3.3	2.5	34
	TE10-2	291	-57	1.4	2.4	15
	TE10-3	302	-73	1.9	1.1	44
	TE43-1	14	+16	7.7	1.6	122
	TE43-2	61	-68	5.6	3.1	46
	TE45-1	78	-61	1.8	0.4	114
	TE45-2	38	-60	2.0	0.6	85
	TE45-3	97	-54	2.2	0.8	70
	TE51-1a	165	-52	4.9	5.2	24
	TE51-1b	163	-54	8.3	1.6	132
	TE51-2a	136	-39	3.8	5.6	17
	TE51-2b	130	-41	7.9	1.9	106
	TE51-3	140	-50	10.4	3.3	80
	TE51-4	170	-55	8.3	2.0	105
	TE51-5	157	-49	6.3	5.9	27
	TE53-1a	159	-54	8.3	2.3	92
	TE53-1b	159	-53	7.4	2.2	85

2.3 Alternating Field Demagnetization

For alternating field demagnetization spectra the data is examined for coercivity, or how hard the magnetization is. This refers to how high a magnetic field must be applied to remove the remanent magnetization. This is influenced by mineralogy, crystal morphology, size, and defects. The intensity of the magnetic field needed to randomize the magnetic signature in a given crystal is related to the relaxation time for that particular crystal. High coercivity crystals do not demagnetize easily, and therefore have a stable remanence which usually causes the enclosing rock to have a high Q value.

2.4 Thermal Demagnetization

For thermal demagnetization studies, the important point is the temperature at which a magnetic grain obtains its magnetic ordering, and hence records the direction of the earth's magnetic field. This is referred to as the blocking temperature, which is slightly below the Curie temperature of ferrimagnetic magnetite, or the Néel temperature of anti-ferromagnetic hematite. As a rock cools, it acquires magnetization over different temperature ranges below the Curie (Néel) temperature(s) of its different crystal constituents. The Curie temperature for a particular crystal is a function of the chemical composition. The purer the grain of magnetite or hematite the higher the Curie or Néel temperature. The addition of contaminants usually lowers the acquisition temperature. The predominant magnetic carriers found in these igneous rocks are magnetite (Fe_3O_4), and hemo-ilmenite ($FeTiO_3$-Fe_2O_3). The most common contaminant of magnetite is Ti, but Mg, Al, Cr and V are also found. In the hemo-ilmenites the common contaminants are Mg, Cr, Al, and V. The most magnetic oxide is commonly magnetite with a Curie temperature near 580 degrees C. Both Curie temperature and magnetic intensity are lowered by Ti substitution. Subsequent to crystallization, oxidation-exsolution of the Ti magnetite grains may occur, having profound effects on both the Curie temperature and the coercivity of the crystal. By contrast hematite has very low magnetic intensity but a very high

Néel temperature near 650 degrees C. Several lines of research indicate that ordered ilmenites in the composition range Ilm $_{70-80}$ behave as intense ferrimagnets with a high unblocking temperature and coercivity somehow linked to the enclosed hematite lamellae. Fundamental research on this front is needed before there can be complete understanding of the magnetism of the Tellnes and similar hemo-ilmenite deposits.

Samples were heated in a shielded furnace to a maximum temperature of 650°C, usually in steps of 100°C in a ASC Thermal Specimen demagnetizer.

2.5 Isothermal Remanent Magnetization

Progressive acquisition of isothermal remanent magnetization (IRM) is a widely used tool for recognizing the presence of high- and low-coercivity-spectrum components. IRM is the remanence acquired by a sample when an external field is applied for a short time at constant temperature and then removed. The coercivity spectra of titanomagnetites are distinguished from those of hematites. Multi-domain and pseudo-single-domain titanomagnetite and magnetite usually saturate in fields up to 0.3 Tesla (T), whereas hematite requires fields greater than 1.0 T for saturation. Ilmenite with hematite exsolution requires a field higher than 0.3 Teslas to saturate in but it can be difficult to distinguish if magnetite is also in the specimen unless subjected to fields of 3T or greater. Samples were subjected to a peak field of 1.25T.

2.6 Demagnetization of Isothermal Remanent Magnetization

The demagnetization spectra of the IRM help to identify domain states of magnetic grains, whether multi-domain, pseudo-single-domain or single domain. In the magnetite series very fine grains of magnetite will be in the pseudo-single-domain and single domain sizes and will impart a very high coercivity to the samples and hence cause high Q values. Most magnetites from slowly cooled igneous rocks will be multi-domain size and contribute mainly to the induced field and have low Q values. However, McEnroe (1996) has documented a variety of intrusive igneous rocks where oxidation-exsolution of ilmenite appears to have reduced effective domain size with consequent increase in coercivity. In the hemo-ilmenite series many of the ilmenite grains with hematite exsolution lamellae will behave as if they were of pseudo-single-domain and single-domain size and cause the samples to have high Q values.

2.7 Q Values (Koningsberger ratio)

The Q value is a useful guide to the type of aeromagnetic anomaly to be expected. A Q value < 1 indicates the samples are contributing mainly to the induced field. A Q value > 1 indicates the NRM is greater than the induced magnetization and is playing a role. A Q value > 10 indicates that NRM is the dominant component of the aeromagnetic signature of the body. When Q is greater than 1 the direction of the NRM **should** be known to understand and model the anomaly and when the Q value is 10 or greater the NRM direction **must** be known to model the anomaly.

$Q = Jr/k(F\mu_0)$ where Jr is the NRM, K is the susceptibility, F is the earth's field at the sample locality and μ_0 is the permeability, usually taken to be 1. When the NRM is greater than the susceptibility/F and the NRM is antiparallel to F, the resultant magnetization of the body will produce a field anomaly antiparallel to F. The possibility of rocks with a strong reversed remanence must always be considered in the interpretation of negative magnetic anomalies.

3. DISCUSSION OF ROCK-MAGNETIC PROPERTIES

3.1 Magnetic Susceptibility

The magnetic susceptibility of the samples in this study varied by more than 3 orders of magnitude from $0.4*10^{-3}$ to $400*10^{-3}$ (Table 3.1). The variation is a function of mineralogy, magnetite versus hematite and ilmenite, and the amount of oxide present in the sample. The samples from the oxide-rich cumulate norites in the Bakka Area had the highest average susceptibilities $378*10^{-3}$ from locality TE26, and $231*10^{-3}$ from locality TE27. The norite samples (TE16) from the oxide -rich cumulate in the Mydland lobe average $181*10^{-3}$. These are all from areas which have magnetic highs and are predominantly magnetite-rich rocks. The samples from the oxide-rich cumulate in the Mydland area, which creates an aeromagnetic low, have an average susceptibility $33*10^{-3}$. Samples from a minor anomaly near Mydland (TE56 and 57) have an average susceptibility of $37*10^{-3}$

In the Heskestad area, average susceptibility is $92*10^{-3}$ for the aeromagnetic low area (sample localities TE 39,40 and 41) and $69*10^{-3}$ for the high (sample localities TE 36, 37 and 38). At first glance, the higher susceptibility of samples from the Heskestad magnetic low compared to those from the Heskestad magnetic high appears contrary to explanations given previously. Though the susceptibility is greater in the samples from the magnetic low region, these samples have on average a remanent value significantly higher than samples from the magnetic high region, and this leads to higher Q values. The higher susceptibility in areas of the magnetic low may also be indicative that there is a significantly greater amount of oxide within that part of the body.

The samples from the Sandbekk area (sample localities TE 60, 61, 62, and 63), which generally produce a slightly positive anomaly had a significant variation in susceptibility with an average susceptibility of $213*10^{-3}$.

The average susceptibility from the samples (TE 3,4,11) collected in the open pit area of the Tellnes mine is $29*10^{-3}$. Sample (TE29) collected from the weathered exposure at the extreme southeast end and most negative aeromagnetic part of the ilmenite norite had an average susceptibility of $101*10^{-3}$, markedly higher than the samples from the Tellnes open pit.

The anorthosite samples (TE 2, 10, 43, 45, 51 and 53) had the lowest susceptibilities with an average of $3*10^{-3}$. The low susceptibilities in the anorthosites, coupled with the high remanence values, lead to the strong negative anomalies over the Åna-Sira anorthosite.

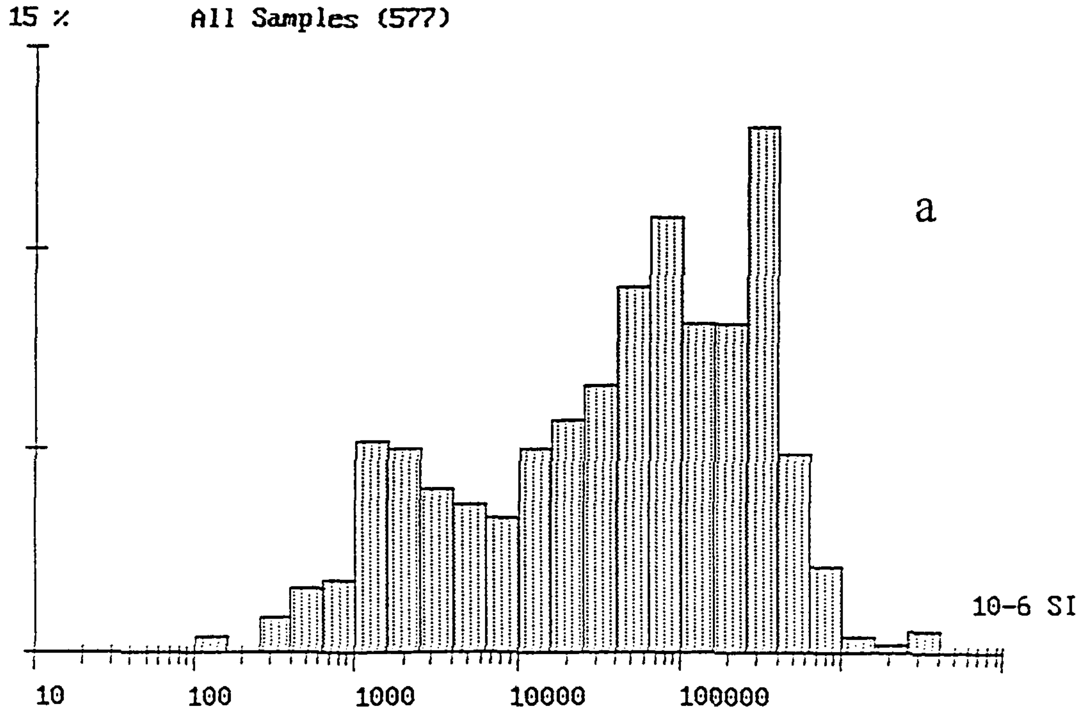
Magnetic susceptibility was also studied in a large suite of samples collected by NGU in 1995 and 1996 for petrophysical determinations. Those samples not measured by McEnroe will be reported on in detail by L. P. Nilsson though an overview of these measurements is given below and are tabulated in Appendix B.

Magnetic susceptibility on 577 samples (Figure 3.1a) has been measured either at NGU or at the University of Massachusetts. The magnetic susceptibility of the samples varied by more than 4 orders of magnitude from $0.11*10^{-3}$ to $2687*10^{-3}$.

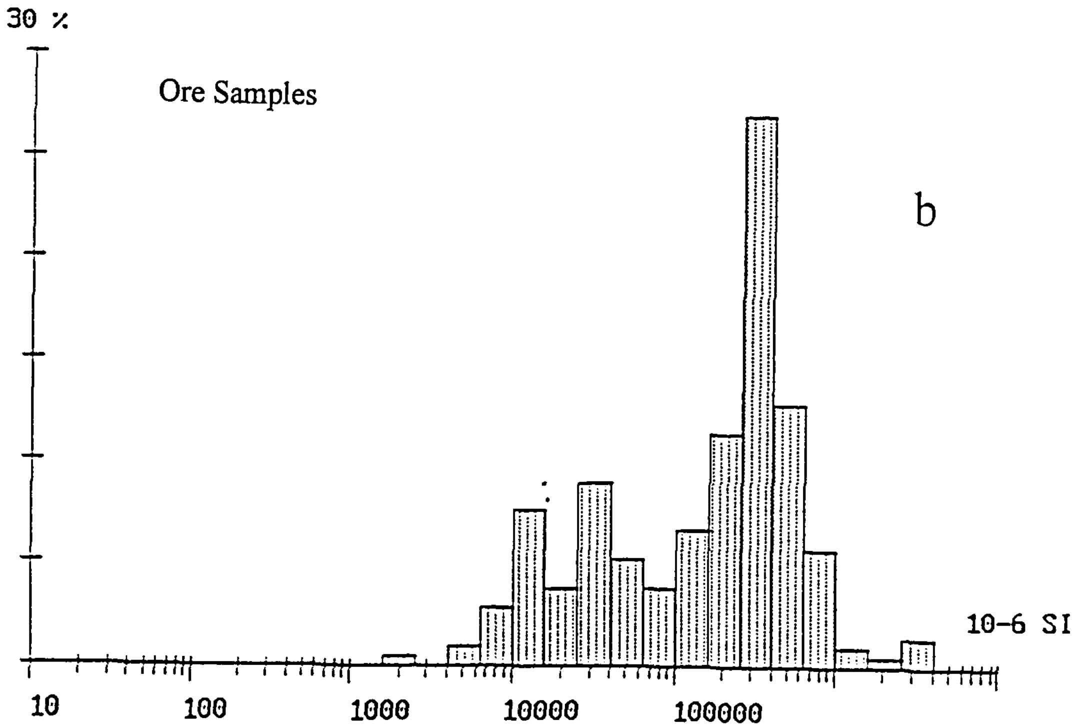
Two hundred and eleven samples were measured from known ore bodies: Blåfjell, Bøstølen, and Storgangen (Figure 3.1b). As expected these samples have the highest average magnetic susceptibility of $288*10^{-3}$ with a range of $1.6*10^{-3}$ to $2687*10^{-3}$. The high end of the spectrum reflects the large magnetite content in many of the ore samples; the lower end of the spectrum reflects larger ilmenite concentrations with magnetite present only as an accessory phase in the assemblage and/or as exsolution lamellae in the silicate grains.

Plotted in Figure 3.1c are one hundred and ninety susceptibility values from norite samples. Included in this group are samples from the Tellnes mine. The average susceptibility of these samples is $66*10^{-3}$, with a range from $0.5 *10^{-3}$ to $497*10^{-3}$. These high susceptibility values are consistent with overall norite petrography, indicating magnetite as an

SUS (E-6 SI)
ArMean : 145424.8428 ± 262519.6874 N: 577
LogMean: 37471.0001 Low: 4901.3398 High: 286467.76
MIN : 110.00000 MAX:2687690.0000 A(log)= .2

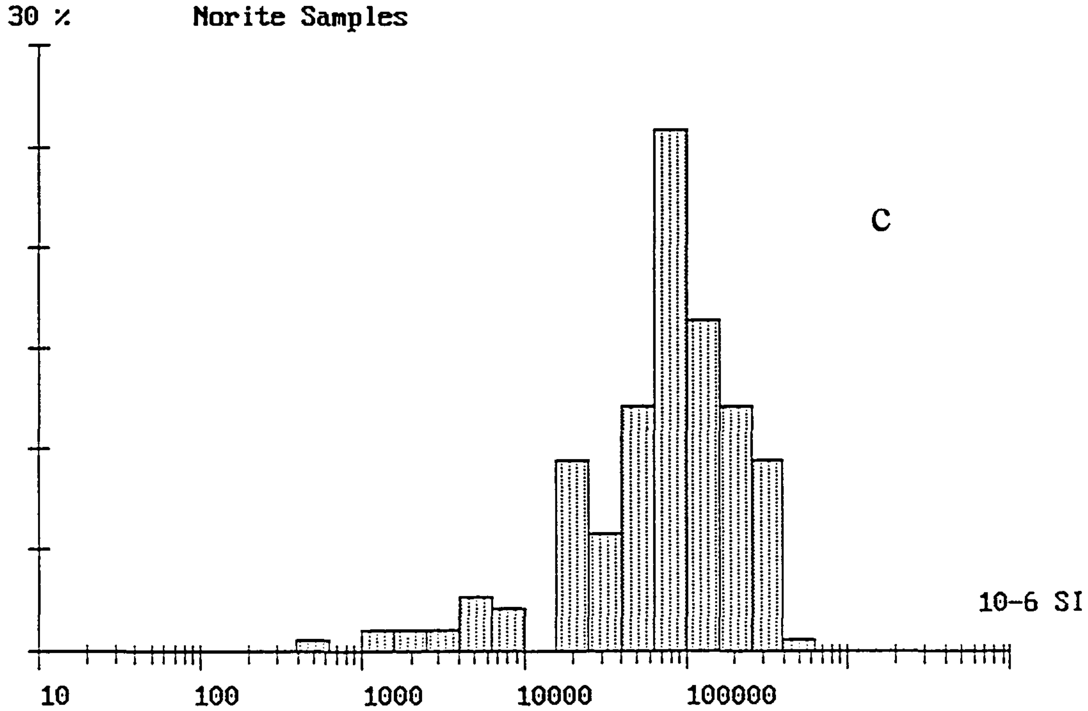


SUS (E-6 SI)
ArMean : 288594.8122 ± 379665.5834 N: 211
LogMean: 137455.9253 Low: 33307.6976 High: 567260.15
MIN : 1600.00000 MAX:2687690.0000 A(log)= .2

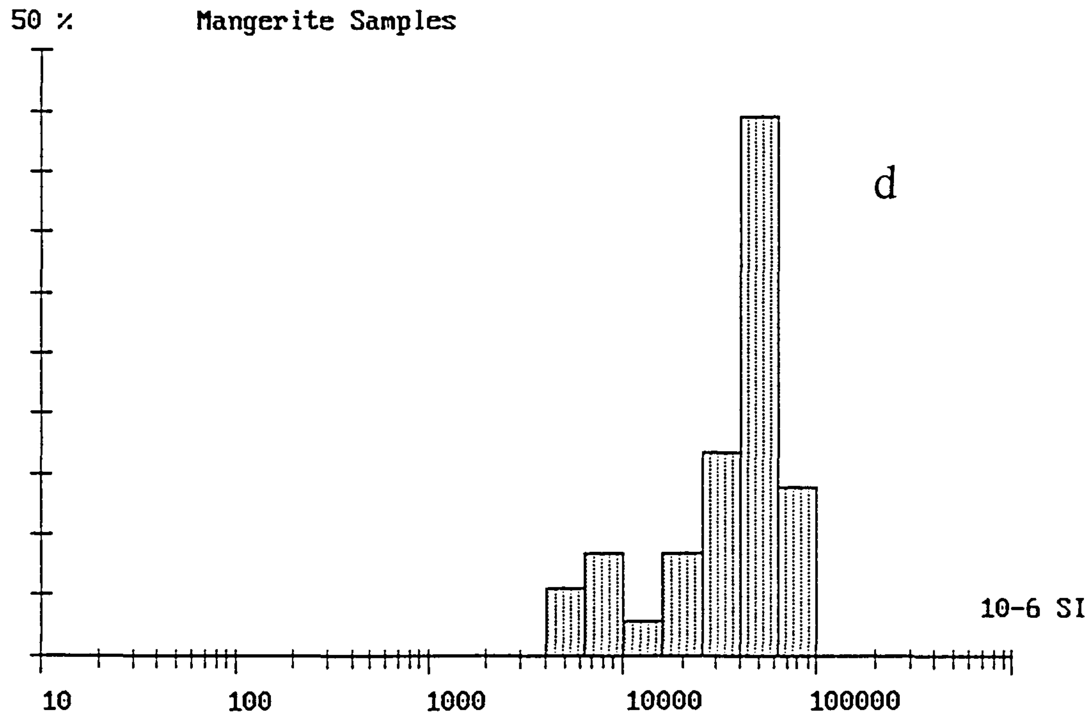


Figures 3.1a - 3.1e. Susceptibility spectra of measurements on samples from NGU's petrophysical collection from the Sokndal map sheet (13114).

SUS (E-6 SI)
ArMean : 108047.0458 ± 94876.7141 N: 190
LogMean: 66385.8652 Low: 19875.0328 High: 221739.66
MIN : 480.00000 MAX: 496560.0000 A(log)= .2



SUS (E-6 SI)
ArMean : 43048.3297 ± 22196.5648 N: 36
LogMean: 34398.1348 Low: 15489.4302 High: 76389.63
MIN : 5180.00000 MAX: 82380.0000 A(log)= .2



accessory to major phase. The mean log susceptibility value of the norite samples is half that of the "ore" samples measured. Based on samples already examined under the microscope, it is proposed that the lower susceptibility samples have more abundant *discrete* ilmenite grains. Samples with higher than average susceptibility may still have a significant *overall* ilmenite content, but the ilmenite partially resides within the magnetite grains. The different oxidation-exsolution textures in the magnetites should not affect the susceptibility values, but may have a strong influence on remanence.

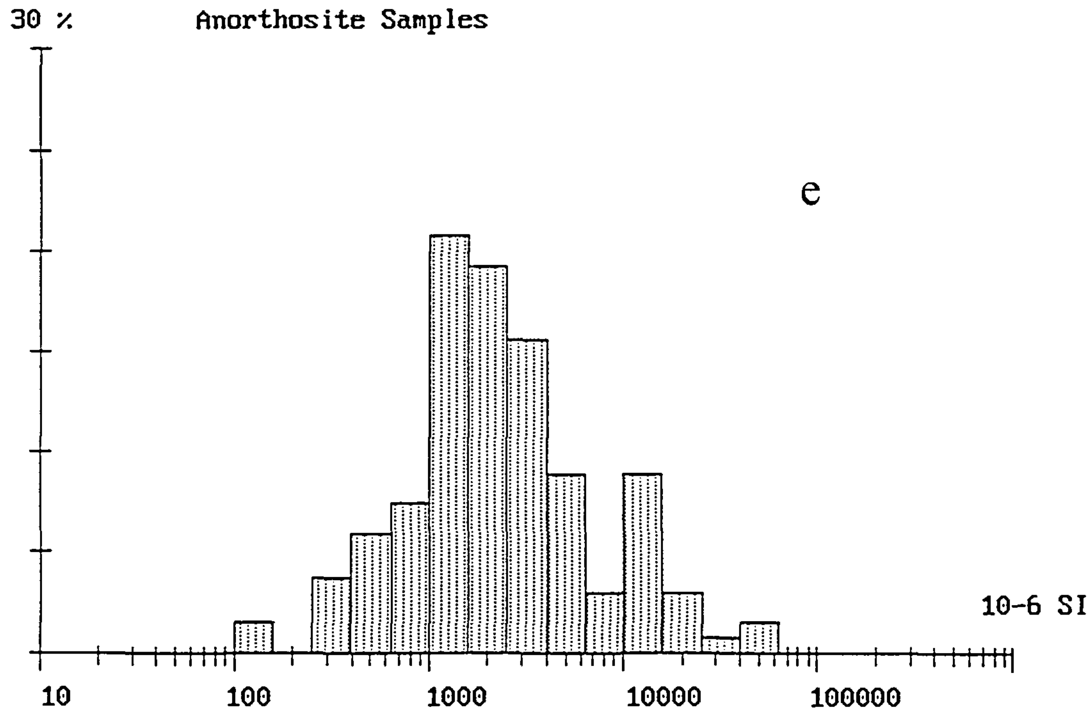
Thirty-six mangerite samples were measured (Figure 3.1d). These have a mean value of $43*10^{-3}$ with a range of $5*10^{-3}$ to $82*10^{-3}$. These high susceptibility values are consistent with magnetite as an accessory phase in all the samples measured.

The Åna-Sira anorthosite samples have a large range in magnetic susceptibility (Figure 3.1e). The average value is very low $4.5*10^{-3}$ with a range from $0.1*10^{-3}$ to $61.4*10^{-3}$. The higher values are indicative of oxide-rich zones. The low susceptibility values are consistent with hematite as the primary magnetic phase in the anorthosite samples. This interpretation is consistent with the very high Q values calculated from the anorthosite samples.

Magnetic Susceptibility and Q Values. An almost linear correlation between susceptibility and Q values is shown in Figure 3.2 with the higher susceptibility corresponding to a lower Q value. The most striking factor shown in Figure 3.2 is the large concentration of samples with a Q value of 1 or greater. The overall highest Q values, almost exclusively greater than 10, are from in the Åna-Sira anorthosite samples. These samples also have the lowest susceptibility values.

The samples with Q values less than 1, mangerites, a variety of norites and undifferentiated ores also have the highest susceptibility values, reflecting the high magnetite content of these samples. Many of these samples are from geographic regions that produce positive high magnetic anomalies.

SUS (E-6 SI)
ArMean : 4552.2219 ± 7574.0959 N: 135
LogMean: 2261.4640 Low: 727.0345 High: 7034.36
MIN : 110.00000 MAX: 61420.0000 A(log)= .2



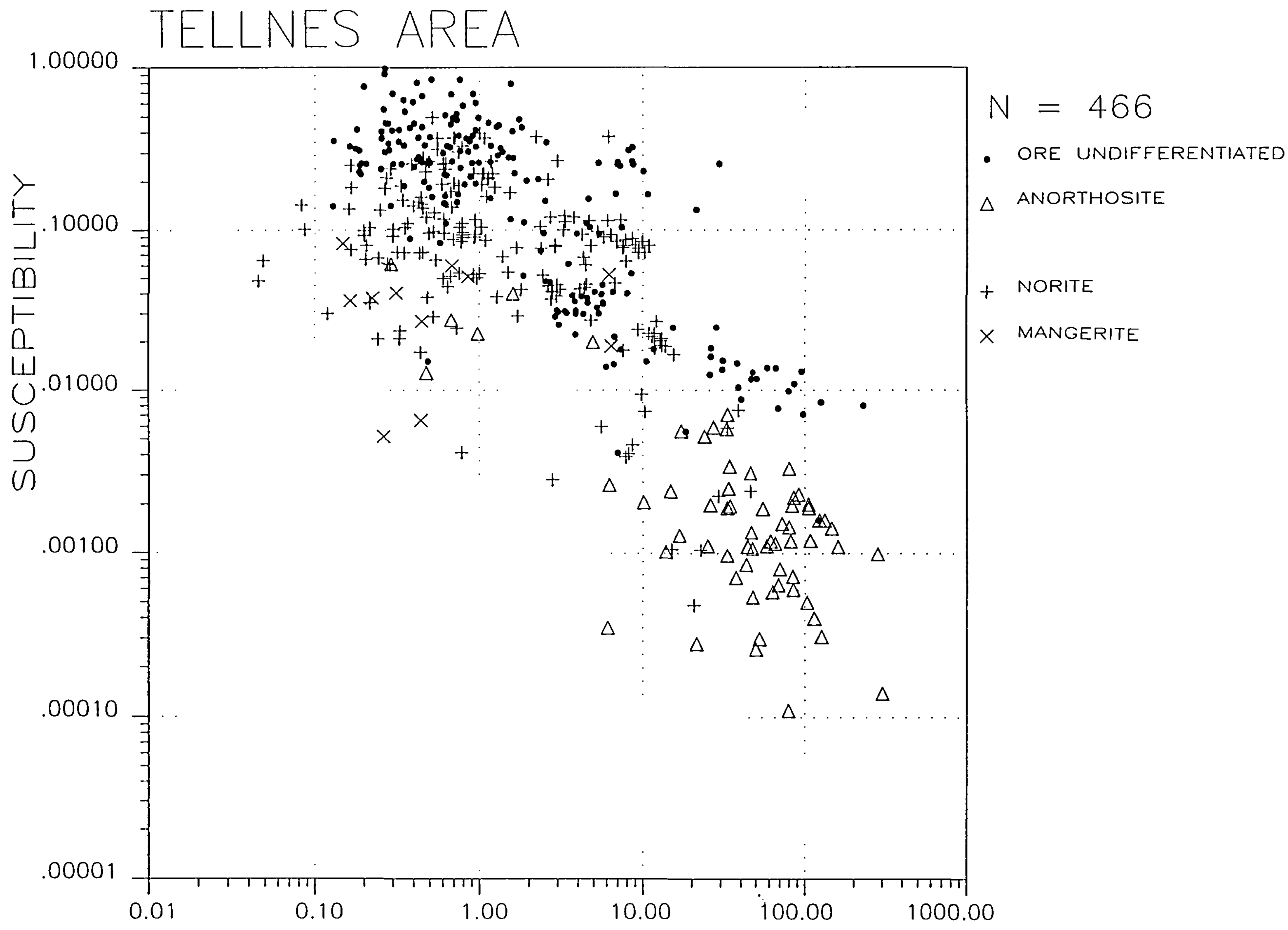


Figure 3.2. Susceptibility values plotted against Q-values. Samples from all rock types in NGU's petrophysical collection from the Sokndal map sheet (13114).

The remaining samples are from a variety of norite bodies, Fe-Ti enriched layers and "ore bodies". These samples are of special interest because they have a susceptibility value greater than 1.5 *10-3 and a Q value greater than 5. These samples should be further investigated. More importantly the samples within this group which have a susceptibility greater than 1 $*10^{-2}$ and a Q value greater than 10 are primary candidates and are likely to be rich in ilmenite. It is strongly suggested that these samples be studied further .

Magnetic Susceptibility and Density. When magnetic susceptibility is plotted against density (Figure 3.3) samples from different rock types plot in distinct fields. This plot also clearly shows which samples are oxide rich. Quite simply the higher the density the greater the opaque concentration, if all samples are from intrusions that had approximately same *pressure* conditions for crystallization and have not been subsequently through high-pressure metamorphism/deformation (for example eclogite facies). The Åna-Sira anorthosite samples on average have the lowest density of the entire data set and lowest susceptibility. The mangerites have on average a lower density and susceptibility than the norites. The norite and undifferentiated ore samples have on average high susceptibility and density values. The samples of most interest are those that have high *density* and high *Q values*. Some of the very interesting ore samples plot outside the boundaries of this diagram due to their very *high density values* and are not shown

The high Q values may well indicate ilmenite and a high density value will indicate significant concentration of ore within the sample. Examples of samples in the region with these qualities are from Blåfjell, Store Ålgard, Frøytlog, Tellnes and from a norite pegmatite. It is strongly suggested that these samples be studied further for mineral properties and mineral chemistry.

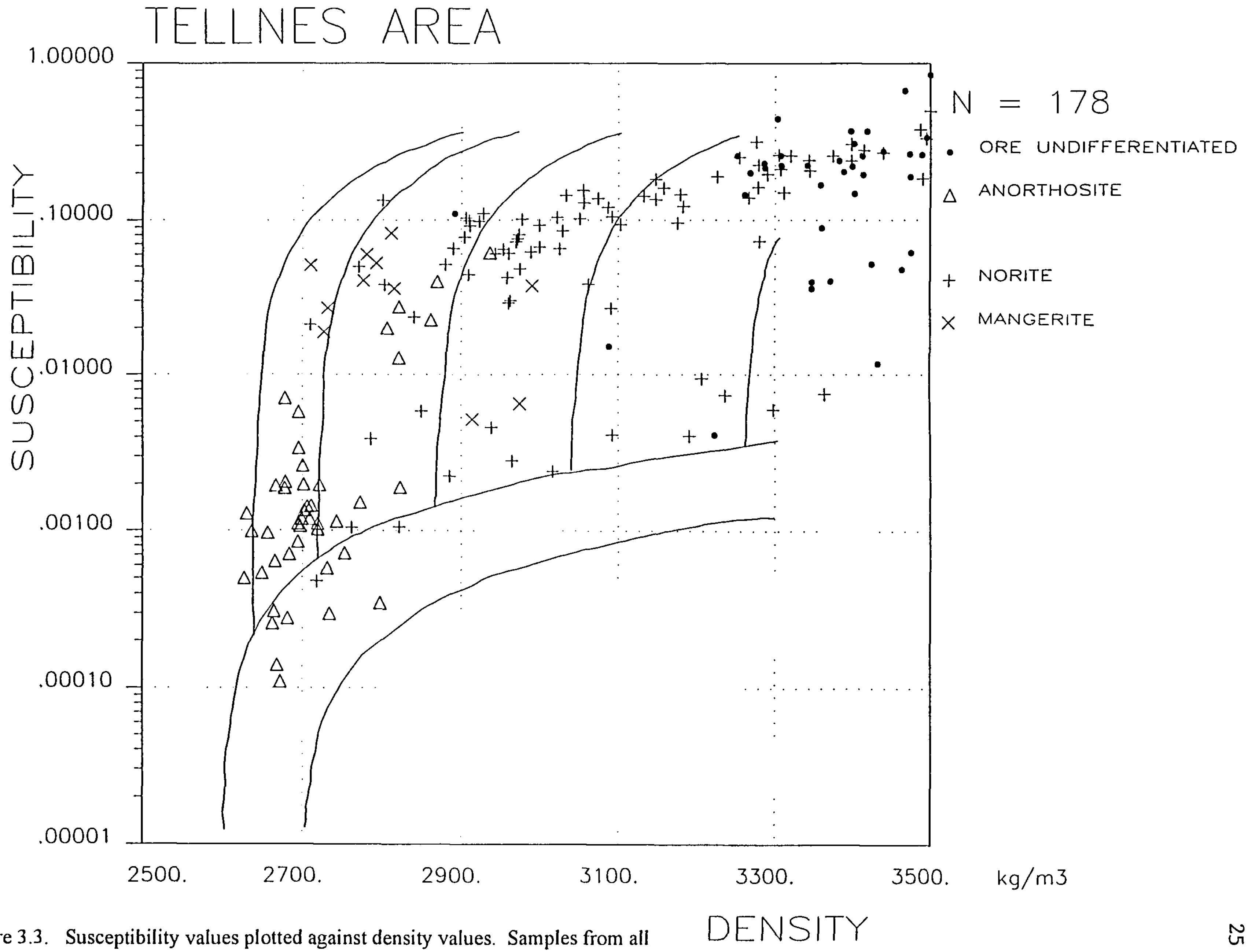


Figure 3.3. Susceptibility values plotted against density values. Samples from all rock types in NGU's petrophysical collection from the Sokndal map sheet (13114).

3.2 Natural Remanent Magnetization

Natural remanent magnetization (NRM) of the samples (Table 3.1) varies significantly in direction (Declination and Inclination) and intensity (J). The samples from the Tellnes mine area all possess a negative inclination. All samples possess a component antiparallel to the earth's present day field. The inclination varies from an almost flat lying vector of -5 to a steeply dipping vector of -86. The declination is generally in the northwest quadrant, on average 277, almost due west. The intensities from the open pit area of the mine have an average value of 7 A/m, whereas the samples from the southeast extension have a markedly higher value of 19 A/m. The aeromagnetic anomaly over the mine is clearly influenced by the negative inclination vectors. Steeply dipping negative inclination vectors are found in all but one sample measured from the Åna-Sira Anorthosite. The declination vector is more dispersed. It is in the northwest, northeast and southeast quadrants. The intensities are lower, on average 5.5A/m.

The samples from the Sandbekk area have high NRM's at 39A/m. The inclinations are both positive and negative, though positive on average. The declinations plot in all four quadrants.

In the Mydland lobe, the samples from the aeromagnetic high all have positive inclinations (+52) with declinations that plot predominantly in the northeast quadrant. The NRM intensities vary from 3 A/m to 9A/m with an average of 5 A/m. The area which produces the negative aeromagnetic low has predominantly steeply dipping negative inclinations with declinations in the southwest and southeast quadrants. The variation in NRM intensities is from 27A/m to 0.2A/m. Excluding the samples from locality TE35, a large anorthosite block within the Mydland lobe, the average NRM intensity is 8A/m very similar to the NRM intensities from the Tellnes mine.

The samples from the aeromagnetic high region in Heskestad have disperse declinations and inclinations that are positive and negative though predominantly negative. The average

NRM intensity is 5A/m. The area with the aeromagnetic low has predominantly negative inclination vectors and dispersed declinations. The average NRM intensity is significantly higher at 22A/m.

3.3 Q Values (Koningsberger ratio)

In general the Q values (Table 3.1) from the Tellnes mine area are high, ranging from Q=2.4 to 31, with an average of 4.8. The NRM directions clearly influence the aeromagnetic anomaly from the mine area. The NRM directions vary, as does the anomaly, from an almost neutral anomaly to a significant negative anomaly. The variation in Q values is consistent with variations in mineralogy and grain size. This will be discussed in detail later. The Q values from the Heskestad negative anomaly region are on average significantly higher, Q = 5.5, as compared to those from the Heskestad positive anomlay region with an average Q value of 1.8. The significant difference in the two sample data sets from Heskestad is that the samples with high Q values have significantly higher NRM intensities. Thus the negative anomaly region is most likely due to the discrete ilmenite with abundant hematite exsolution and ilmenite with oxidation-exsolution of hematite or magnetite in the silicate grains.

In the northwestern part of the Mydland lobe the Q values are very low (Q = 0.7). This positive anomaly is caused by a strong component of the induced present day field. These samples all have high susceptibility values (~$180*10^{-3}$) due to the significant magnetite component. The samples from the negative anomaly in the southeastern part of the Mydland lobe have an average Q value of 7.3. The predominant negative inclinations are influencing the aeromagnetic signature of these rocks. The oxide mineralogy, predominantly hemo-ilmenite, is consistent with high Q values.

The oxide-rich cumulate norites from Bakka Area have relatively low Q values of 1.0 The susceptibility values are very high $378*10^{-3}$ (TE26) and $221*10^{-3}$ (TE27) consistent with the magnetite-rich mineralogy. It is surprising that the NRM intensities are as high as they are, up to 16A/m. It is possible that the susceptibility is not giving a true estimate of the oxide content of these rocks. There are significant differences in the magnetites from the two localities studied which is discussed in detail in the oxide petrography.

The Sandbekk Q values, on average Q = 4.7, are surprisingly high for such magnetite-rich rocks with susceptibility values up to $400*10^{-3}$, though on average $213*10^{-3}$. The NRM intensities vary significantly and are most likely mineralogically controlled.

The Q values from the Åna Sira Anorthosite range from Q = 17 to 159 with an average of 77. These very high Q values are due to the high NRM intensities and low susceptibilities. The negative inclination vectors from these samples clearly dominate the aeromagnetic signature from the anorthosites. Though all the samples from the Åna Sira Anorthosite have Q values that clearly indicate remanence as the dominant contributor to the magnetic anomalies the large range in Q values may be contributing to the slight variation found in this anomaly.

3.4 Overview of Thermal, Alternating Field Demagnetization and IRM Saturation Studies

Results of the thermal, alternating field and isothermal remanent demagnetization measurements are briefly discussed here and will be presented in greater detail in the next report.

Thermal Demagnetization Results. Three classes of behavior were found in the data set:

1.) Samples from localities TE16, TE26 and TE 27, all from regions with pronounced high aeromagnetic anomalies, displayed a thermal decay indicative of magnetite as the primary magnetic carrier, with unblocking temperatures between 400°C and 580°C (Figure 3.4). The range in unblocking temperatures reflects the compositional differences in the samples and possibly the effects of microstructures within the magnetite grains.

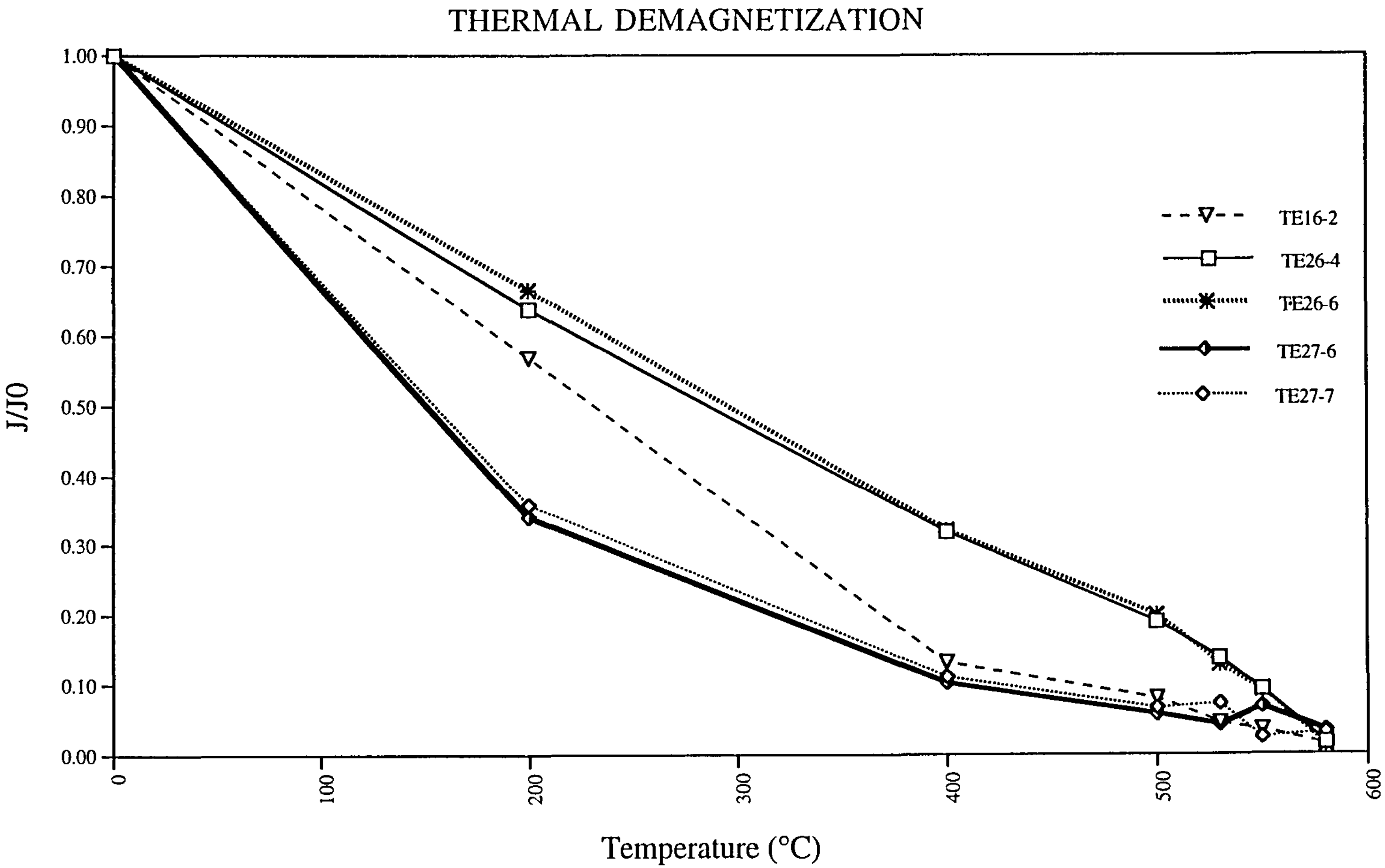


Figure 3.4 Thermal demagnetization spectra of magnetite rich samples from the Bakka area of the Bjerkreim-Sokndal Lopolith and cumulate norites in the Mydland Lobe. Samples are from regions with distinct positive aeromagnetic anomalies.

2.) Samples from the Tellnes mine area unblocked predominantly between 550°C to 580°C (Figure 3.5). This narrow temperature interval should reflect a nearly pure end-member magnetite. However, several of these samples contain little magnetite, and hence these thermal demagnetization results would appear to reflect the demagnetization temperature of titanohematite lamellae in ilmenite, where the lamellae would contain 12-18% ilmenite end-member composition in solid solution. Ferrian ilmenite by itself would have a very much lower unblocking temperature, and the exact mechanism by which titanohematite lamellae in ilmenite control the thermal unblocking of the host ferrimagnetic ferrian ilmenite is not yet understood.

3.) Samples with unblocking temperatures up to 620°C (Figure 3.5). Samples from the Åna-Sira anorthosite have a small higher temperature component commonly persisting up to 620°C in addition to a larger component in the 550°C to 580°C range. This component is carried by the hematite lamellae in residing either in the plagioclase or in discrete grains of hemo-ilmenite. These samples all had very high Q values, and came from regions of pronounced negative anomalies.

Alternating Field Results. This data set showed a large variation in coercivities (Figure 3.6). Median destructive fields ranged from 20mT to 50mT. The higher coercivities were found in the anorthosite samples and in some samples from the Tellnes mine area. The high coercivities primarily reflect a different magnetic mineralogy. Samples with only hemo-ilmenite have much higher coercivities than those with hemo-ilmenite and coexisting magnetite. Samples from the mangerites and norites that contain magnetite and ilmenite without hematite exsolution lamellae have lower coercivities. Within the magnetite-rich rocks where the ilmenite resides mostly as oxidation-exsolution lamellae, the variation in coercivity reflects the different microtextures in the magnetites.

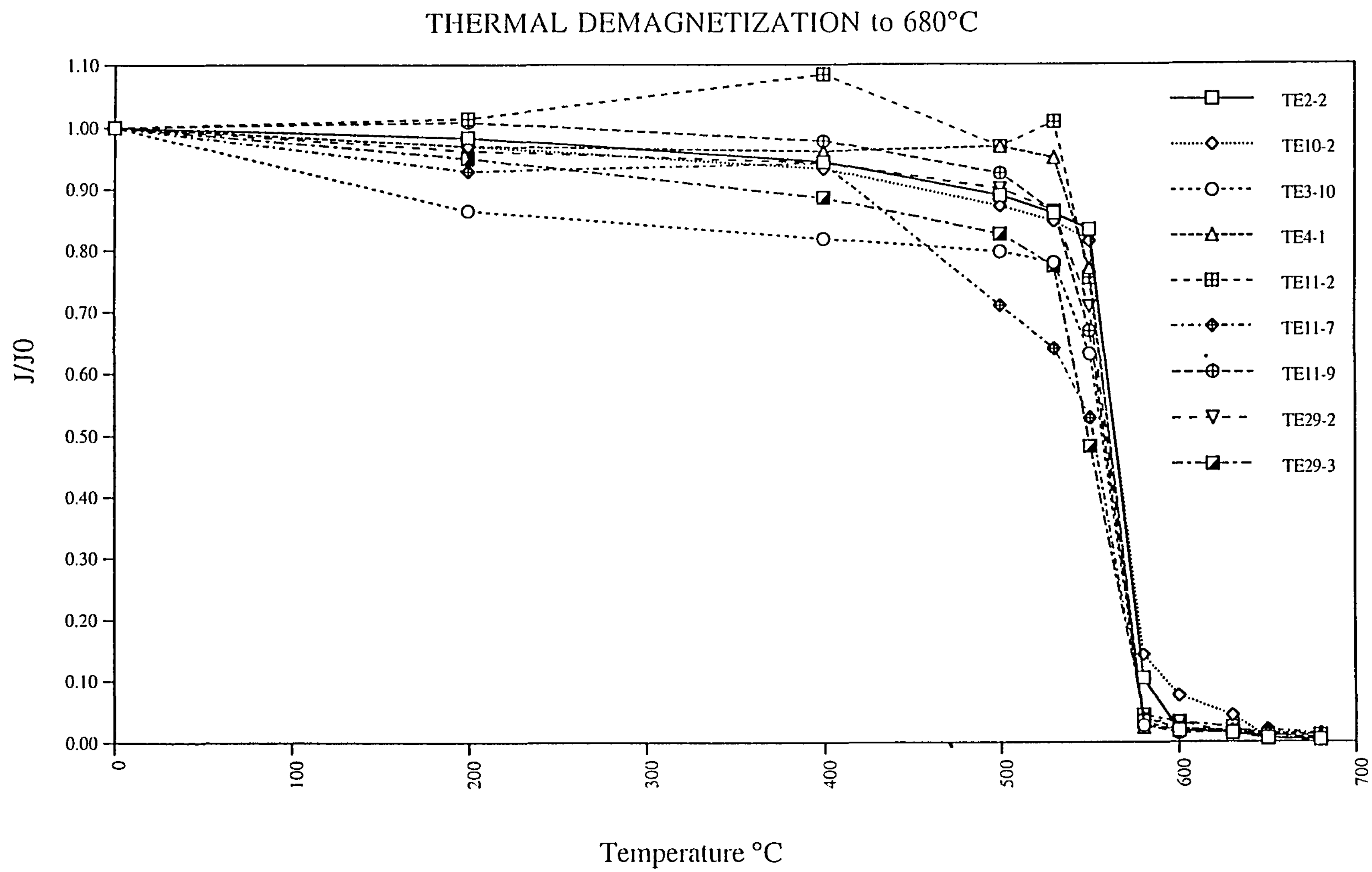


Figure 3.5 Thermal demagnetization spectra of ilmenite enriched samples ilmenite the Åna Sira anorthosite; Tellnes ore deposit; Bjerkreim-Sokndal Lopolith: Heskestad and Mydland. Samples are from regions with distinct negative aeromagnetic anomalies.

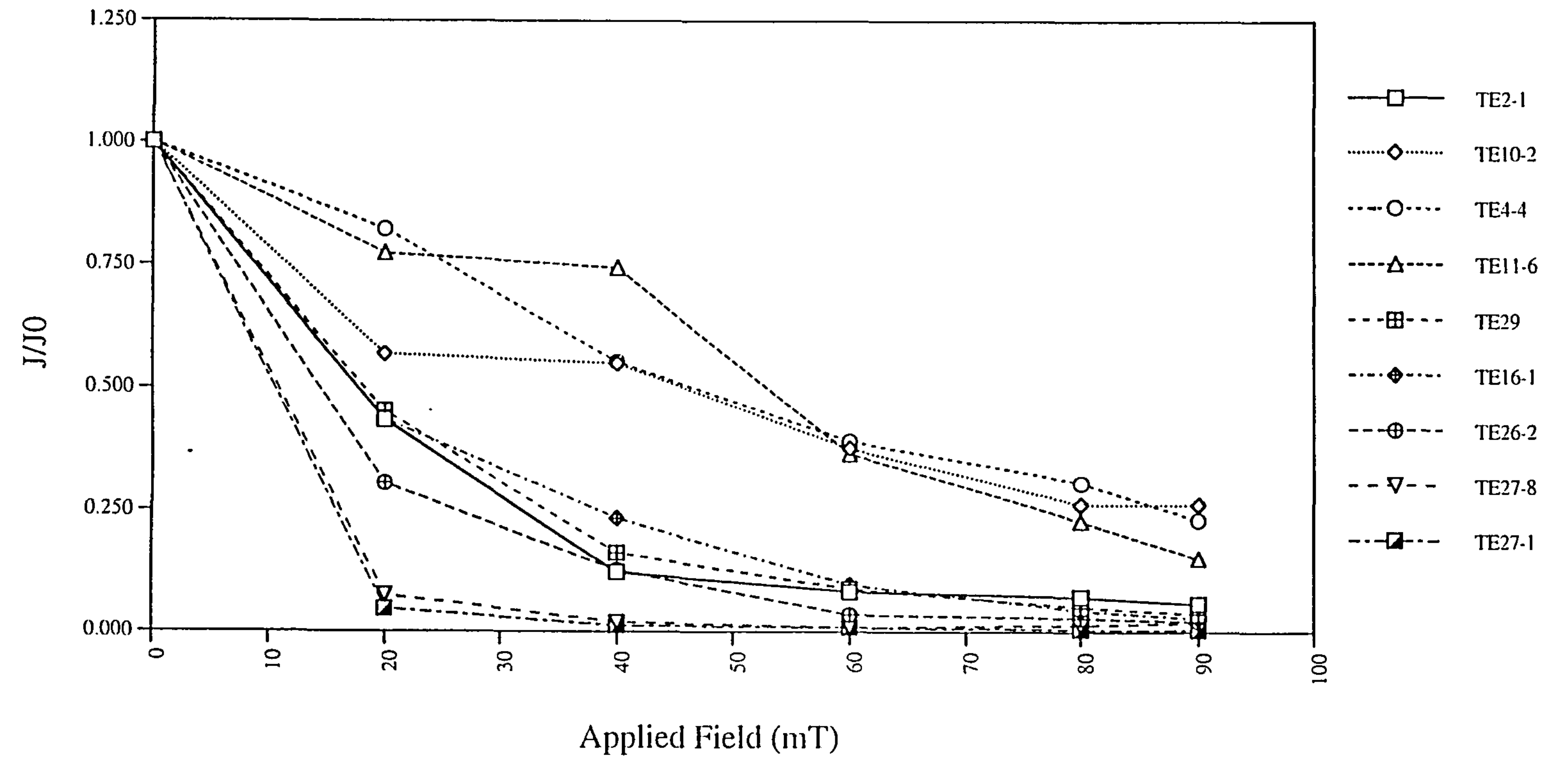


Figure 3.6. Alternating field demagnetization spectra normalized to NRM. Maximum field of 0.8 Teslas applied to samples.

Isothermal Remanent Magnetization Results. Samples were subjected to a field of up to 1.2T . Samples with magnetite as an accessory phase or as a primary magnetic phase usually saturated by 0.2T (Figure 3.7). Samples with only hemo-ilmenite as the magnetic phase or with a significant proportion of hemo-ilmenite did not saturate until higher fields. When the demagnetization of the IRM and the NRM are compared, the nature of the decay is indicative of grain size and coercivities. The NRM in the anorthosite samples and other samples with abundant hemo-ilmenite had an NRM that was more resistant to the alternating (AF) demagnetizing field than the IRM. This indicates a significant component of single-domain or pseudo-single-domain (PSD) behavior (Lowrie and Fuller, 1971; Bailey and Dunlop, 1983). Many samples show a mixed behavior of PSD grains and multi-domain grains, with a removal of some components at a low-field (< 20mT), and then display a high coercive component as shown by an increased resistance to the AF field. These samples all had magnetite as a primary or coexisting phase.

When the thermal and alternating field demagnetization results are coupled with other rock magnetic properties this can aid in understanding of the nature of the aeromagnetic signatures from this region.

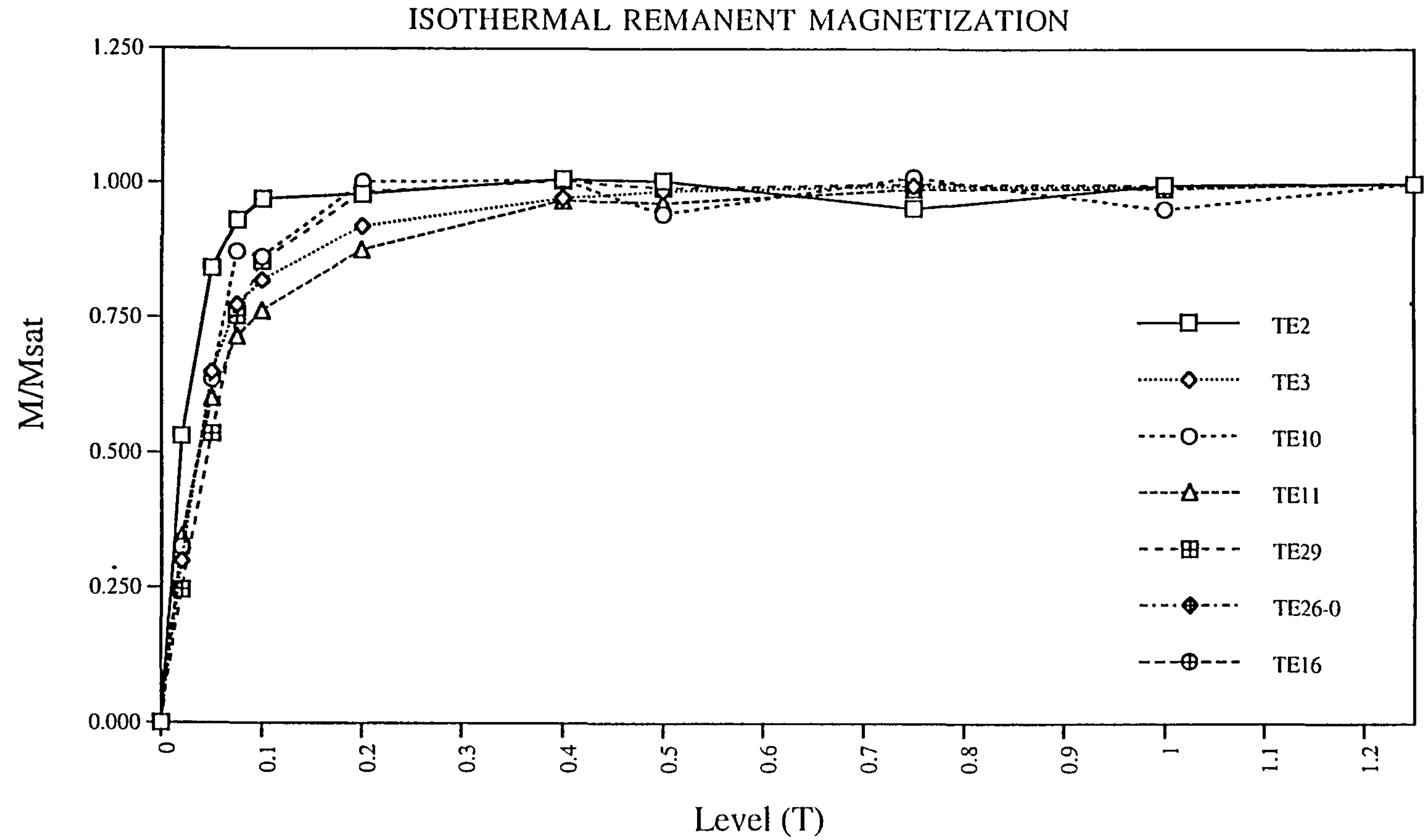


Figure 3.7. Isothermal remanent magnetization (IRM) acquisition diagram.
Normalized IRM (magnetization applied normalized to saturation magnetization).
Field is in Teslas.

4. OXIDE PETROGRAPHY

4.1 Introduction

Reflected - and transmitted-light microscopy were performed to understand better the magnetic carriers and the degrees of alteration of the magnetic phases, and to determine if the magnetic carriers are in equilibrium with the mineral assemblages present. Thin sections were examined using standard petrographic microscope techniques. The phases present, textural relationships, and character and amount of alteration were noted. Polished sections were examined using oil immersion with a reflected-light microscope. Crystal form, exsolution, oxidation and alteration of the opaque minerals were noted. For grains showing evidence of oxidation exsolution, the classification system of Haggerty (1976) was used to describe the extent of oxidation exsolution of magnetite-ulvöspinel C (cubic) and ilmenite R (rhombohedral) solid solution members, as given below.

Magnetite-ulvöspinel C (cubic) oxidation classification:

C1: optically homogeneous ulvöspinel-rich magnetite solid solution.

C2: Magnetite-enriched solid solution with a small number of "oxidation-exsolved" ilmenite lamellae parallel to {111} of spinel parting planes.

C3: Ulvöspinel-poor magnetite solid solution with densely crowded "oxy-exsolved" ilmenite along {111} parting planes of the cubic host.

Ilmenite R (rhombohedral) oxidation classification:

R1: homogeneous, unoxidized primary ilmenite

R2: light tan ilmenite with fine wisp-like sigmoidal lenses of ferrian rutile developed along {0001} and {0111} parting planes of the ilmenite.

R3: increases in thickness of ferrian rutile lenses, in reflectivity, and in anisotropy.

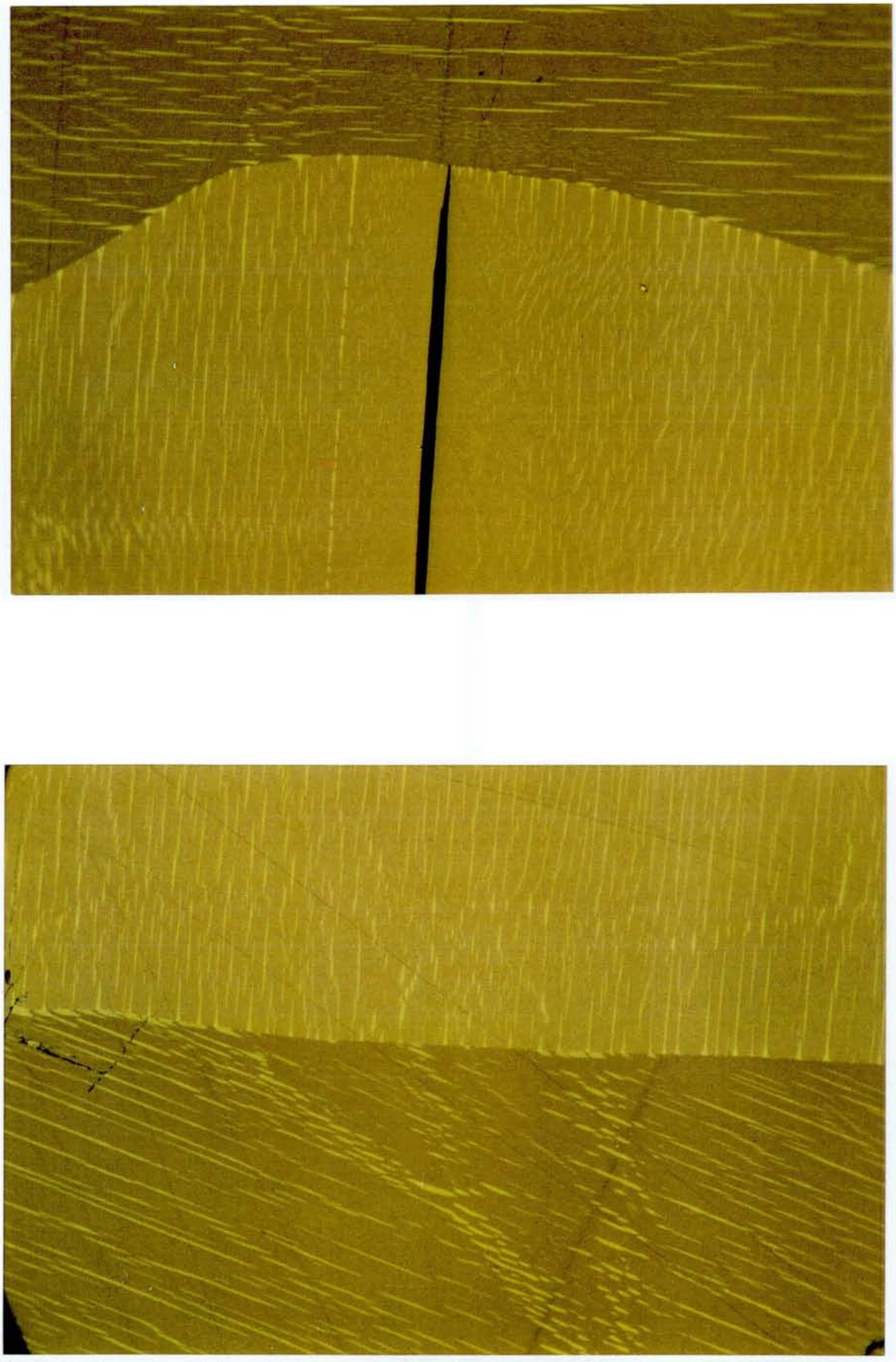
R4: metastable four-phase assemblage of ferrian ilmenite and titanohematite in equal amounts as host, and ferrian rutile and rutile as lenses or as discrete lamellae along {0001} and {0111} parting planes.

4.2 Tellnes Mine Area (Sample Localities TE3-11 exclusive of TE10)

The ilmenite norite samples examined in thin section from the open pit area of the mine (Figures 4.1 - 4.6) contain both magnetite and ilmenite in varying amounts. In all samples ilmenite has abundant hematite exsolution lamellae along the {0001} plane. Multiple generations of hematite exsolution, down to the micron scale, are observed in the ilmenites in all samples studied from the open pit area of the mine. Pleonaste spinel (along the $MgAl_2O_4$ - $FeAl_2O_4$ join) exsolution is observed in many of the ilmenite grains. The ilmenite area immediately surrounding the spinel is usually depleted of hematite lamellae. The Fe^{3+} component has gone into the spinel. The spinel probably "exsolved" out prior to the hematite exsolution lamellae. At the boundaries between two ilmenite grains there is commonly a higher concentration of hematite component. Magnetite is present as discrete grains with pleonaste exsolution. When magnetite is adjacent to ilmenite a magnetite-spinel-ilmenite symplectite commonly has formed. Immediately adjacent to the magnetite grain the ilmenite is free of hematite exsolution. A very short distance into the ilmenite grain, abundant very fine hematite exsolution is present. In the clinopyroxenes very fine exsolution lamellae of ilmenite with hematite exsolution is found. In the orthopyroxenes a fine-grained symplectite of magnetite and ilmenite is observed.

4.3 Southern Extension of the Tellnes Norite Zone (Sample Locality TE29)

This ilmenite norite sample was collected from a natural outcrop from the southern extension of norite body which at present is not mined. The character of the oxides (Figures 4.7 and 4.8) in this sample differs considerably from the oxides found in the active pit of the mine. Ilmenite and magnetite are the two major oxide phases. The ilmenite grains are homogenous and lack any exsolution of hematite. The lack of exsolution of hematite in the ilmenite is not dependent solely on diffusional re-equilibrium as hematite exsolution is not present in discrete ilmenite grains. When magnetite and ilmenite are adjacent there is commonly



'igure 4.1 Ilmenite with multiple generations of very fine hematite exsolution lamellae. Well developed spinel needle shown in top photograph. Photographed in reflected light with a blue filter at 1200x.

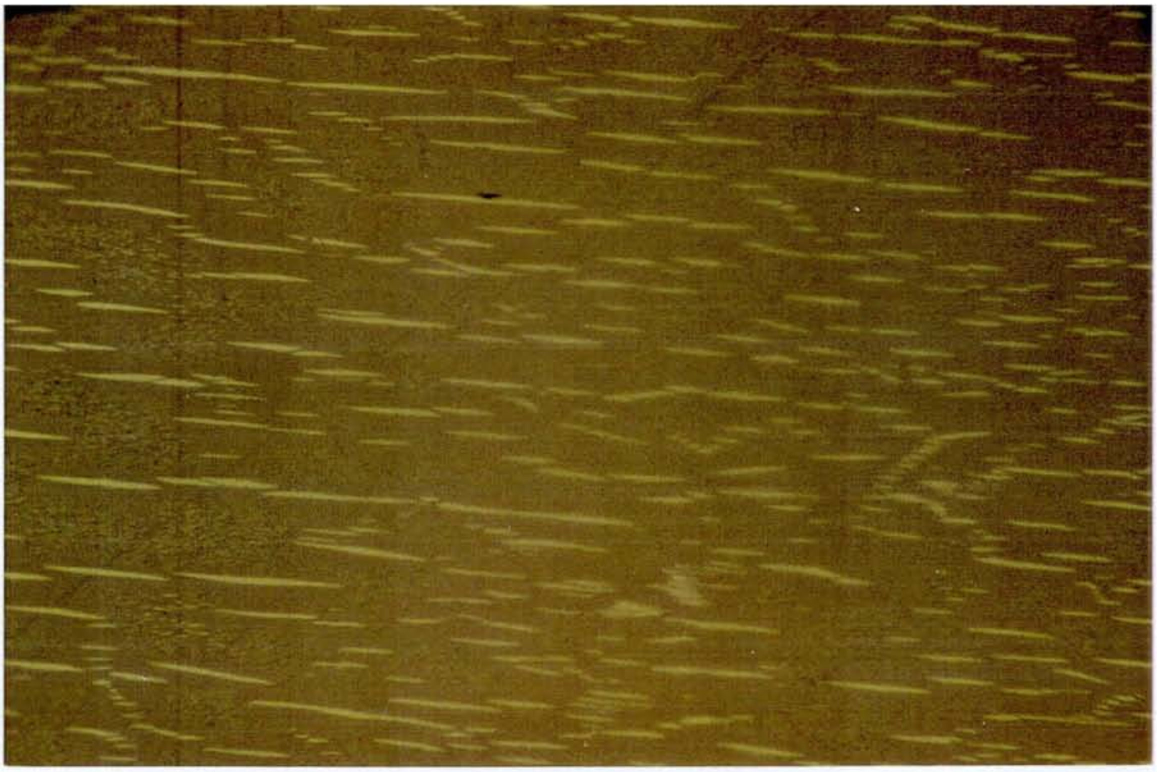
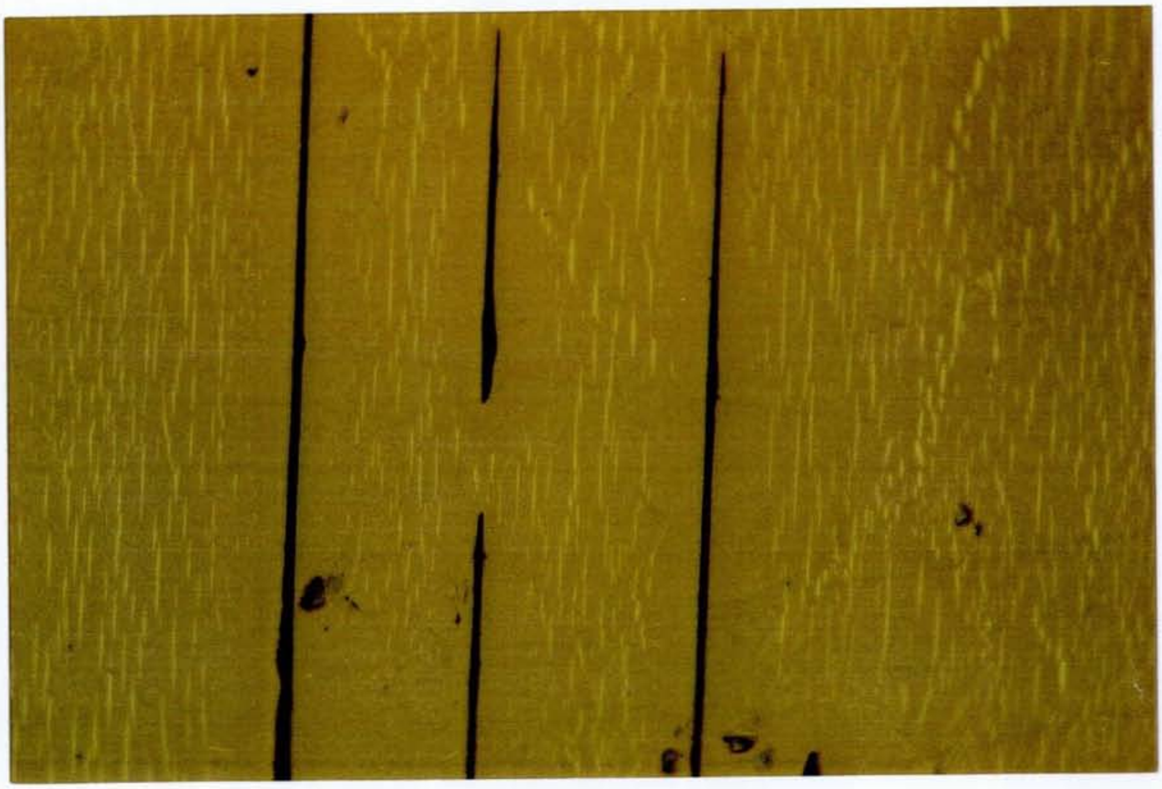


Figure 4.2 Ilmenite with multiple generations of fine and very fine hematite exsolution lamellae. Photographed in reflected light with a blue filter at 1200x.



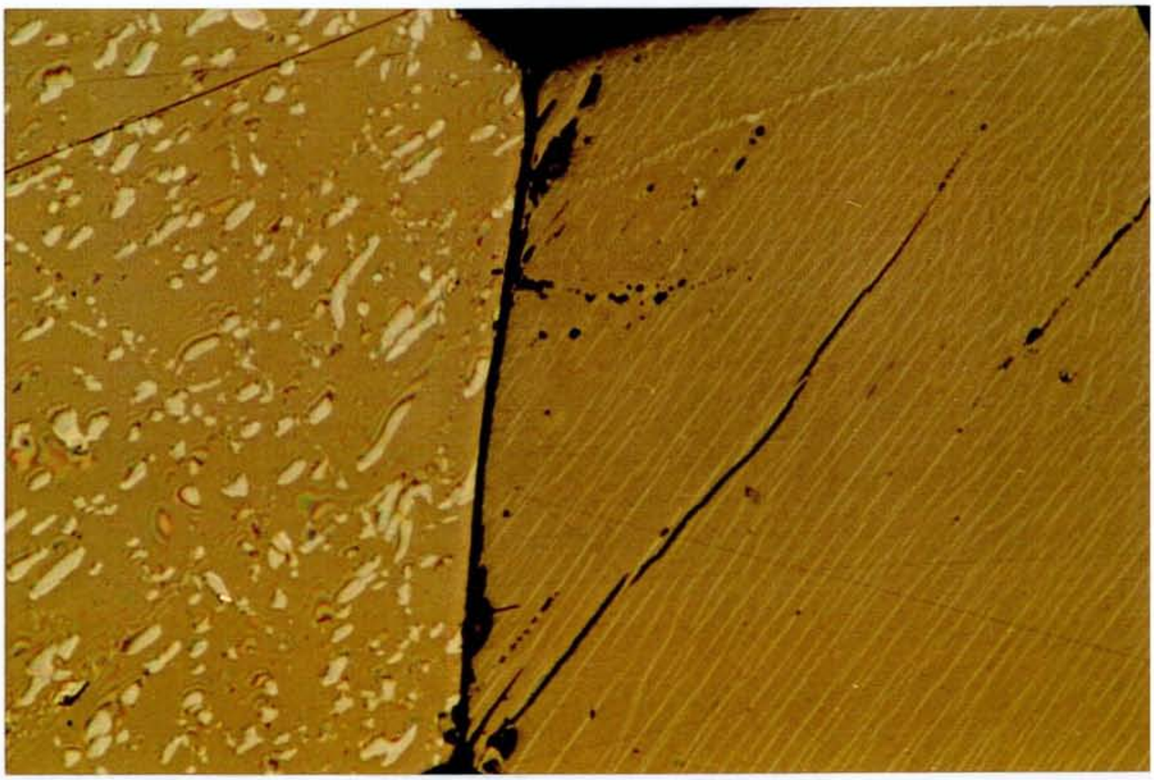


Figure 4.3 Ilmenite with very fine hematite exsolution lamellae. Well developed spinel ıeedles shown in top photograph. Photographed in reflected light with a blue filter ıt 1200x

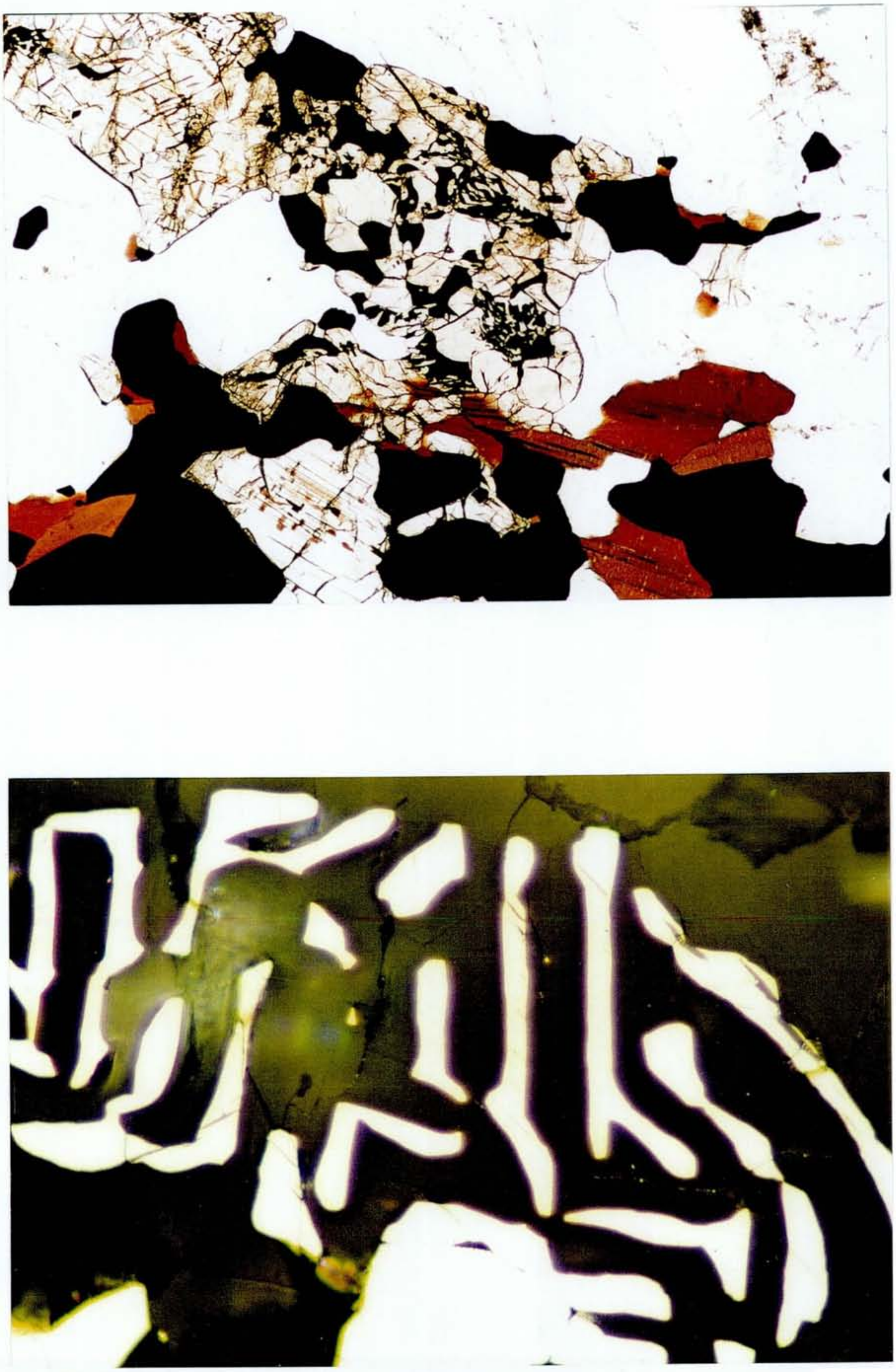


Figure 4.4 (Top) Plagioclase, biotite, orthopyroxene with magnetite-ilmenite symplectite and discrete hemo-ilmenite. Photographed in Transmitted light with a blue filter at 50x (Bottom) Magnetite with oxidation exsolution of ilmenite in orthopyroxene. Photographed in reflected light with a blue filter at 1200x.

Figure 4.5 Magnetite with oxidation-exsolution of ilmenite in orthopyroxene. Discrete grain of hemo-ilmenite is adjacent to orthopyroxene. Photographed in reflected light with a blue filter at 500x (top) 1200x (bottom).

Figure 4.6 Ilmenite with very fine hematite exsolution lamellae adjacent to magnetite with fine spinel needles. Note at grain contact a spinel, ilmenite and magnetite symplectite (top). Very fine exsolution in clinopyroxene of ilmenite with hematite exsolution (bottom). Photographed in reflected light with a blue filter at 1200x

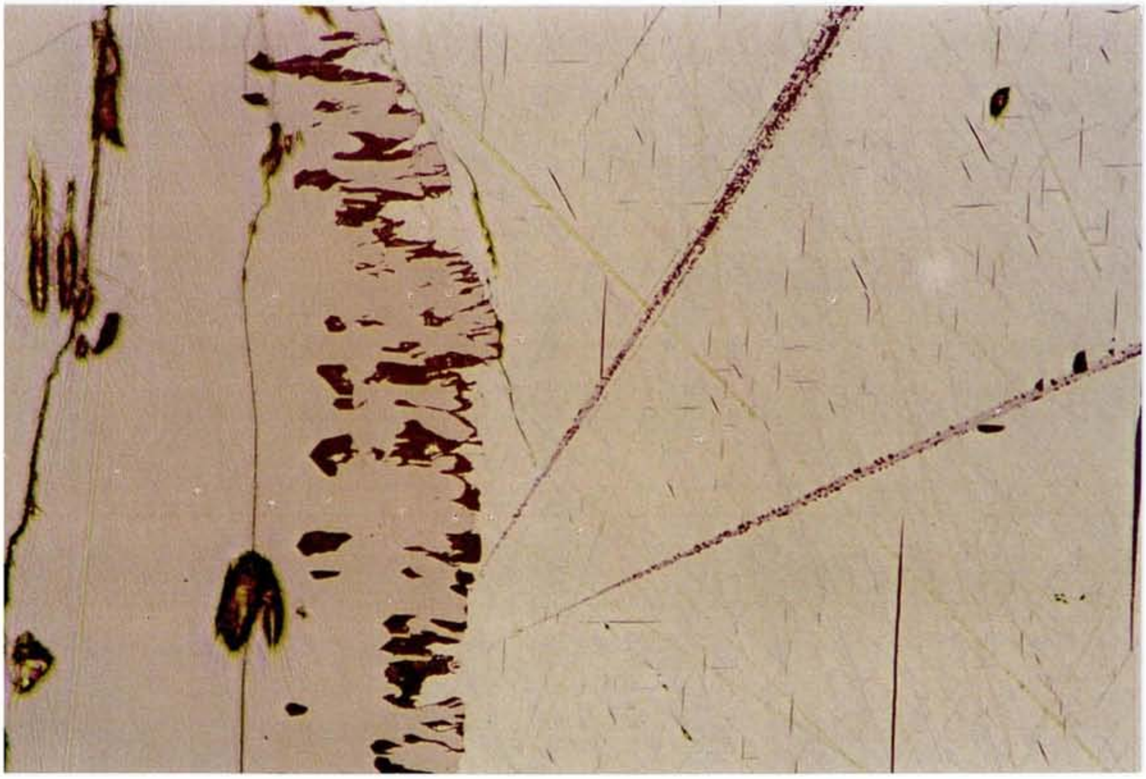
a magnetite-spinel-ilmenite symplectite at the border between the two grains. The magnetite grains do have minor {111} ilmenite lamellae. These lamellae are full of small spinel rods. The oxide exsolution found in the clinopyroxenes and orthopyroxenes is magnetite with ilmenite oxidation-exsolution. These exsolutions are very, very fine, have a high shape anisotropy, and play an important role in the magnetic signature of these rocks.

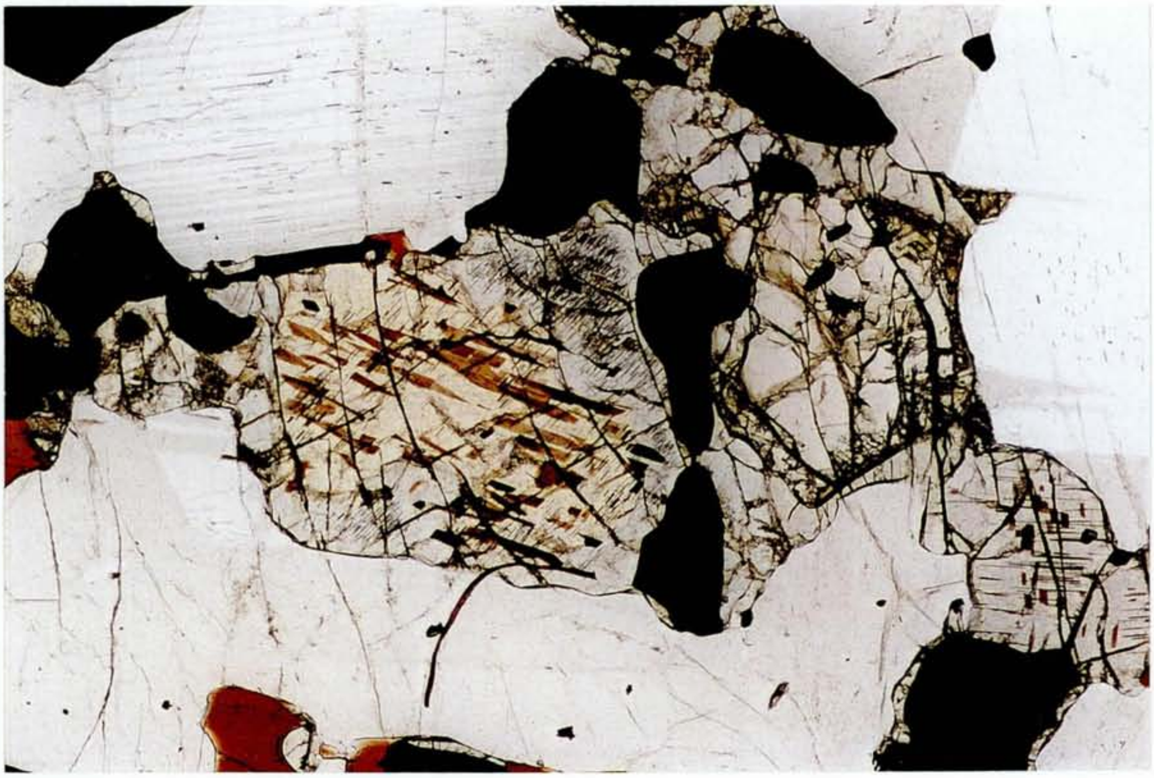
4.4 Ana-Sira Anorthosite (Samples Localities TE2-1, TE10-2)

The discrete oxides found in the two samples examined from the Ana-Sira Anorthosite (Figure 4.9) are ilmenite with hematite exsolution, hematite with ilmenite exsolution and spinel. A further oxidation of ilmenite to rutile is observed in a number of the hemo-ilmenite grains (R2 to R3). The internal reflections from the rutile are clearly shown in the photomicrographs from the anorthosite. The hematite exsolution in the ilmenite and ilmenite exsolution in the hematite is on a very fine scale. Multiple generations of exsolution are present down to the micron scale and probably continue down to below the optical resolution of the microscope. There are many very, very fine opaque exsolutions in the plagioclases that in most cases are too fine to determine accurately on the optical microscope. Some of these are rutile but magnetite and hematite exsolutions are also a possibility.

Southern Extension (Locality TE 29)

Figure 4.7 (Top) Magnetite with oxidation exsolution of ilmenite trellis lamellae and very fine spinel needles and adjacent ilmenite grain. Photographed in reflected light with a blue filter at 100x. (Bottom) Magnetite with oxidation exsolution of ilmenite trellis lamellae and very fine spinel needles note adjacent ilmenite grain does not contain hematite lamellae and well developed magnetite-spinel-ilmenite symplectite. Photographed in reflected light with a blue filter at 850x.





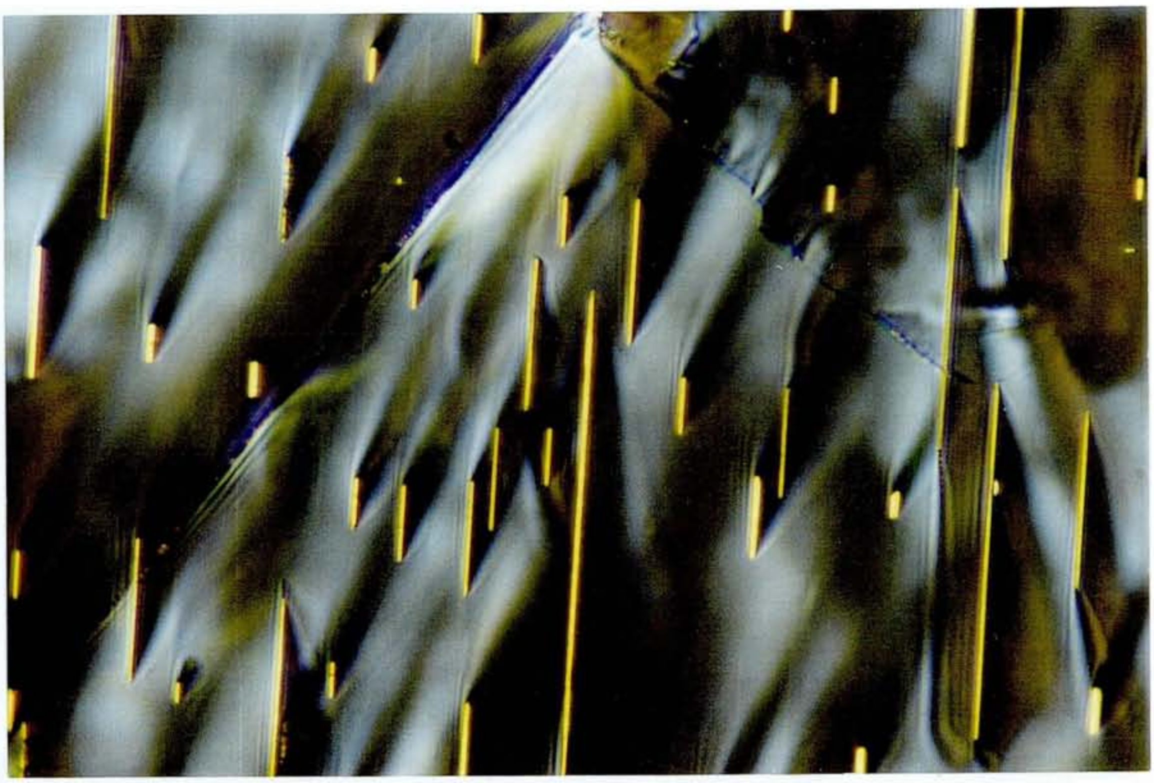
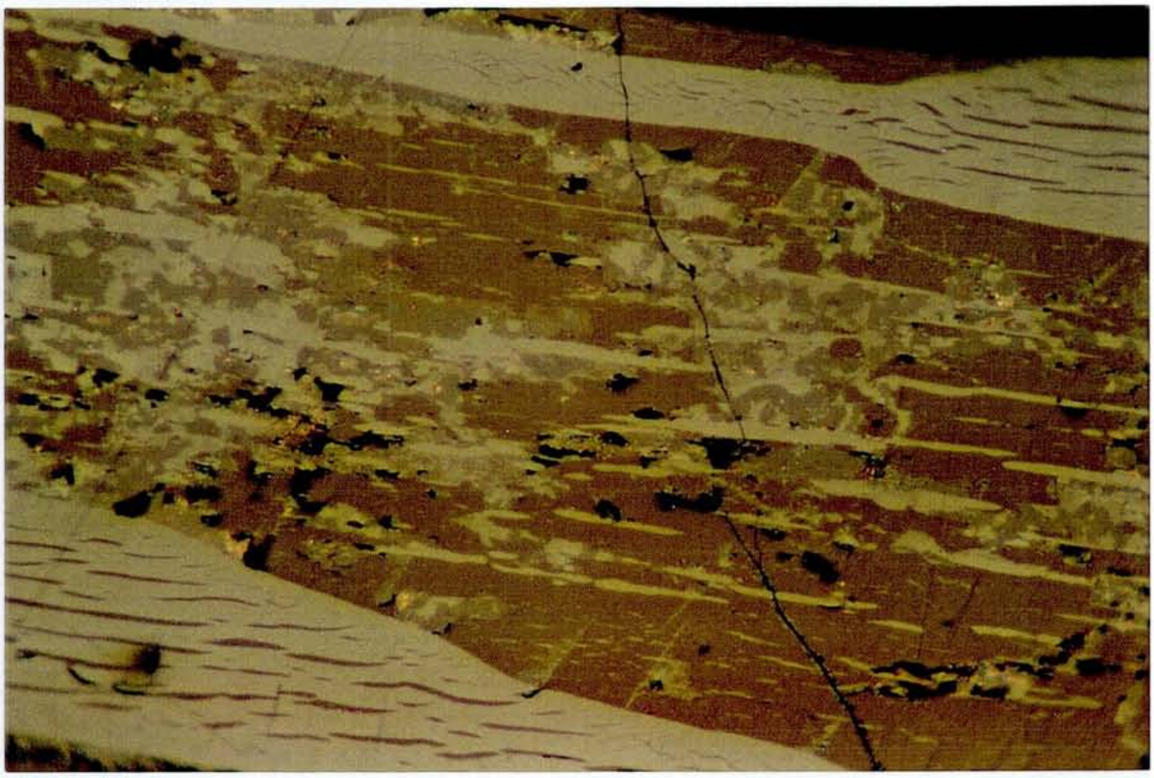


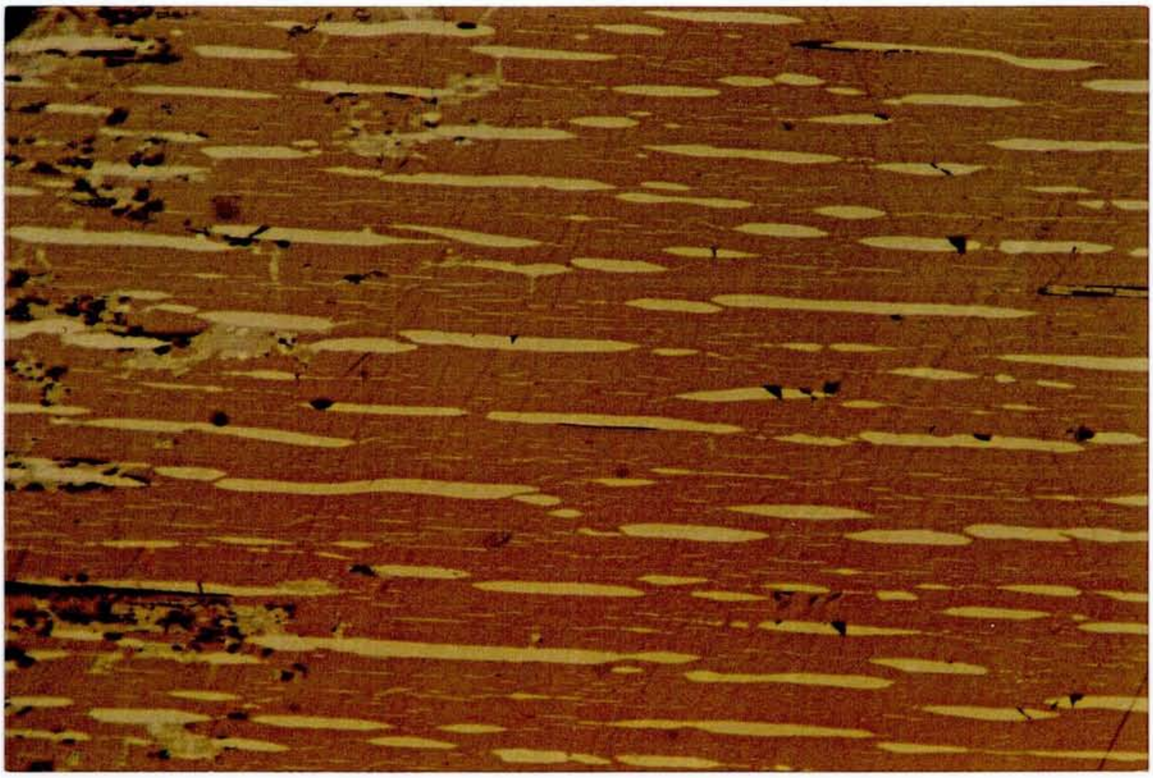
Figure 4.8 (Top) Plagioclase, biotite, clinopyroxene with opaque lamellae and discrete ilmenite and magnetite grains. Photographed in Transmitted light with a blue filter at 50x (Bottom) Magnetite with oxidation exsolution of ilmenite in clinopyroxene. Photographed in reflected and transmitted light with a blue filter at 1200x.

Åna Sira Anorthosite

Localities TE2 and TE10

Figure 4.9 Discrete grains of ilmenite with very fine hematite exsolution lamellae and hematite with ilmenite lamellae. Internal reflections in top photograph are due to minor alteration of the ilmenite lamellae to rutile (Sample TE2-1 top; TE10-2 bottom). Photographed in reflected light with a blue filter at 1200x

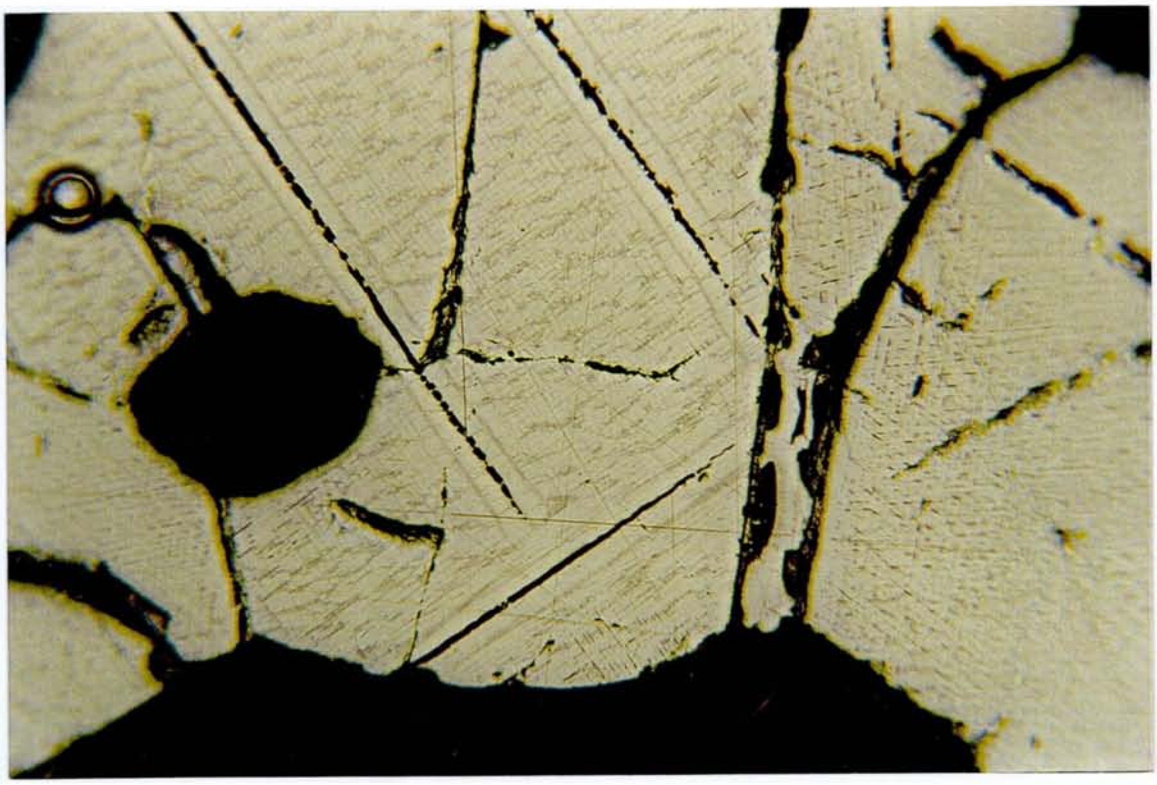




4.5 Oxide-rich Cumulate Norite of the Bakka Positive Aeromagnetic Anomaly Area, Bjerkreim-Sokndal Lopolith (Sample Localities TE25, TE26, TE27)

Sample TE 26 and sample TE 25 (Figures 4.10 - 4.13) contain abundant magnetite with ilmenite oxidation-exsolution. The very fine exsolution pattern is indicative of ulvöspinel exsolution from magnetite that later oxidized to ilmenite. This transitional pattern from a lit-par-lit Usp_{SS} to a lamellar Usp_{SS} which has oxidized to ilmenite, is found throughout this sample. Well developed spinel needles are present along {100} planes. These are present as at least two generations of pleonaste 1) found as large rods and 2) very fine needles. The immediate area surrounding the pleonaste lamellae is magnetite rich and free of ilmenite. Though abundant ilmenite is present in this sample most of it exists as a very, very fine intergrowth with magnetite.

Sample TE 27 contains abundant magnetite and ilmenite as discrete grains and as intergrowths. When magnetite and ilmenite are adjacent grains there is commonly a spinel-magnetite-ilmenite symplectite at the border of the two grains. The magnetite grains are Ti-poor and have only minor narrow {111} ilmenite lamellae. The ilmenite lamellae are dotted and rimmed by spinel. There are coarse and fine black rods of pleonaste spinels in the magnetites exsolving along the {100} spinel planes. There are several generations of exsolution present in the magnetites. Some of the pleonastes are offset by ilmenite lamellae while others are exsolving from the ilmenite lamellae. It would appear that the ilmenite and magnetite have re-equilibrated because the ilmenite lacks hematite exsolution and the magnetite has very few lamellae of ilmenite. Pyrite and/or pyrrhotite are present with spinel along fractures in the magnetite. Oxide exsolution in the clinopyroxenes was not observed. The lack of hematite lamellae in the ilmenite, and magnetite-ilmenite oxidation-exsolution in the clinopyroxenes, in addition to the lack of fine microtextures in magnetites yields a very different magnetic signature than the ilmenite norite at the Tellnes mine.



Bakke Area Positive Aeromagnetic High

Localities TE26 and TE27

Figure 4.10 Magnetite with very fine cloth-like oxidation exsolution of ilmenite lamellae. Also present two generations of spinel. Photographed in reflected light with a white filter at 500x. (Sample TE26)

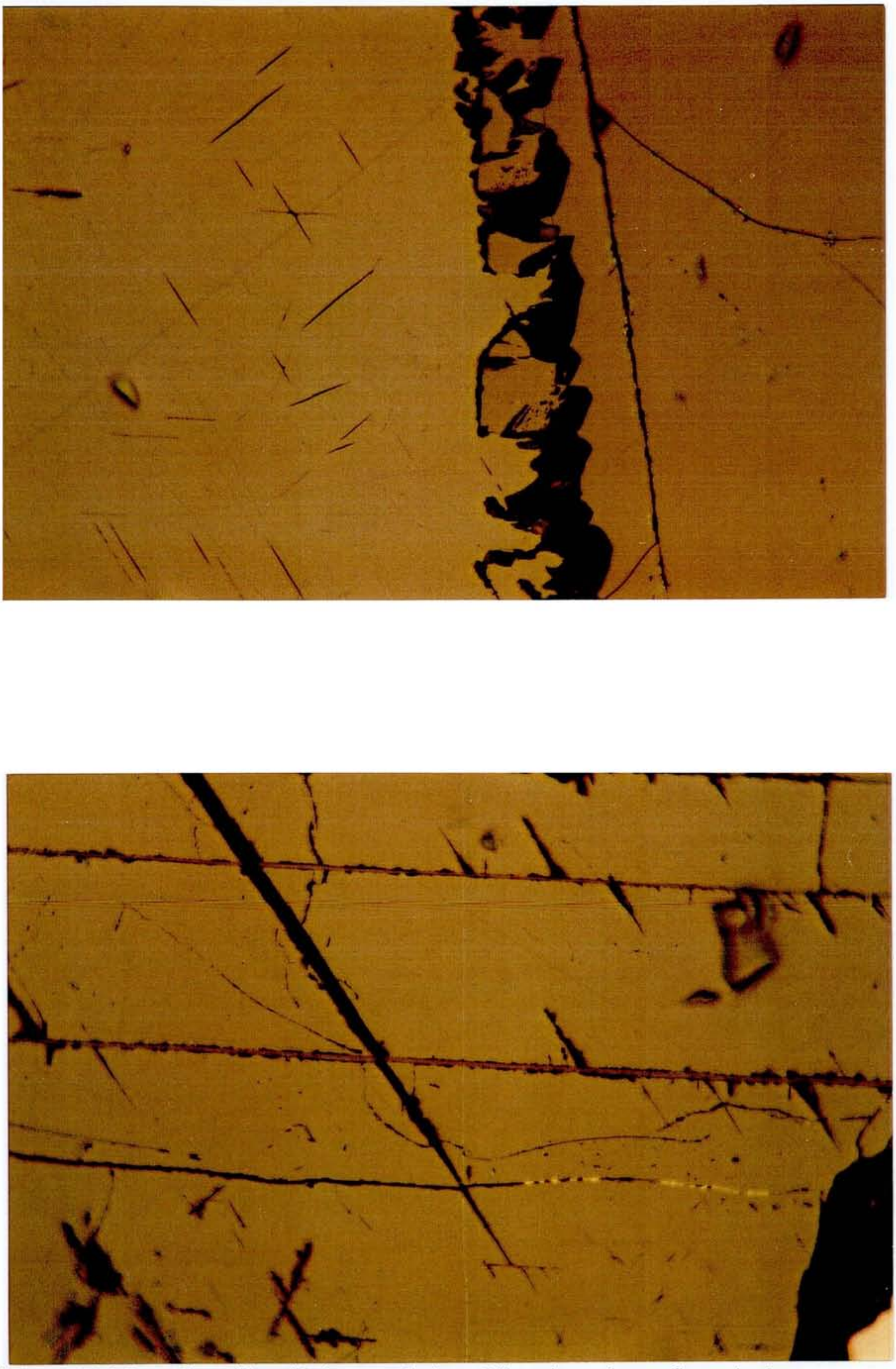


Figure 4.11 Magnetite with oxidation exsolution of ilmenite and very fine spinel exsolution needles. Note adjacent ilmenite grain next to magnetite is free of hematite exsolution. Photographed in reflected light with a white filter at 500x. (Sample TE27)

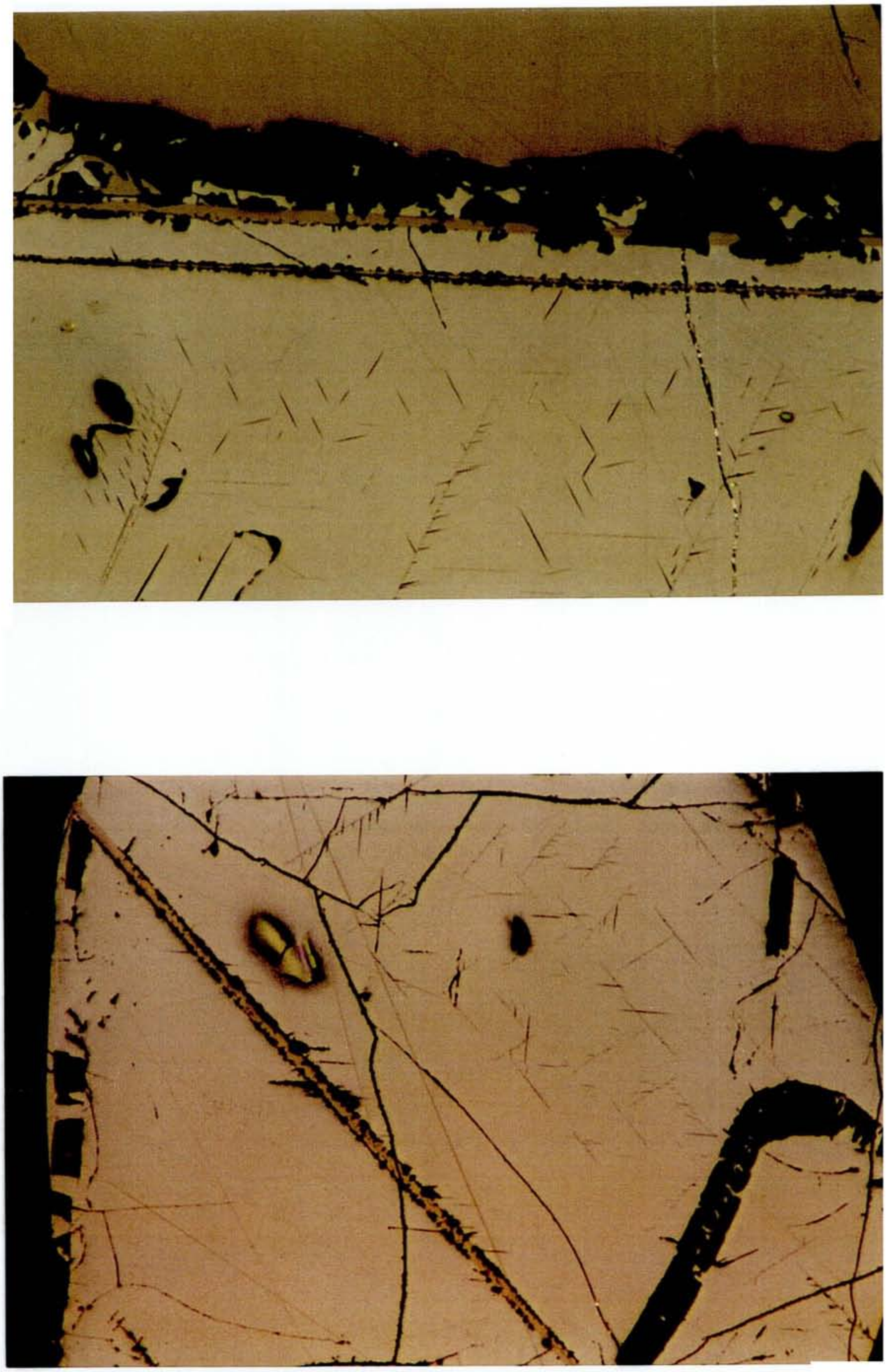


Figure 4.12 Magnetite with minor oxidation exsolution of ilmenite lamellae and very fine spinel exsolution needles. Well developed magnetite -spinel-ilmenite symplectite. Note lack of hematite exsolution in ilmentite. Photographed in reflected light with a blue filter at 500x. (Sample TE 27)

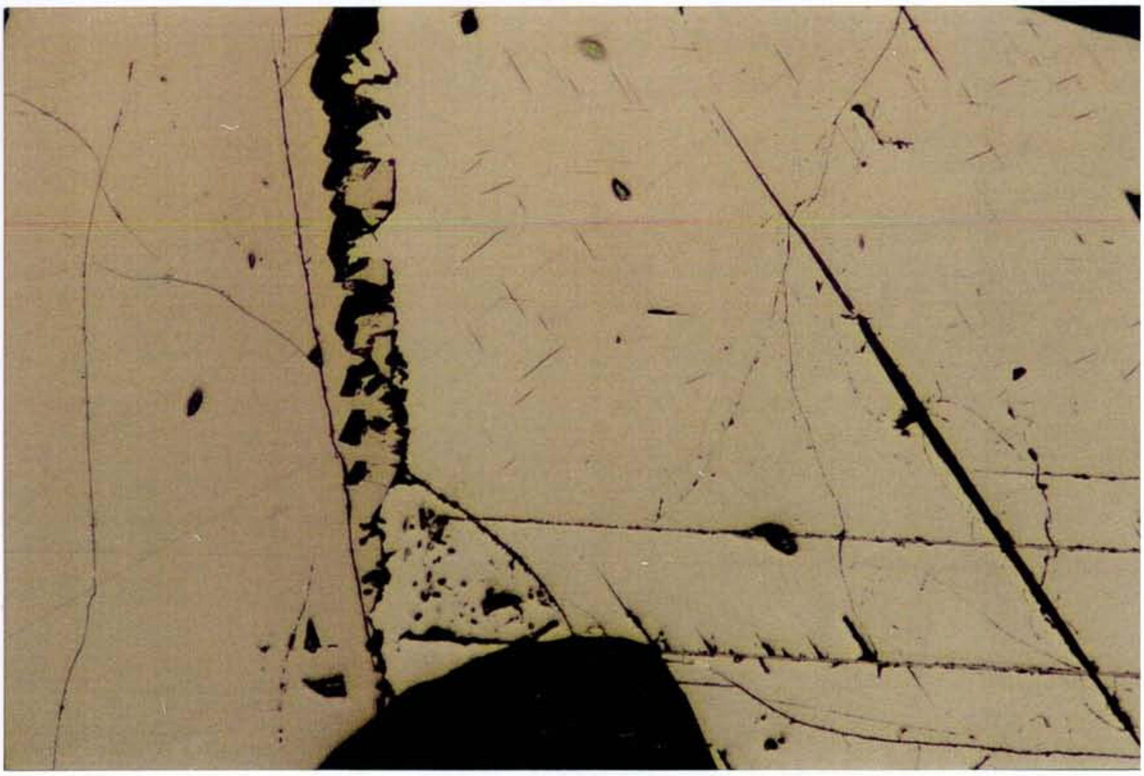


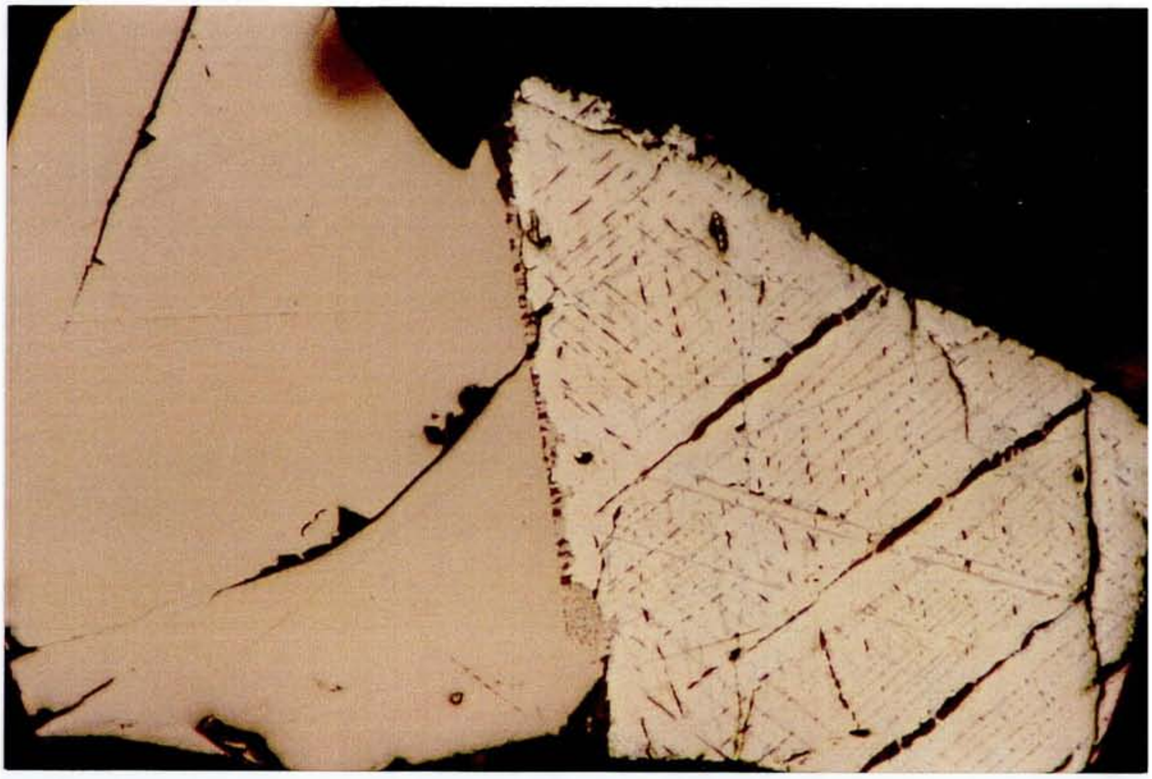
Figure 4.13 Magnetite with minor oxidation exsolution of ilmenite trellis lamellae and very fine {100} spinel exsolution needles. Secondary pyrite in late stage vein (Top). Magnetite adjacent to Ilmenite with a magnetite -spinel-ilmenite symplectite at contact. Note lack of hematite exsolution in ilmenite (Bottom) . Photographed in reflected light with a blue filter at 500x. (Sample TE 27)

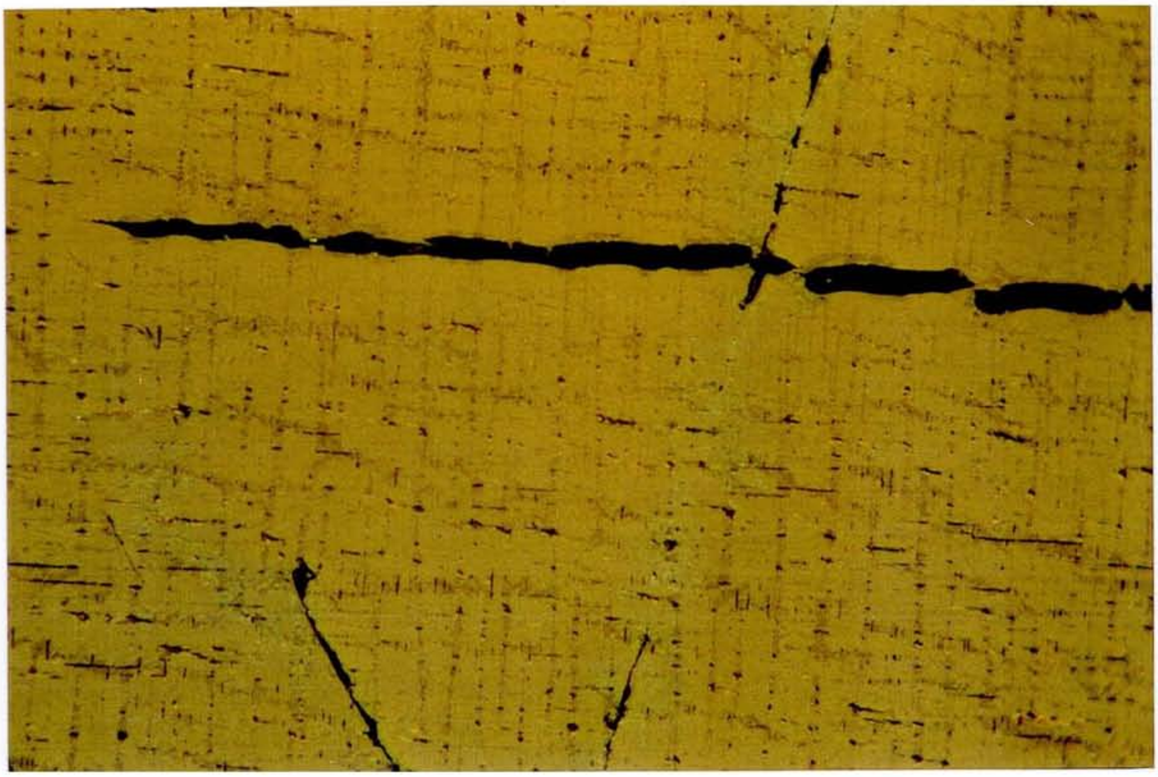
4.6 Oxide-rich Cumulate Norite of the Mydland Positive Aeromagnetic Anomaly Area, Bjerkreim-Sokndal Lopolith (Sample Locality TE16) and Quartz Mangerite East of the Mydland Positive Aeromagnetic Anomaly (Sample Localities TE56-1 and TE57-1a)

Sample TE16 was collected from a norite in the central section of the large positive aeromagnetic anomaly at Mydland. The two dominant oxides in this sample are magnetite and ilmenite (Figures 4.14 - 4.17). The magnetite grains display very-fine oxidation-exsolution as cloth-like pattern of lamellae of ilmenite. Trellis (C2) lamellae of ilmenite are also present in magnetite. Very fine spinel exsolution usually accompanies the ilmenite trellis lamellae. Large and small rods of spinel exsolution are found throughout the magnetites. The larger spinel rods are rimmed by ilmenite. The area directly surrounding the spinel rods with ilmenite rims is devoid of fine ilmenite exsolution yielding areas of nearly pure magnetite. Hematite exsolution was not observed in the large ilmenite grains. Though minor spinel intergrowths and/or needles were found in the ilmenites and the border between the ilmenite and magnetite grains only displayed minor reaction rims of spinel-magnetite-ilmenite. Secondary alteration of titano-magnetite to titano-maghemite was observed in many of the magnetite grains.

The quartz mangerite samples (TE56-1 and TE57-1a) from east of the Mydland lobe contain abundant magnetite with fine C2 {111} trellis oxidation-exsolution lamellae of ilmenite and/or C2-C3 sandwich type lamellae (Figures 4.18 - 4.19). Within the ilmenite lamellae and rimming the ilmenite lamellae very fine-grained spinel exsolution is commonly observed in both samples TE56-1 and TE57-1a. When magnetite is in direct contact with ilmenite a spinel-magnetite-ilmenite symplectite is not present. Spinel lamellae and/or intergrowths of spinel can be found in the ilmenite. Hematite exsolution was not observed in any of the ilmenites, either those adjacent to magnetites, or those present as discrete grains.

Figure 4.14 Magnetite with oxidation-exsolution lamellae of ilmenite and very fine spinel {100} exsolution needles and coarser developed spinel exsolution. A minor magnetite-spinel-ilmenite symplectite at contact with ilmenite grain. Note lack of hematite exsolution in ilmenite (Top). (Bottom) Magnetite with {111} lamellae of ilmenite and {100} lamellae of spinel. Coarser spinel is rimmed by ilmenite. Photographed in reflected light with a blue filter at 500x. (Sample TE 16-4)





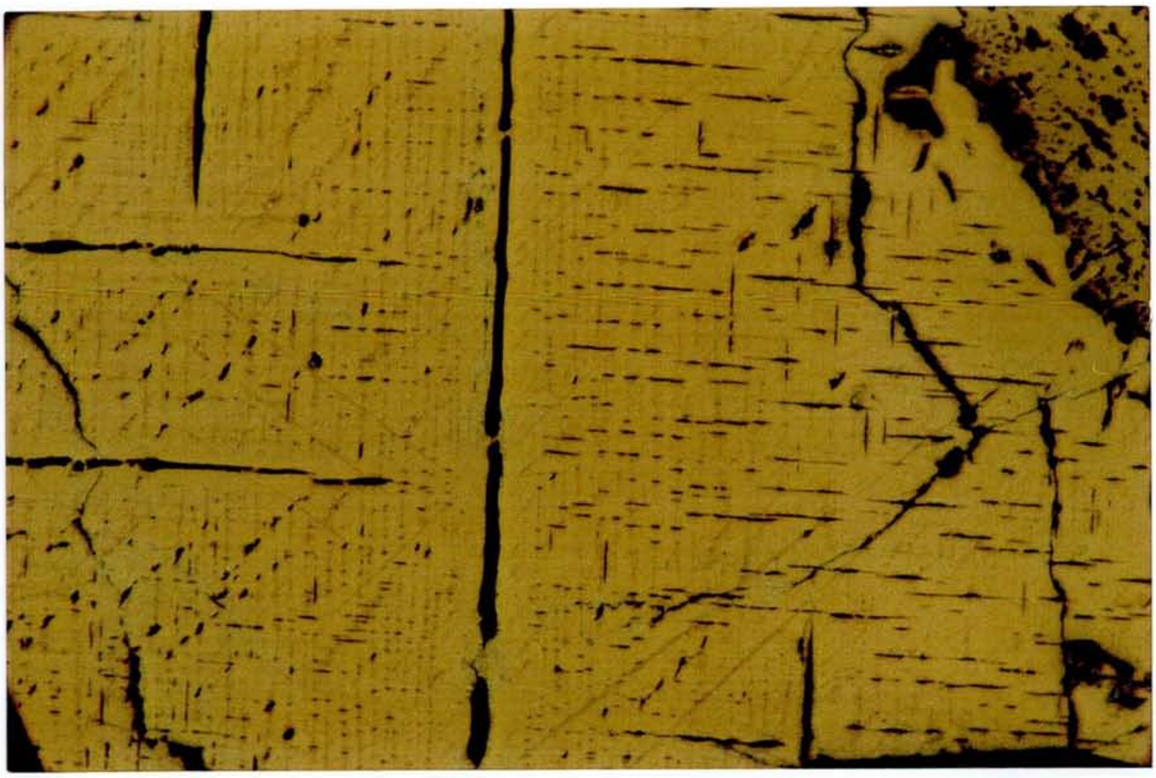
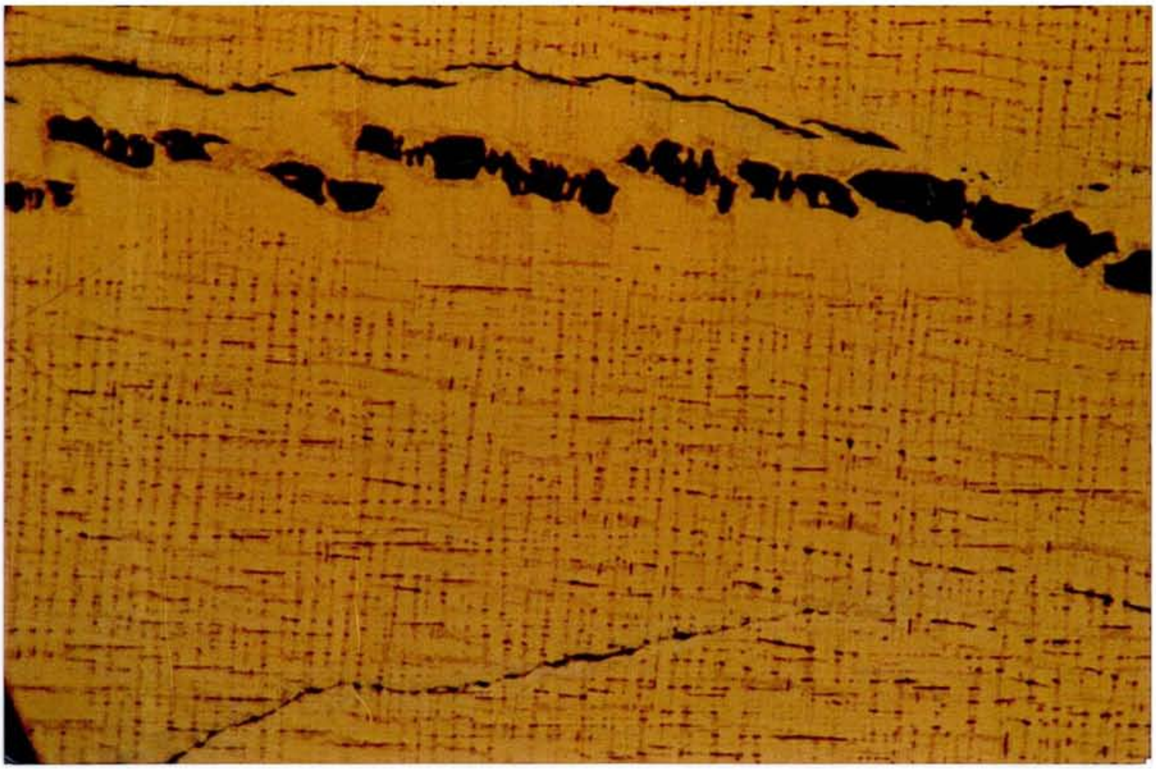


Figure 4.15 Magnetite with oxidation exsolution of ilmenite trellis lamellae and very fine spinel exsolution needles. Minor alteration to maghemite as shown by bluish color along cracks. Photographed in reflected light with a white filter at 500x. (Sample TE 16)

Figure 4.16 Magnetite with oxidation exsolution of ilmenite trellis lamellae and very fine spinel exsolution needles. Well developed spinel intergrowths. Photographed in reflected light with a white filter at 500x. (Sample TE 16)



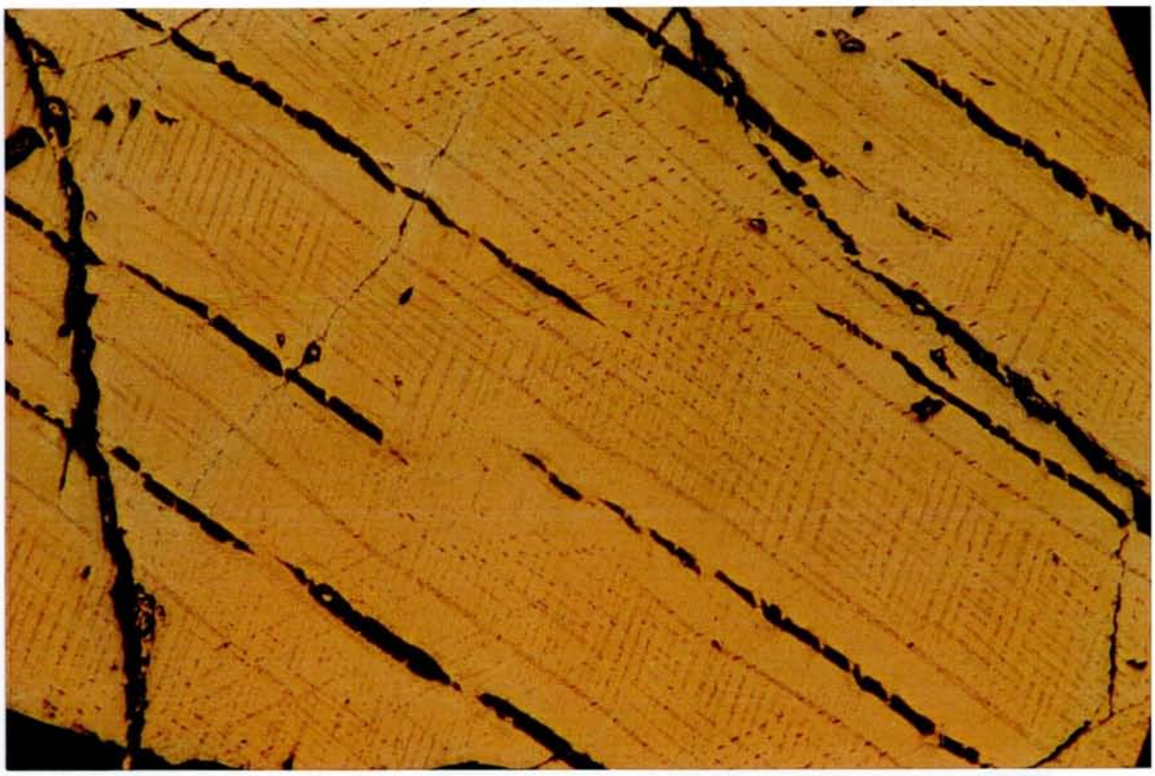


Figure 4.17 Magnetite with oxidation exsolution of ilmenite trellis lamellae and cloth-like texture of ilmenite oxidation-exsolution and very fine spinel needles. Note ilmenite rims on first generation of spinel. Photographed in reflected light with a white filter at 500x. (Sample TE 16)

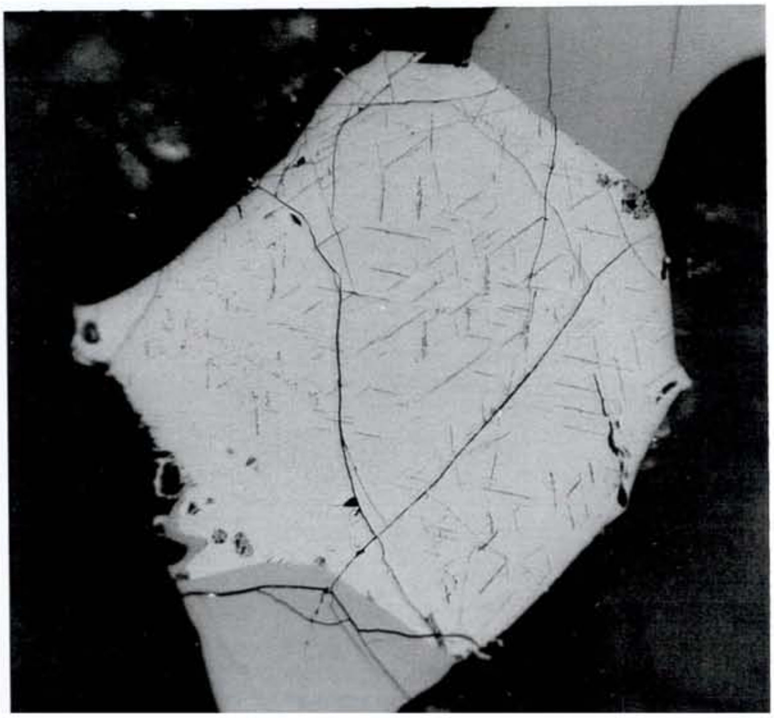


Figure 4.18 Magnetite with minor oxidation-exsolution of ilmenite lamellae and very fine spinel exsolution needles. Note lack of hematite exsolution in ilmenite. Photographed in reflected light with a green filter at 250x. (Sample TE 56)

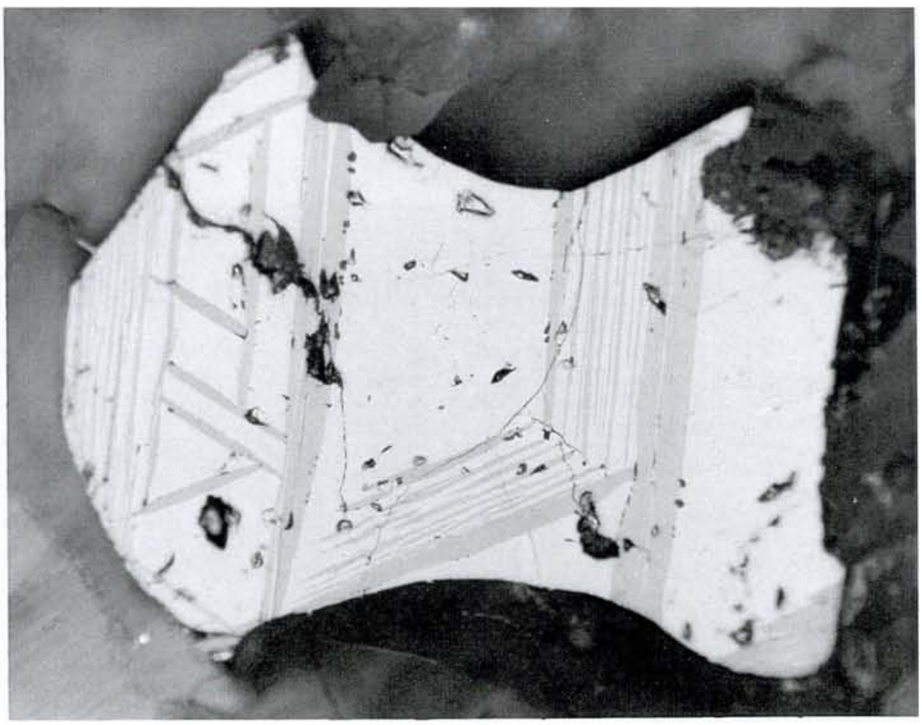


Figure 4.19 Magnetite with sandwich type oxidation-exsolution of ilmenite lamellae. Photographed in reflected light with a green filter at 250x. (Sample TE 57)

4.7 Oxide-rich Cumulate Norite of the Mydland Negative Aeromagnetic Anomaly Area, Bjerkreim-Sokndal Lopolith (Sample Localities TE33, TE34, TE35)

The norite sample TE33 (Figures 4.20 - 4.22 and 4.27) contains abundant ilmenite with{0001} hematite exsolution lamellae. The exsolution lamellae do not appear to be so well developed as those found in the ilmenites from the Tellnes mine area. Minor exsolution needles or rods are present in the ilmenite but these ilmenites are poorer in spinel component compared to the Tellnes ilmenites. Pyrite and pyrrhotite are common accessory phases and as inclusions in the ilmenite grains. When ilmenite and sulfide are in contact it does not appear to have an effect on the hematite exsolution. The clinopyroxenes have dense lamellae of oxides. Magnetites with ilmenite oxidation-exsolution along {111} planes are common. Ilmenites with {0001}hematite exsolution are also found in the pyroxenes.

Norite sample TE34 (Figures 4.23 - 4.26 and 4.28) differs from sample TE33 in that there is magnetite with {111} lamellae of ilmenite and the ilmenite lamellae are commonly rimmed by spinel. The ilmenite lamellae in the magnetite are few (C2). There are multiple generations of spinel lamellae. When magnetite and ilmenite are in contact, the boundary is clean, very different from the magnetite-spinel-ilmenite spinel symplectites observed at many other localities. Hematite lamellae are present in all the observed ilmenite grains, although these hematite lamellae are not so coarse as those found in other parts of the region, especially the Tellnes mine area. Ilmenites with hematite exsolution are found in the clinopyroxenes. Pyrite and pyrrhotite are common accessory minerals.

Oxide-rich Cumulate Norite of the Mydland Negative Aeromagnetic Anomaly Area

Localities TE33, TE34, TE35

Figure 4.20 Plagioclase, biotite, orthopyroxene and clinopyroxene with magnetite-ilmenite and hemo-ilmenite exsolution and discrete hemo-ilmenite. Photographed in transmitted light with a blue filter at 50x (Samples TE 33-4a and TE33-6a

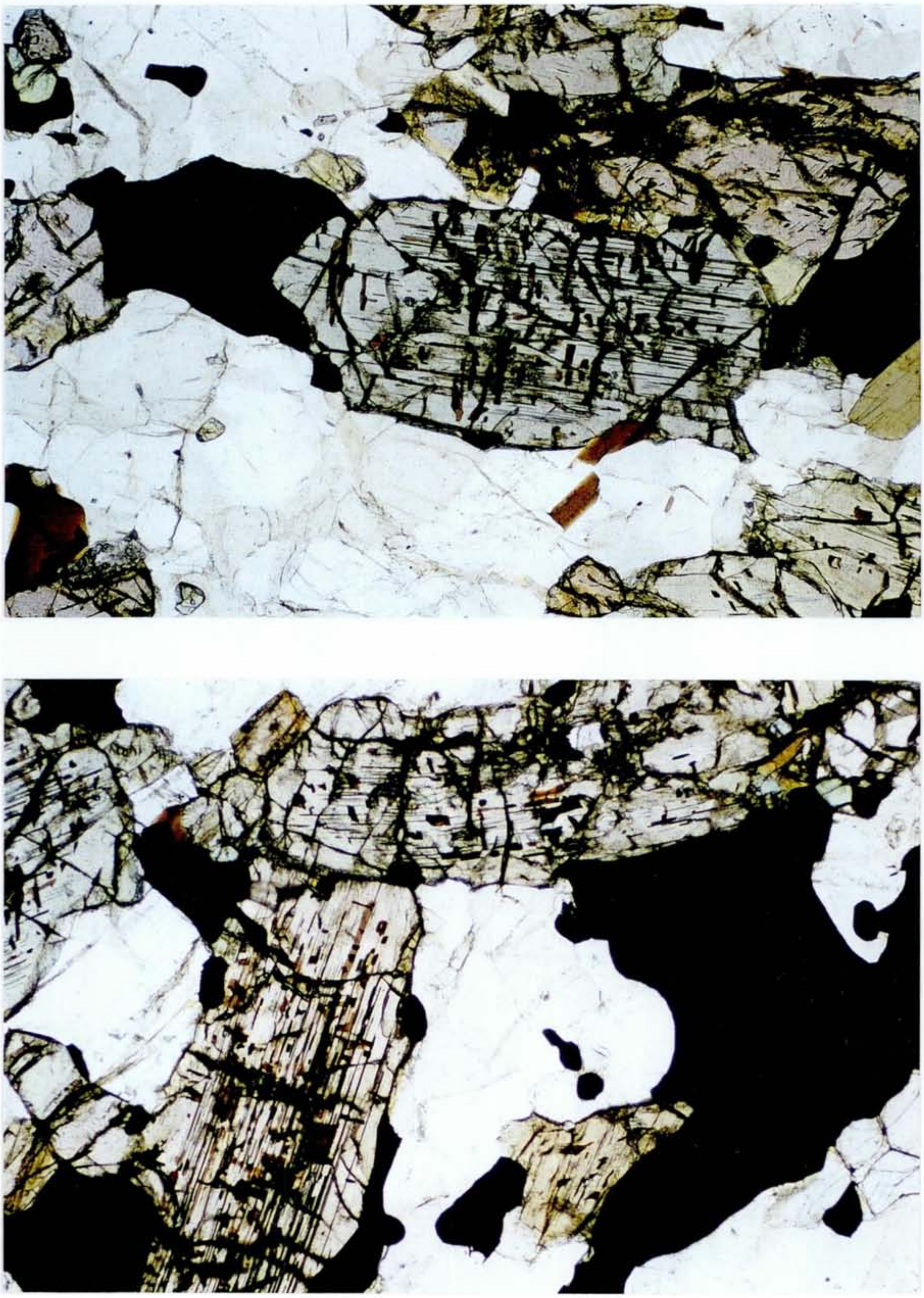


Figure 4.21 Ilmenite with finely developed hematite exsolution lamellae and small spinel needles Photographed in reflected light with a blue filter at 850x. (Samples TE 33-4a and TE33-6a)

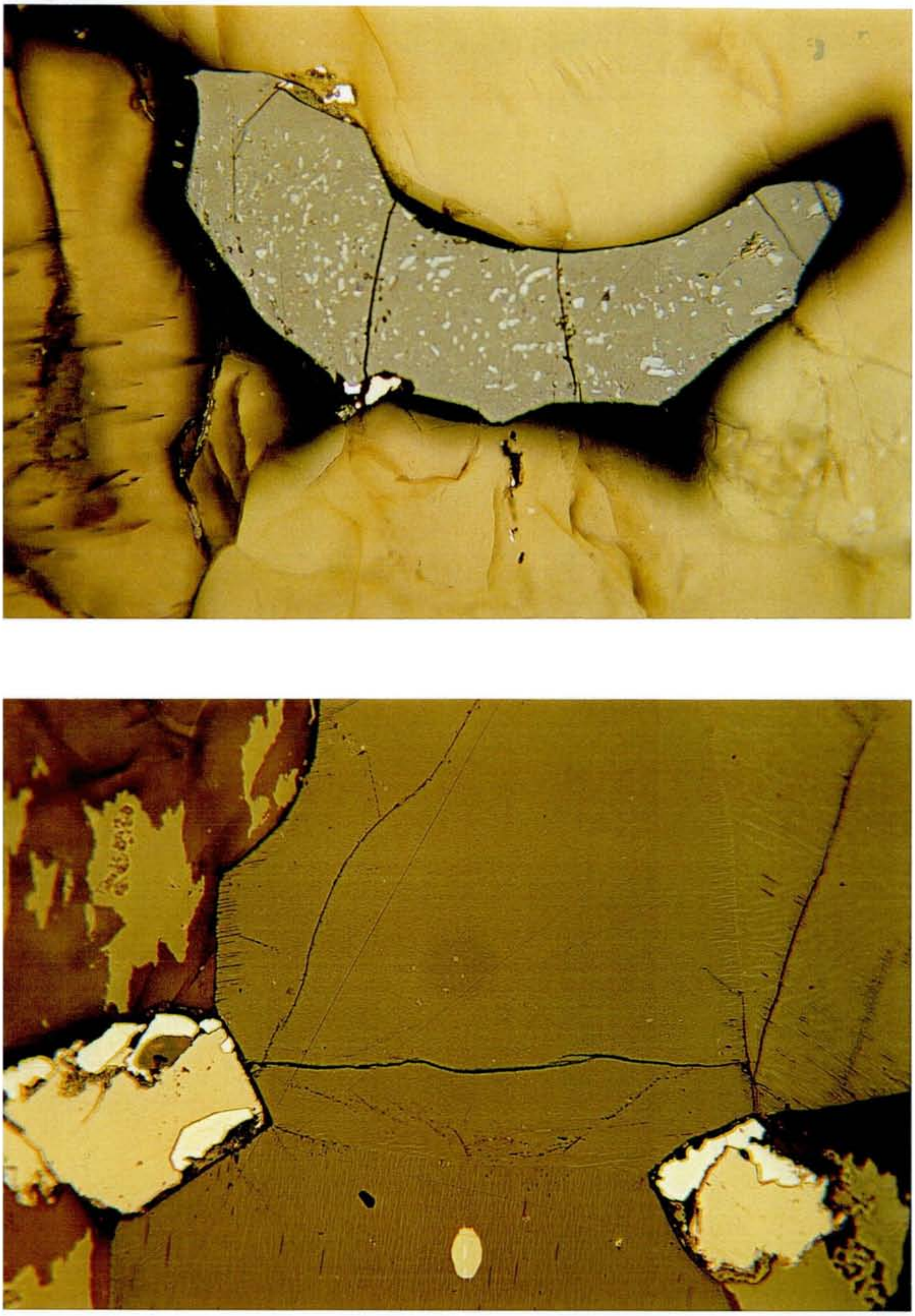


Figure 4.22 (Top) Ilmenite with hematite exsolution lamellae. (Bottom) Ilmenite with poorly developed hematite exsolution lamellae with pyrite and pyrrhotite. Photographed in reflected light with a blue filter at 250x. (Samples TE 33-4a)

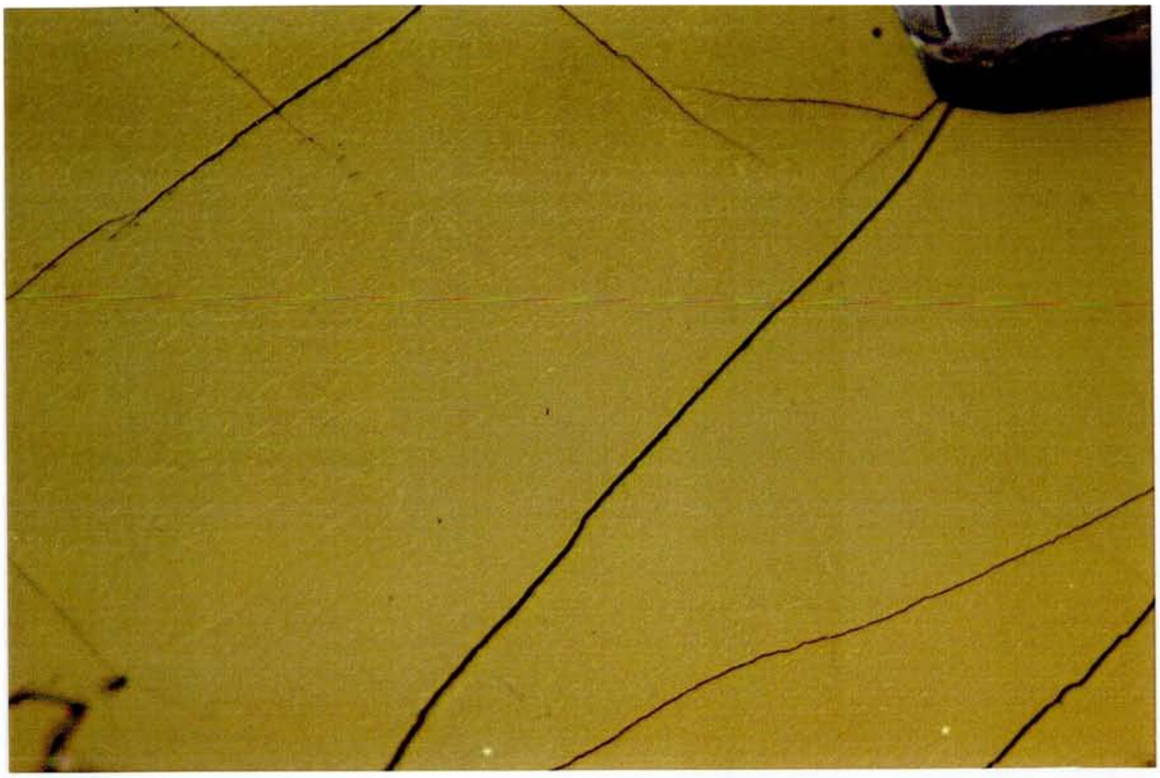


Figure 4.23 Ilmenite with hematite exsolution lamellae and minor spinel lamellae (Top). Ilmenite with fine hematite exsolution lamellae and magnetite. Note lack of lamellae in magnetite and lack of magnetite-spinel-ilmenite symplectite at grain boundary between ilmenite and magnetite (Bottom). Photographed in reflected light with a white filter at 250x. (Sample TE 34-7)

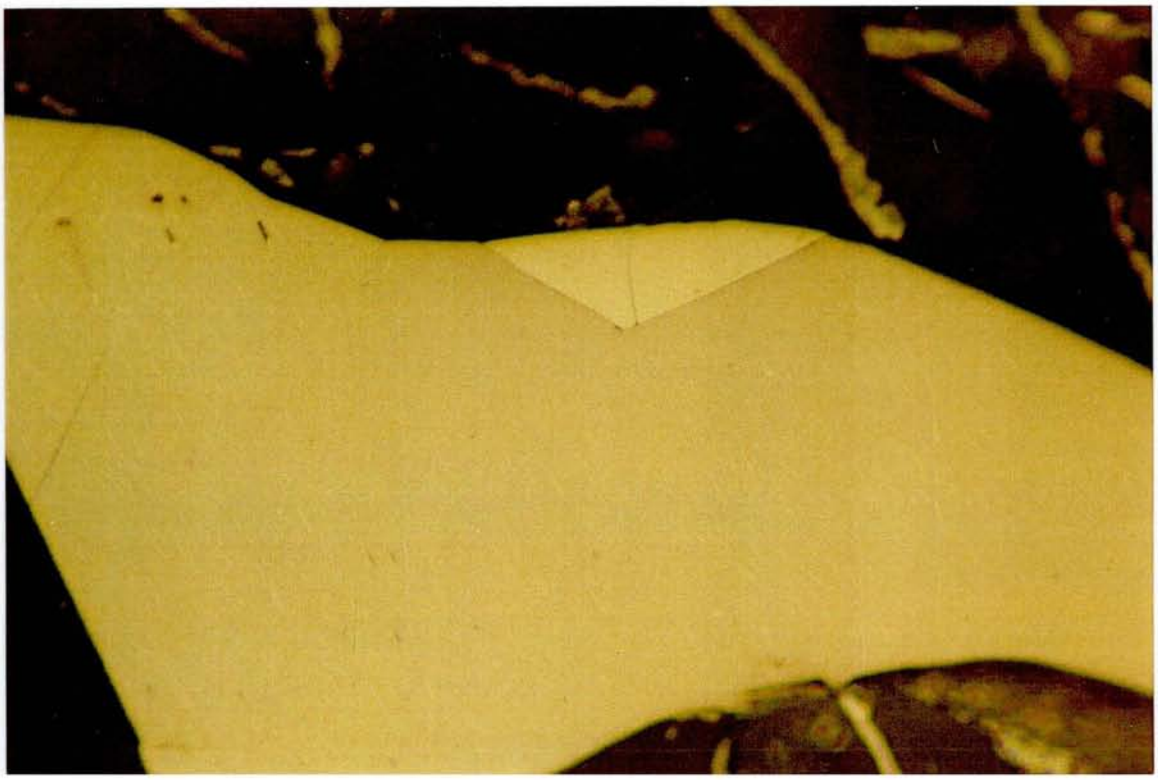
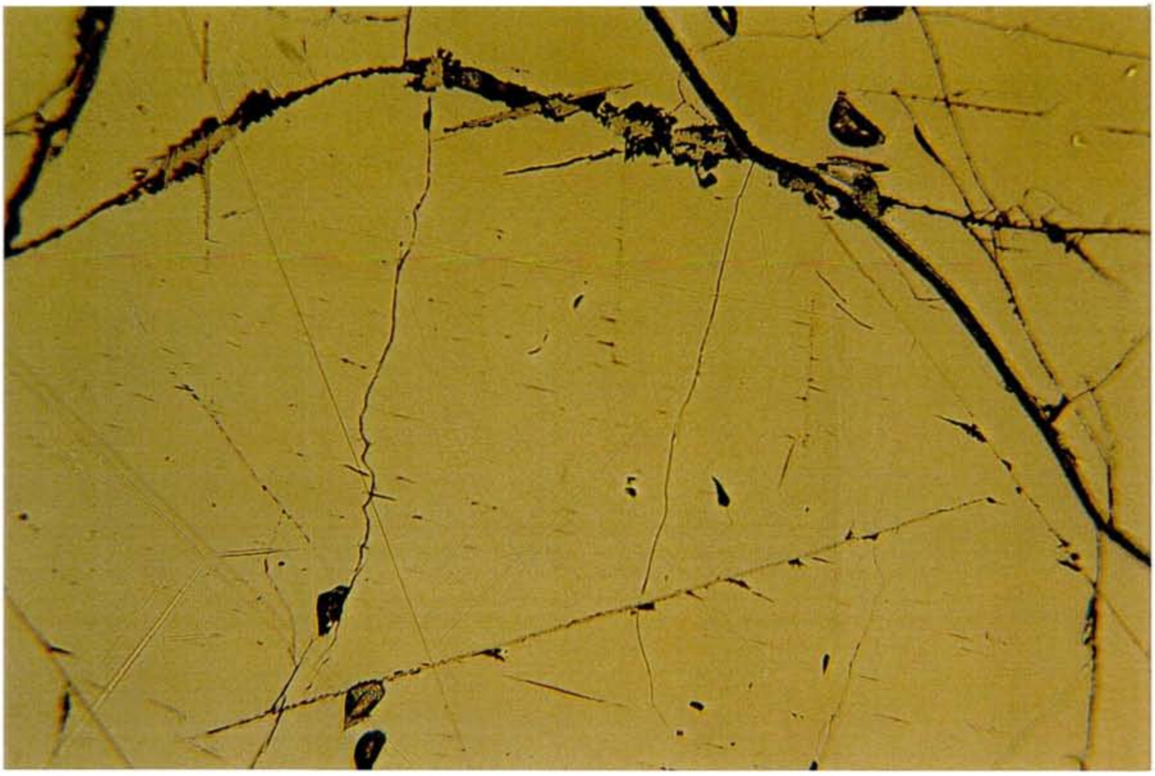


Figure 4.24 Ilmenite with hematite exsolution lamellae and minor spinel coexisting with pure magnetite. Photographed in reflected light with a white filter at 850x (Top) and 250x (Bottom). (Sample TE 34-7)



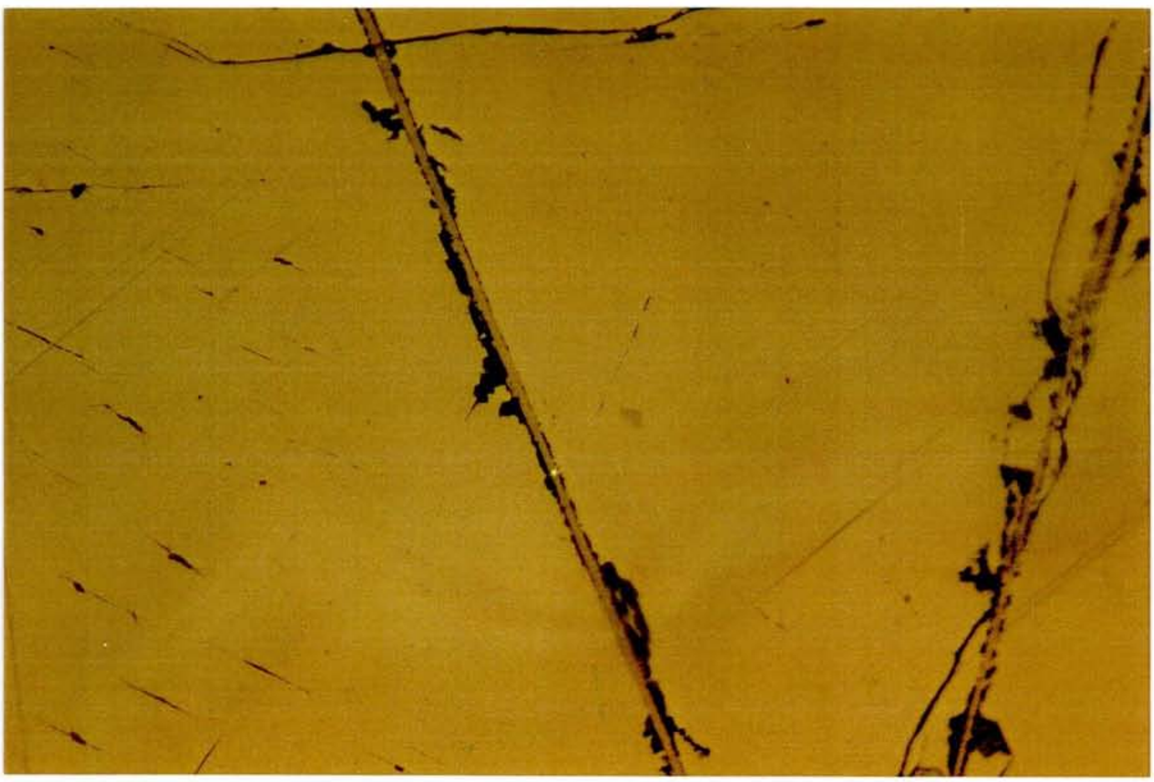


Figure 4.25 Magnetite with trellis lamellae of ilmenite and very fine needles of spinel and very fine spinel exsolution needles. Photographed in reflected light with a white filter at 250x (Top) and 850x (Bottom). (Sample TE 34-7)

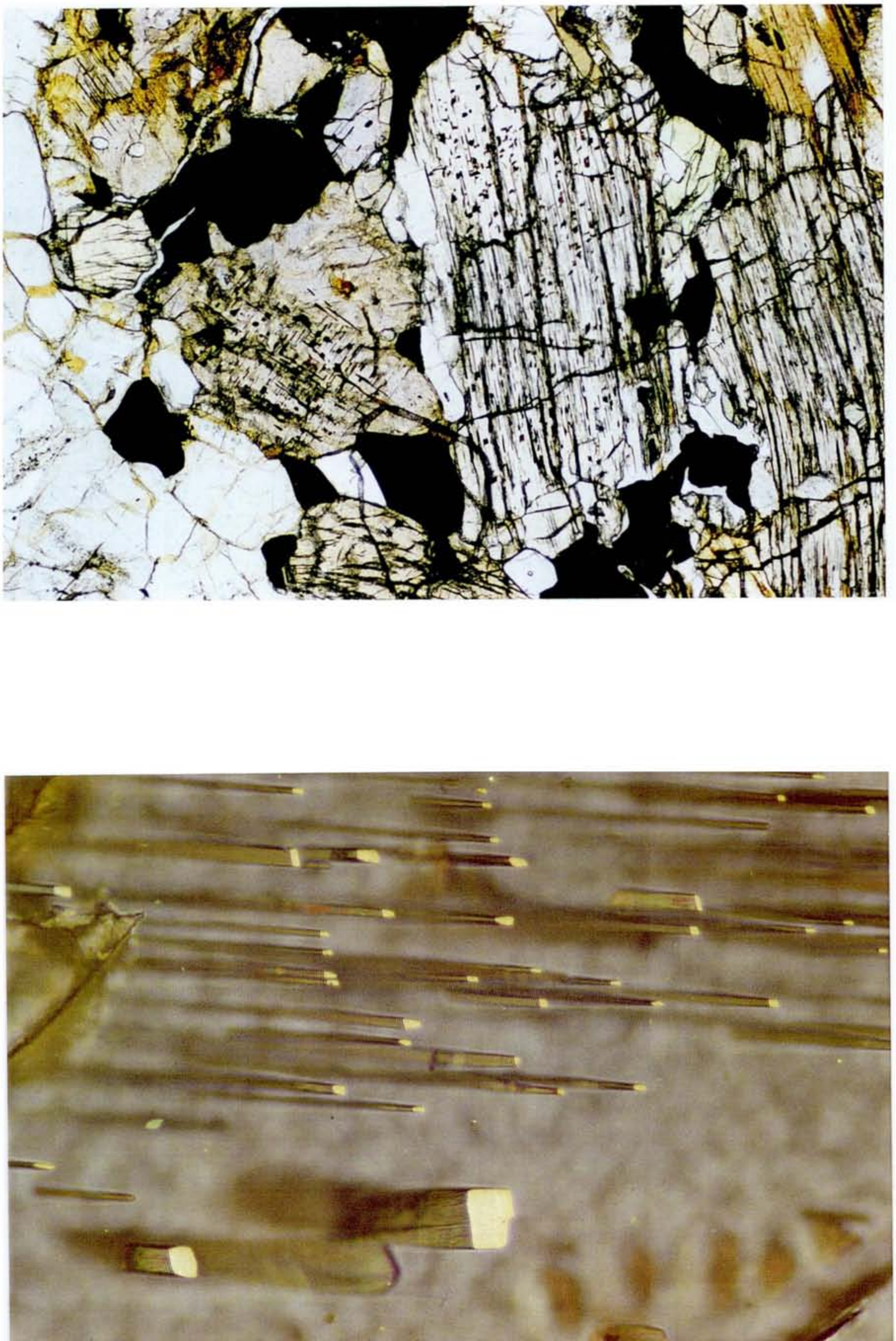


Figure 4.26 (Top) Plagioclase, biotite, orthopyroxene and clinopyroxene with magnetite-ilmenite and hemo-ilmenite exsolution and discrete hemo-ilmenite. Photographed in transmitted light with a blue filter at 50x (Bottom) Ilmenite with exsolution of hematite in the pyroxene. Photographed in reflected light with a blue filter at 850x. (Sample TE34-7)

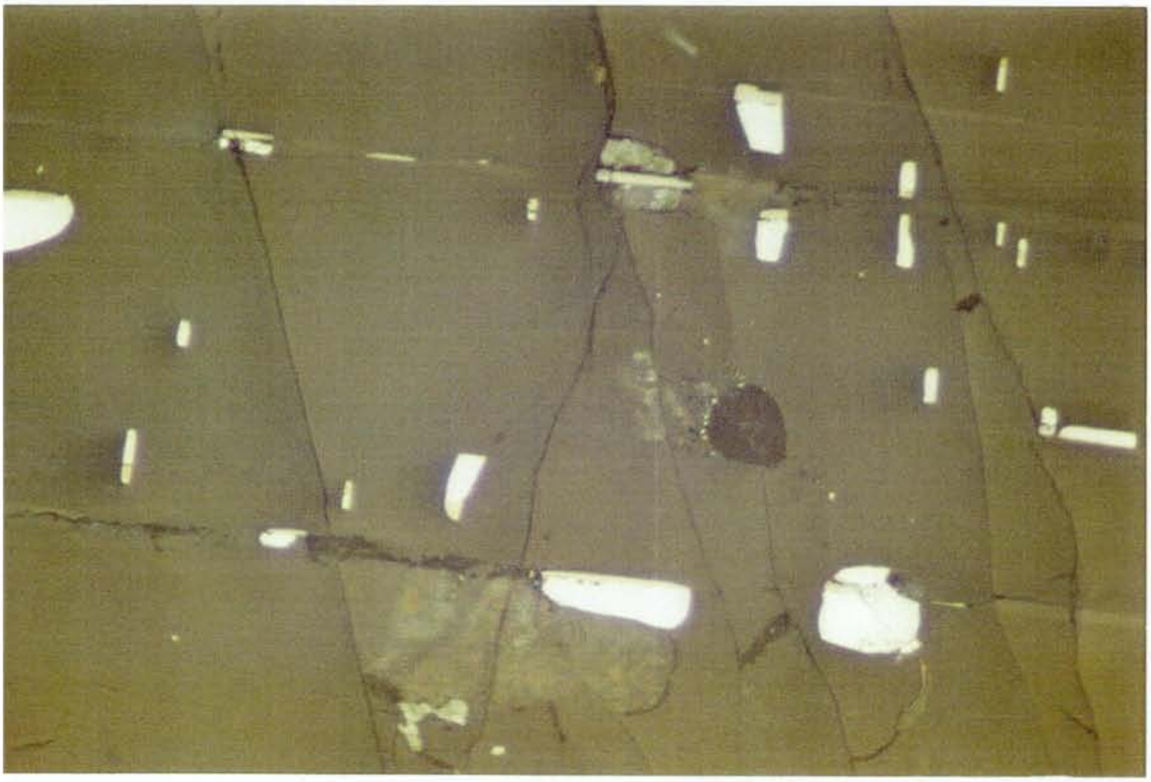


Figure 4.27 (Top) In silicates, inclusions of magnetite with oxidation-exsolution of ilmenite. Photographed in reflected light with a blue filter at 250x. (Bottom) Magnetite with oxidation exsolution of ilmenite in the pyroxene. Photographed in reflected light with a blue filter at 850x. (Sample TE 33-4a and TE 33-6a)

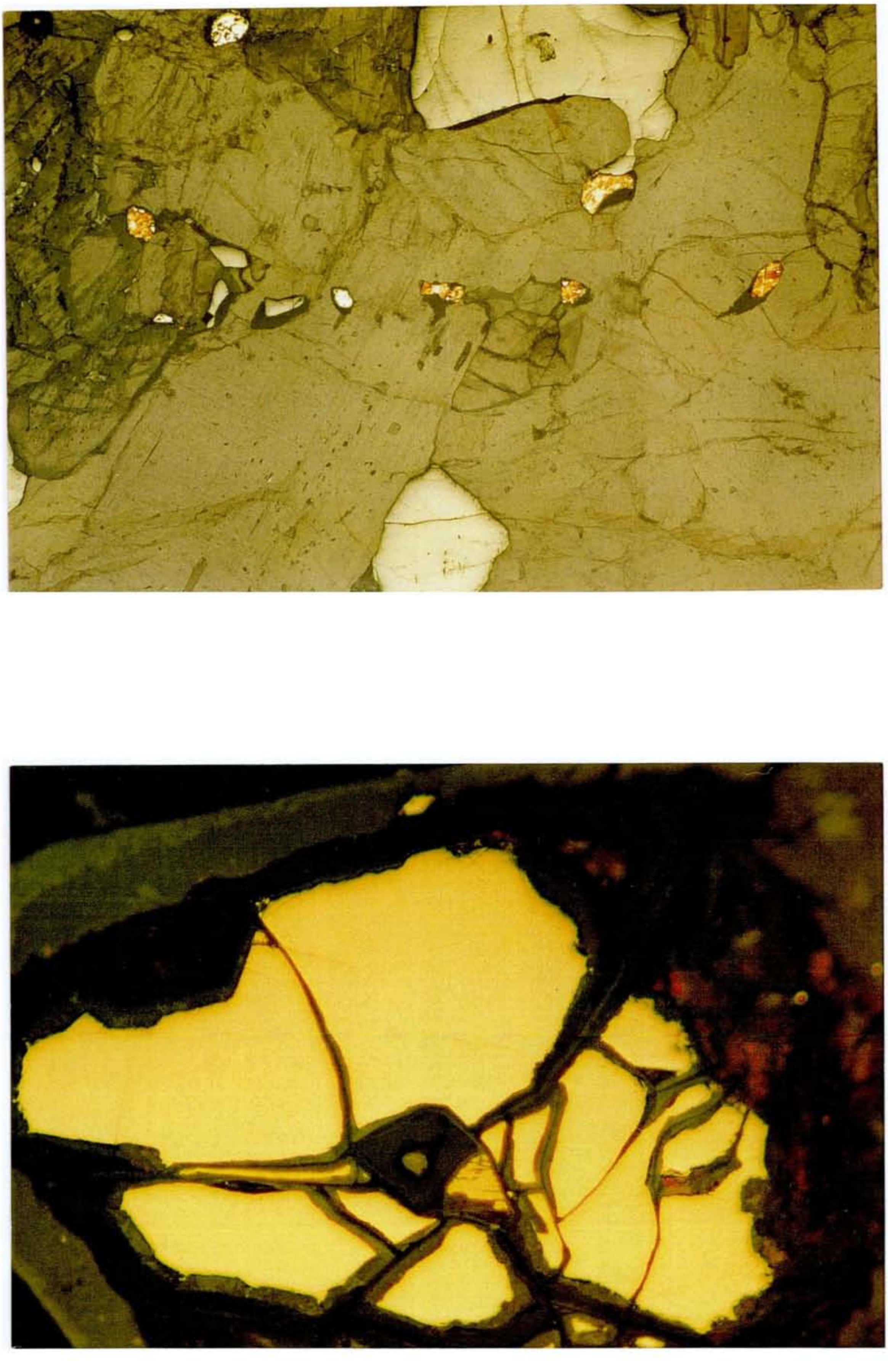


Figure 4.28 Pyrite, pyrrhotite and hematite. Photographed in reflected light with a white filter at 250x (Top) and 850x (Bottom). (Sample TE 34-7)

4.8 Oxide rich Cumulate Norite of the Heskestad Negative Aeromagnetic Anomaly Area, Bjerkreim-Sokndal Lopolith (Sample Localities TE39, TE40, TE41)

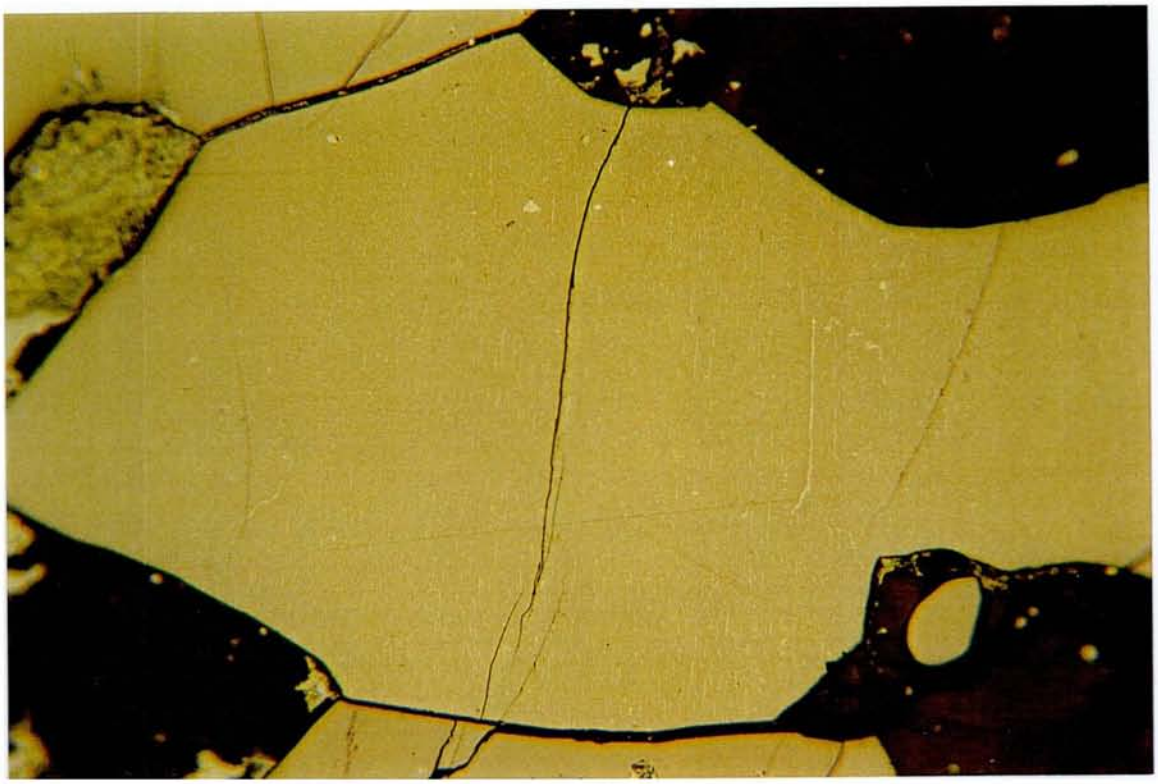
Sample TE39 is from the unlayered gabbronorite (Figures 4.29 - 4.31). Magnetite and ilmenite are the two predominant opaque minerals. The ilmenite grains have poorly developed hematite lamellae. In addition there appear to be fewer hematite lamellae in the ilmenite grains than are found in the ilmenite grains from the open pit of the Tellnes Mine area. Very fine spinel exsolution is observed in the ilmenite grains along with the hematite exsolution. The magnetite grains show very minor oxidation-exsolution ilmenite lamellae. Fine-scale spinel exsolution is observed in magnetites. The boundary between magnetite and ilmenite grains can be clean, lacking a reaction boundary or may have a minor spinel symplectite. Sulfide inclusions are commonly observed in the ilmenite grains. The pyroxenes contain very fine exsolution of magnetite and ilmenite.

Sample TE 40 from a gabbronorite contains ilmenite, magnetite and sulfides (Figures 4.32 and 4.33). All the ilmenites have very fine {0001} hematite exsolution. Spinel is commonly observed exsolving from the ilmenite. Magnetite has rare trellis {111} oxidation-exsolution lamellae of ilmenite. The ilmenite lamellae have spinel needles exsolving along the interface of the ilmenite lamellae and the magnetite. The pyroxene grains contain very fine exsolution lamellae of ilmenite with{111} hematite exsolution and magnetite with very fine ilmenite oxidation exsolution. There are better developed magnetites with ilmenite oxidation grains that may be better referred to as inclusions. The abundant hemo-ilmenite and magnetite-ilmenite lamellae and inclusions in the silicates play a crucial role in the magnetic response of this norite body.

Oxide rich Cumulate Norite of the Heskestad Negative Aeromagnetic Anomaly Area, Bjerkrem - Sokndal Lopolith

Localities TE39, TE40, TE41

Figure 4.29 Plagioclase, biotite, orthopyroxene and clinopyroxene. Hemo-ilmenite exsolution and magnetite-ilmenite oxidation-exsolution are found in the pyroxene also present discrete hemo-ilmenite grains. Photographed in transmitted light with a blue filter at 50x. (Samples TE 39-4 and TE 40-1)



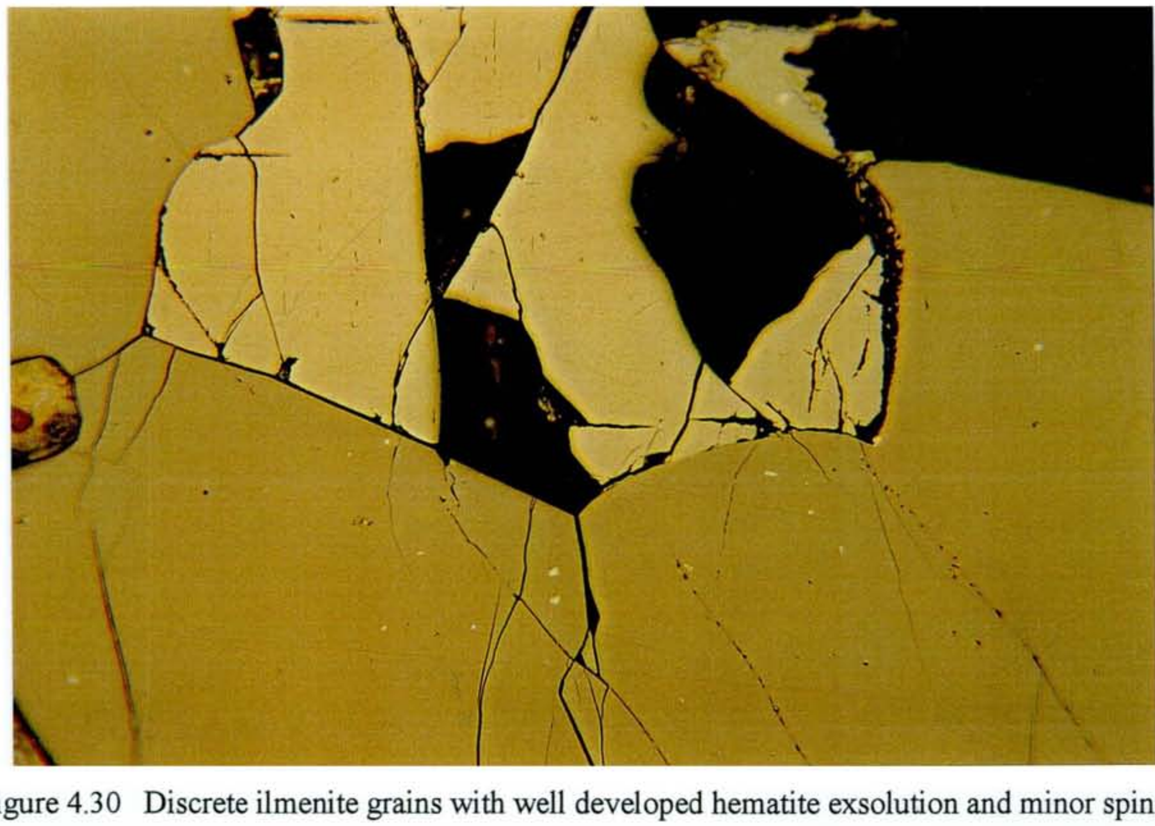


Figure 4.30 Discrete ilmenite grains with well developed hematite exsolution and minor spinel (Top). Ilmenite with hematite exsolution with coexisting magnetite. Magnetite has fine {100} spinel exsolution needles and along the grain boundary a magnetite -spinel-ilmenite symplectite (Bottom). Photographed in reflected light with a white filter at 250x. (Sample TE 39-4)

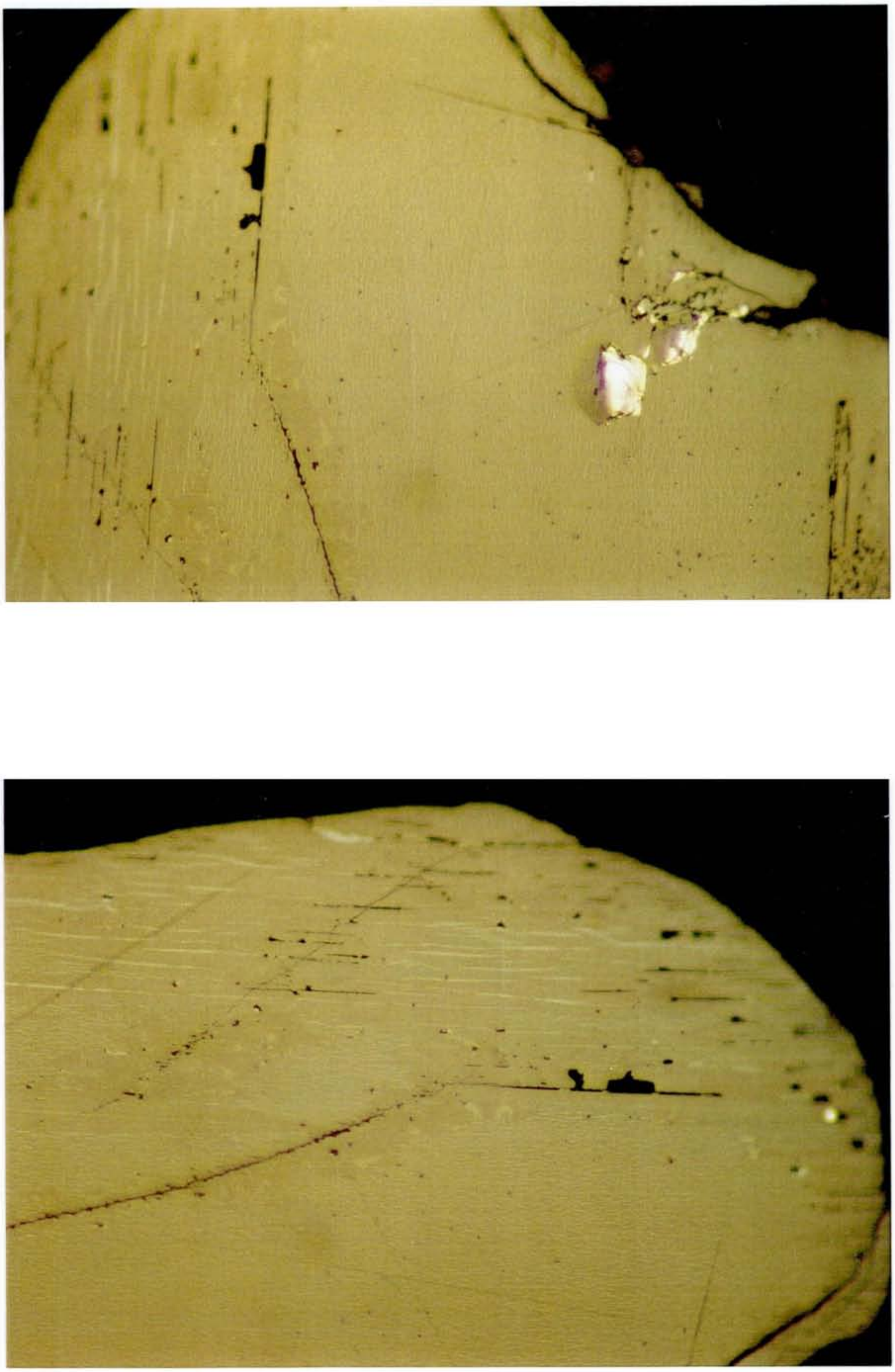


Figure 4.31 Ilmenite with better developed hematite exsolution lamellae, spinel rods and sulfide inclusions. The ilmenite areas around the spinel rods appear to be free of hematite lamellae. Photographed in reflected light with a white filter at 500x. (Sample TE 3[illegible])

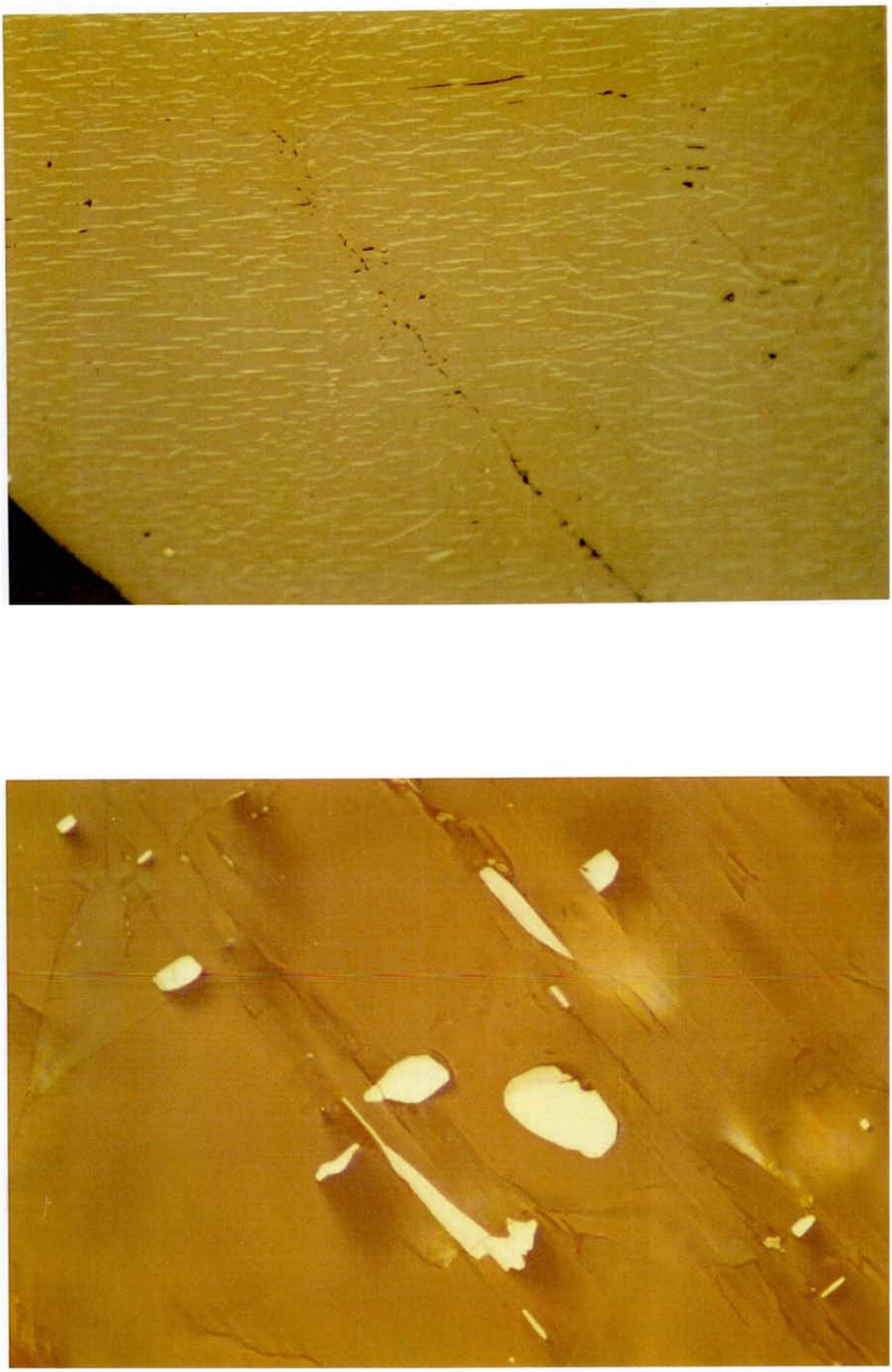


Figure 4.32 (Top) Ilmenite with hematite exsolution lamellae and minor spinel. (Bottom) Magnetite with oxidation exsolution of ilmenite as inclusions in silicates. Photographed in reflected light with a blue filter at 850x. (Sample TE 40-1)

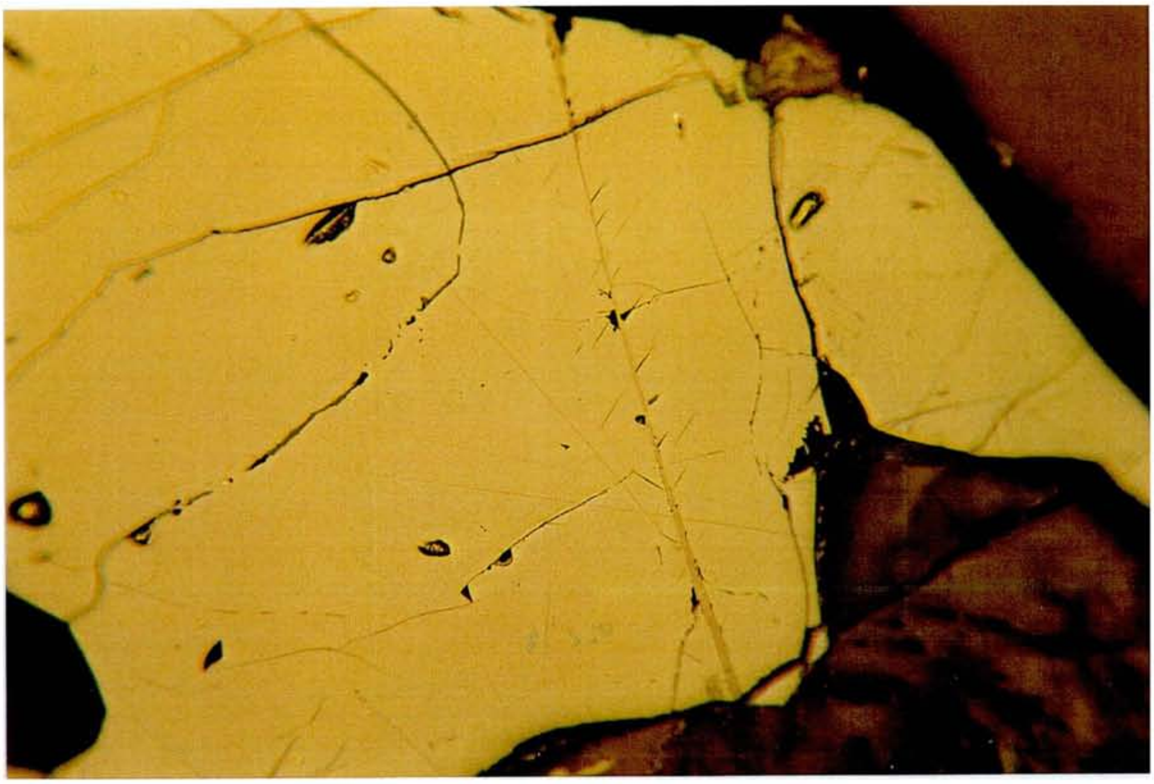


Figure 4.33 (Top) Magnetite with oxidation exsolution of ilmenite lamellae and very fine spinel exsolution needles. (Bottom) Magnetite-ilmenite lamellae in pyroxene. Photographed in reflected light with a blue filter at 250x. (Sample TE 40-1)

In sample TE41 ilmenite and magnetite are the dominant opaque grains (Figures 4.34 - 4.37). The ilmenites all contain very fine {0001} hematite exsolution lamellae. The hematite lamellae are better developed than the hematite lamellae observed in the ilmenites from samples TE 39 and TE40, reminiscent of the hematite lamellae from the Tellnes mine. Minor spinel lamellae are found in the ilmenites. When magnetite is in contact with ilmenite there is a minor spinel rim or a clean boundary. Magnetite grains have rare oxidation-exsolution of ilmenite and minor spinel exsolution. Oxide exsolutions in pyroxenes are similar to those found in samples TE39 and TE40. Pyrite and pyrrhotite are common accessory minerals.

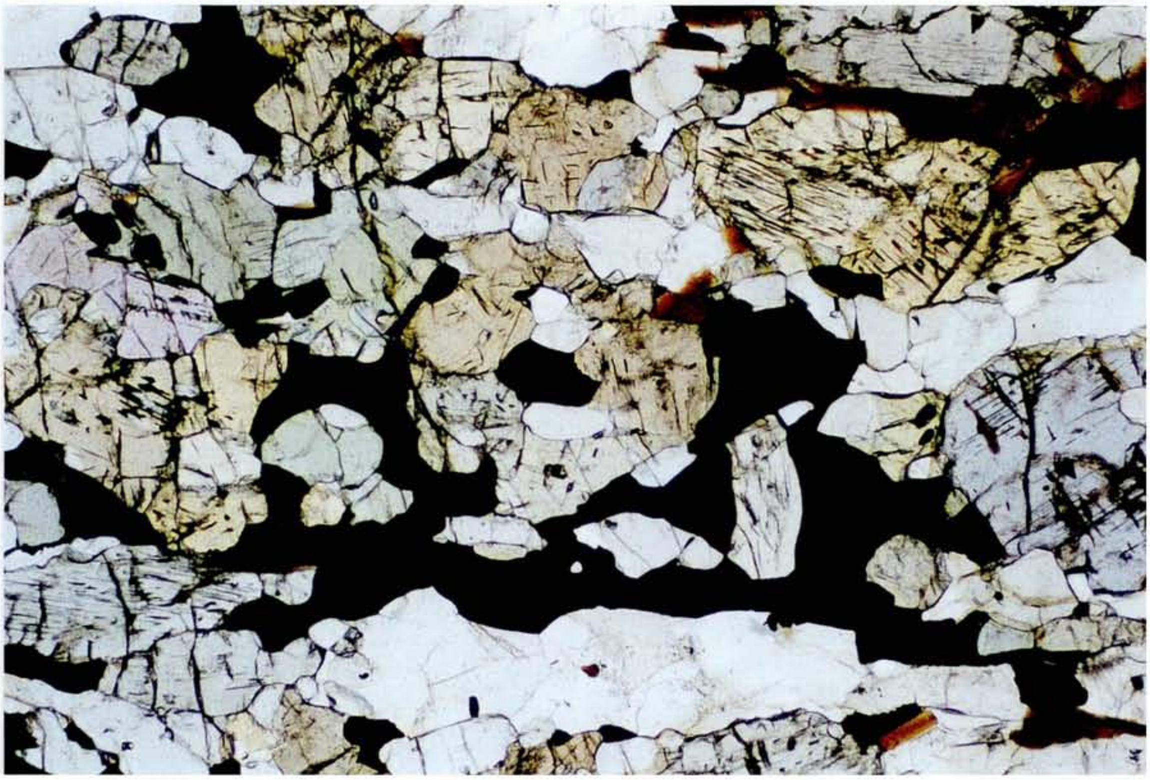


Figure 4.34 (Top) Plagioclase, biotite, clinopyroxene and orthopyroxene with magnetite-ilmenite and hemo-ilmenite exsolution and discrete hemo-ilmenite. Photographed in transmitted light with a blue filter at 50x (Bottom) Ilmenite with exsolution lamellae of hematite adjacent to magnetite grain with fine spinel exsolution. Photographed in reflected light with a blue filter at 250x. (Sample TE39-4 and TE41-2b)

Figure 4.35 Ilmenite with multiple generations of fine hematite exsolution lamellae. Photographed in reflected light with a white filter at 850x. (Sample TE 41-2b)

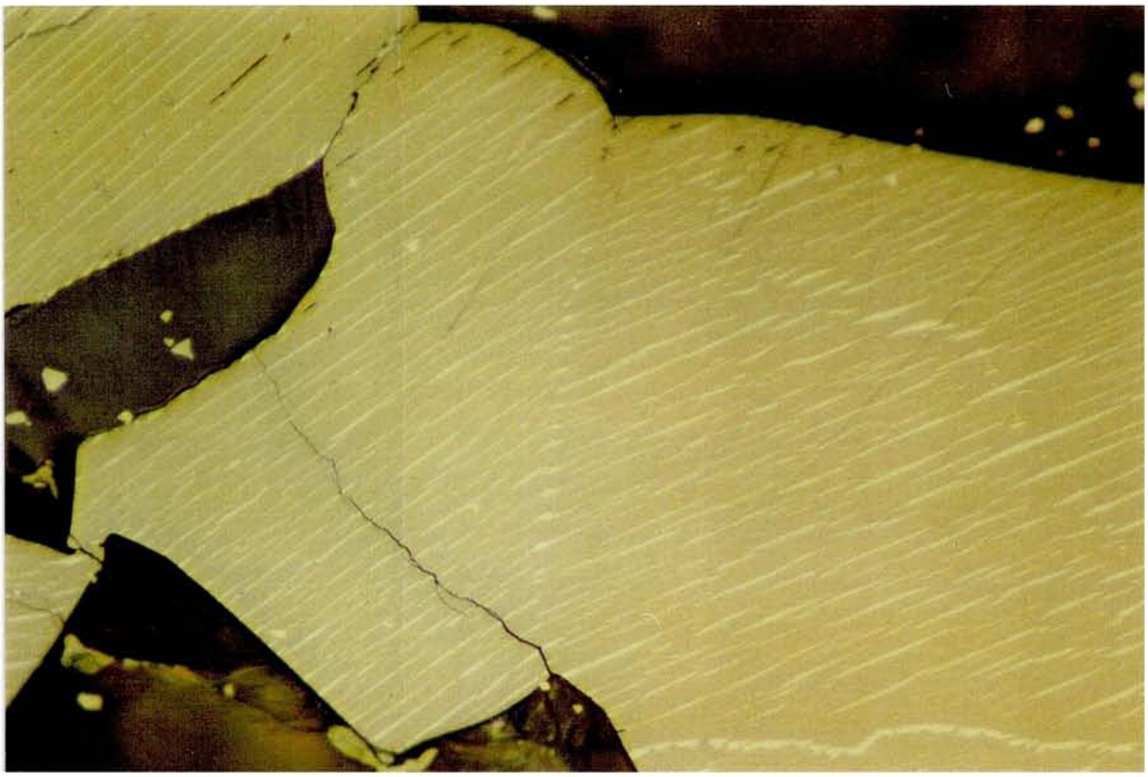
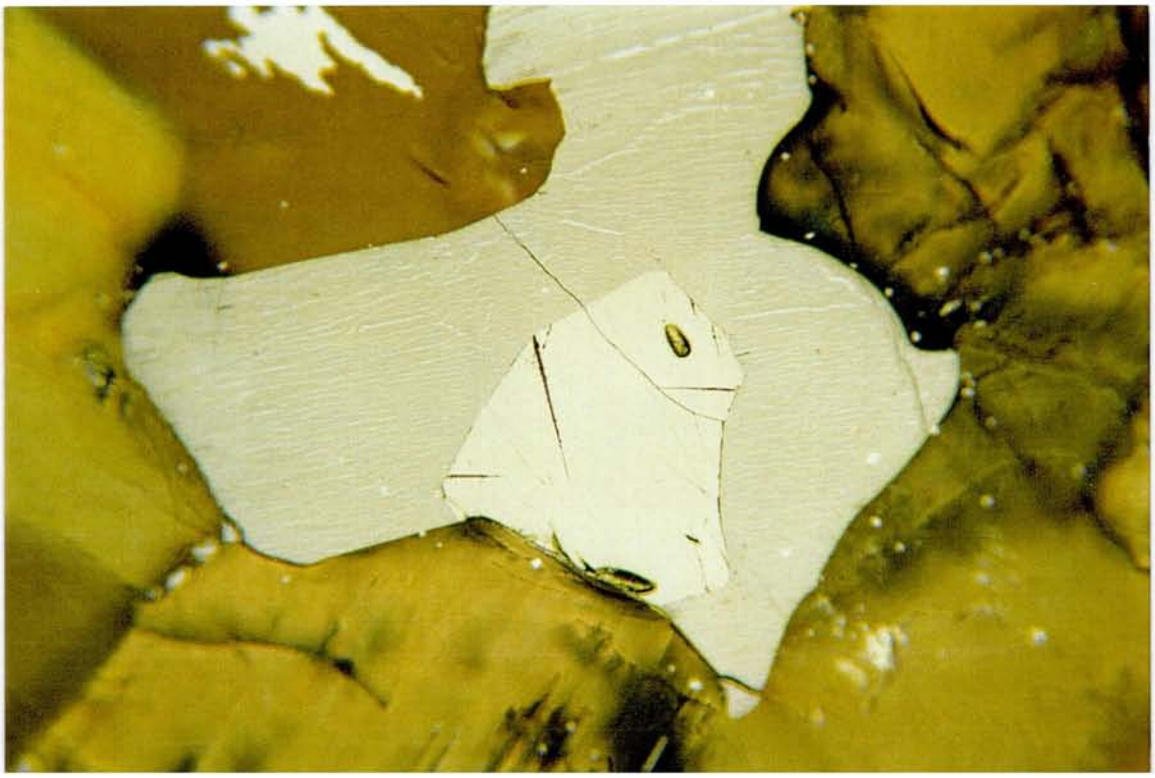


Figure 4.3[illegible] (Top) Ilmenite with well developed hematite exsolution lamellae. (Bottom) Ilmenite with hematite exsolution lamellae and pyrite, spinel and pyrrhotite intergrowth. (Photographed in reflected light with a blue filter at 850x and 250x. (Sample TE 41-2b)



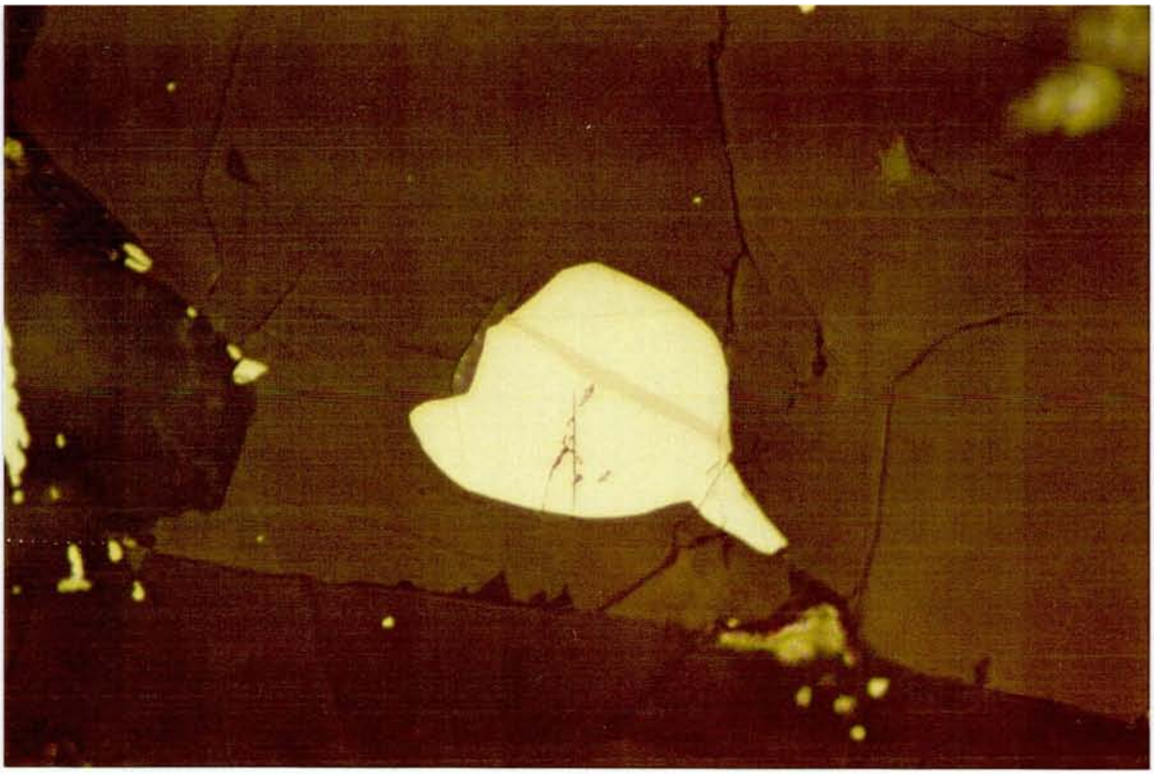


Figure 4.37 (Top) Ilmenite with hematite exsolution lamellae and magnetite with minor ilmenite and spinel. (Bottom) Magnetite inclusion with oxidation exsolution of ilmenite. Photographed in reflected light with a white filter at 250x and 850x. (Sample TE 41-2b)

4.9 Sandbekk Area of the Storgangen Intrusion (Sample Localities TE60, 61, 62, 63).

The samples collected in the Sandbekk region from the Storgangen intrusion have a diverse opaque mineralogy. Samples TE60 and TE61 were collected from an Fe-Ti-oxide-rich layer in the norite. Samples TE62 and TE63 were collected from the rich Fe-Ti oxide ore. In all samples the discrete opaque minerals are magnetite, ilmenite and sulfides.

Sample TE60-2a (Figure 4.38) contains discrete ilmenite with fine {0001} hematite exsolution. Spinel exsolution is commonly observed along with the hematite exsolution in the ilmenite. The spinel exsolution is very fine grained. There appears to be a diffusion halo around the spinel. Where the spinel is present there is a region free of hematite exsolution immediately surrounding the spinel. When two grains of ilmenite are in contact, a rim of spinel between the two ilmenites may be found. The pyroxene grains contain abundant "exsolution" of opaque minerals, including ilmenite with hematite exsolution, and magnetite with ilmenite oxidation-exsolution.

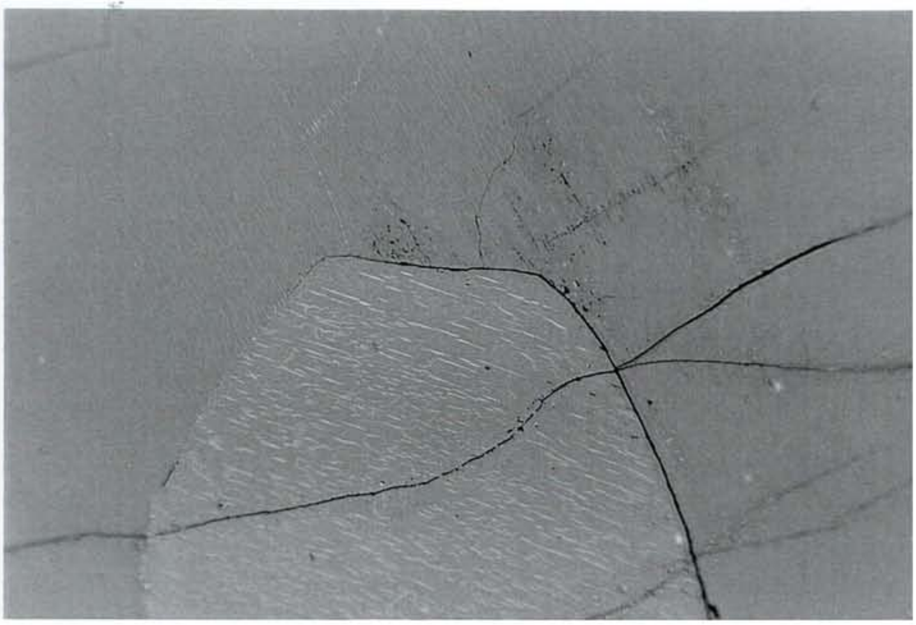
Sample TE61-1a (Figure 4.39) contains magnetite with oxidation-exsolution of ilmenite {111}. Aluminous spinel needles are common exsolution products found in magnetite (parallel to {100} and in ilmenite. When ilmenite and magnetite form a composite grain, hematite exsolution is present in ilmenite from the grain boundary between the ilmenite and magnetite. Directly at the boundary there is no visible hematite exsolution. It is assumed that a diffusional exchange between the ilmenite and magnetite occurred on a very small scale. Discrete ilmenite grains have very fine exsolution of hematite.

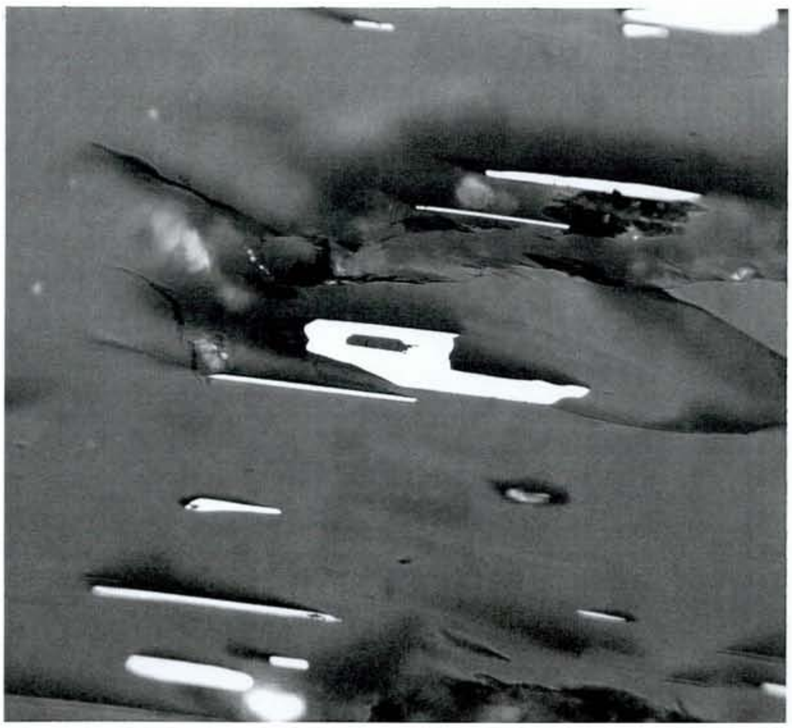
Samples TE62-3 and TE63-1a (Figures 4.40 - 4.42) contain abundant magnetite, ilmenite and sulfides. Magnetite has abundant exsolution of spinel along the {100} planes. Small needles of ilmenite oxidation-exsolution lamellae with spinel exsolution are present in magnetite. Away from the contact with magnetite, ilmenite has hematite exsolution and needles

Sandbekk Area of the Storgangen Intrusion

Localities TE60, TE61, TE62, TE63

Figure 4.38 (Top) Ilmenite with hematite exsolution lamellae. (Bottom) Magnetite with oxidation exsolution of ilmenite lamellae and ilmenite with very fine hematite exsolution. as inclusions in silicates. Photographed in reflected light with a white filter at 250x. (Sample TE 60-2a)





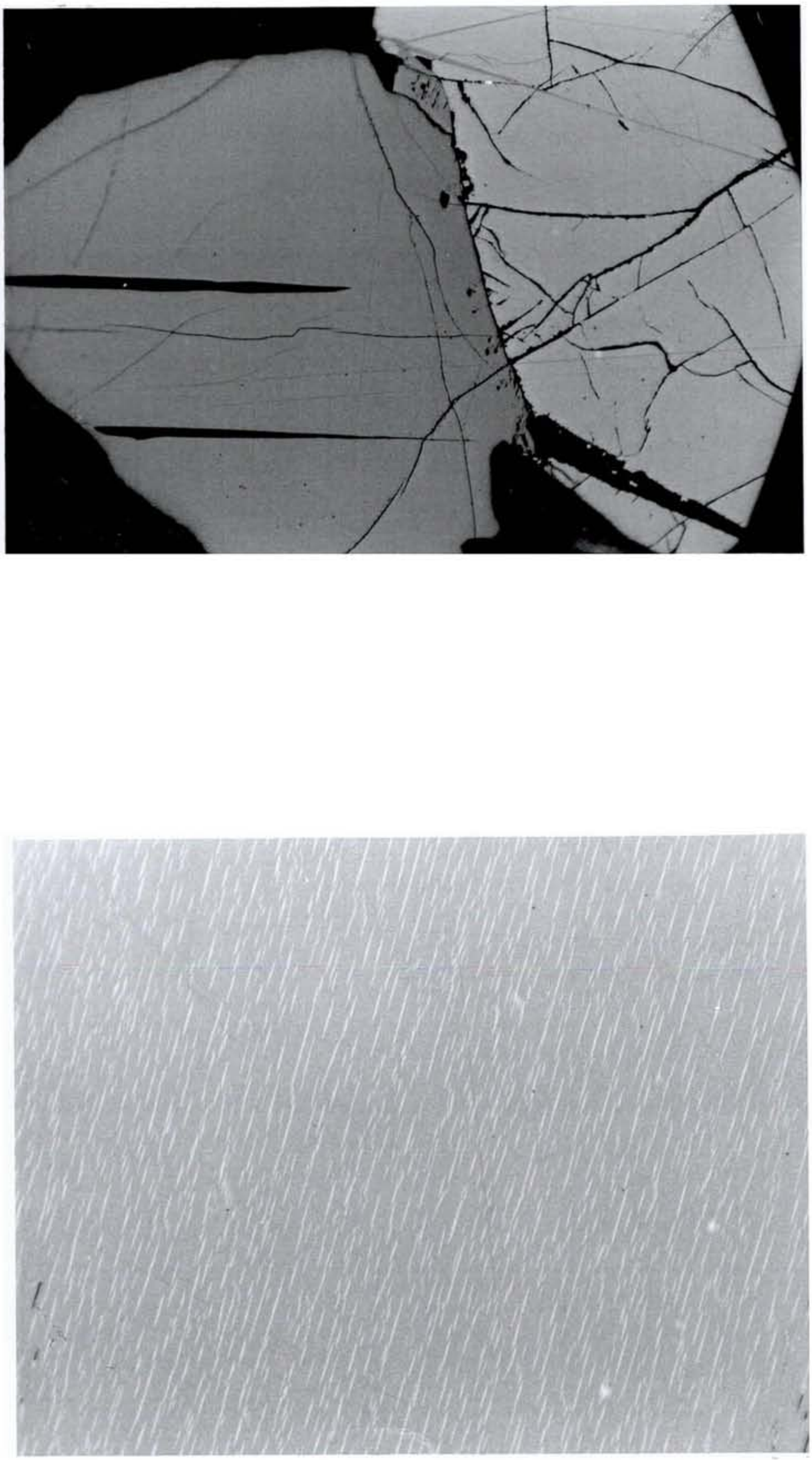


Figure 4.39 (Top) Magnetite with ilmenite and spinel. (Bottom) Ilmenite with hematite exsolution lamellae. Photographed in reflected light with a green filter at 850x. (Sample TE 61-1a)

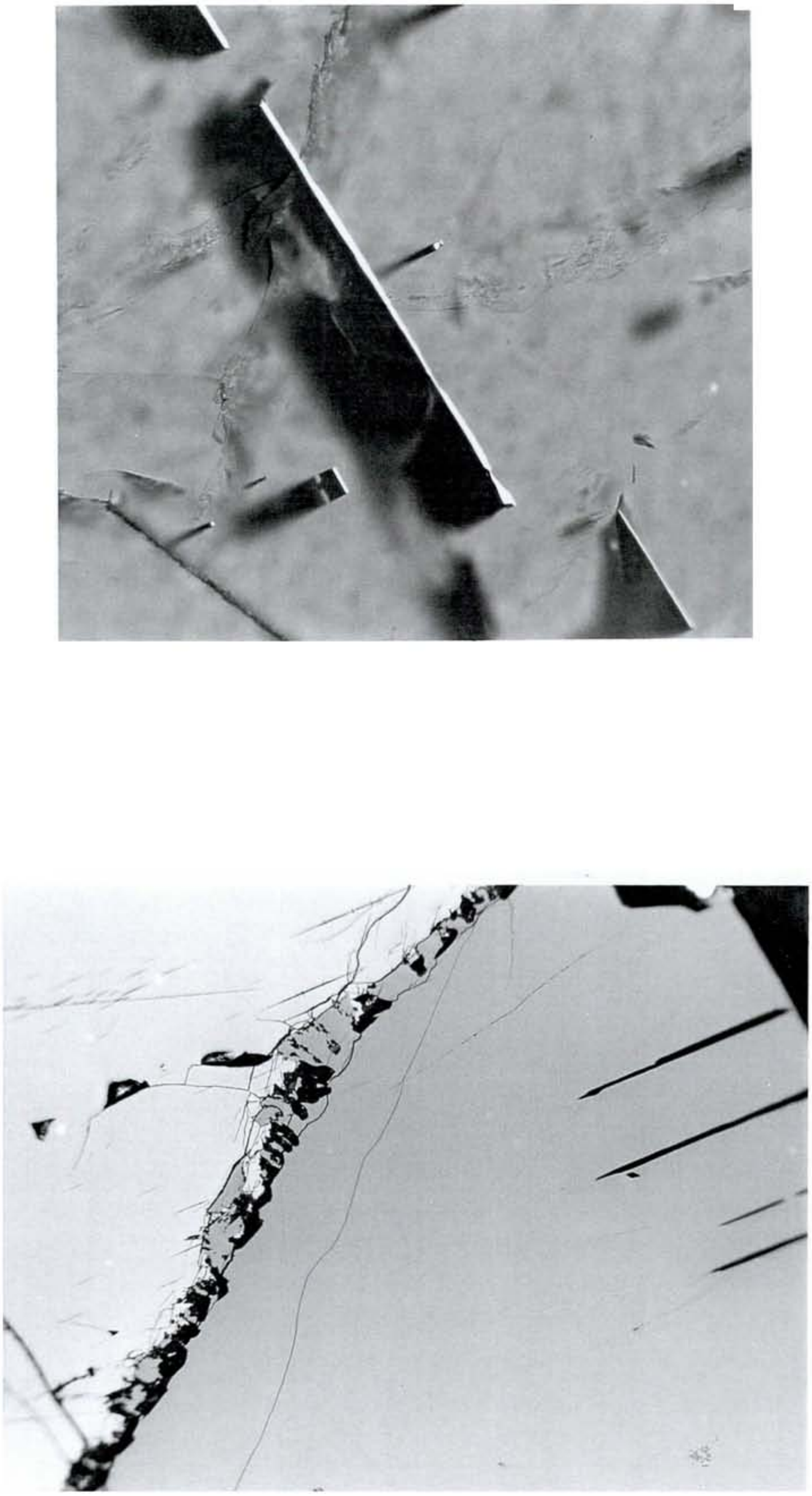
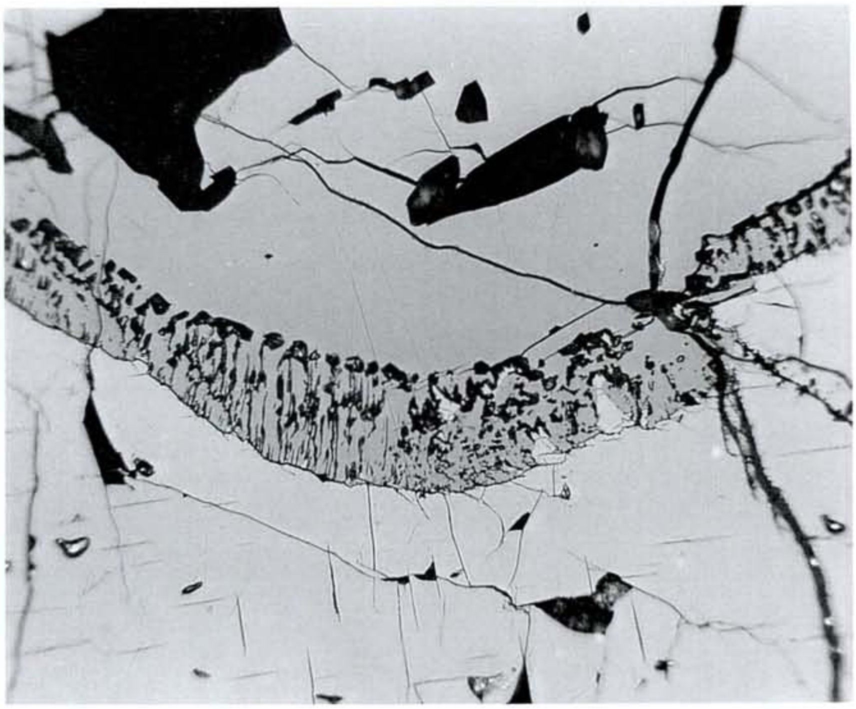


Figure 4.40 (Top) Ilmenite with hematite exsolution in silicates. (Bottom) Magnetite with ilmenite and spinel spinel rods. Ilmenite has weak hematite lamellae. Photographed in reflected light with a green filter at 250x. (Sample TE 62-3)

of spinel are commonly found within ilmenite grains. When magnetite and ilmenite are in contact, a symplectite of magnetite, ilmenite and spinel usually is present (Fig. 4.41 and 4.42). Discrete ilmenite grains contain very fine grained (< 1μm) hematite lamellae (Fig. 4.42). Pyrite and pyrrhotite are present in many samples from Sandbekk. The presence of sulfide does not appear to inhibit the exsolution of hematite in ilmenite when these grains are in contact.

4.10 Eia-Rekefjord Intrusion in Urdal (Sample Locality TE59-1)

The Jotunite sample (TE59-1) collected from the Eia-Rekefjord Intrusion contains abundant magnetite with oxidation-exsolution, C2-C3, sandwich type lamellae of ilmenite and fine C2 {111} trellis oxidation-exsolution ilmenite lamellae (Figure 4.43). Hematite exsolution was not observed in discrete ilmenite grains or magnetite-ilmenite intergrowths. Many magnetite grains have external composite grains of ilmenite within the magnetite grain. Some of the ilmenites showed minor alteration to rutile. This may be due to a slight metamorphic overprint (Caledonian?). The lack of hematite exsolution in the ilmenite yields distinct magnetic properties.



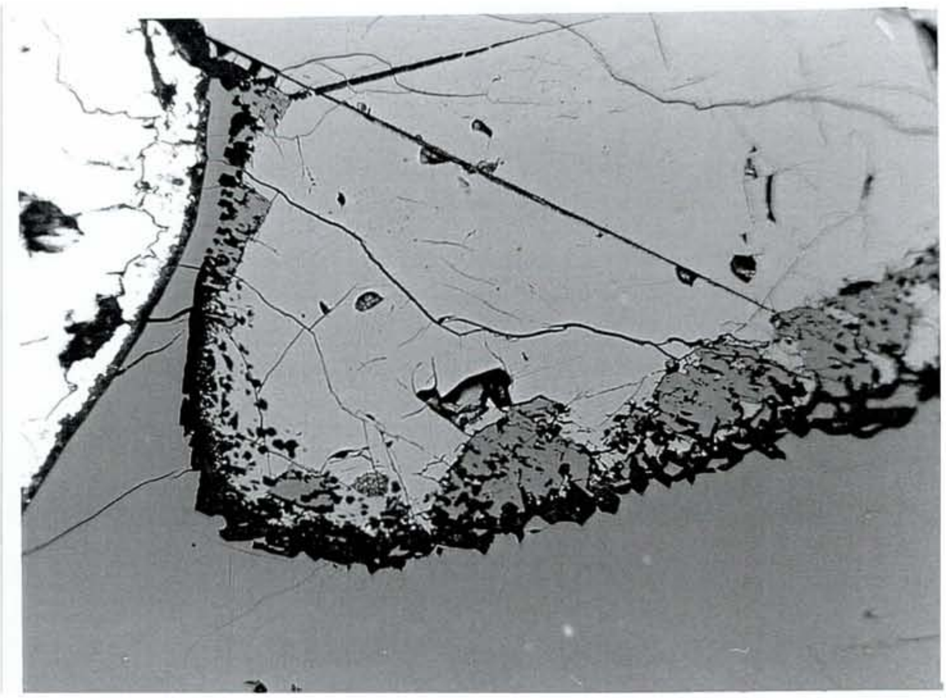


Figure 4.41 (Top) Magnetite with {100} spinel exsolution and ilmenite with spinel. Well developed magnetite-ilmenite-spinel symplectite at grain boundary (Sample TE 62-3). (Bottom) Ilmenite-magnetite-pyrite and pyrrhotite. Magnetite has {111}lamellae of ilmenite which are full of spinel needles. Sulfides and magnetite have a spinel symplectite at grain boundaries. (Sample TE 62-2b). Photographed in reflected light with a green filter at 250x.

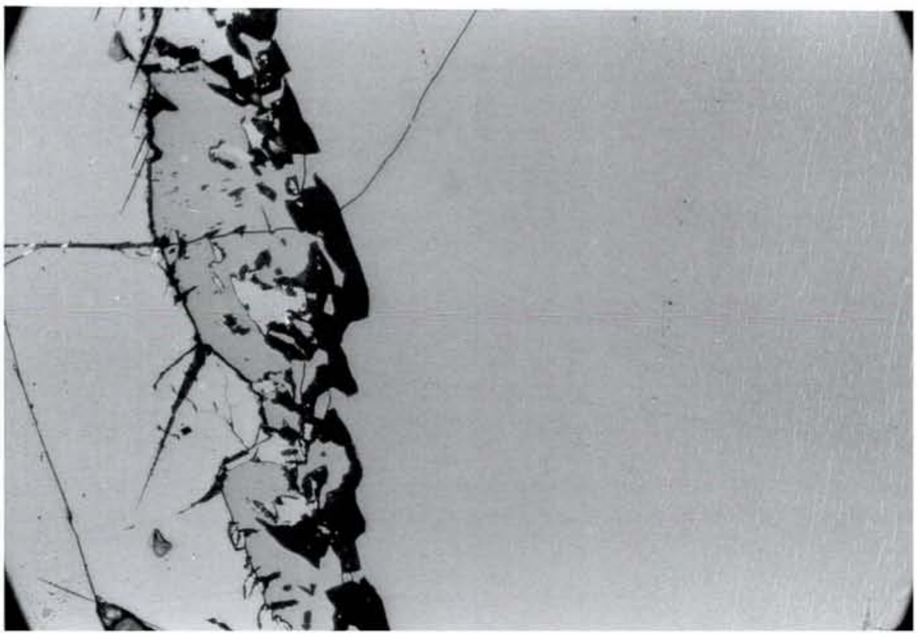
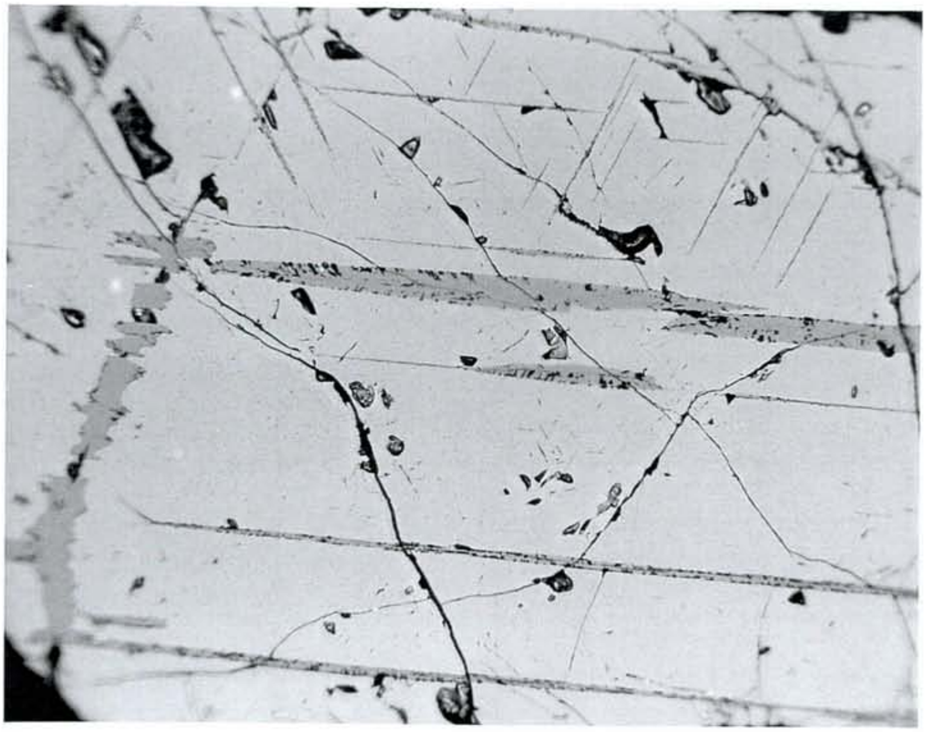


Figure 4.42 (Top) Ilmenite with multiply generations of hematite exsolution lamellae. (Bottom) Magnetite with ilmenite and spinel symplectite. Magnetite has lamellae of ilmenite and spinel. Also note weak hematite exsolution in ilmenite away from magnetite -ilmenite contact. Photographed in reflected light with a green filter at 850x and 650x. (Sample TE 63-1a)



Eia-Rekefjord Intrusion (Urdal)

Locality TE59

Figure 4.43 Magnetite with sandwich and trellis type oxidation-exsolution of ilmenite lamellae. Lamellae display very fine intergrowths of spinel. Photographed in reflected light with a green filter at 250x. (Sample TE 59)

4.11 Conclusions of Oxide Petrography: Correlation with Magnetic Sources

A detailed discussion of the correlation of the oxide petrography with the magnetic sources is proposed for future work. A first approximation of the correlation is presented here.

Hemo-ilmenite. There is a very strong correlation between remanence-controlled aeromagnetic signatures and the presence of hematite exsolution in the ilmenite if there is no coexisting magnetite. The NRM remanence vectors measured from this area are predominantly steeply negative. For example if only hemo-ilmenite is present in the rock, as has been observed in some anorthosite samples, then the aeromagnetic signature is negative. If ilmenite with hematite exsolution is coexisting with magnetite then the magnetite tends to partially or completely dominate the aeromagnetic signature. The hemo-ilmenite is contributing the remanent signature but the magnetite is contributing to the induced signature and the resultant Q values are around or less than 1. The coexisting assemblage of magnetite plus ilmenite with hematite exsolution produces an array of anomalies from neutral to slight positive to slightly negative.

Magnetite. Given the microtextures reported by Duchesne (1970, 1972, 1992), Gierth and Krause (1973) and McEnroe (this report), it is quite possible that remanence is playing a role in some of the titano-magnetites with cloth-like and very fine trellis lamellae textures. When magnetite is the dominant oxide and the ilmenite lacks hematite exsolution lamellae, the magnetic response is strongly positive, representing a strong induced signature parallel to the present day earth's magnetic field. There is a question about the role of microstructures within magnetite grains. Harrison and Putnis (1995), Banfield et al (1994) and McEnroe (1996) have postulated that microstructures in magnetite may play an important role in remanence acquisition and retention. In this case it may be important, in that we may underestimate the amount of magnetite present in the body because we are evaluating the magnetic response based on a purely induced signature. This will be discussed in detail in the next report.

Magnetite-Ilmenite and Hematite-Ilmenite Exsolution in Silicates. An understanding of the role of magnetite-ilmenite and ilmenite-hematite exsolution in the silicates is fundamental to an accurate aeromagnetic interpretation to this region. It appears that when there are abundant magnetite-ilmenite exsolutions in the silicates, primarily in the pyroxenes, these very fine lamellae are the dominant contributors to the aeromagnetic signature. This is very well demonstrated by the change in character of the aeromagnetic anomaly over the Tellnes mine area. If we can find a good correlation between the norite bodies which contain exsolution in the pyroxenes and in addition are rich in ilmenite, then this will become a very important geophysical and petrological exploration tool. The same relationship between remanence, abundant ilmenite with hematite exsolution, and magnetite-ilmenite and ilmenite-hematite exsolution in the silicates, is found in the Tellnes area, Mydland and Heskestad areas. All of these areas have negative aeromagnetic anomalies. This relationship will be explored further in the next report.

5. MINERAL CHEMISTRY

5.1 Analytical Method

Microprobe analyses were made with a Cameca SX50 electron microprobe set at an accelerating potential of 15 keV, a sample current of 15 nA, and a typical beam diameter of 1 μm. Counting times of 20 or 30 seconds per element were used. Analytical precision is estimated at ± 0.1 weight percent for oxide components present at the 1 weight percent level. Analyses are given in Appendix A.

5.2 Compositions of Ilmenite

Overall Features. A comprehensive view of the chemistry of ilmenites in the study area is given in Figure 5.1 in terms of weight % MgO versus weight % TiO_2 . Ti-rich analyses are poor in hematite component; Ti-poor analyses are rich in hematite component and reflect areas rich in hematite exsolution lamellae. The MgO amount reflects variations in geikielite component, which is lower in hematite lamellae than in the host.

Tellnes Mine Area. Probe analyses were carried out on three samples from the Tellnes ore body, two from the Mine (TE3, TE11) and one from the southern extension (TE29). In Figure 5.2 ilmenite analyses are plotted in terms of weight % MgO versus weight % TiO_2, and Figure 5.3 shows an equivalent plot for sample TE3 only. These two figures show an array of compositions that are the result of four different processes: A) Variation in the bulk composition of primary ilmenite as a result of magmatic processes; B) Composition variation as a result of analyses in which an attempt was made to analyze hematite exsolution lamellae in ilmenite; C) Compositions produced by secondary reactions between ilmenite and magnetite, commonly producing spinel-bearing reaction symplectites or with sulfides; and D) Ilmenite exsolution lamellae in pyroxene grains.

A) If one examines the bulk ilmenite content of each of these three samples (Figure 5.2), there is a chemical progression from hematite-richest compositions in TE3, through

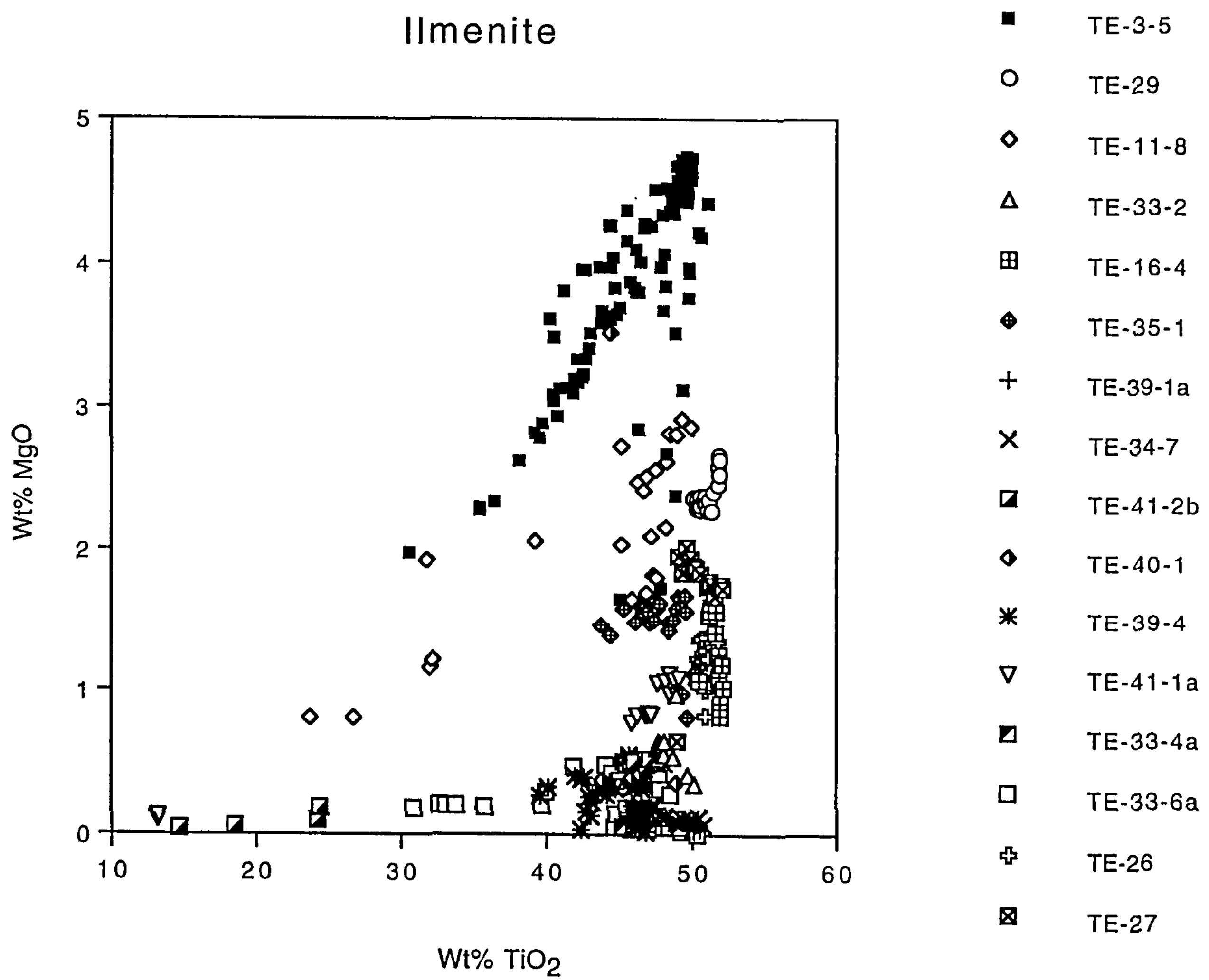


Figure 5.1. Composite plot of all ilmenite and hemo-ilmenite analyses in terms of weight % MgO versus weight % TiO_2. Ti-rich analyses are poor in hematite component; Ti-poor analyses are rich in hematite component. MgO amount reflects variations in geikielite component. More hematite-rich analyses, as expected, contain a smaller geikielite component.

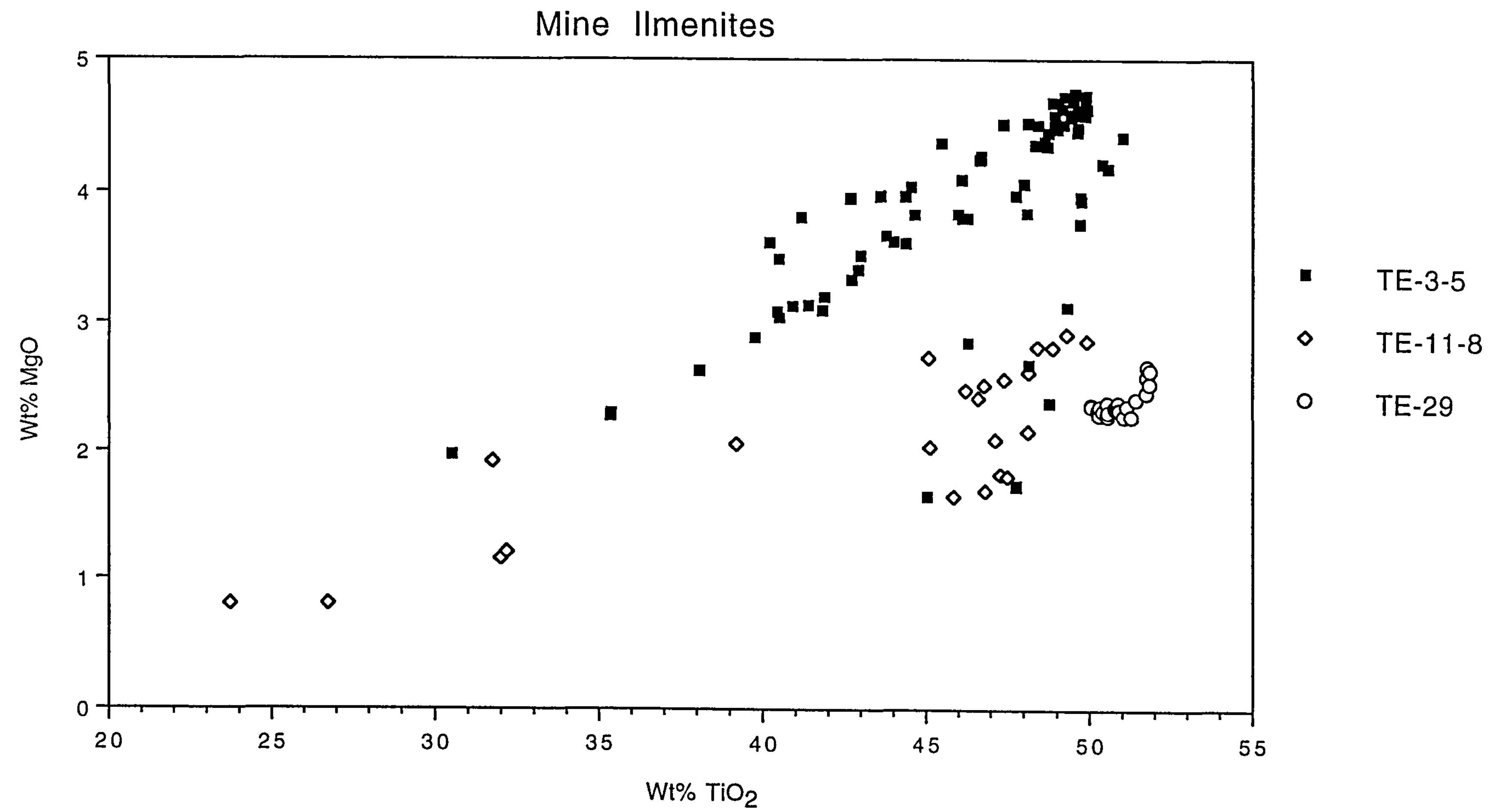


Figure 5.2. Plot of ilmenite and hemo-ilmenite analyses from the Tellnes Mine area in terms of weight % MgO versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. These analyses are also low in MgO. There appears to be a continuum of bulk compositions from the lowest Ti (highest hematite) and highest Mg content of TE-3, through intermediate Ti and intermediate Mg of TE-11, to the highest Ti (lowest hematite) and lowest Mg of TE-29 in the southwest extension. This trend in bulk ilmenite composition is believed to be a result of progress of fractional crystallization and is currently being tested by analyzing pyroxenes for Fe/(Fe+Mg) as a differentiation index. Consistent with the reduced hematite content of sample TE-29, it contains no exsolution lamellae of hematite, like TE-3 and TE-11, and Ti-rich ilmenite coexists with magnetite. Detailed features of reaction symplectites involving Zn-bearing spinels between ilmenite and magnetite in TE-29 will be described in a later report.

TE11, to hematite-poor compositions in TE29. This progression is reflected by the presence of significant magnetite and of a major amount of oxide exsolution in pyroxene in TE29 as contrasted with the other two samples. This progression is also reflected by decreasing MgO content in bulk ilmenite, by decreasing Cr_2O_3 content in bulk ilmenite, and by increasing Fe/(Fe+Mg) in pyroxene. These variations most probably reflect the progress of magmatic differentiation in the Tellnes intrusion.

B) In addition to measurements of bulk ilmenite composition, an attempt was made to estimate the compositions of hematite lamellae exsolved within the ilmenite hosts. In all cases the lamellae are too small to obtain analyses on hematite alone, but the trends of the analyses in samples TE3 and TE11 indicate the elements that are concentrated in hematite lamellae as compared to the host.

C), D) Details of compositions in symplectites, adjacent to sulfides, and in exsolution lamellae in pyroxene are not yet well understood, but the composition trends are dramatically different from those where ilmenite was undergoing hematite exsolution (Figure 5.3).

The same mine area samples are evaluated in Figure 5.4 for weight % Cr_2O_3 versus weight % TiO_2. Again the low Ti analyses represent areas rich in hematite exsolution lamellae in samples TE3 and TE11. The trends of these samples toward higher Cr_2O_3 with decreasing TiO_2 illustrate the concentration of Cr as eskolaite component in the hematite lamellae. A similar plot in Figure 5.5 of weight % Al_2O_3 versus weight % TiO_2, may show a very slight enrichment of Al_2O_3 as a corundum component in the hematite, but this is equivocal and the high Al analyses may only reflect small spinel grains decorating grain and exsolution boundaries.

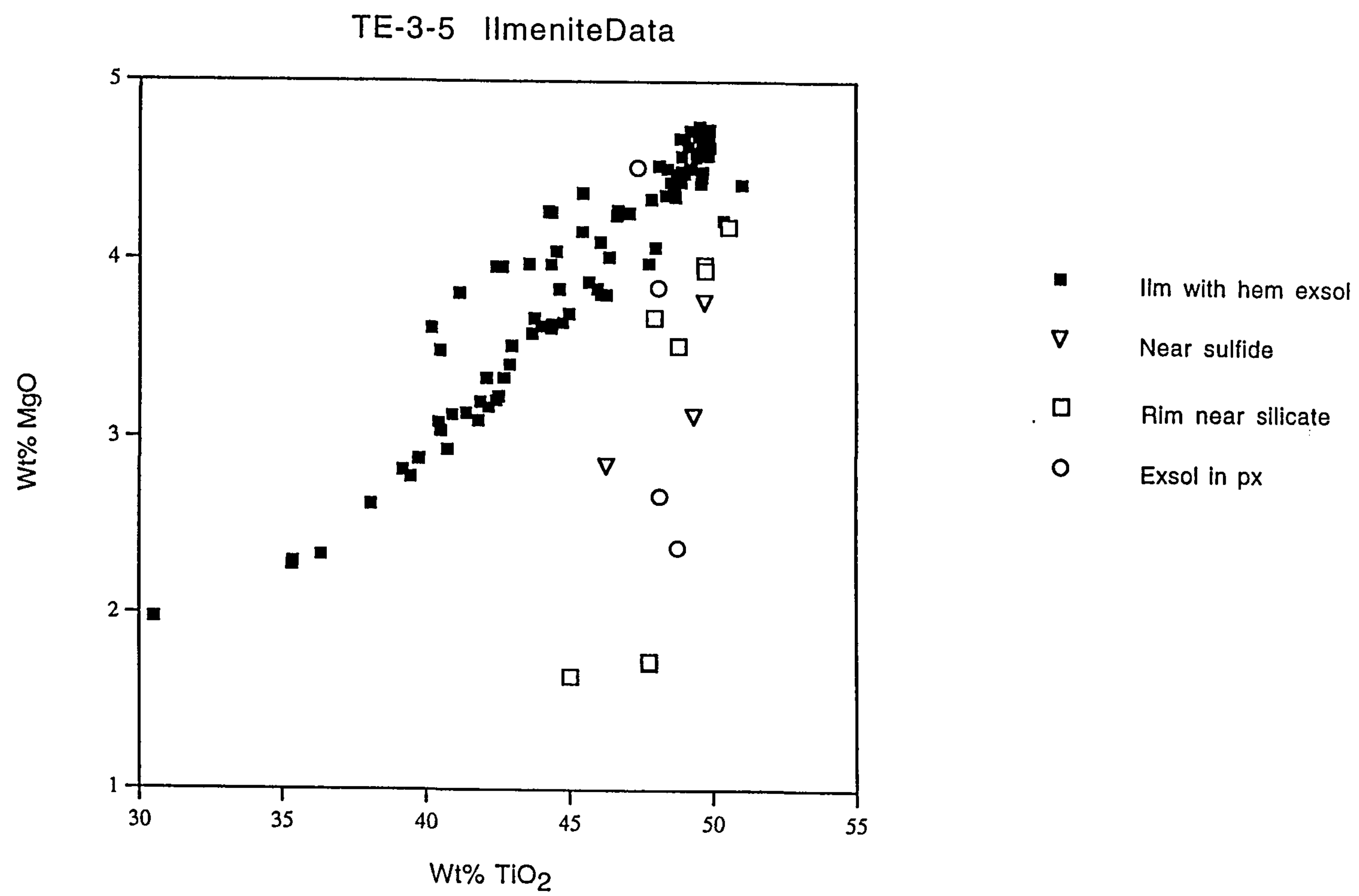


Figure 5.3. Details of ilmenite analyses from sample TE-3 from the Tellnes Mine in terms of weight % MgO versus weight % TiO_2. The main trend (black symbols) includes the bulk discrete ilmenite and analyses of areas rich in hematite exsolution lamellae. Grains in contact with silicates and with sulfides, or ilmenite exsolution lamellae in pyroxene all follow a different trend than the hematite exsolutions in discrete ilmenite, indicating that different equilibria control these compositions.

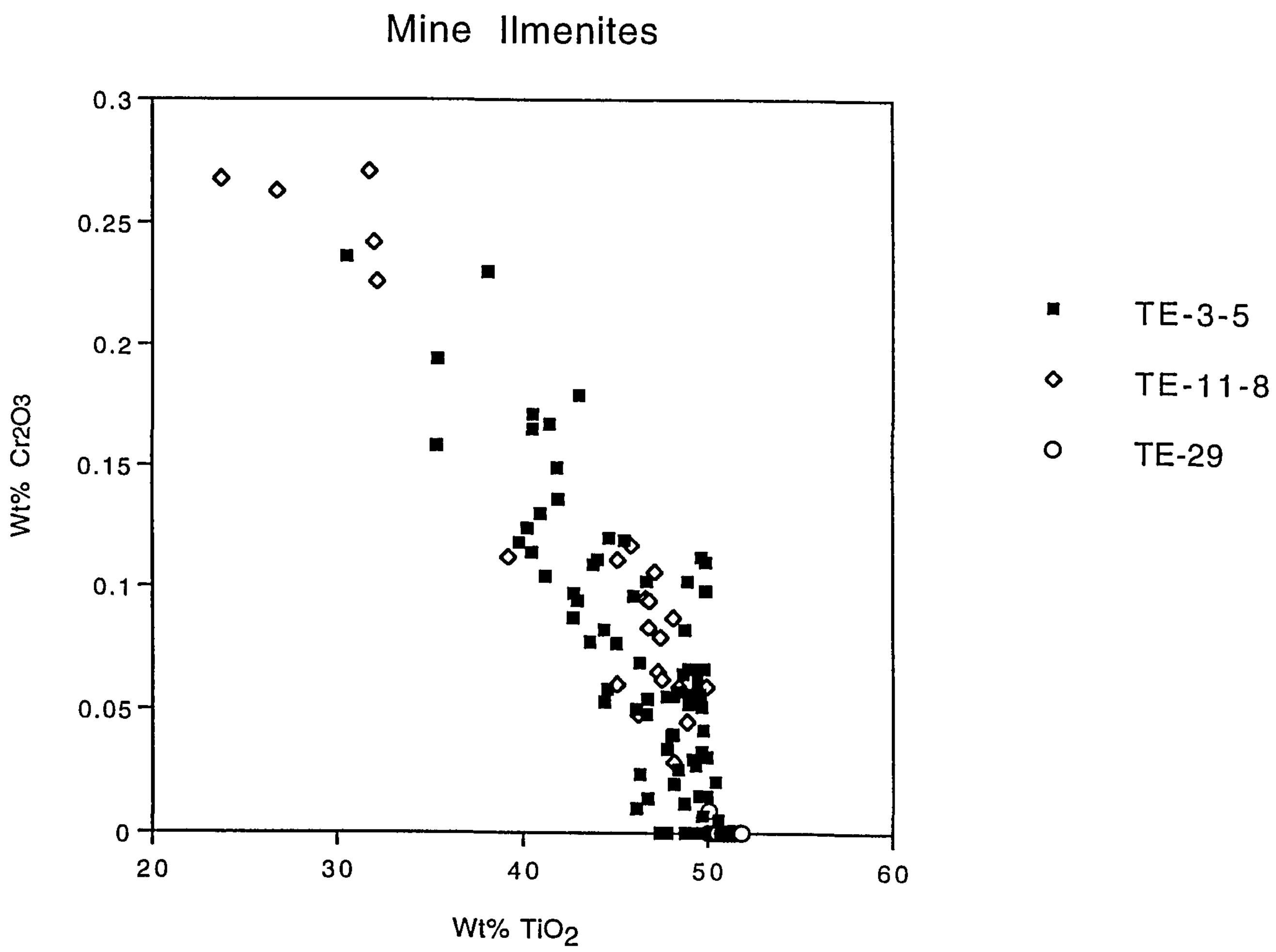


Figure 5.4. Plot of ilmenite and hemo-ilmenite analyses from the Tellnes Mine area in terms of weight % Cr_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. Low Ti analyses are also richest in Cr_2O_3, indicating incorporation of an eskolaite component into the exsolving hematite. Ilmenite in TE-29 contains no hematite exsolution lamellae and very little Cr_2O_3, consistent the occurrence of magnetite and a magmatically evolved composition.

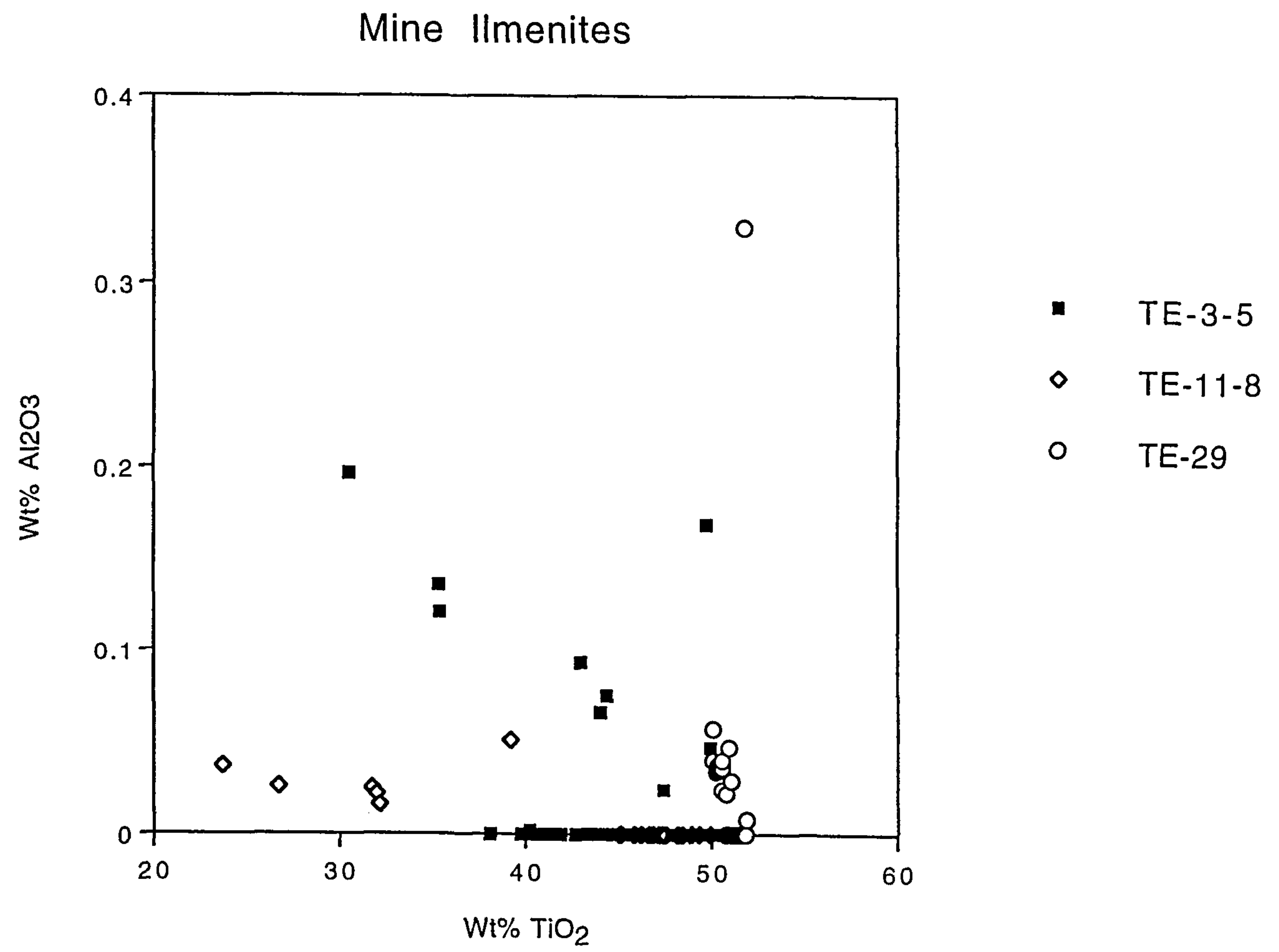


Figure 5.5. Plot of ilmenite and hemo-ilmenite analyses from the Tellnes Mine area in terms of weight % Al_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. Although several low Ti analyses are rich in Al_2O_3 suggesting a possible corundum component in hematite, most analyses are low in Al_2O_3. The highest amounts of Al_2O_3 are associated with analyses in TE-29 adjacent to spinel-bearing symplectite, and it is likely that most high Al_2O_3 analyses are of areas overlapping small spinel grains decorating the margins of exsolution lamellae.

Oxide Cumulate Norites, Bakka Area (TE26, 27). Compositions of ilmenite in these magnetite-rich rocks are shown in Figures 5.6 and 5.7. The range of Ti content is very small indicating limited if any exsolution of hematite lamellae. The trend of variable MgO content within the range 49 to 52 % TiO_2 is not presently explained, but is clearly different from the trends in other samples produced by hematite exsolution. There is no consistent relationship between Cr and Ti content such as that shown in samples with hematite lamellae, and the Cr_2O_3 values are very close to the detection limit.

Oxide Cumulate Norites, Mydland Area (TE16, 33, 34, 35). Compositions of ilmenite in these rocks are plotted in Figure 5.8 in terms of weight % MgO versus weight % TiO_2, in Figure 5.10 in terms of weight % Cr_2O_3 versus weight % TiO_2, and in Figure 5.11 in terms of weight % Al_2O_3 versus weight % TiO_2. Figure 5.9 shows details of sample TE35. Highest Ti analyses in all these figures represent approximate bulk compositions of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. These analyses are also lower in MgO. Sample TE16 contains Ti-rich ilmenite coexisting with magnetite and no hematite exsolution lamellae. Hematite lamellae are scarce and very fine-grained in TE33-2a, TE33-4a and TE34-7, and more abundant in TE33-6a and TE35-1. Details of sample TE35 in Figure 5.9 include a trend of gradually decreasing MgO with decreasing TiO_2 consistent with hematite exsolution, and a much lower MgO group of ilmenite exsolutions in magnetite. Note that the maximum amount of MgO is 1.75% as compared to 2 to 4.5% at the Tellnes Mine (Figure 5.2). Low Ti analyses are also richest in Cr_2O_3 (Figure 5.10), suggesting incorporation of an eskolaite component into the exsolving hematite, but a number of low-Ti low-Cr analyses make this interpretation questionable. Note that the maximum amount of Cr_2O_3 is about 0.15 % as compared to about 0.27 % in Tellnes samples (Figure 5.4). Very few analyses contain significant Al (Figure 5.11), and those that do may be due to small spinel lamellae.

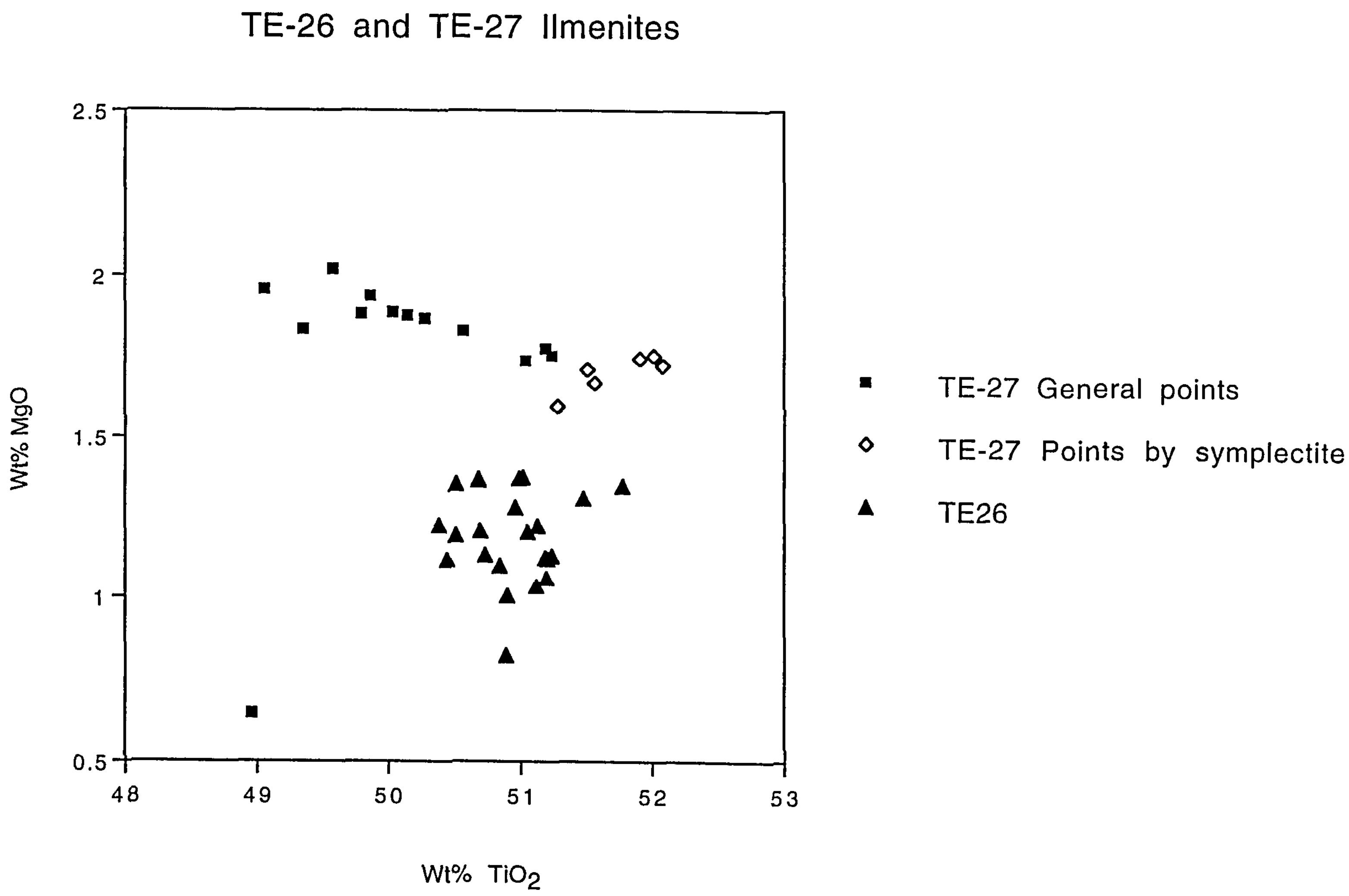


Figure 5.6. Plot of ilmenite and hemo-ilmenite analyses from the Bakke area of the Bjerkrem-Sokndal lopolith in terms of weight % MgO versus weight % TiO_2. These ilmenites coexist with magnetite. They show a very small variation in TiO_2. content indicating a lack of significant hematite exsolution lamellae.

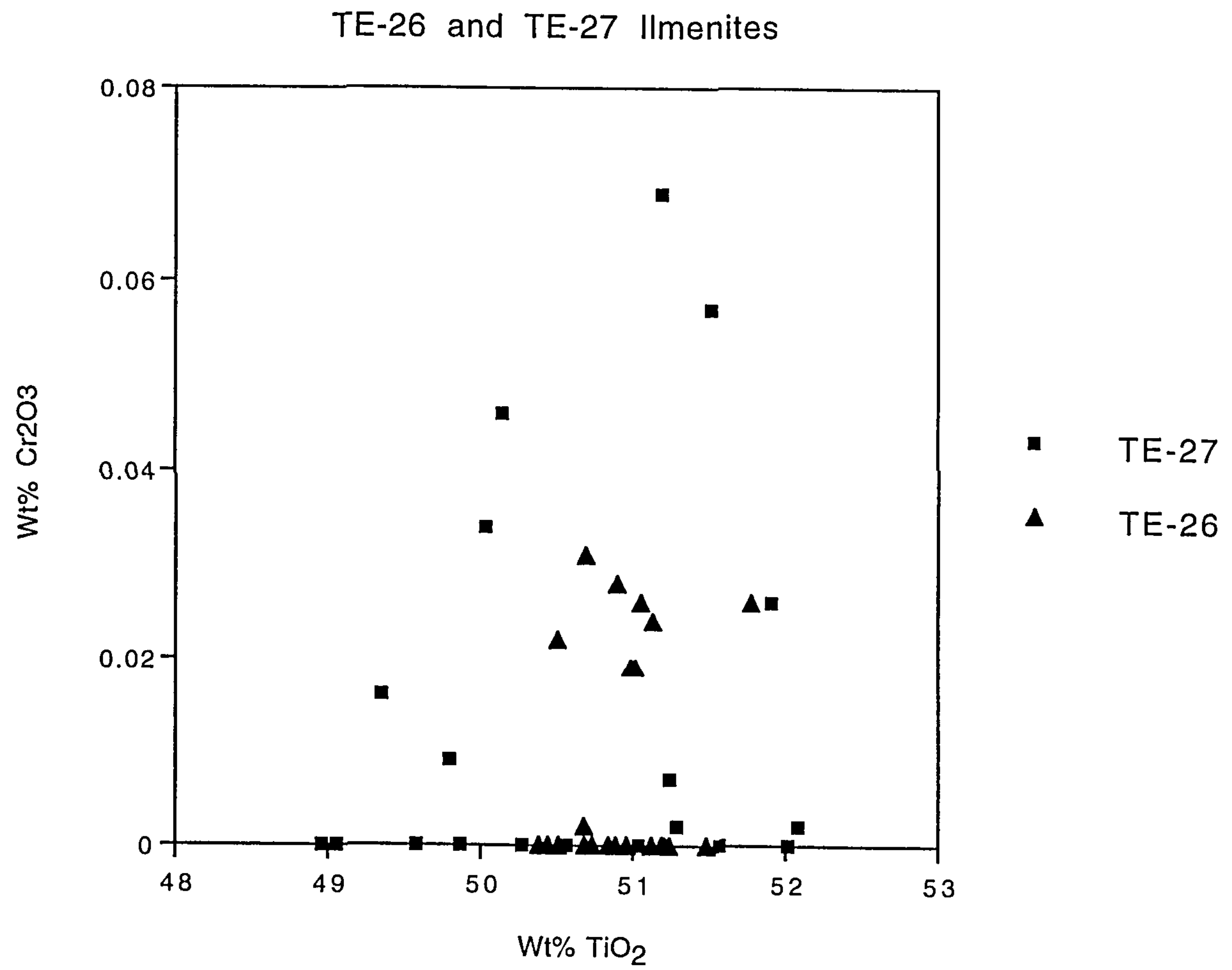


Figure 5.7. Plot of ilmenite and hemo-ilmenite analyses from the Bakke area of the Bjerkrem-Sokndal lopolith in terms of weight % Cr_2O_3 versus weight % TiO_2. These ilmenites coexist with magnetite. They show a very small variation in TiO_2. content indicating a lack of significant hematite exsolution lamellae. There is no consistent relationship between Cr and Ti content such as that shown in samples with hematite lamellae, and the Cr_2O_3 values are very close to the detection limit.

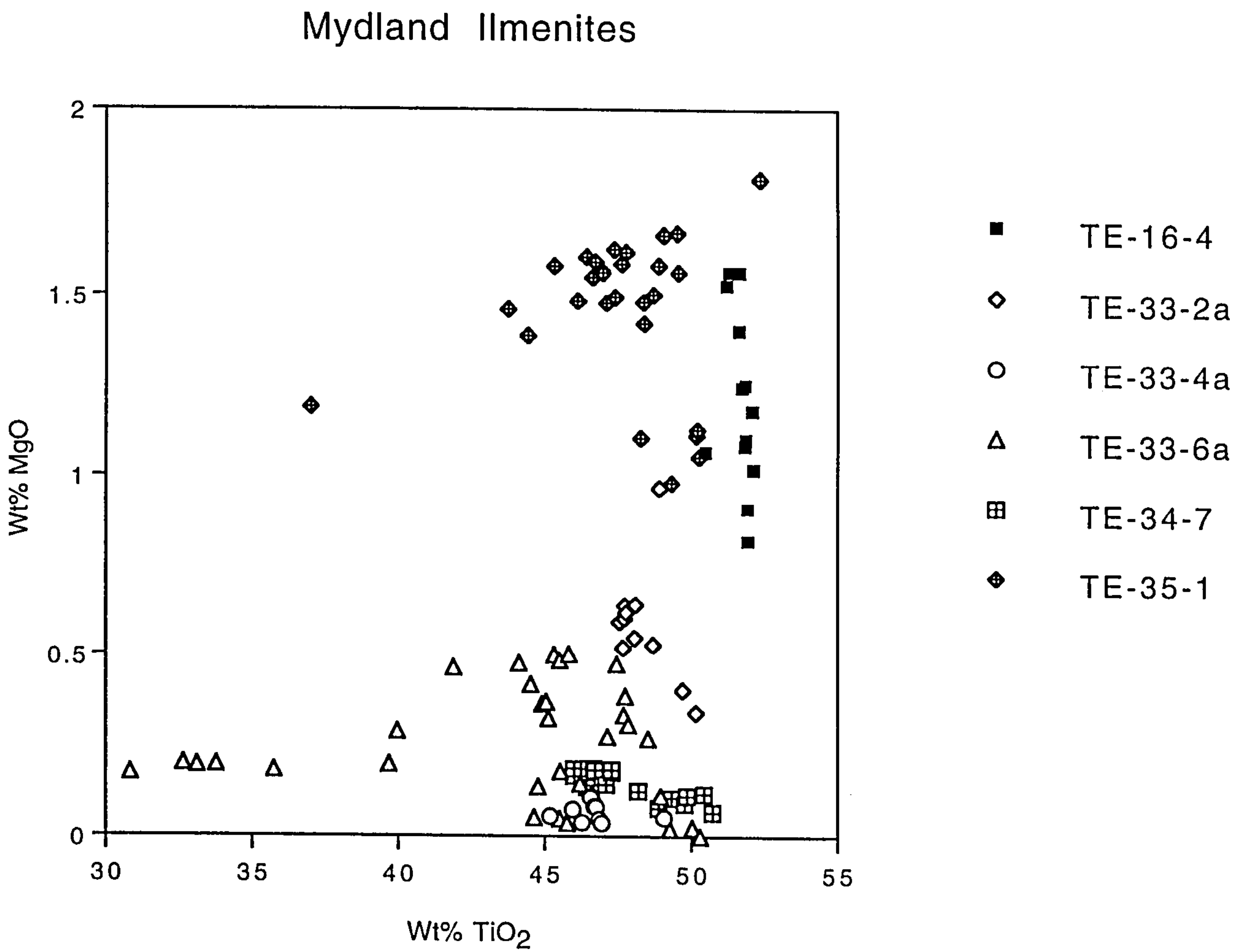


Figure 5.8. Plot of ilmenite and hemo-ilmenite analyses from the Mydland area of the Bjerkrem-Sokndal lopolith in terms of weight % MgO versus weight % TiO_2. Highest Ti analyses represent approximate bulk compositions of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. These analyses are also lower in MgO. Sample TE-16 contains Ti-rich ilmenite coexisting with magnetite and no hematite exsolution lamellae. Hematite lamellae are scarce and very fine-grained in TE-33-2a, TE-33-4a and TE-34-7, and more abundant in TE-33-6a and TE-35-1. Note that the maximum amount of MgO is 1.75 % as compared to 2 to 4.5% at the Tellnes Mine (Figure 5.3).

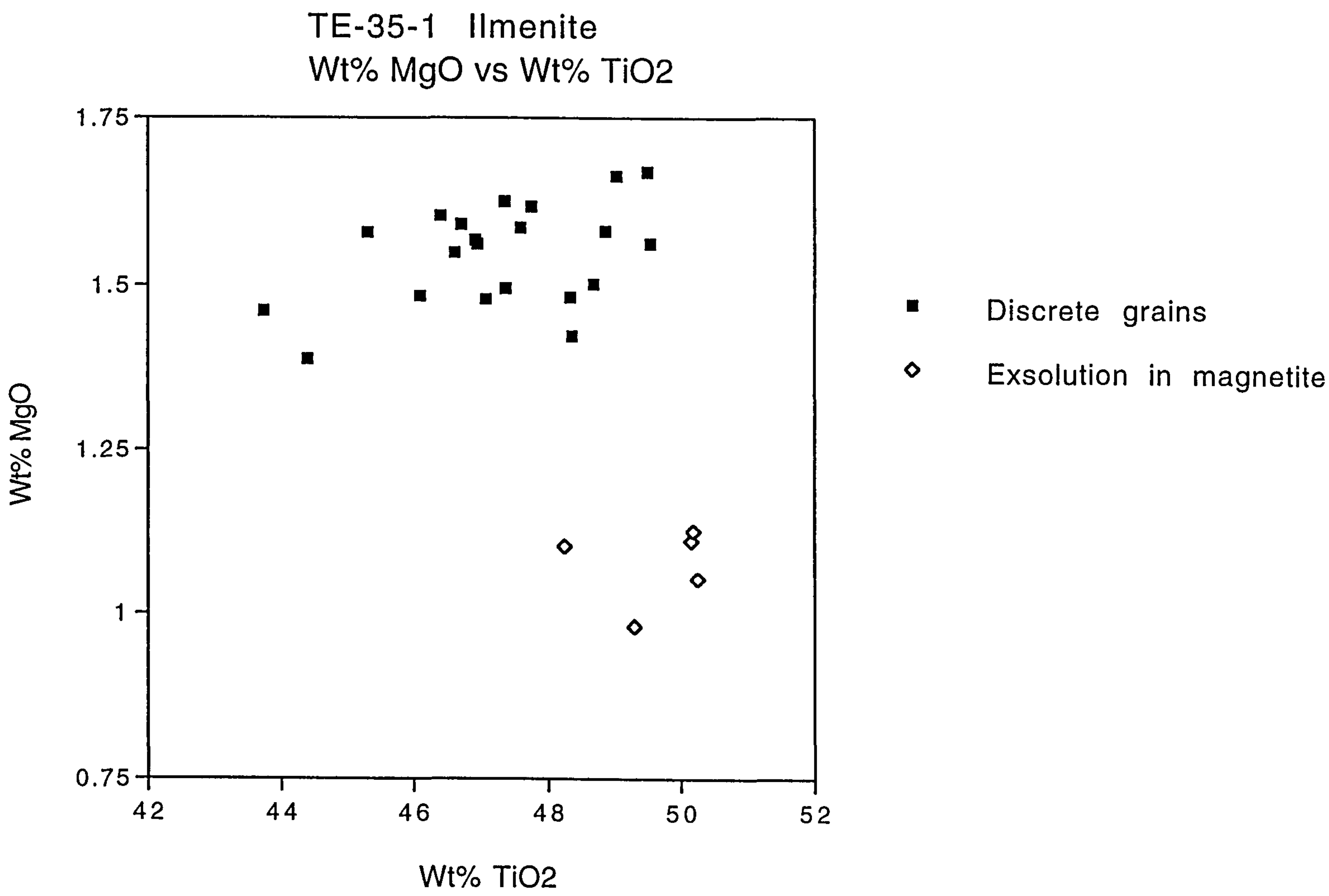


Figure 5.9. Details of ilmenite analyses from sample TE-35-1 from the Mydland area of the Bjerkrem-Sokndal lopolith in terms of weight % MgO versus weight % TiO_2.. The main trend (black symbols) includes the bulk discrete ilmenite and analyses of areas rich in hematite exsolution lamellae. Grains that are oxy-exsolution lamellae in magnetite follow a different trend with much lower MgO content controlled by magnetite crystal chemistry.

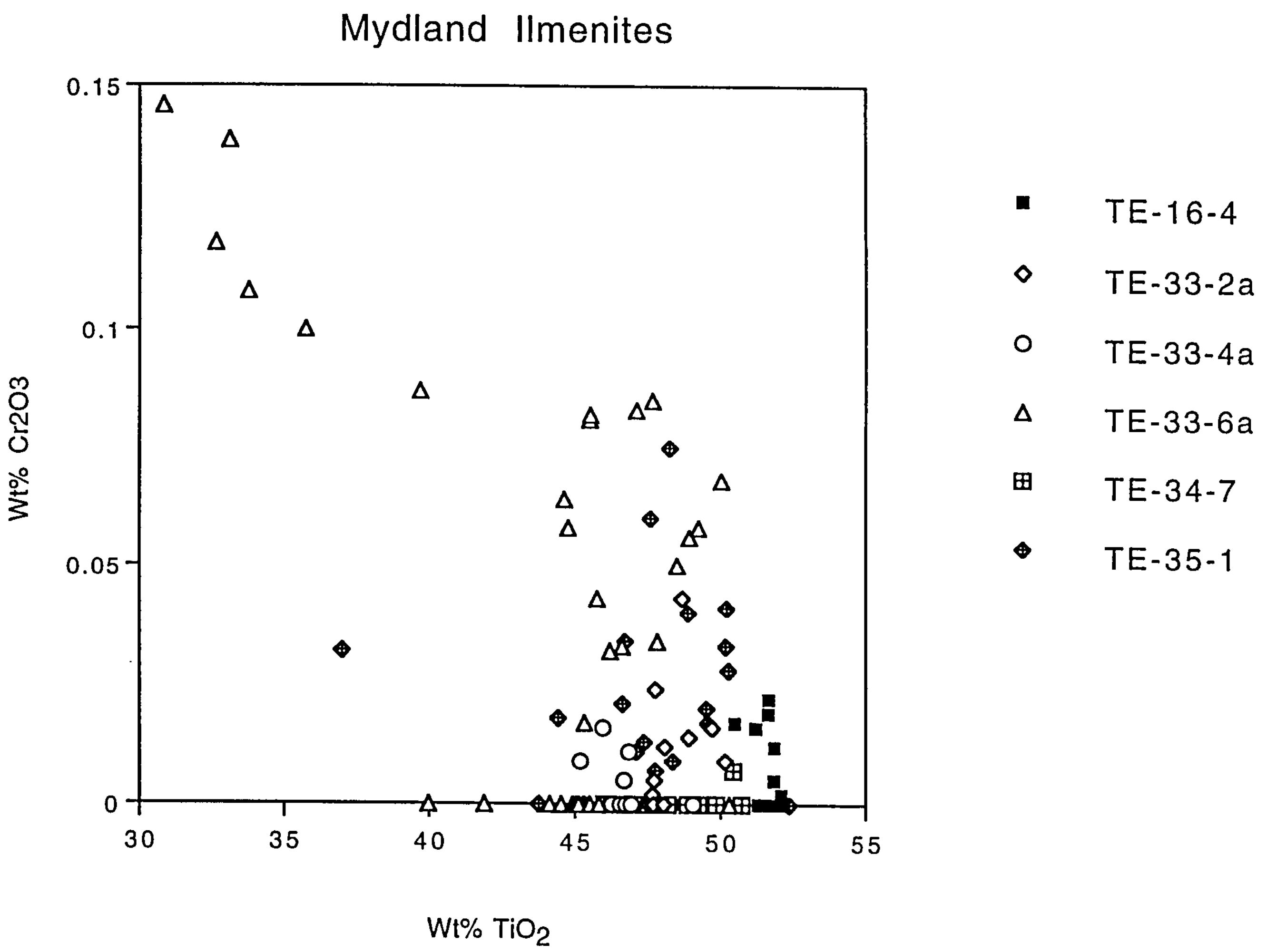


Figure 5.10. Plot of ilmenite and hemo-ilmenite analyses from the Mydland area of the Bjerkrem-Sokndal lopolith in terms of weight % Cr_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. Low Ti analyses are also richest in Cr_2O_3, suggesting incorporation of an eskolaite component into the exsolving hematite, but a number of low-Ti low-Cr analyses make this interpretation questionable. Note that the maximum amount of Cr_2O_3 is about 0.15 % as compared to about 0.27 % in Tellnes samples (Figure 5.4).

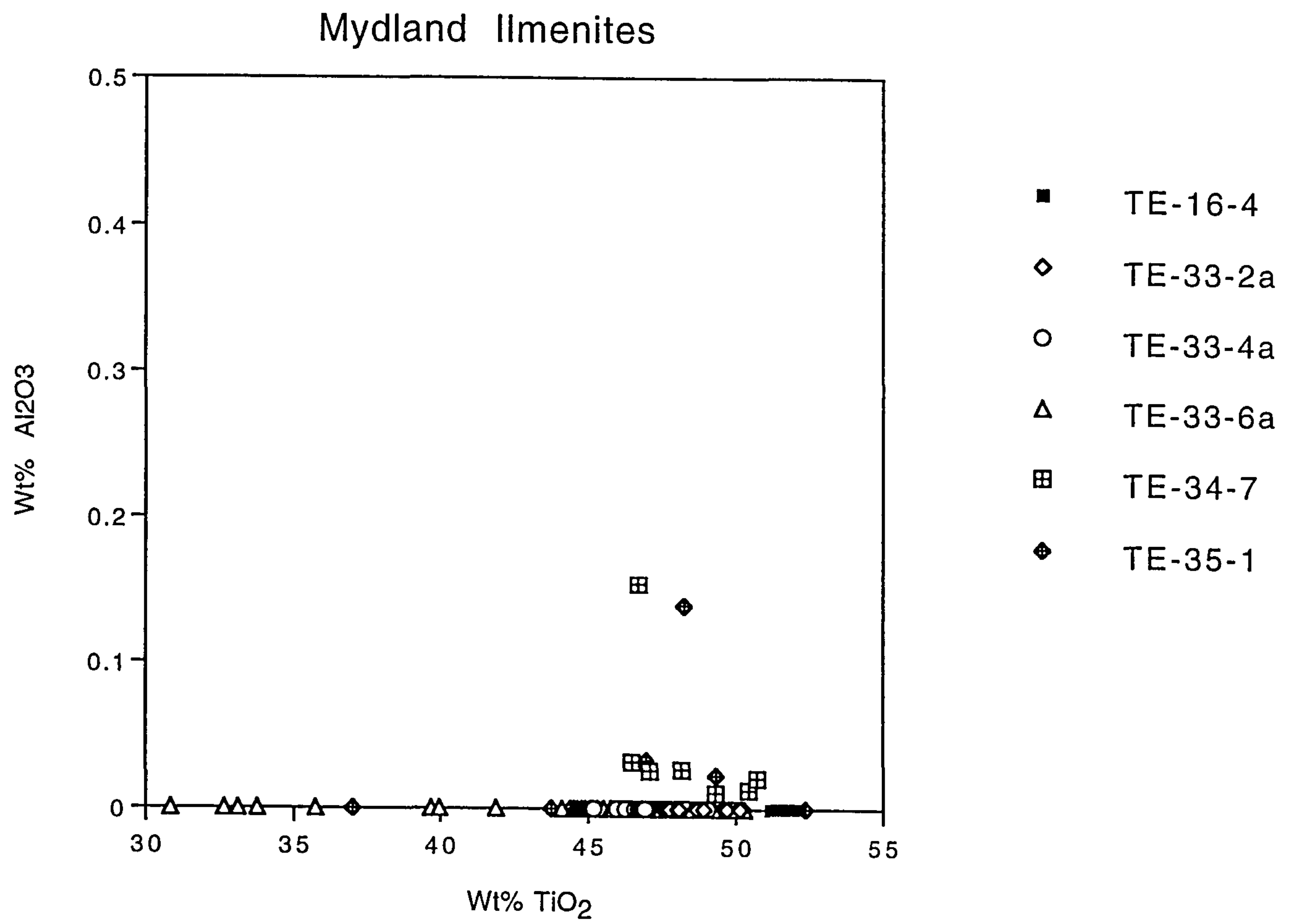


Figure 5.11. Plot of ilmenite and hemo-ilmenite analyses from the Mydland area of the Bjerkrem-Sokndal lopolith in terms of weight % Al_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. Low Al_2O_3 content of nearly all analyses indicates that there is not a corundum component in the exsolved hematite.

Oxide Cumulate Norites, Heskestad Area (TE39, 40, 41). Compositions ofilmenite in these rocks are plotted in Figure 5.12 in terms of weight % MgO versus weight % TiO_2, in Figure 5.13 in terms of weight % Cr_2O_3 versus weight % TiO_2, and in Figure 5.14 in terms of weight % Al_2O_3 versus weight % TiO_2. The few low Ti analyses in samples TE41-1a and TE41-2b represent points including abundant hematite exsolution lamellae. These analyses are also lower in MgO than the Ti-rich ilmenite in the same sample (Figure 5.12). The other samples appear to lack hematite exsolution and they contain less than 0.5 weight % MgO. Note that the maximum amount of MgO is 1.1% as compared to 2 to 4.5% at the Tellnes Mine (Figure 5.2). Low Ti analyses are also generally richer in Cr_2O_3 (Figure 5.13) than the high-Ti analyses in the same sample, suggesting incorporation of an eskolaite component into the exsolving hematite, but several low-Ti low-Cr analyses make this interpretation questionable. Grains apparently lacking hematite exsolution locally have as high or higher Cr. Note that the maximum amount of Cr_2O_3 is about 0.1 % as compared to about 0.27 % in Tellnes samples (Figure 5.4). Very few analyses contain significant Al (Figure 5.11), but the lowest Ti analyses are richer in Al, possibly explained by a corundum component in ilmenite.

Compositions of ilmenites in samples TE33 and TE35 from Mydland and samples TE41-1a and TE41-2b from Heskestad are plotted in Figure 5.15* in terms of weight % V_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk compositions of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. High V_2O_3 content of low-Ti analyses compared to high-Ti analyses suggests that there is a V_2O_3 component in the exsolved hematite.

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* Since preparation of this group of Figures, additional V_2O_3 analyses have been completed. These are presented as Figures in an Appendix as Figures 5.5V, 5.7V, 5.11V, and 5.15V showing relationships between weight % V_2O_3 and weight % TiO_2 in ilmenite, in groups of samples from Tellnes Mine, Bakka, Mydland, and Heskestad areas, respectively.

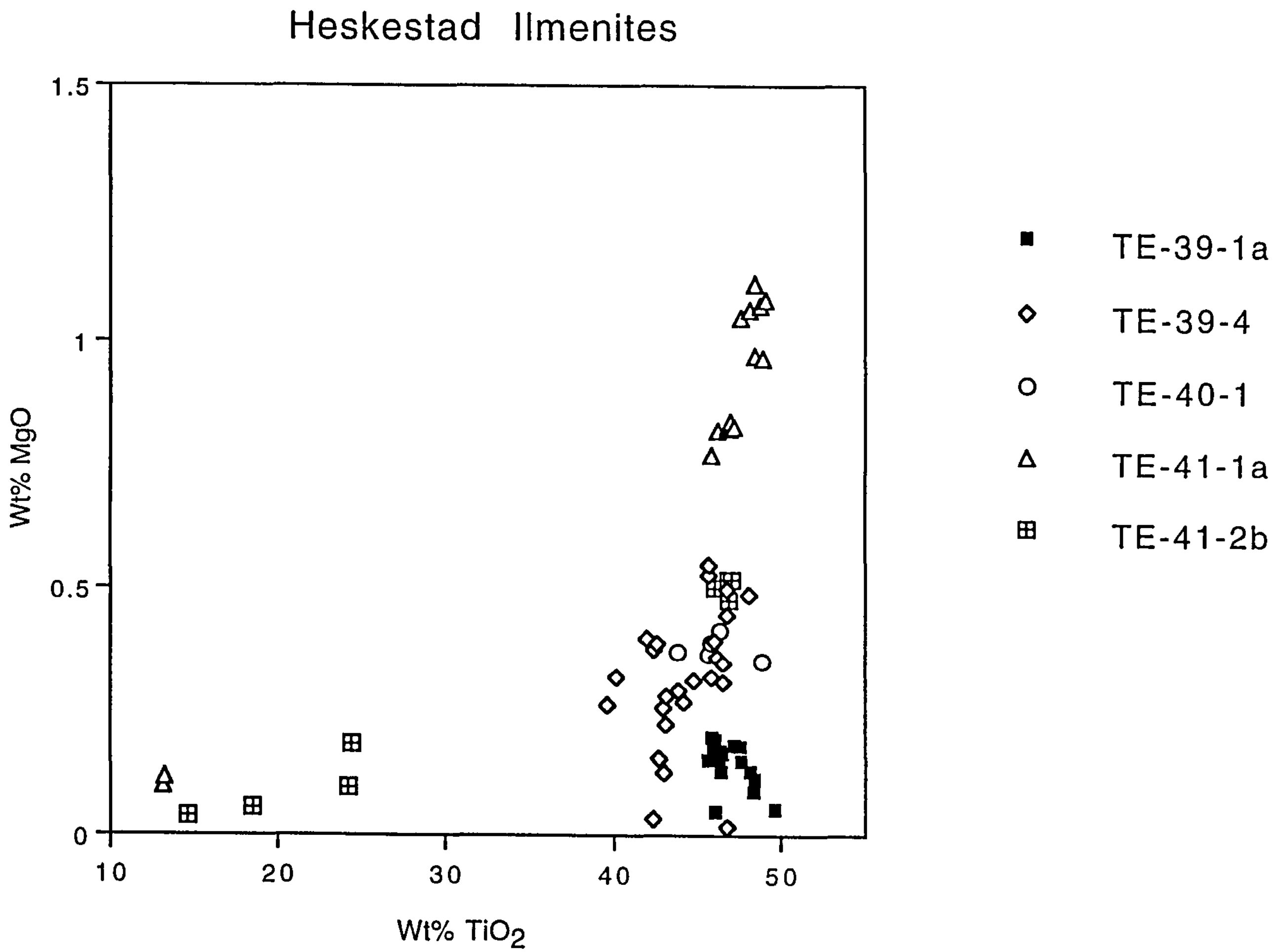

Figure 5.12. Plot of ilmenite and hemo-ilmenite analyses from the Heskestad area of the Bjerkrem-Sokndal lopolith in terms of weight % MgO versus weight % TiO_2. Highest Ti analyses represent approximate bulk compositions of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. These analyses are also lower in MgO than Ti-rich ilmenites in the same sample. Samples TE-39-1a, TE-39-4, and TE-40-1 contain Ti-rich ilmenite coexisting with magnetite and little or no hematite exsolution lamellae. Samples TE-41-1a and TE-41-2b contain more hematite exsolution lamellae. Note that the maximum amount of MgO is just above 1% as compared to 2 to 4.5% at the Tellnes Mine (Figure 5.3).

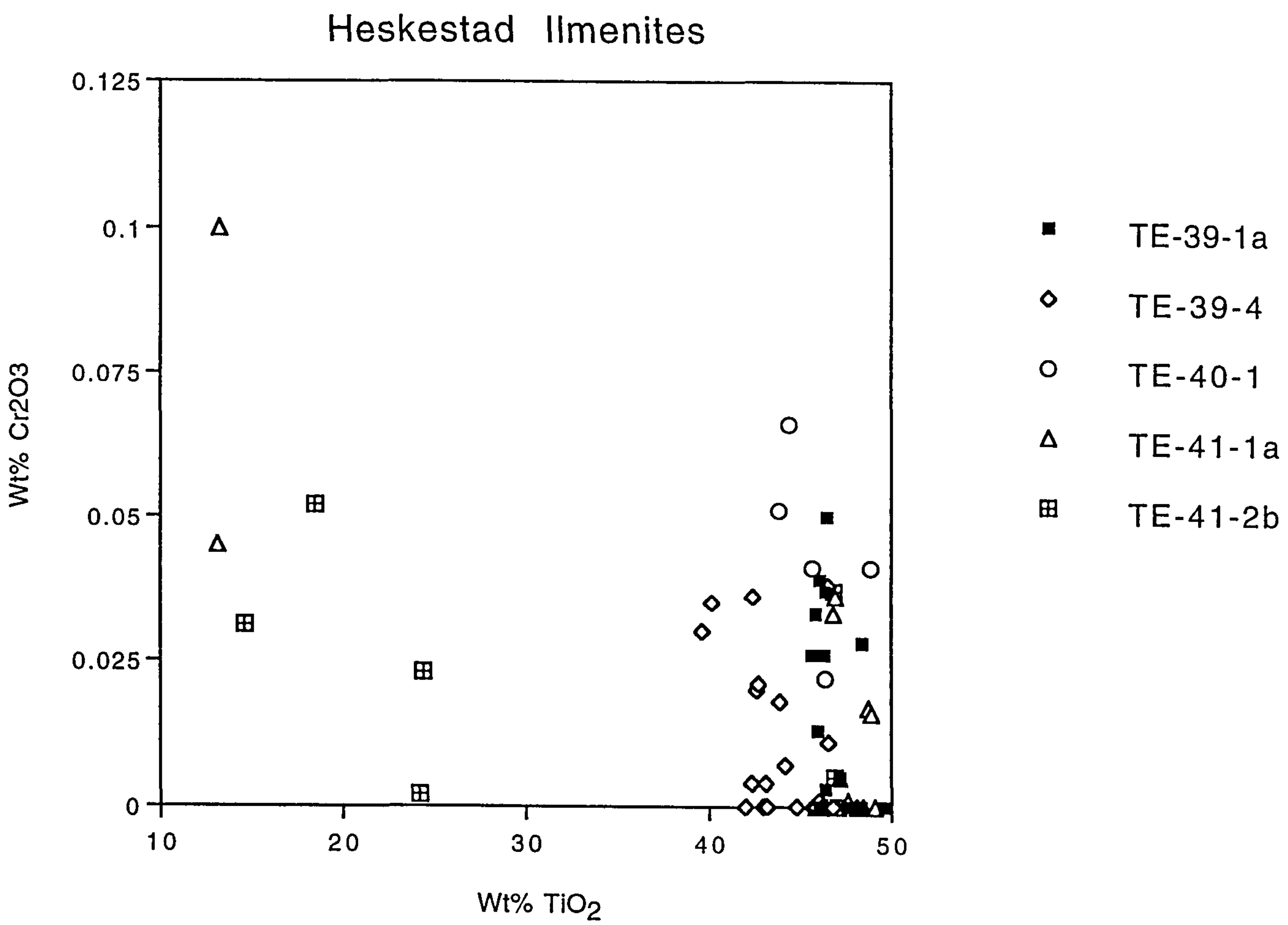

Figure 5.13. Plot of ilmenite and hemo-ilmenite analyses from the Heskestad area of the Bjerkrem-Sokndal lopolith in terms of weight % Cr_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. Low Ti analyses are also richer in Cr_2O_3 than Ti-rich ilmenites in the same sample, suggesting incorporation of an eskolaite component into the exsolving hematite, but a number of high-Ti high-Cr analyses make this interpretation questionable. Note that the maximum amount of Cr_2O_3 is about 0.1 % as compared to about 0.15% in the Mydland samples (Figure 5.10) and 0.27 % in Tellnes samples (Figure 5.4).

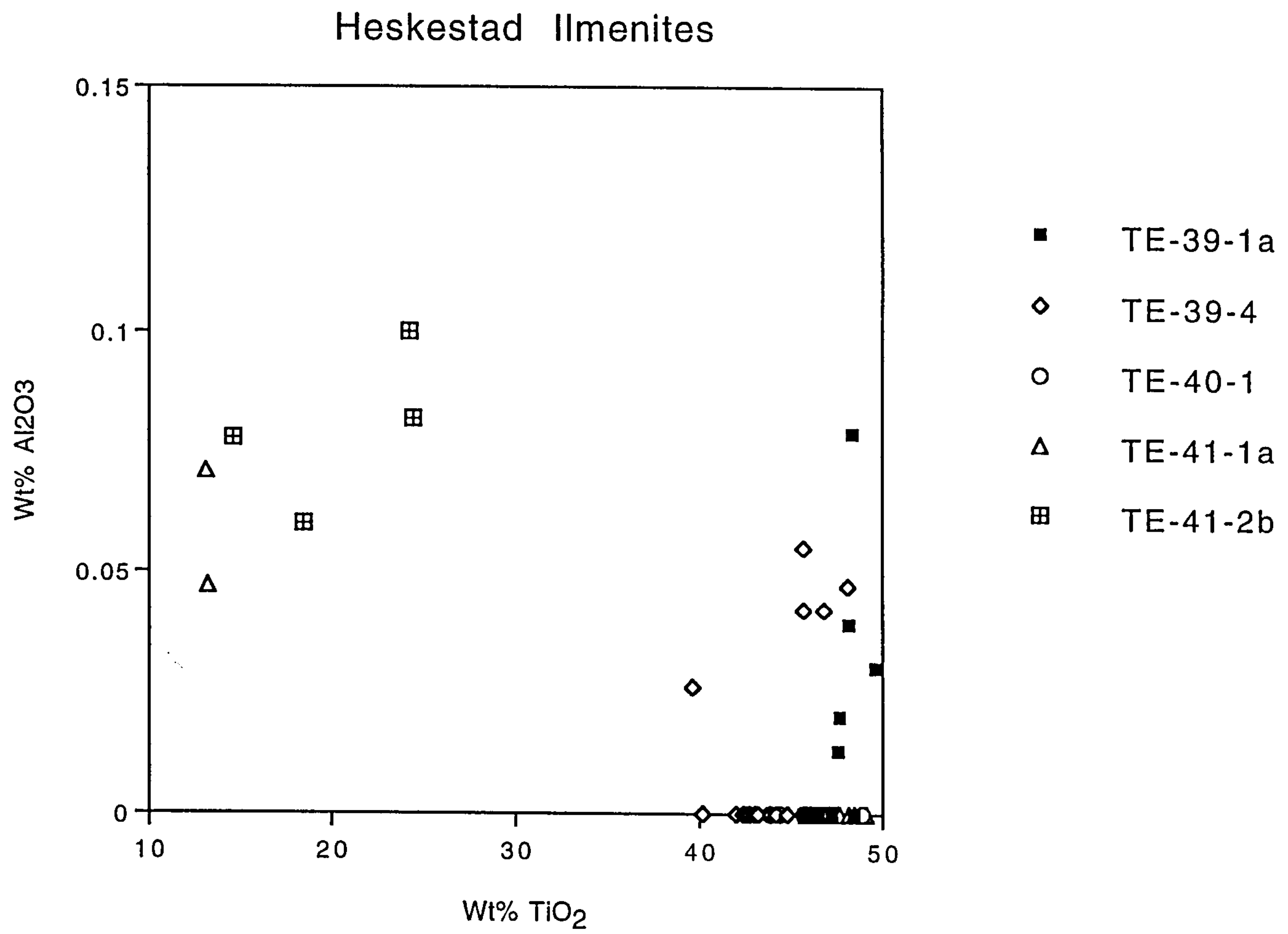

Figure 5.14. Plot of ilmenite and hemo-ilmenite analyses from the Heskestad area of the Bjerkrem-Sokndal lopolith in terms of weight % Al_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. High Al_2O_3 content of low-Ti analyses compared to high-Ti analyses in the same sample suggests that there is a corundum component in the exsolved hematite, but high Al content in other samples is not yet accounted for.

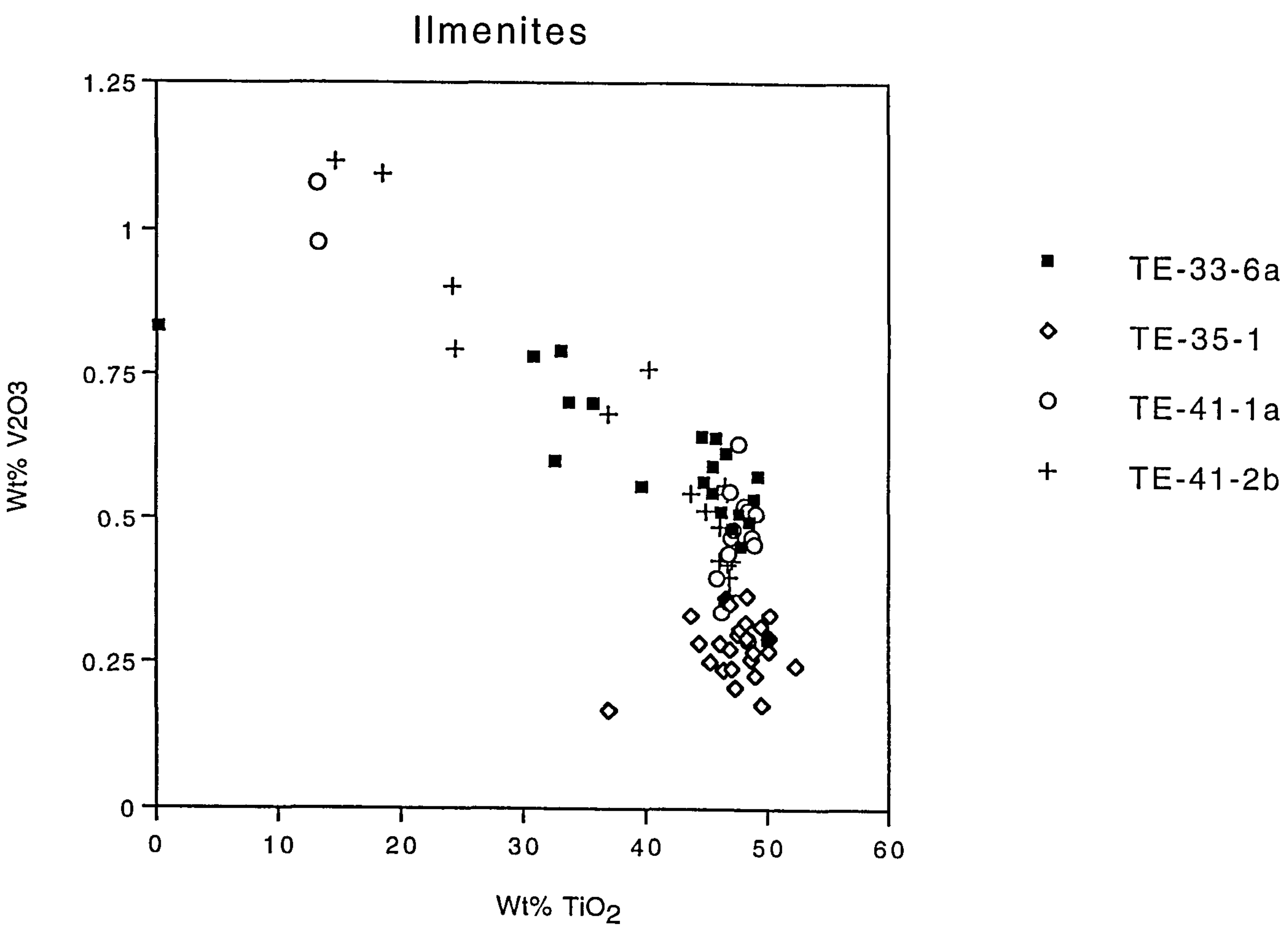

Figure 5.15. Plot of ilmenite and hemo-ilmenite analyses from the Mydland and Heskestad areas of the Bjerkrem-Sokndal lopolith in terms of weight % V_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. High V_2O_3 content of low-Ti analyses compared to high-Ti analyses suggests that there is a V_2O_3 component in the exsolved hematite. The quantitative analysis of V_2O_3 in ilmenite is complicated by a partial overlap of the Ti and V X-ray peaks. However, this figure shows that V_2O_3 increases as TiO_2 decreases, so that true V_2O_3 content of the Ti-rich ilmenites may be lower than shown. One cannot say how much V_2O_3 is in ilmenite, but it is likely below 0.5 weight %. V_2O_3 perhaps as high as 1 weight % is in hematite. Because of this analytical problem only samples with extensive hematite exsolution are shown. Magnetite in the same samples (data not shown) also has up to 1 weight % V_2O_3.

5.3 Comparisons of Compositions of Ilmenite and Magnetite

A group of figures was prepared to compare the compositions of ilmenites and magnetites from the different rock groups. All compositions are plotted in terms of weight % or weight ratio of oxides, but could later be reformulated in terms of molar or atomic ratios if desired. The figures can be laid out in a rectangular array, where vertical columns A, B, C, and D represent four different chemical plots, and where horizontal rows 1, 2, 3, 3a, and 4 represent different rock groups. The columns and rows are each described separately in the text, but there is an independent caption describing the contents and interpretation of each of the figures numbered 5.16 through 5.35. Each individual figure is numbered consecutively, but following the number the column and row is also indicated. Altogether there are 20 figures in a 4x5=20 array. In a separate set of two foldouts in the pocket such an array is shown, in this case a 4x4=16 array omitting Row 3 in favor of Row 3a.

Vertical Columns. On each diagram the vertical axis represents the ratio $TiO_2/(TiO_2+Fe_2O_3)$, which effectively separates ilmenite at high ratios near the top of the diagram, and magnetite at low ratios. Analyses overlapping hematite exsolution lamellae in ilmenite register as lower values than ilmenite, whereas rare ulvöspinel and ilmenite oxidation-exsolution lamellae in magnetite register as higher values than magnetite.

Column A. The horizontal axis is weight % MgO. Note the varied horizontal scales with highest values in row 1 and lowest in row 3.

Column B. The horizontal axis is the weight ratio MgO/(MgO+FeO). Note the varied horizontal scales with highest values in row 1 and lowest in row 3.

Column C. The horizontal axis is weight % Cr_2O_3. Note the varied horizontal scales with highest values in row 1 and lowest in row 2.

Column D. The horizontal axis is weight % V_2O_3. Note the varied horizontal scales with highest values in row 4 and lowest in row 1.

Horizontal Rows. These rows represent the various geographic areas covered in the study as indicated below.

Row 1. Analyses from the Tellnes Mine and vicinity, samples TE3, TE11, and TE29.

Row 2. Analyses from the Mydland Magnetic High (sample TE16) and Bakka High (samples TE26, TE27) of the Bjerkreim-Sokndal Lopolith.

Row 3. Analyses from the Mydland Magnetic Low (samples TE33, TE34) of the Bjerkreim-Sokndal Lopolith excluding an anorthosite xenolith.

Row 3a. Analyses from the Mydland Magnetic Low (samples TE33, TE 34) of the Bjerkreim-Sokndal Lopolith including an anorthosite xenolith (sample TE35).

Row 4. Analyses from the Heskestad area (samples TE39, TE40, and TE41) of the Bjerkreim-Sokndal Lopolith.

Interpretations of composition relationships in each figure are given in the caption.

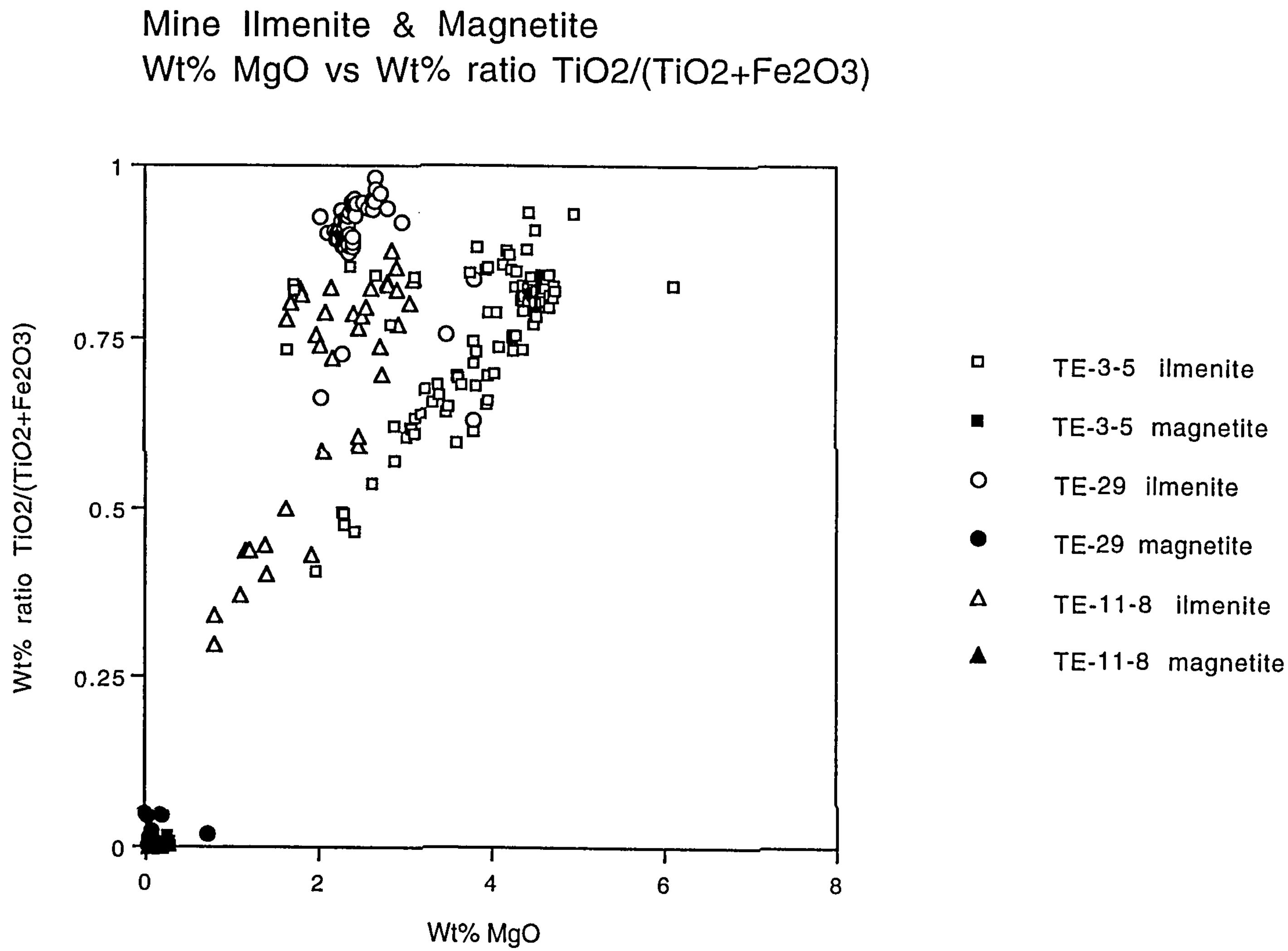

Figure 5.16 (1A). Analyses from the Tellnes Mine and vicinity, samples TE3, TE11, and TE29, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % MgO. Magnetites show little exsolution and very low MgO. Host ilmenites in TE29 are highest in TiO_2 indicating lowest hematite content, show little hematite exsolution, and are lowest in MgO. Host ilmenites in TE11 and TE3 are lower in TiO_2, show low TiO_2 tails indicating extensive hematite exsolution, and are higher in MgO. The trend of host ilmenites from highest MgO and lowest TiO_2 in TE3 to lowest MgO and highest TiO_2 is probably a primary magnatic trend.

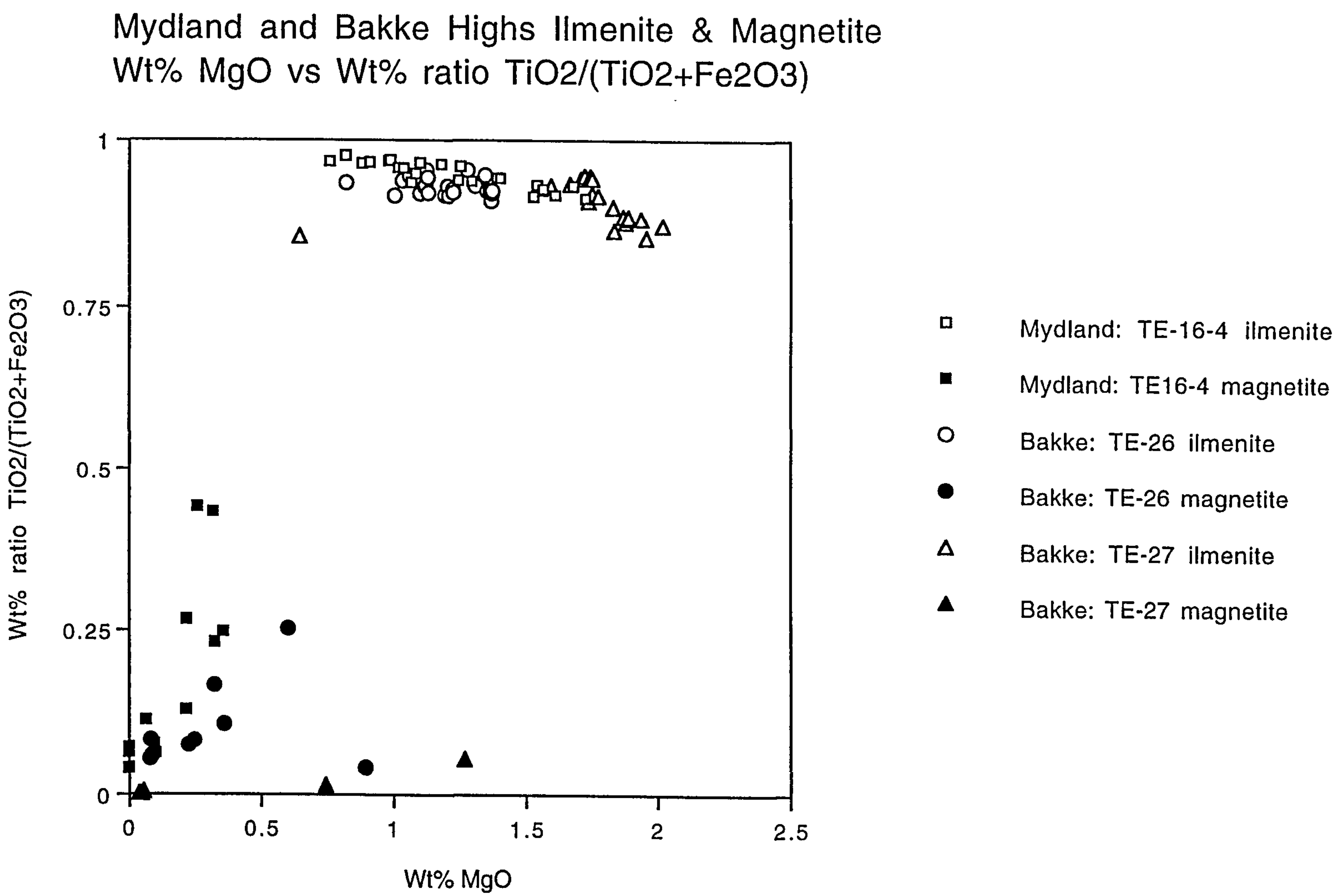

Figure 5.17 (2A). Analyses from the Mydland Magnetic High (sample TE16) and Bakke High (samples TE26, TE27) of the Bjerkrem-Sokndal Lopolith., plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % MgO. Magnetites in TE16 and TE26 give evidence of considerable exsolution of ulvospinel and/or ilmenite and locally up to about 1% MgO. High TiO_2 contents of ilmenites give no evidence of hematite exsolution. The trend of decreasing TiO_2 contents with increasing MgO would be even more pronounced when plotted in atomic coordinates, and may be an extension of the magmatic trend suggested for Figure 5.16.

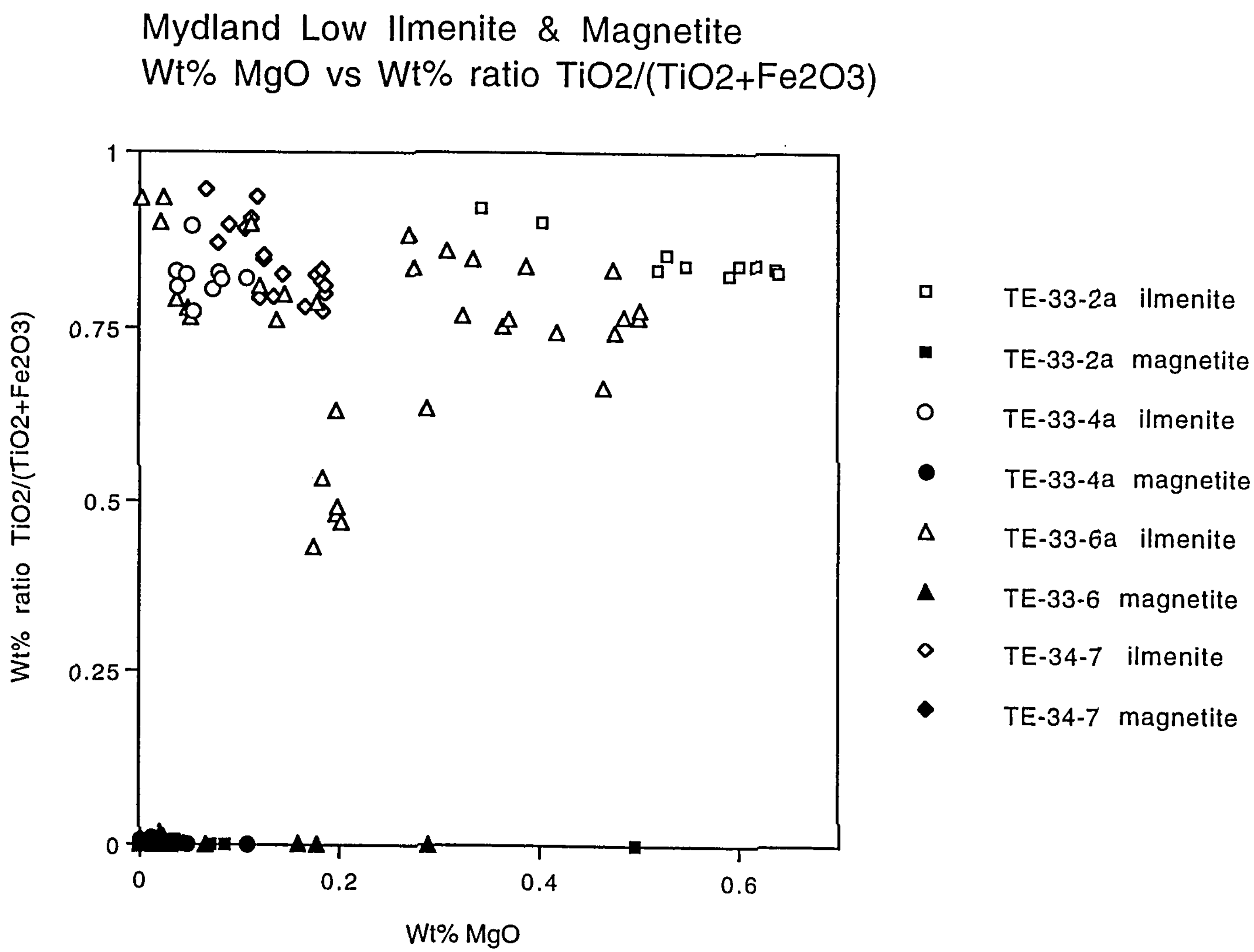

Figure 5.18 (3A). Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith excluding an anorthosite xenolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % MgO. Magnetites show no evidence of exsolution and very low MgO. The analysis with highest MgO may overlap fine spinel TiO_2 contents of ilmenites are high, but not so high as those in Figure 2A, indicating higher hematite content, but give little evidence of hematite exsolution except for sample TE33-6 where it is extensive. As in previous figures, ilmenites are consistently richer in MgO than magnetites, even though absolute amounts are very low.

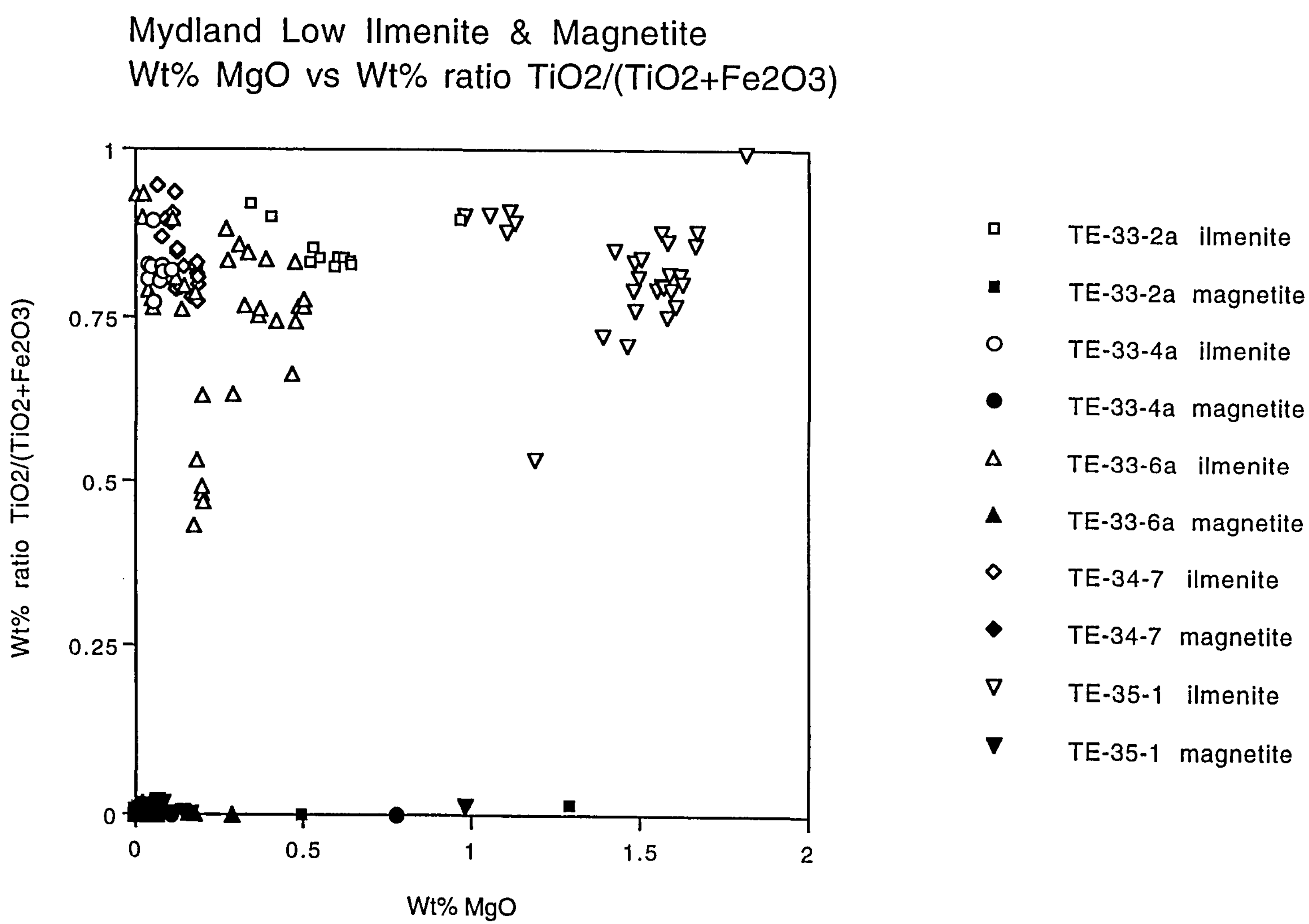

Figure 5.19 (3aA). Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith including an anorthosite xenolith (sample TE35), plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % MgO. Magnetites show no evidence of exsolution and very low MgO. The analyses with highest MgO may overlap fine spinel High TiO_2 contents of ilmenites give little evidence of hematite exsolution except for sample TE33-6 and the anorthosite xenolith TE35) where it is extensive. As in previous figures, ilmenites are consistently richer in MgO than magnetites, even though absolute amounts are very low.

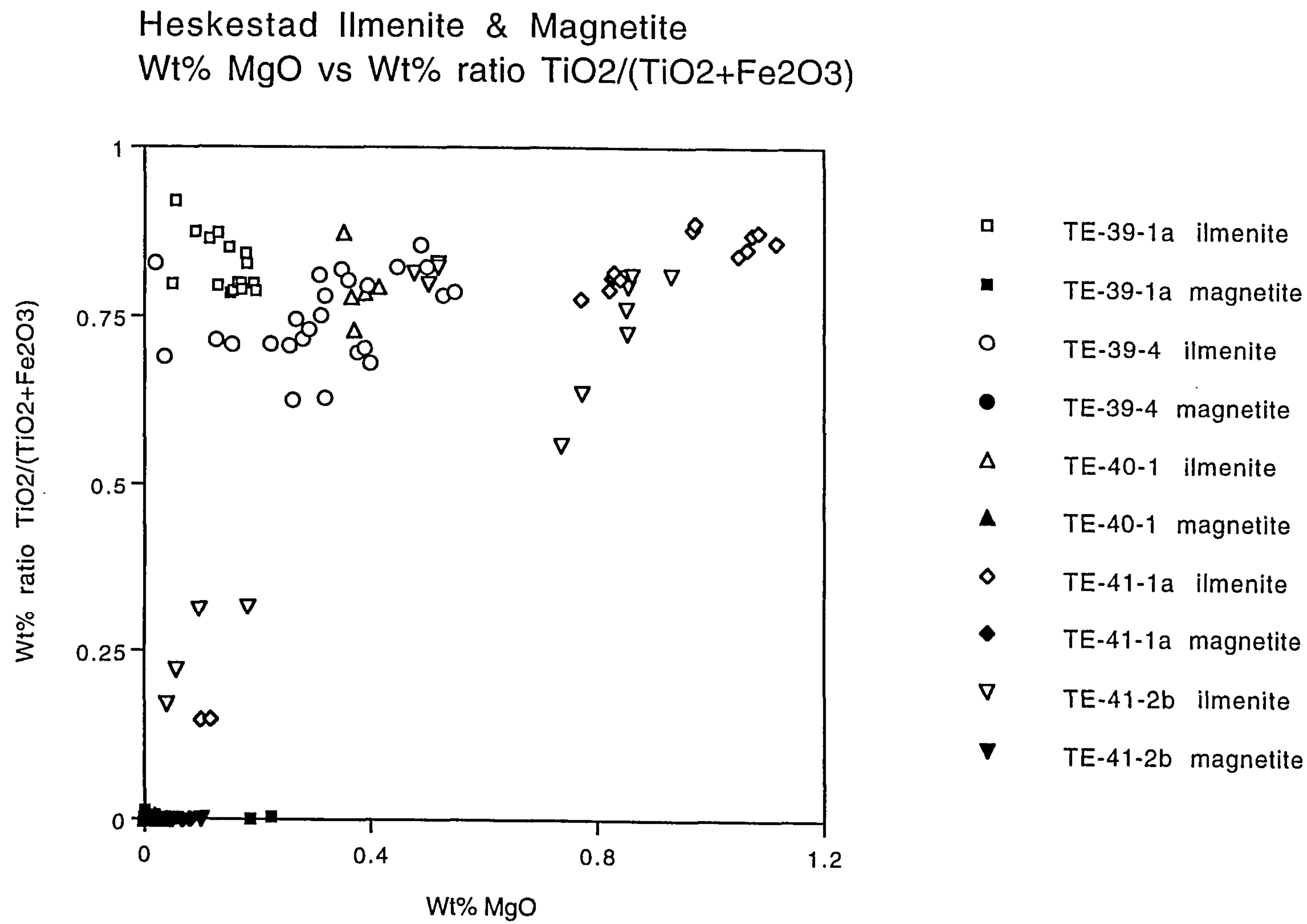

Figure 5.20 (4A). Analyses from the Heskestad area (samples TE39,TE40, and 41) of the Bjerkrem-Sokndal Lopolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % MgO. Magnetites show no evidence of exsolution and very low MgO. TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.17, indicating higher hematite content, but give little evidence of hematite exsolution except for samples TE41 where it is extensive. As in previous figures, ilmenites are consistently richer in MgO than magnetites. Interestingly, the two examples with chemical evidence of hematite exsolution are also the most Mg-rich.

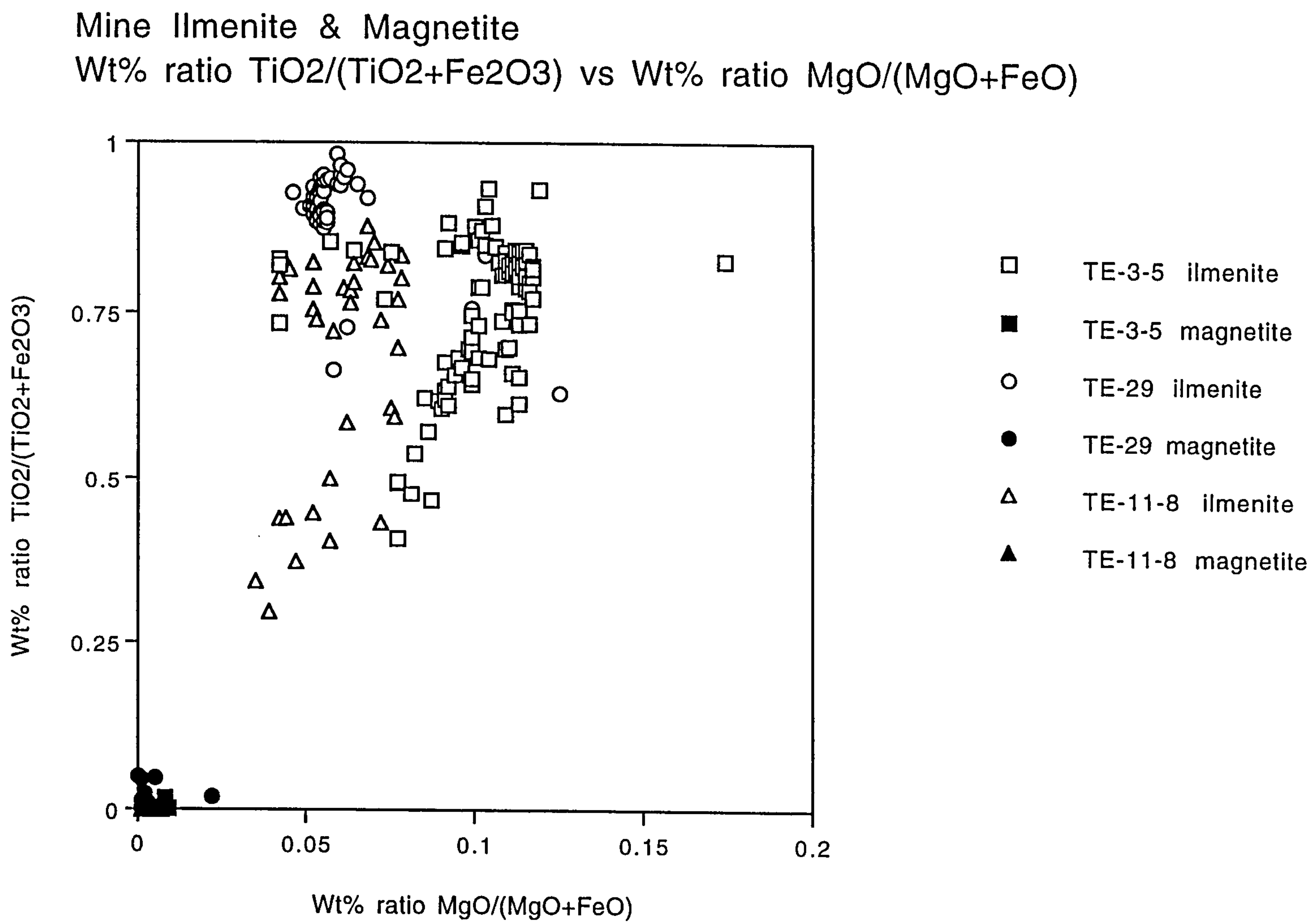

Figure 5.21 (1B). Analyses from the Tellnes Mine and vicinity, samples TE3, TE11, and TE29, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus the weight ratio MgO/(MgO+FeO). Magnetites show little exsolution and very low MgO. Host ilmenites in TE29 are highest in TiO_2 indicating lowest hematite content, show little hematite exsolution, and are lowest in MgO. Host ilmenites in TE11 and TE3 are lower in TiO_2, show low TiO_2 tails indicating extensive hematite exsolution, and are higher in MgO. The trend of host ilmenites from highest MgO and lowest TiO_2 in TE3 to lowest MgO and highest TiO_2 is probably a primary magnatic trend.

Mydland and Bakke Highs Ilmenite & Magnetite
Wt% ratio MgO/(MgO+FeO) vs Wt% ratio TiO2/(TiO2+Fe2O3)

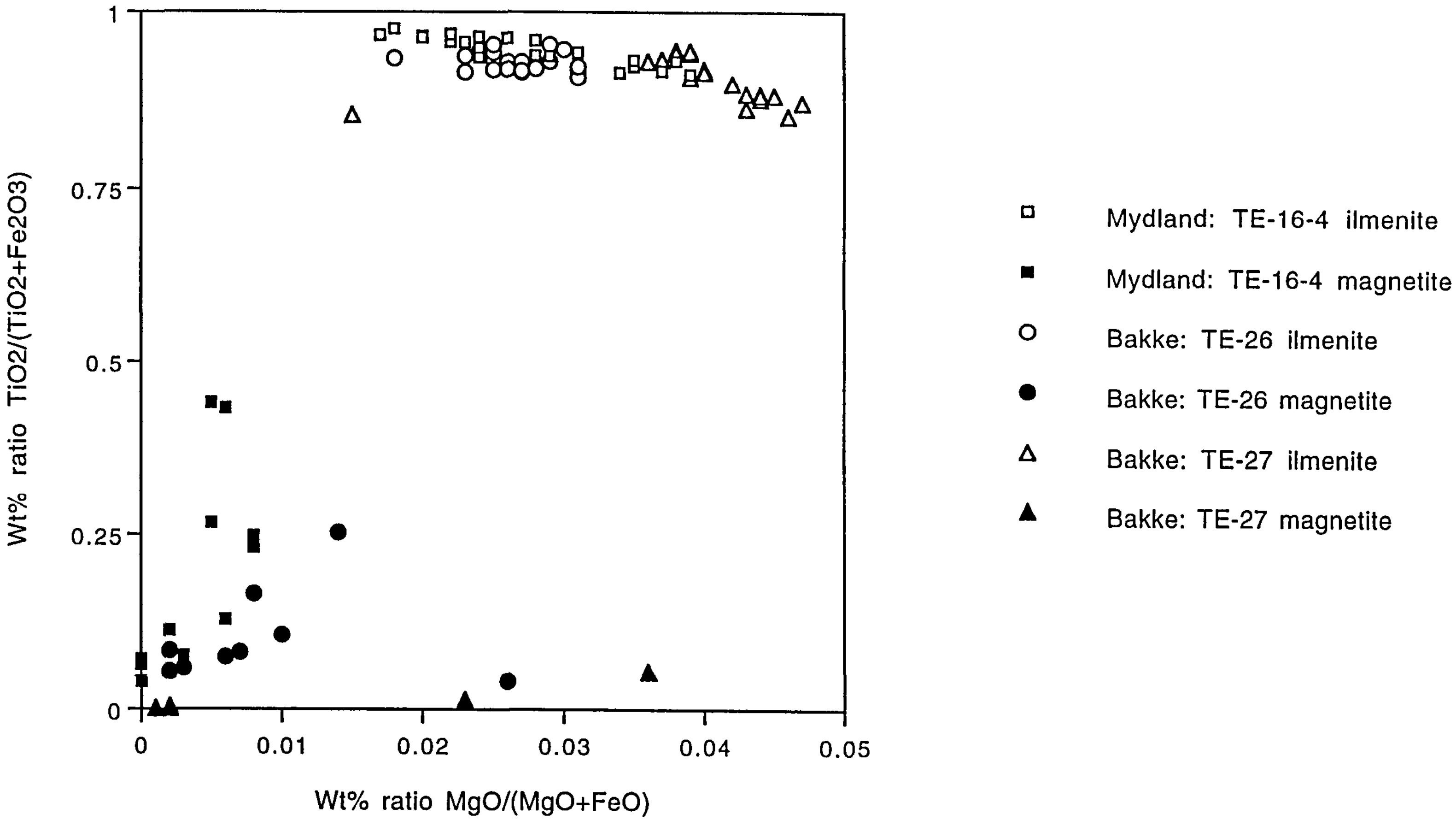

Figure 5.22 (2B). Analyses from the Mydland Magnetic High (sample TE16) and Bakke High (samples TE26, TE27) of the Bjerkrem-Sokndal Lopolith., plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus the weight ratio MgO/(MgO+FeO). Magnetites in TE16 and TE26 give evidence of considerable exsolution of ulvospinel and/or ilmenite and locally up to about 1% MgO. High TiO_2 contents of ilmenites give no evidence of hematite exsolution. The trend of decreasing TiO_2 contents with increasing MgO would be even more pronounced when plotted in atomic coordinates, and may be an extension of the magmatic trend suggested for Figure 5.16.

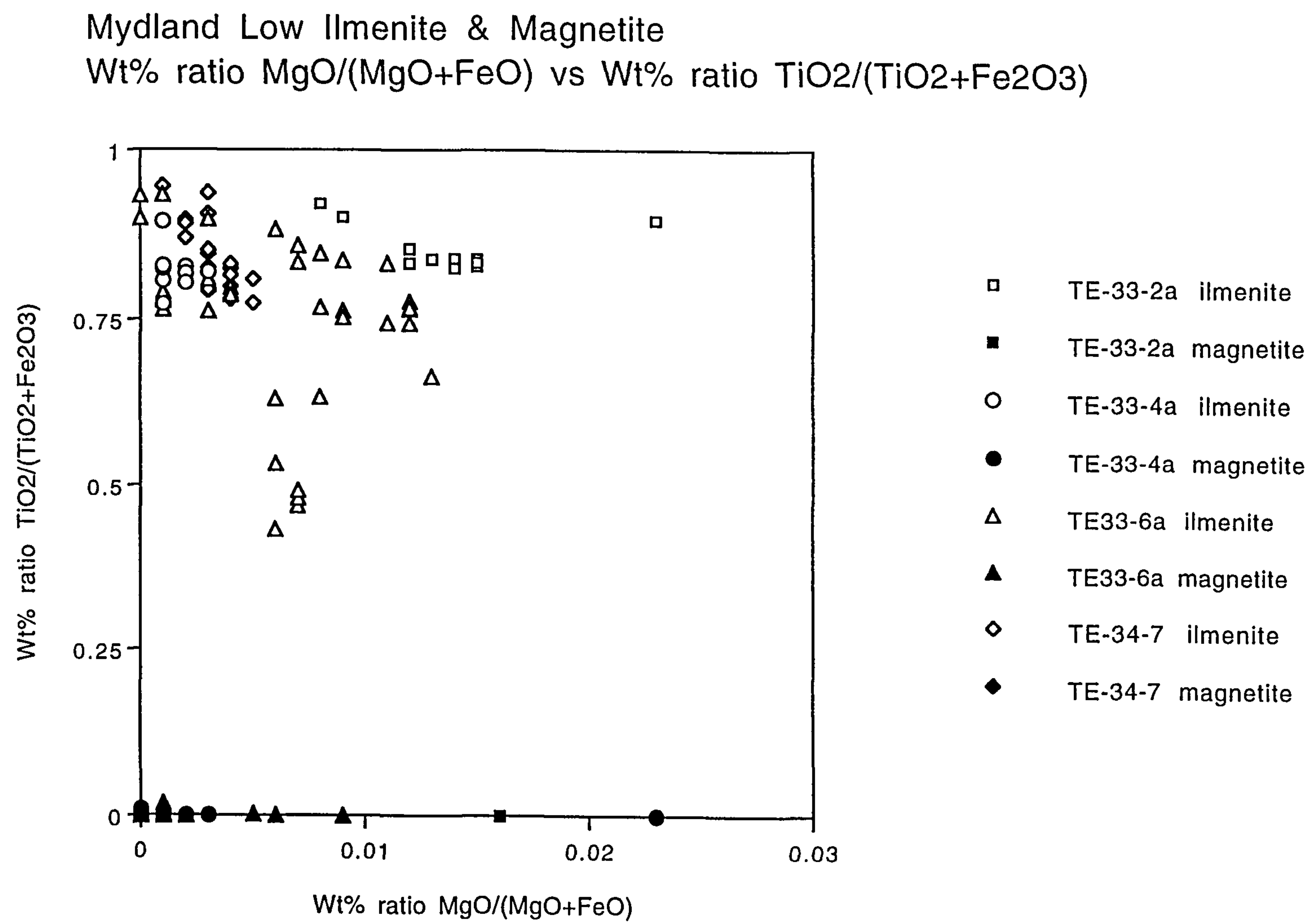

Figure 5.23 (3B). Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith excluding an anorthosite xenolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus the weight ratio MgO/(MgO+FeO). Magnetites show no evidence of exsolution and very low MgO. The analysis with highest MgO may overlap fine spinel TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.17, indicating higher hematite content, but give little evidence of hematite exsolution except for sample TE33-6 where it is extensive. As in previous figures, ilmenites are consistently richer in MgO than magnetites, even though absolute amounts are very low.

Mydland Low Ilmenite & Magnetite
Wt% ratio MgO/(MgO+FeO) vs Wt% ratio TiO2/(TiO2+Fe2O3)

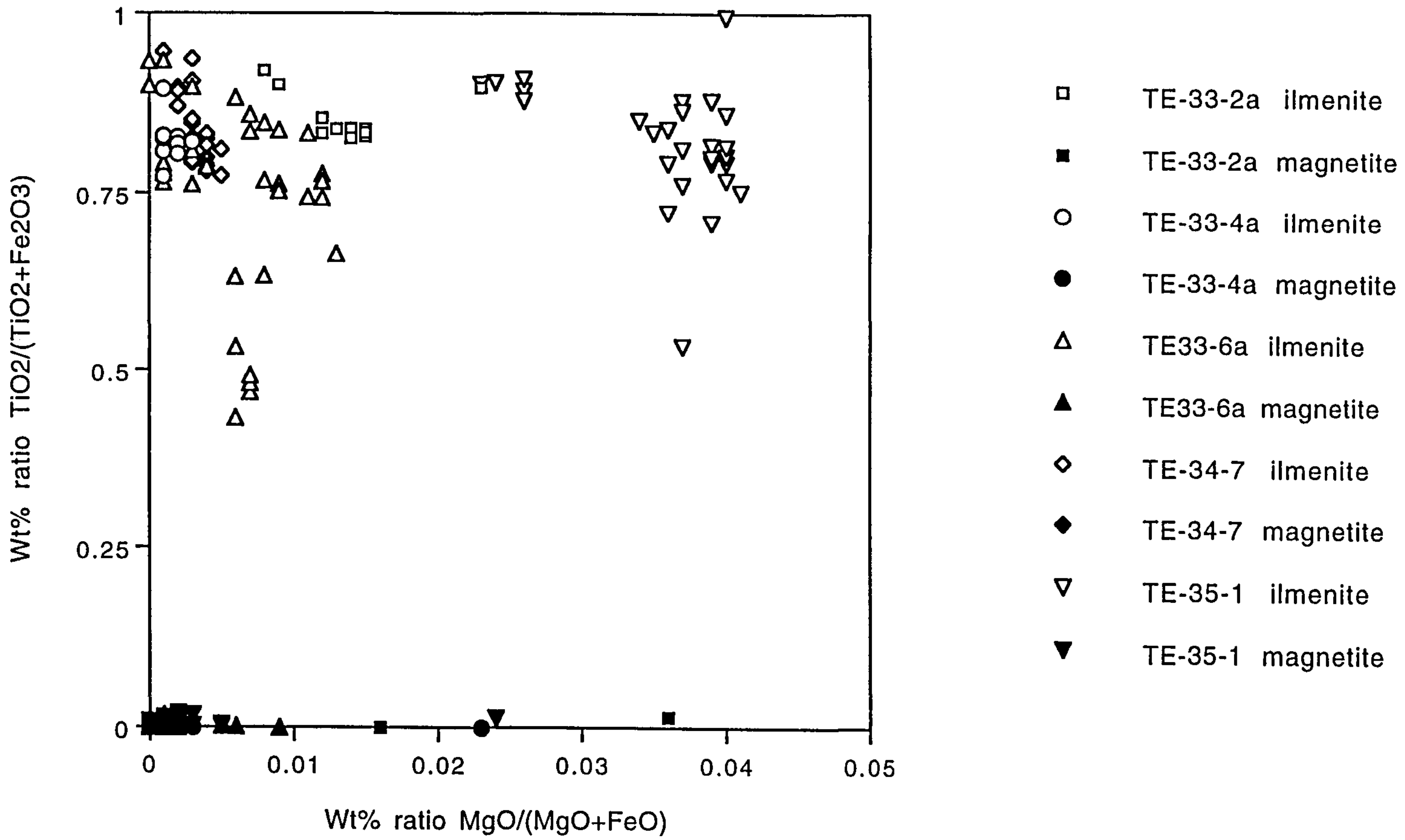

Figure 5.24 (3aB) Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith including an anorthosite xenolith (sample TE35), plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus the weight ratio MgO/(MgO+FeO). Magnetites show no evidence of exsolution and very low MgO. The analyses with highest MgO may overlap fine spinel High TiO_2 contents of ilmenites give little evidence of hematite exsolution except for sample TE33-6 and the anorthosite xenolith TE35) where it is extensive. As in previous figures, ilmenites are consistently richer in MgO than magnetites, even though absolute amounts are very low.

Heskestad Ilmenite & Magnetite
Wt% ratio MgO/(MgO+FeO) vs Wt% ratio TiO2/(TiO2+Fe2O3)

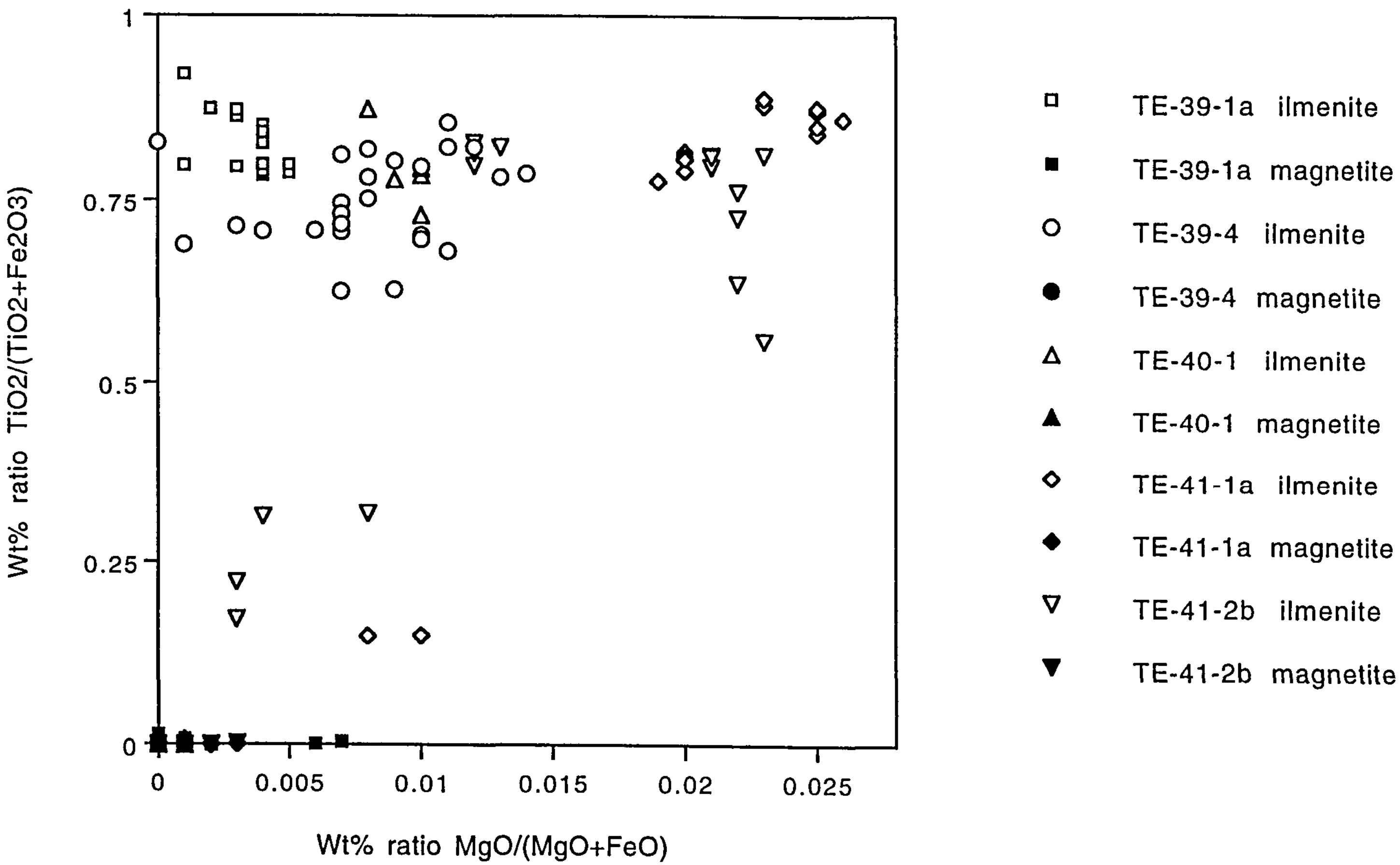

Figure 5.25 (4B) Analyses from the Heskestad area (samples TE39,TE40, and 41) of the Bjerkrem-Sokndal Lopolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus the weight ratio MgO/(MgO+FeO). Magnetites show no evidence of exsolution and very low MgO. TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.17, indicating higher hematite content, but give little evidence of hematite exsolution except for samples TE41 where it is extensive. As in previous figures, ilmenites are consistently richer in MgO than magnetites. Interestingly, the two examples with chemical evidence of hematite exsolution are also the most Mg-rich.

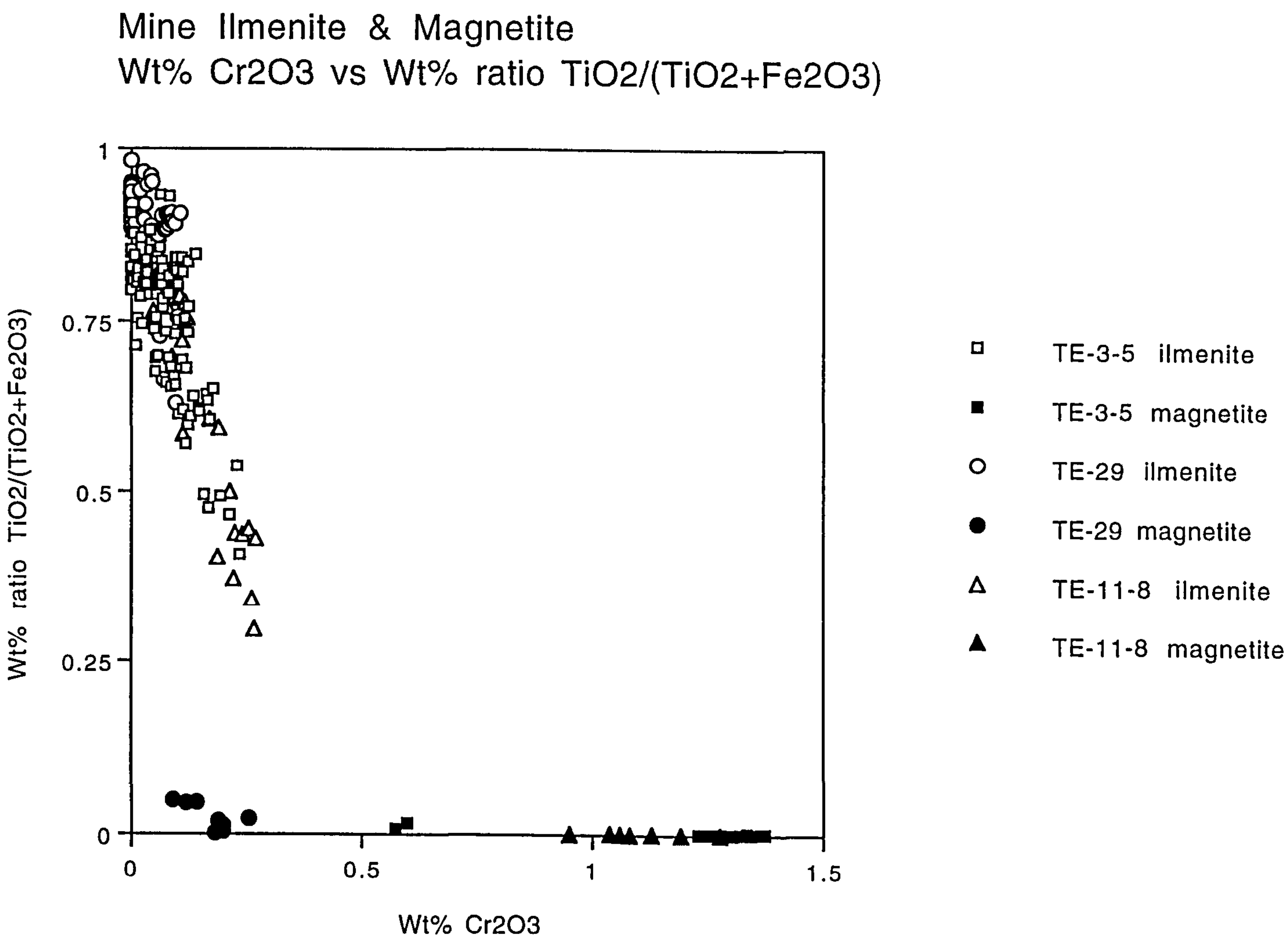

Figure 5.26 (1C) Analyses from the Tellnes Mine and vicinity, samples TE3, TE11, and TE29, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % Cr_2O_3. Magnetites show little exsolution and up to 1.4 % Cr_2O_3 with the highest value in sample TE3, considered to be magmatically most primitive (see Figures 5.16, 5.21) . Host ilmenites show extremely low Cr_2O_3 but there is a consistent trend of increasing Cr_2O_3 with decreasing TiO_2 and hematite exsolution in samples TE3 and TE11 to a maximum of about 0.25%, though lamellae still have lower Cr_2O_3 than coexisting magnetite.

Mydland and Bakke Highs Ilmenite & Magnetite
Wt% Cr2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)

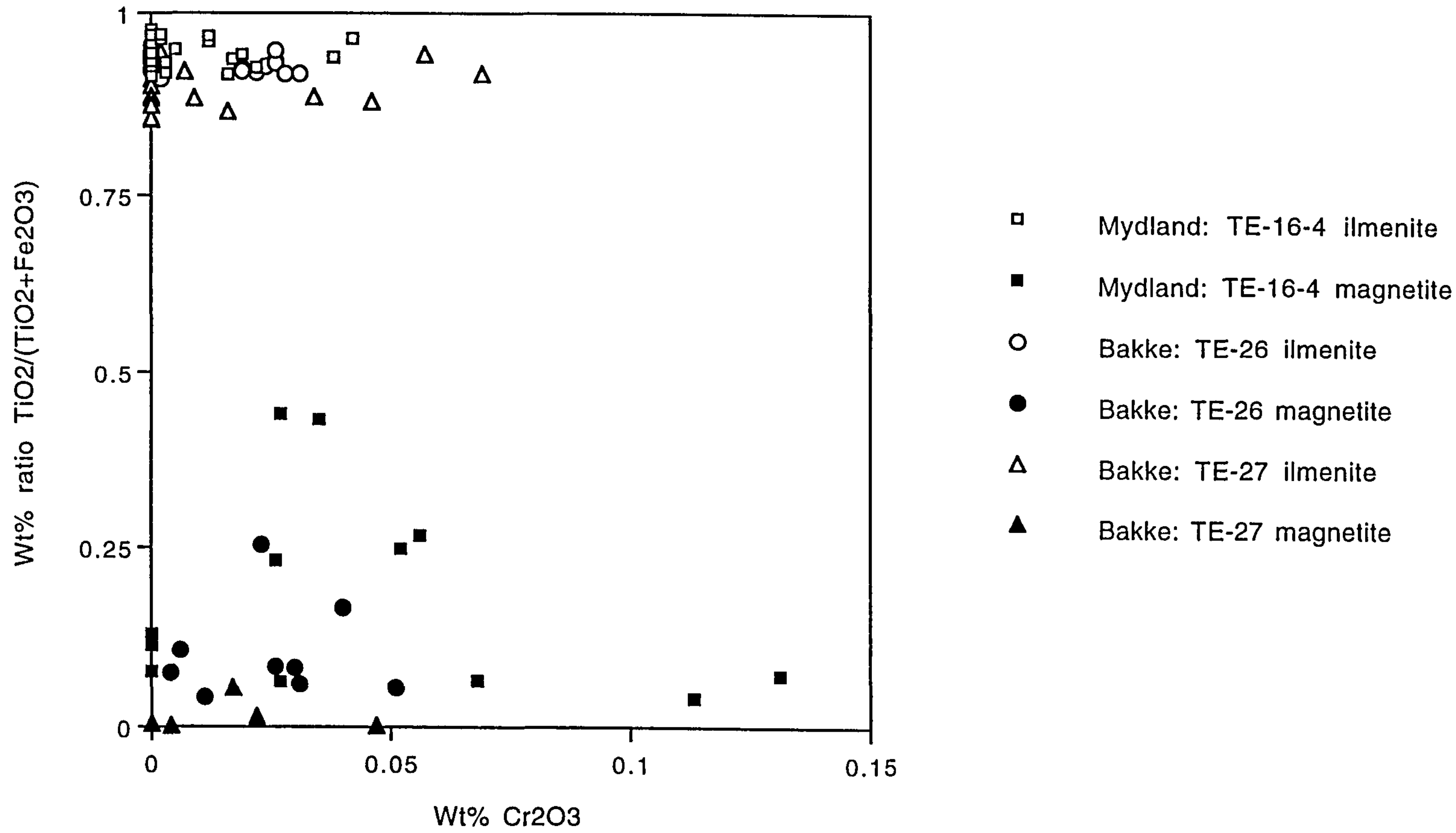

Figure 5.27 (2C) Analyses from the Mydland Magnetic High (sample TE16) and Bakke High (samples TE26, TE27) of the Bjerkrem-Sokndal Lopolith., plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % Cr_2O_3. Magnetites in TE16 and TE26 give evidence of considerable exsolution of ulvospinel and/or ilmenite and locally up to about 0.14 % Cr_2O_3. High TiO_2 contents of ilmenites give no evidence of hematite exsolution, and Cr_2O_3 contents are very low, all below about 0.07%. Detection of a "magmatic trend" in ilmenites between these samples and those of Figure 1C could perhaps be discerned by plotting all analyses together at the same scale.

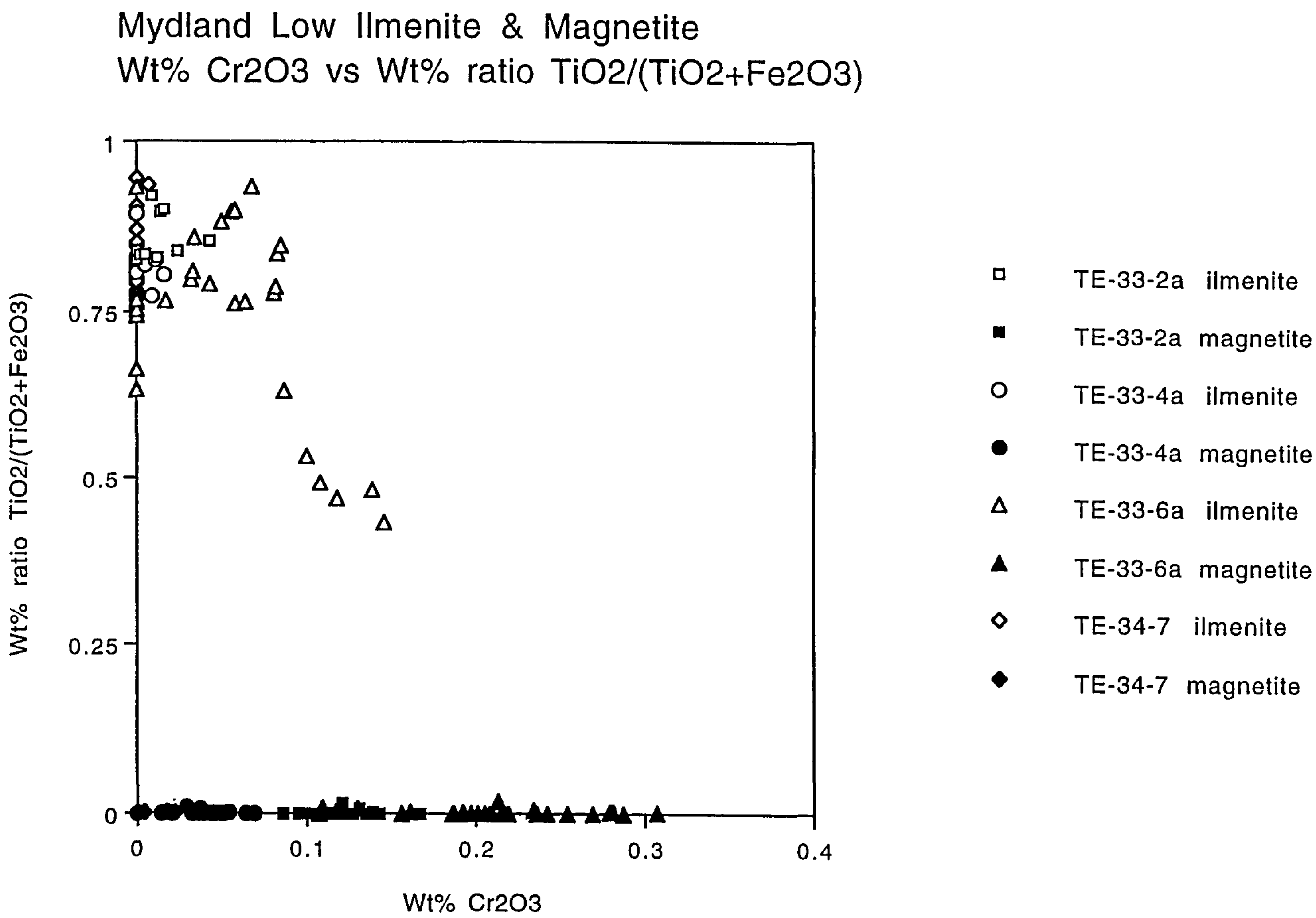

Figure 5.28 (3C) Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith excluding an anorthosite xenolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % Cr_2O_3. Magnetites show no evidence of exsolution and Cr_2O_3 up to 0.3%. TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.17, indicating higher hematite content, but give little evidence of hematite exsolution except for sample TE33-6 where it is extensive. Cr_2O_3 content of ilmenite is below 0.1 % except in hematite exsolution areas where it increases up to 0.15%. As in previous figures, magnetites are consistently higher in Cr_2O_3 than ilmenites, even though absolute amounts are very low.

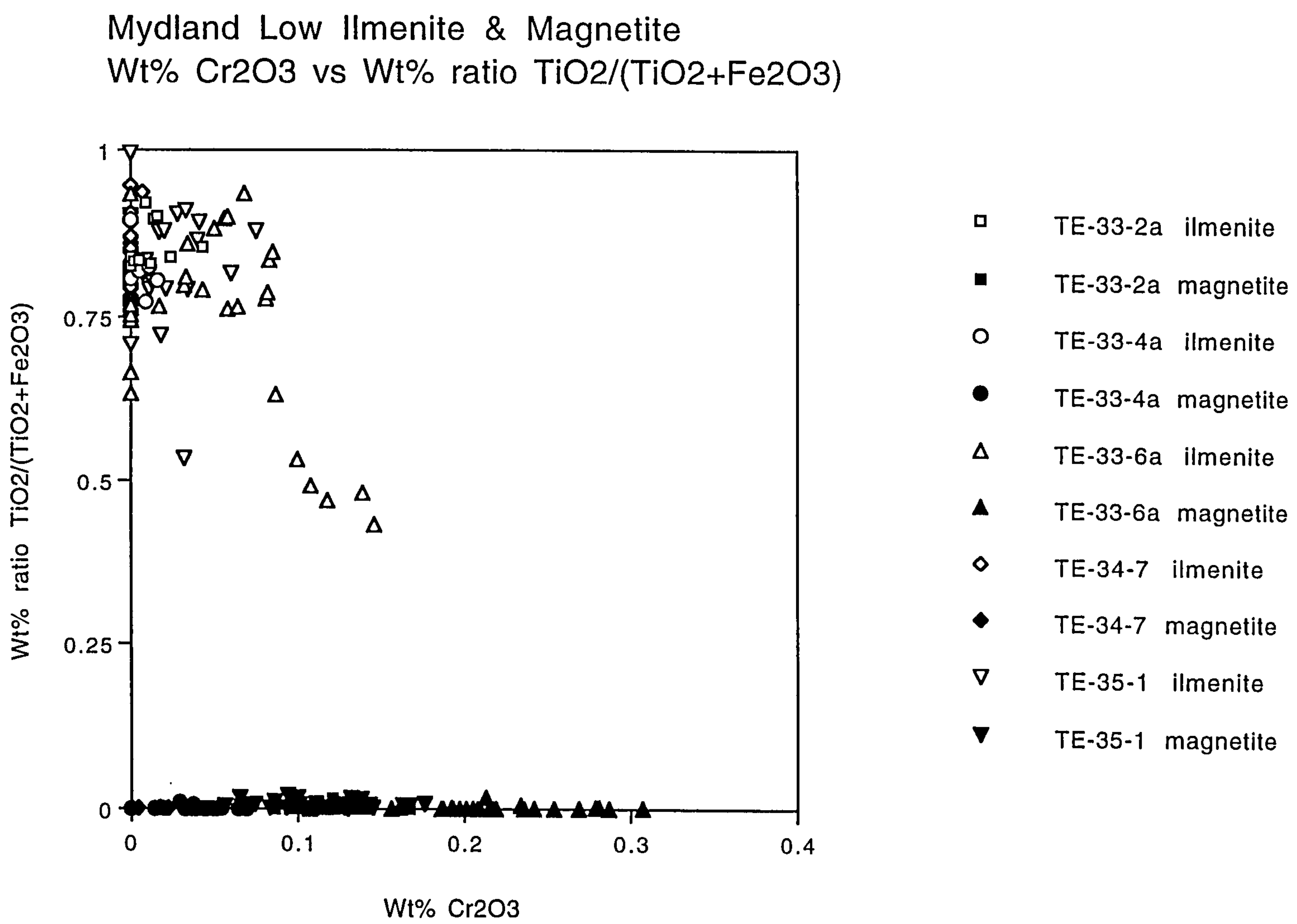

Figure 5.29 (3aC) Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith including an anorthosite xenolith (sample TE35), plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % Cr_2O_3. Magnetites show no evidence of exsolution and Cr_2O_3 up to 0.3%. TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.17, indicating higher hematite content, but give little evidence of hematite exsolution except for samples TE33-6 and anorthosite inclusion TE35 where it is extensive. Cr_2O_3 content of ilmenite is below 0.1 % except in hematite exsolution areas where it increases up to 0.15%. As in previous figures, magnetites are consistently higher in Cr_2O_3 than ilmenites, even though absolute amounts are very low. Addition of the anorthosite inclusion to this plot shows little because both magnetite and ilmenite are low inCr_2O_3.

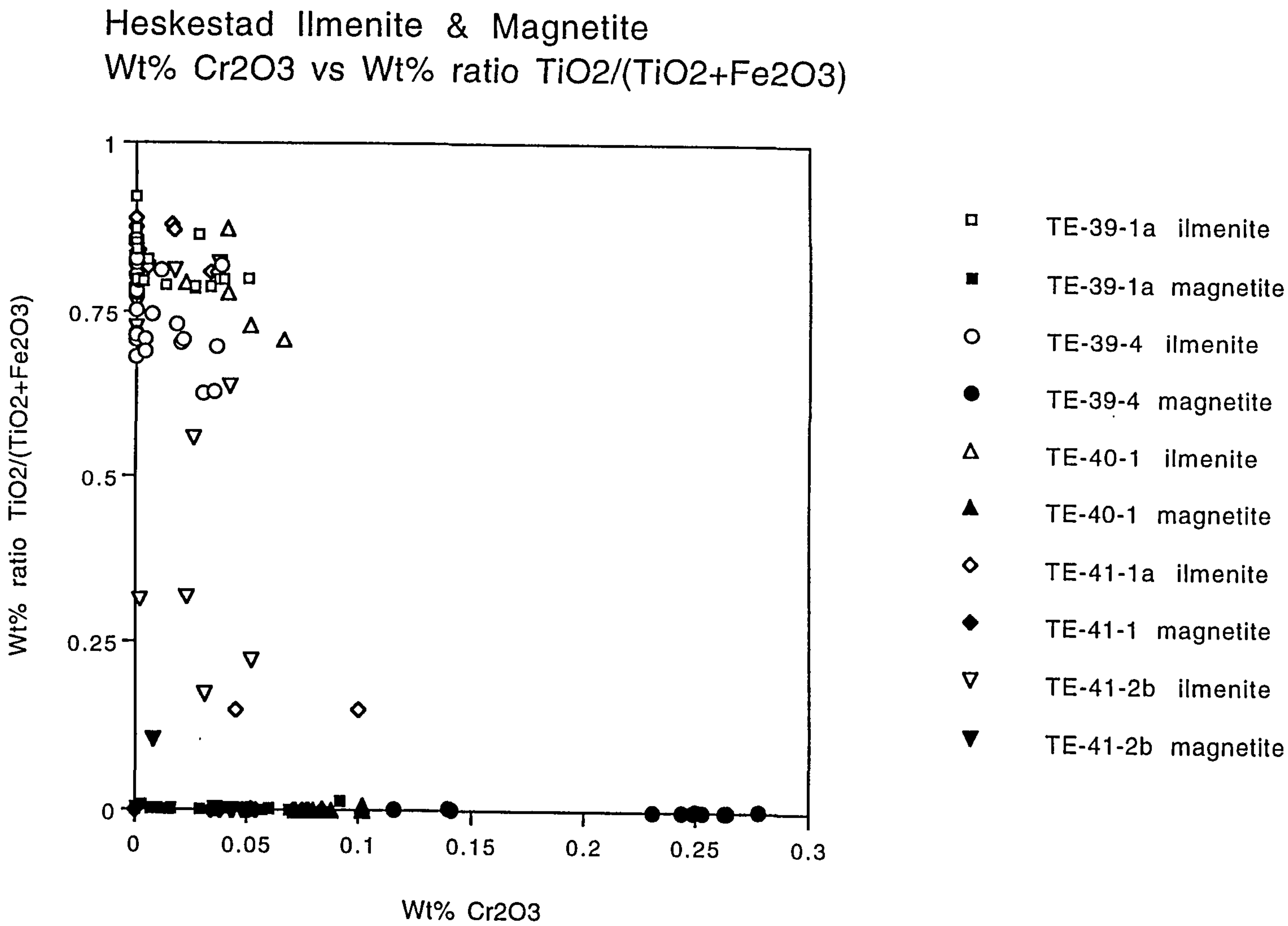

Figure 5.30 (4C) Analyses from the Heskestad area (samples TE39,TE40, and 41) of the Bjerkrem-Sokndal Lopolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % Cr_2O_3. Magnetites show no evidence of exsolution and Cr_2O_3 up to 0.28%. TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.17, indicating higher hematite content, but give little evidence of hematite exsolution except except for samples TE41 where it is extensive . Cr_2O_3 content of ilmenite is below 0.07 % except for one analysis at 0.1% in a hematite exsolution area. As in previous figures, magnetites are consistently higher in Cr_2O_3 than ilmenites, even though absolute amounts are very low.

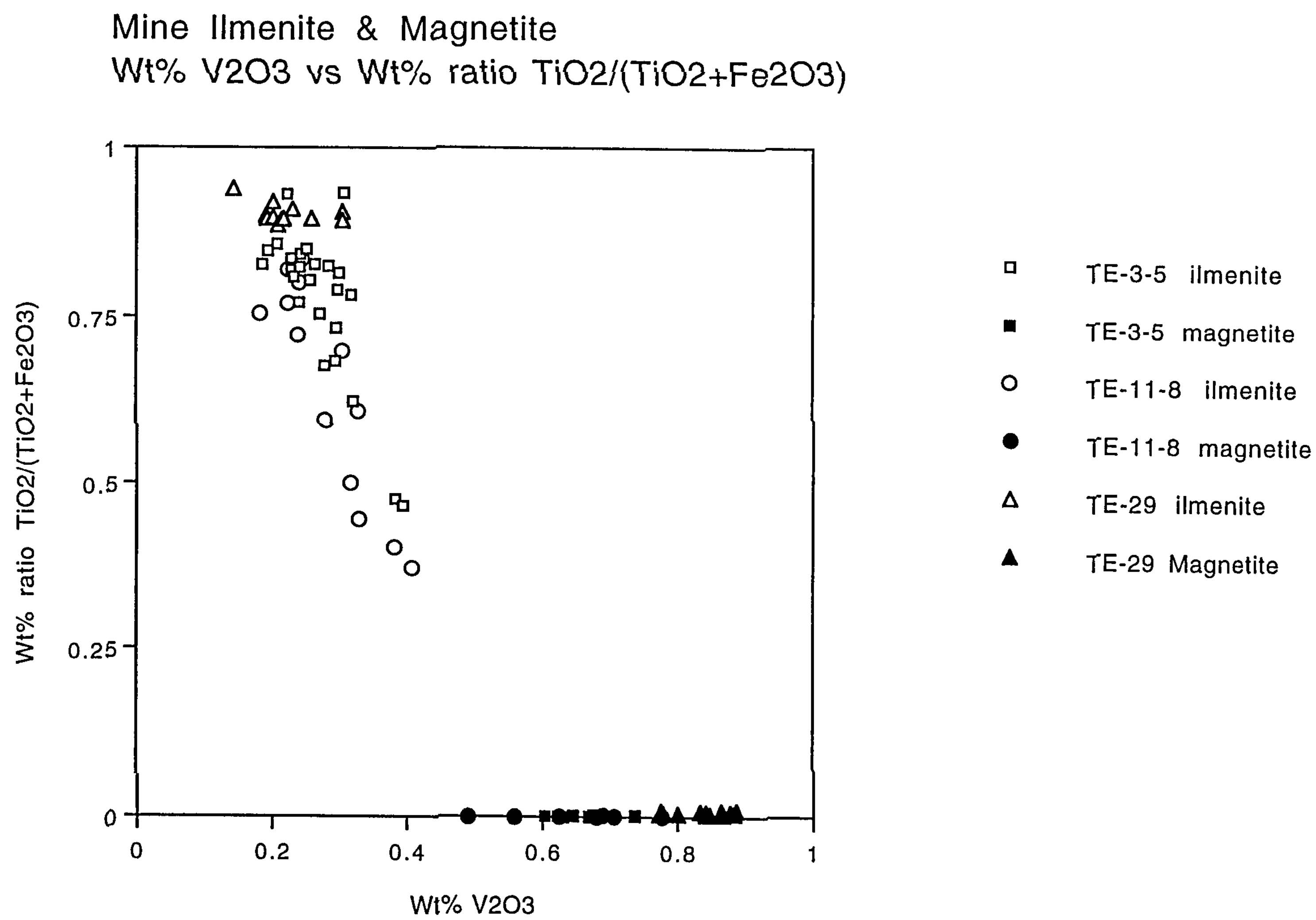

Figure 5.31 (1D) Analyses from the Tellnes Mine and vicinity, samples TE3, TE11 and TE2 plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % V_2O_3. Magnetites show little exsolution and V_2O_3 up to 0.9 %, highest in TE29 and lowest in TE11. Host ilmenites in TE11 and TE3 are lower in TiO_2 than in sample TE29 and have about 0.2-0.3 % V_2O_3. They show low TiO_2 tails indicating extensive hematite exsolution, and these have up to 0.4% V_2O_3. The ilmenites in TE29 are not substantially exsolved and have similar V_2O_3 to the other host ilmenites.

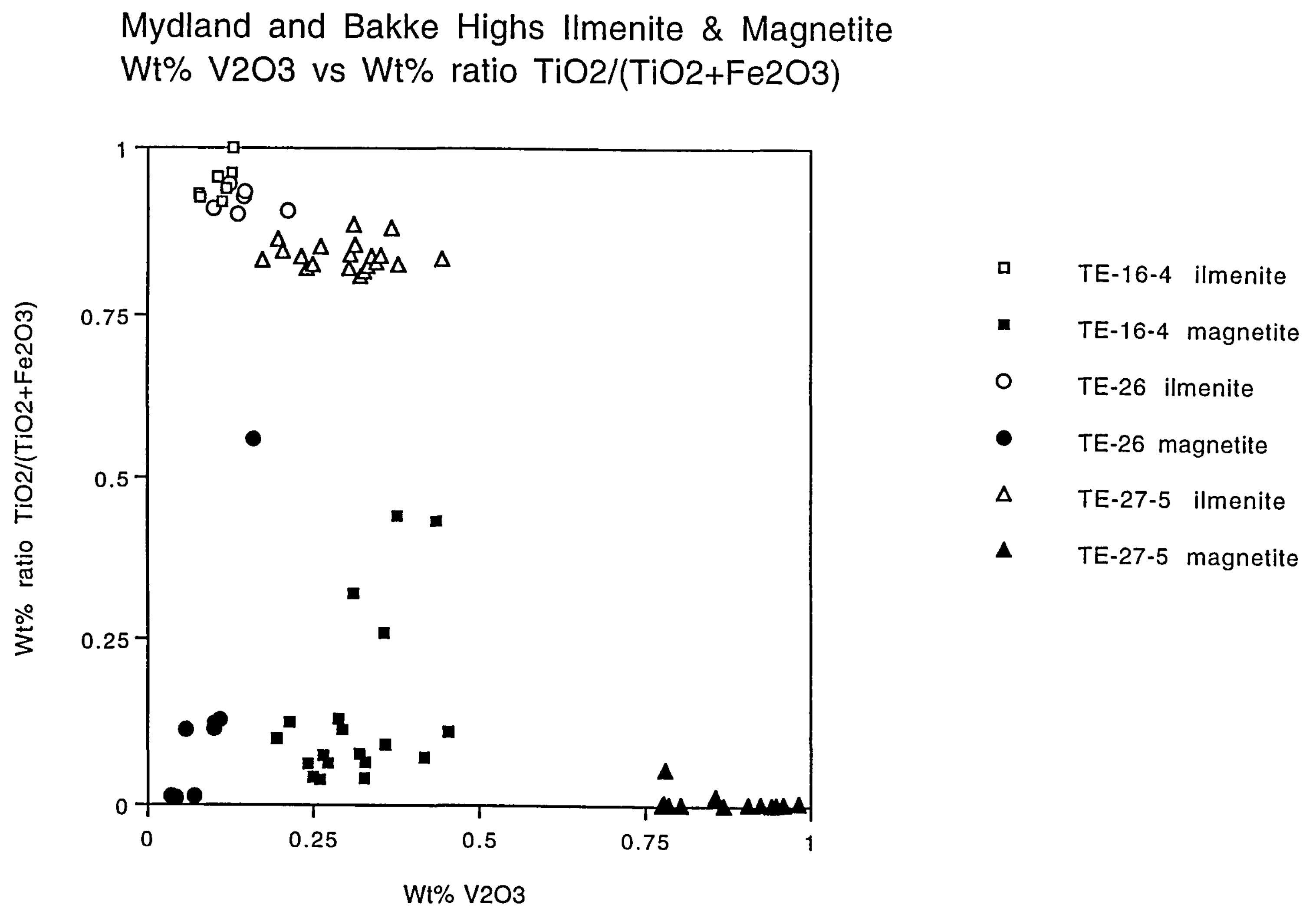

Figure 5.32 (2D) Analyses from the Mydland Magnetic High (sample TE16) and Bakke High (samples TE26, TE27) of the Bjerkrem-Sokndal Lopolith., plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % V_2O_3. The behavior of these samples is not well understood. TE27 shows little chemical evidence of exsolution, although the ilmenite composition is less Ti-rich than the other two samples. TE26, a very magnetite-rich sample higher in the layered sequence of the lopolith contains very low V, and, unlike all other samples has ilmenite that is richer in V than magnetite. The low V magnetite contains exsolution of ulvospinel later altered to ilmenite, which is apparently higher in V than the host. TE16 has a very similar low V ilmenite host, but the magnetite is richer in V than the ilmenite. However, like TE26, the fine altered ulvospinel exsolution again appears to be richer in V than the magnetite host. It is tentatively suggested that the spectacular drop in V_2O_3 between TE27 and TE26 may mark the appearance of magnetite as a primary precipitate from the magma, thus depleting the residual liquids in vanadium. A similar drop may have occurred between the samples of the Mydland Low, TE33, TE34 (Figure 5.34) and sample TE16 of the Mydland High.

Mydland Low Ilmenite & Magnetite
Wt% V2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)

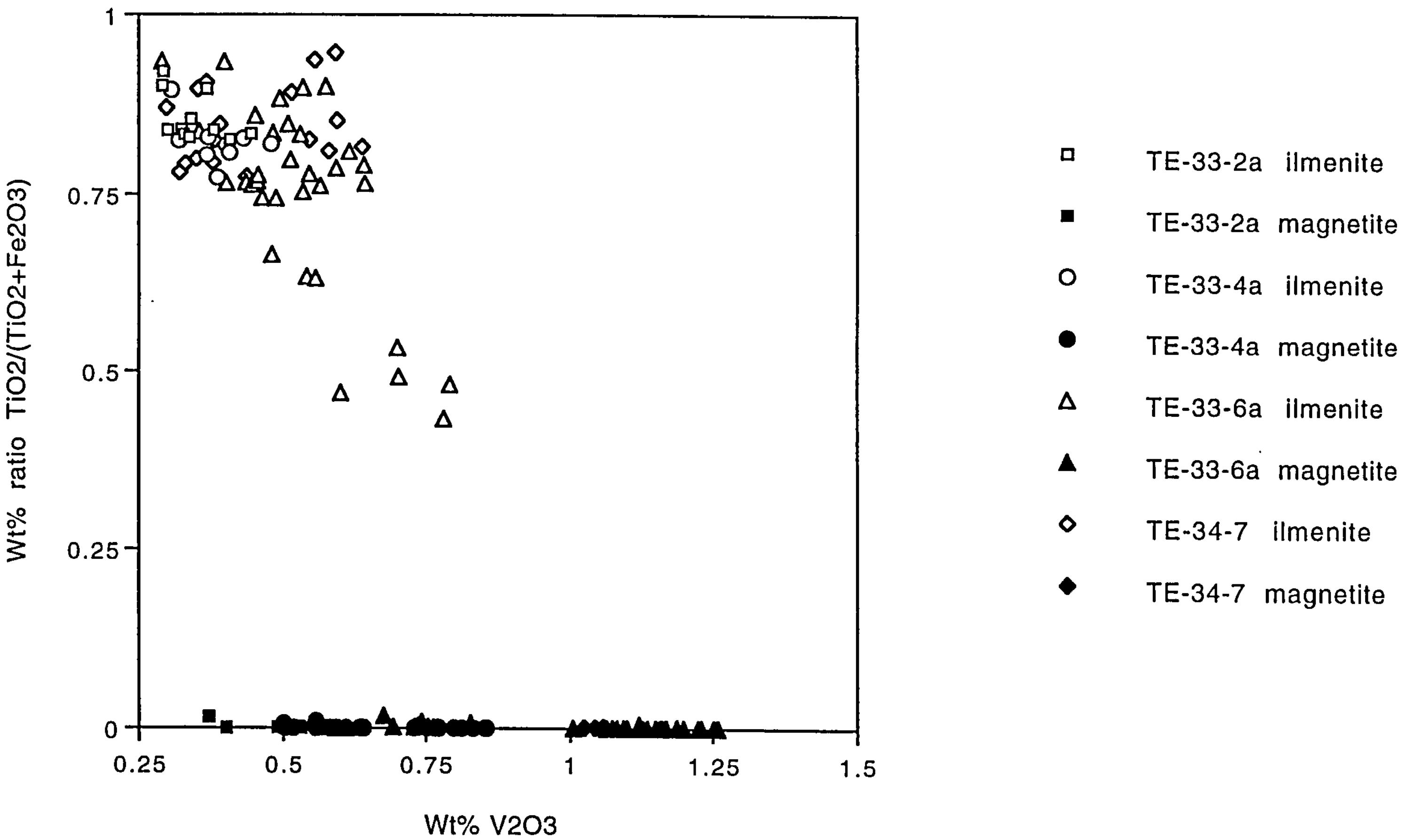

Figure 5.33 (3D) Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith excluding an anorthosite xenolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % V_2O_3. Magnetites show no evidence of exsolution and V_2O_3 up to 1.25%. TiO_2 contents of ilmenites are high, but not so high as those in Figure 2D, indicating higher hematite content, but give little evidence of hematite exsolution except for sample TE33-6 where it is extensive. V_2O_3 content of ilmenite is below 0.7 % except in hematite exsolution areas where it increases up to 0.85%. As in previous figures, magnetites are consistently higher in V_2O_3 than ilmenites.

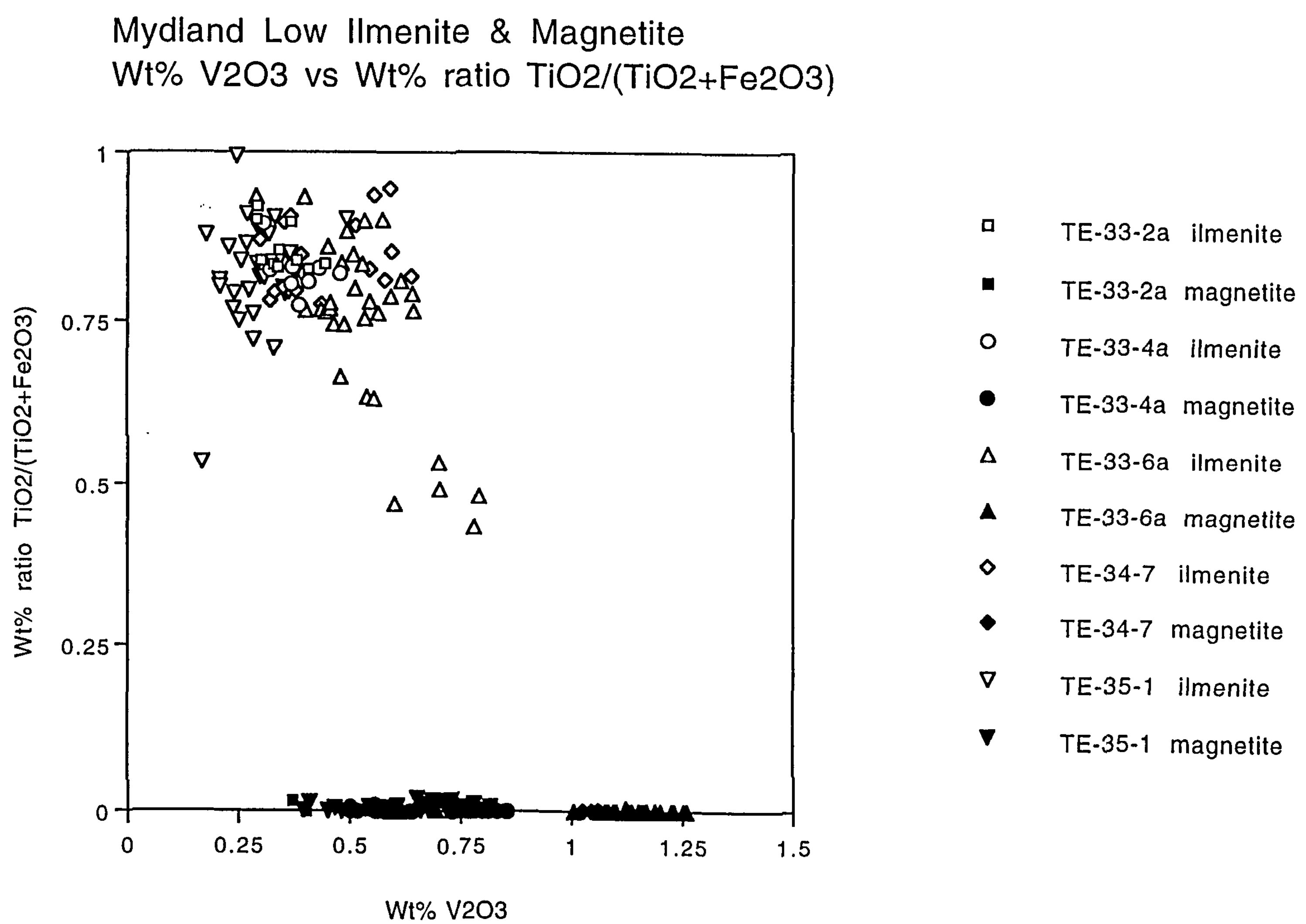

Figure 5.34 (3aD) Analyses from the Mydland Magnetic Low (samples TE33,TE34) of the Bjerkrem-Sokndal Lopolith including an anorthosite xenolith (sample TE35), plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % V_2O_3. Magnetites show no evidence of exsolution and V_2O_3 up to 1.25%. TiO_2 contents of ilmenites are high, but not so high as those in Figure 2D, indicating higher hematite content, but give little evidence of hematite exsolution except for sample TE33-6 and the anorthosite xenolith TE35 where it is extensive. V_2O_3 content of ilmenite is below 0.7 % except in hematite exsolution areas where it increases up to 0.85%. As in previous figures, magnetites are consistently higher in V_2O_3 than ilmenites. Addition of the anorthosite inclusion to this plot shows little because both magnetite and ilmenite are low in V_2O_3.

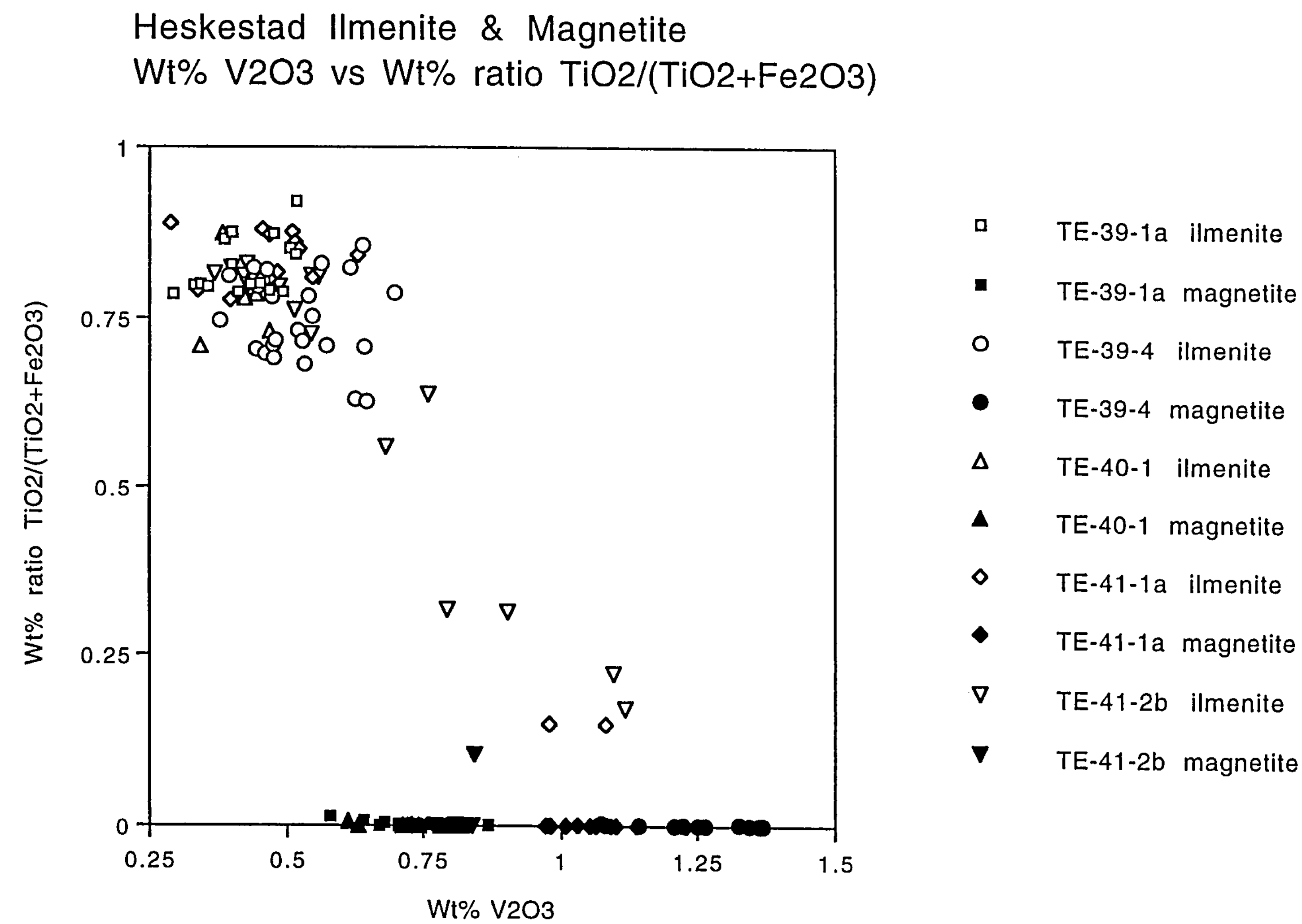

Figure 5.35 (4D) Analyses from the Heskestad area (samples TE39,TE40, and 41) of the Bjerkrem-Sokndal Lopolith, plotted in terms of the ratio $TiO_2/(TiO_2+Fe_2O_3)$ versus weight % V_2O_3. Magnetites show no evidence of exsolution and high V_2O_3 up to 1.27 %. TiO_2 contents of ilmenites are high, but not so high as those in Figure 5.32, indicating higher hematite content, but give little evidence of hematite exsolution except for samples TE41 where it is extensive. V_2O_3 content of ilmenite is below 0.75 % except in hematite exsolution areas where it increases up to 1.1 %. As in previous figures, ilmenites are poorer in V_2O_3 than magnetites. In the two examples with chemical evidence of hematite exsolution, the hematite rich areas contain V_2O_3 amounts equal to or exceeding the magnetite.

5.4 Comparisons of Compositions of Ilmenite and Magnetite with Pyroxenes

In this group of figures the compositions of typical ilmenites and magnetites are plotted against the ratio $Fe^{2+}/(Fe^{2+}+Mg)$ of coexisting pyroxenes, and the coexisting pyroxenes against each other. The main purpose of these tests was to determine the relationships between oxide compositions and the relative igneous evolution of the host rocks in terms of the Fe ratio as a differentiation index. The figures are in five groups as follows:

Orthopyroxenes vs. Ilmenites (Figures. 5.36-5.38)

Orthopyroxenes vs. Magnetites (Figures 5.39-5.41

Calcic pyroxenes vs. Ilmenites (Figures 5.42-5.44)

Calcic pyroxenes vs. Magnetites (Figures 5.45-5.47)

Orthopyroxenes vs. Calcic Pyroxenes (Figure 5.48)

The poor correlations between calcic pyroxene ratios and Cr_2O_3 and V_2O_3 in ilmenite and magnetite are baffling in view of the good correlations for orthopyroxene ratios, and lead us to suspect we are dealing with two different populations. This needs to be explored.

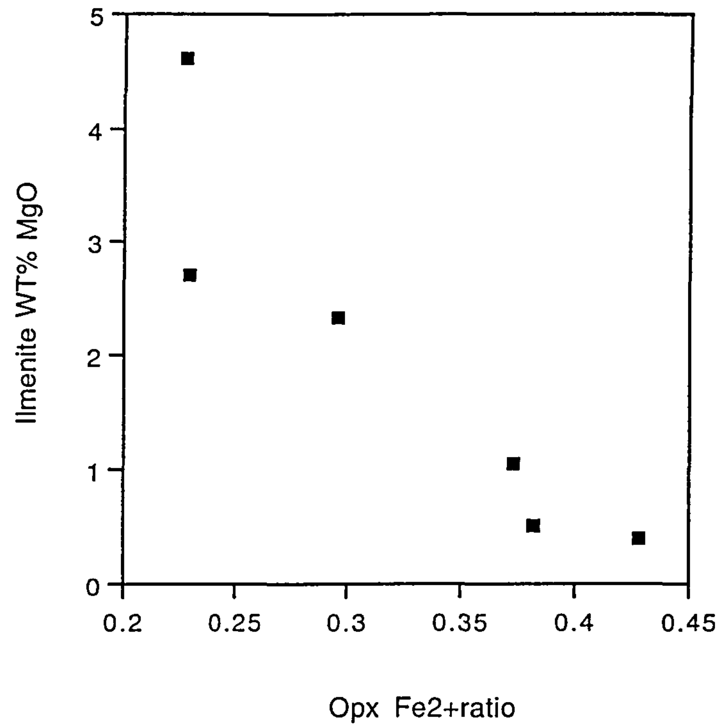

Figure 5.36. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % MgO in typical Imenite. As expected, samples with the most magnesian pyroxenes contain the most magnesian ilmenites.

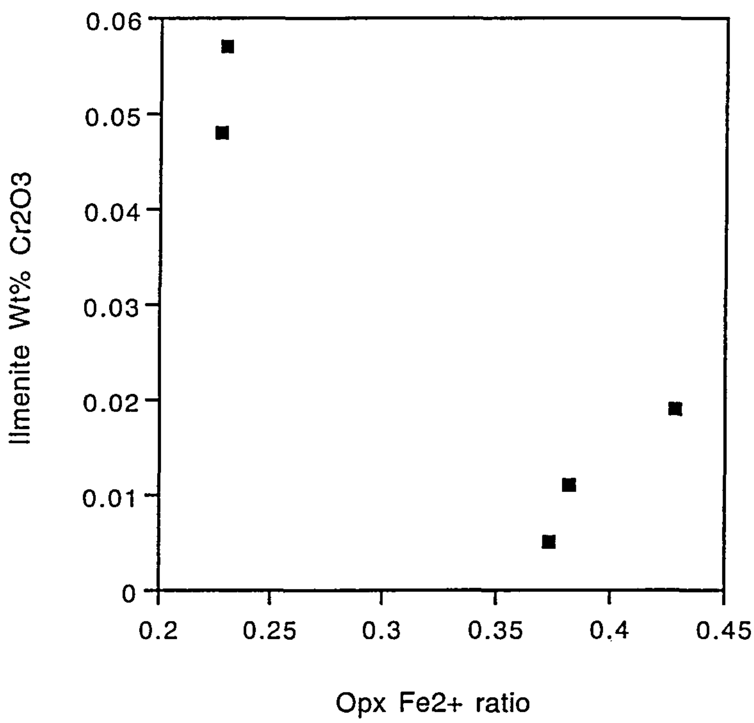

Figure 5.37. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % Cr_2O_3 in typical ilmenite. As expected, samples with the most magnesian pyroxenes contain the most chromian ilmenites.

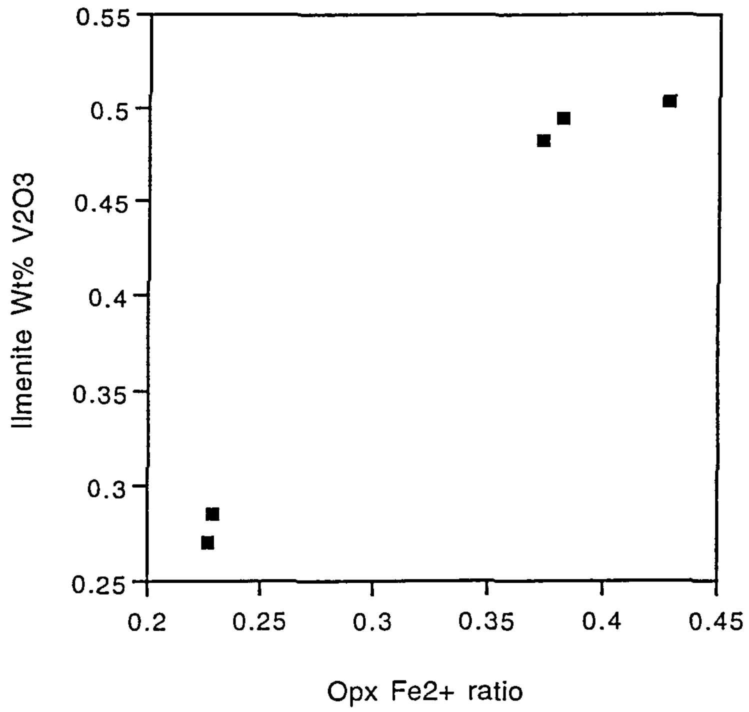

Figure 5.38. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % V_2O_3 in typical ilmenite. As expected, samples with the most magnesian pyroxenes contain the least vanadian ilmenites.

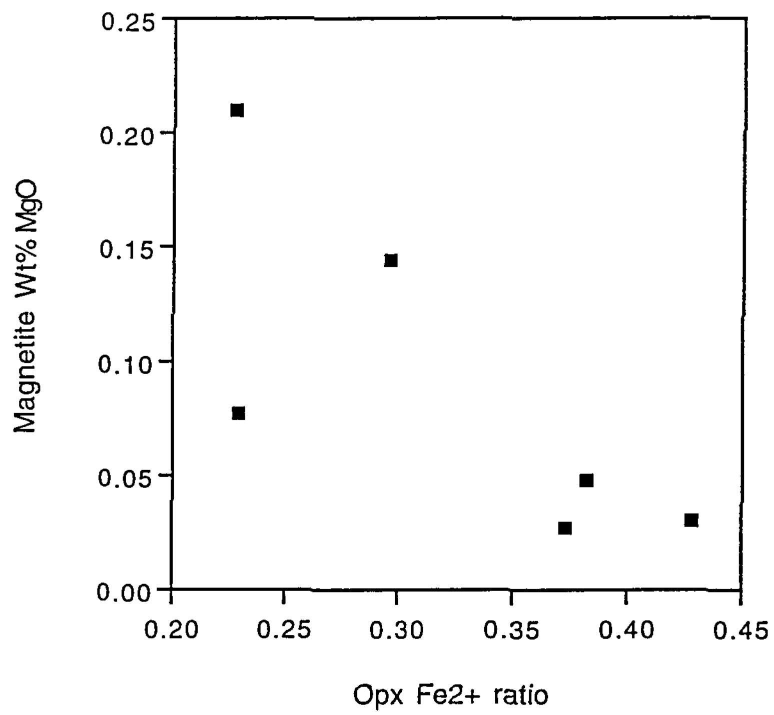

Figure 5.39. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % MgO in typical magnetite. Samples with the most magnesian pyroxenes generally contain the most magnesian magnetites.

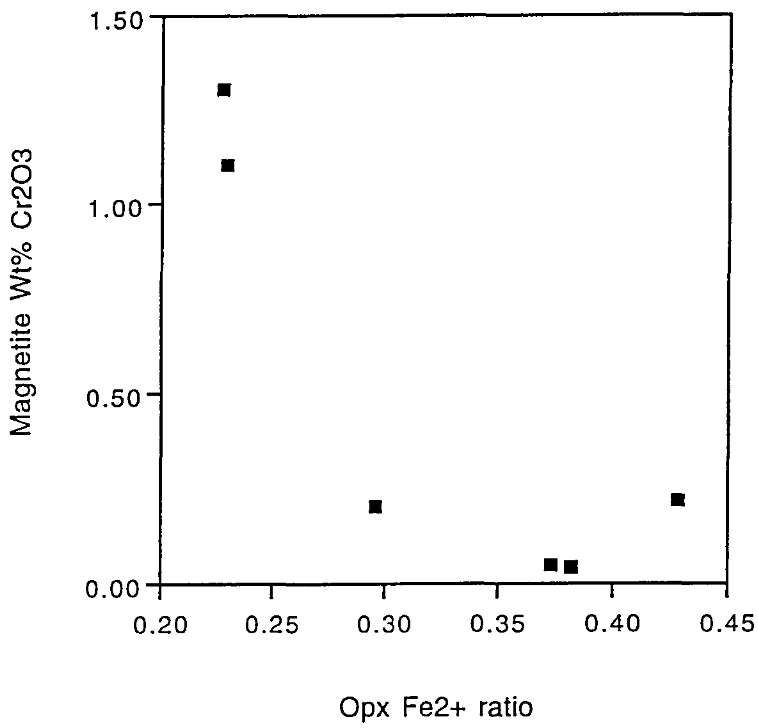

Figure 5.40. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % Cr_2O_3 in typical magnetite. Samples with the most magnesian pyroxenes contain the most chromian magnetites.

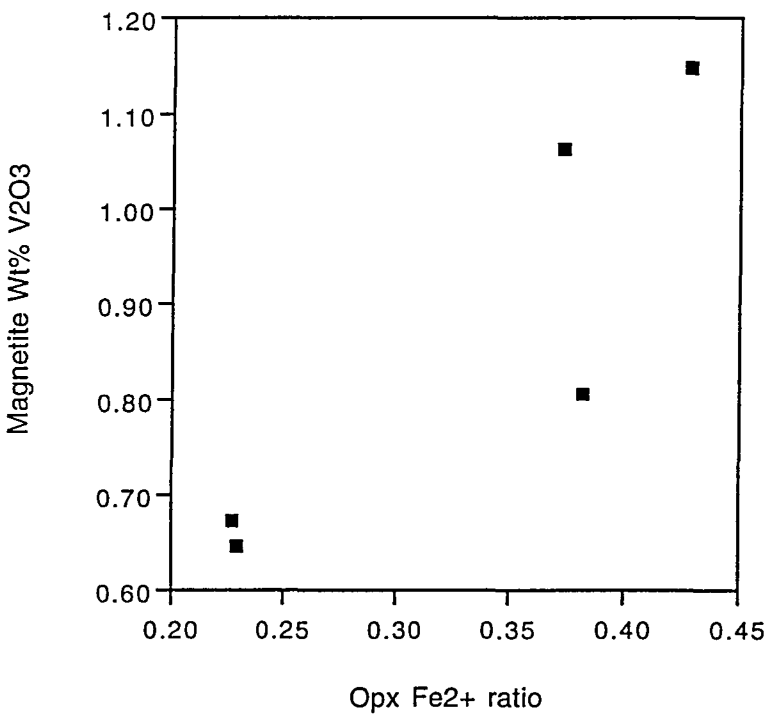

Figure 5.41. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % V_2O_3 in typical magnetite. Samples with the most magnesian pyroxenes contain the least vanadian magnetites.

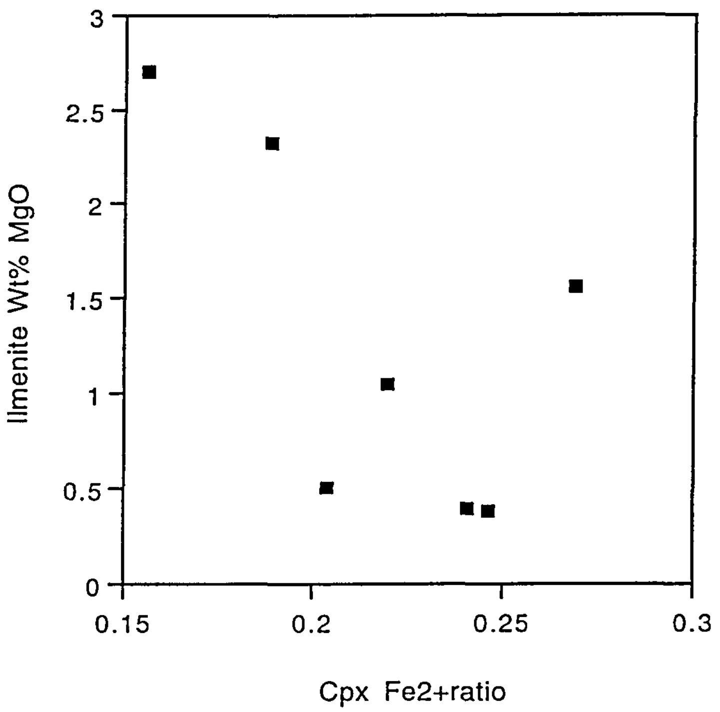

Figure 5.42. Compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % MgO in typical ilmenite. Generally samples with the most magnesian pyroxenes contain the most magnesian ilmenites but correlation is not strong.

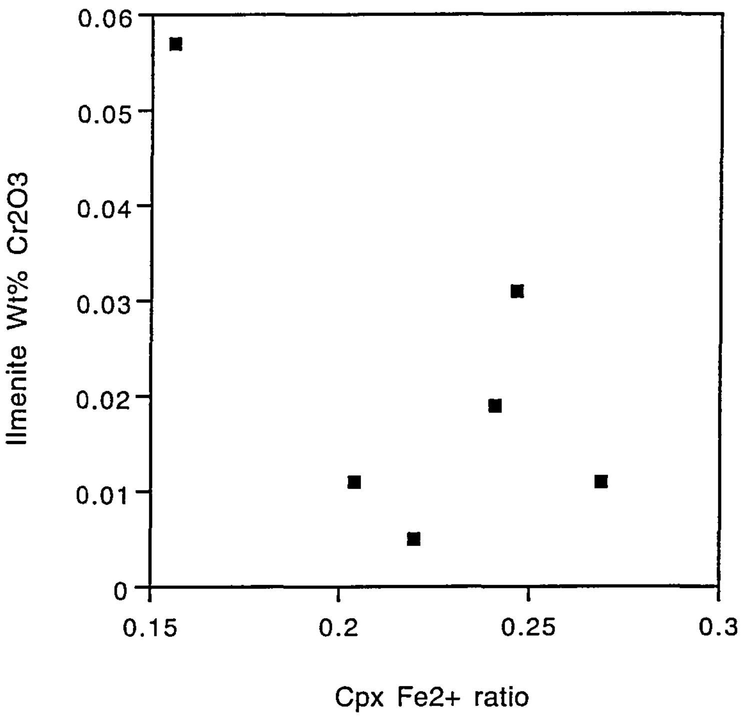

Figure 5.43. Compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % Cr_2O_3 in typical ilmenite. The sample with the most magnesian pyroxenes contains the most chromian ilmenite, but the correlation is not strong.

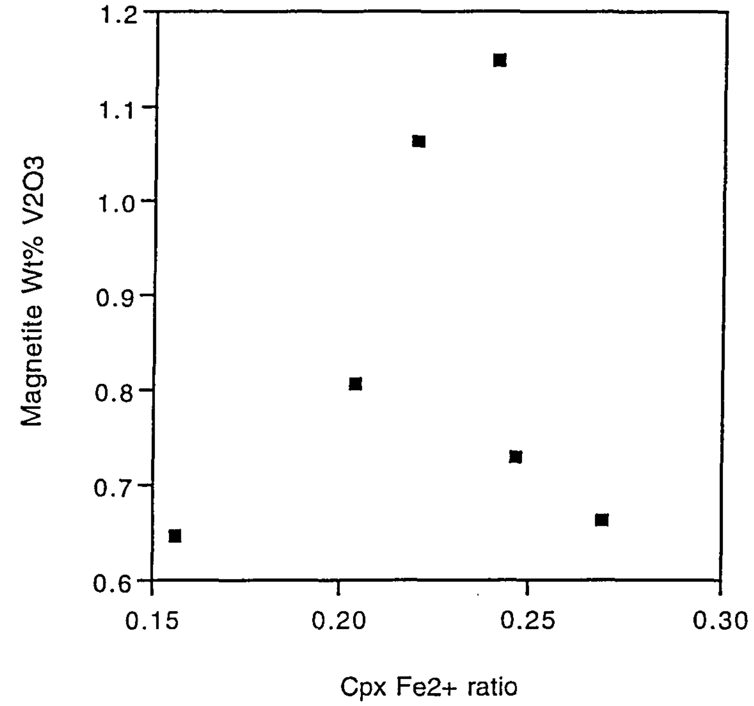

Figure 5.44. Compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % V_2O_3 in typical ilmenite. Correlation between vanadium and calcic pyroxene composition is poor.

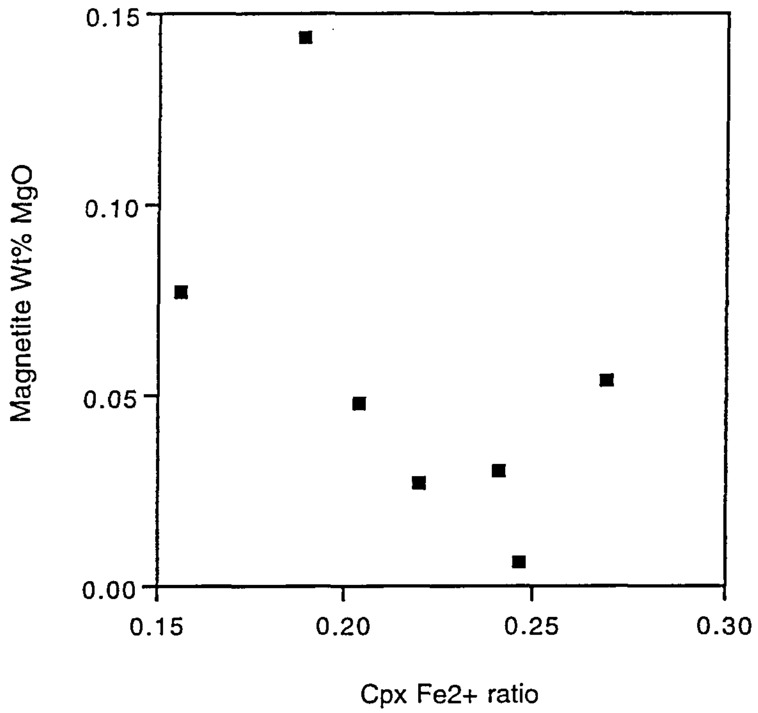

Figure 5.45. Compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % MgO in typical magnetite. Generally samples with the most magnesian pyroxenes contain the most magnesian magnetites but correlation is not strong.

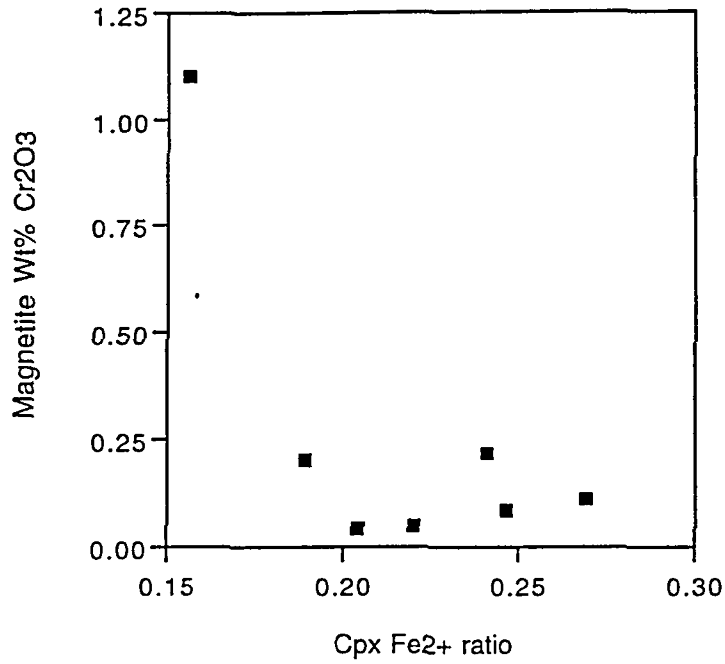

Figure 5.46. Compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % Cr_2O_3 in typical magnetite. The sample with the most magnesian pyroxene contains the most chromian magnetite, but correlation is not strong.

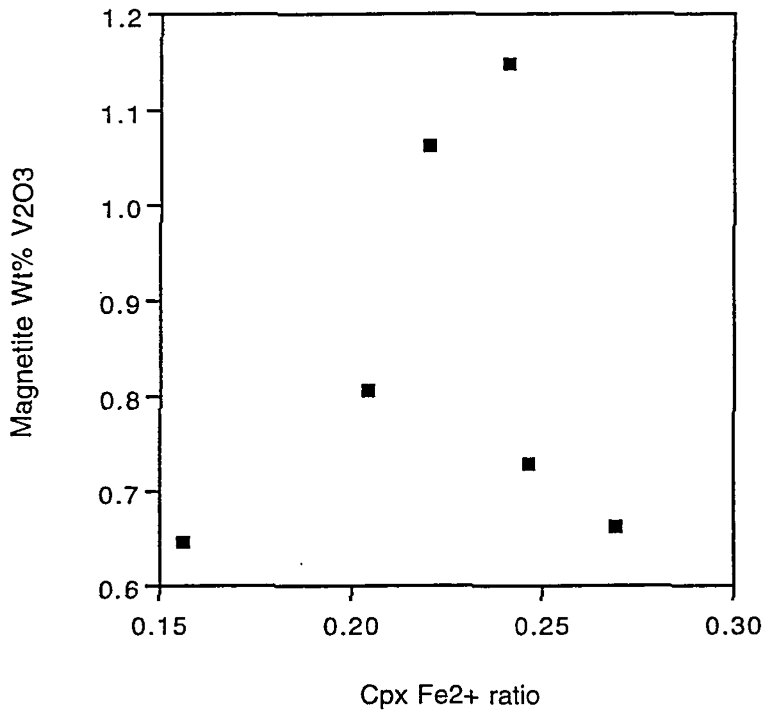

Figure 5.47. Compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against weight % V_2O_3 in typical magnetite. Correlation between vanadium in magnetite and calcic pyroxene composition is poor.

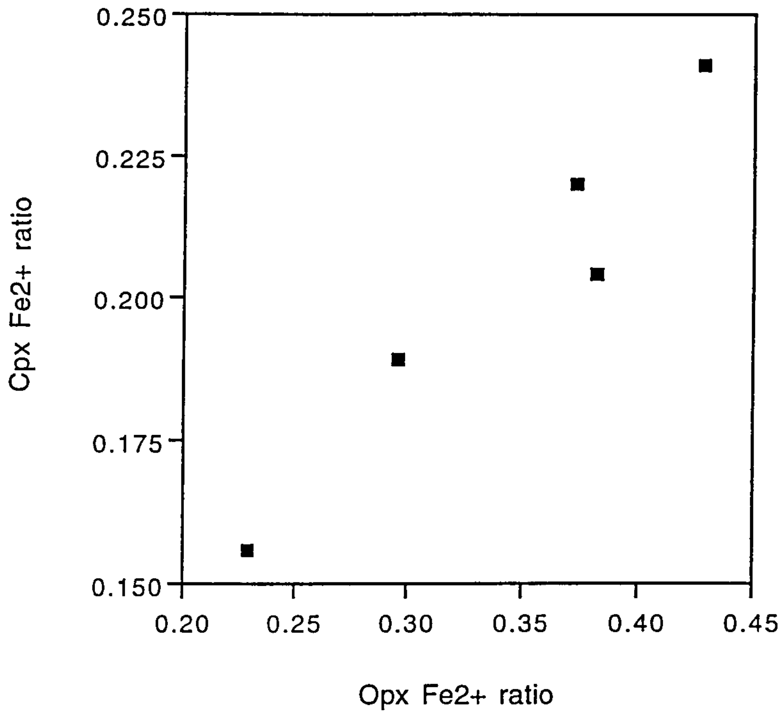

Figure 5.48. Compositions of orthopyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$ against compositions of calcic pyroxenes plotted in terms of molar ratio $Fe^{2+}/(Fe^{2+}+Mg)$. As expected, there is an excellent correlation between pyroxene compositions in those few samples where both pyroxenes were analyzed.

5.5 Correlation of Mineral Chemistry with Petrography

The analytical data and chemical plots show which samples contain ilmenite and which contain magnetite, and the chemical variations of these minerals. These confirm the observations in polished sections showing very few exsolution features in most magnetites, but major amounts of hematite exsolution ilmenite in certain groups of samples such as those from the regions with slightly positive to negative aeromagnetic anomalies. Probably the most significant general observations are the following: 1) most of the magnetites are now close to end member magnetites without significant ulvöspinel component, 2) certain magnetites in the Bakka and Mydland areas are extensively exsolved with very fine ilmenite in a cloth-like texture after ulvöspinel, 3) in some samples the ilmenite is also close to end member composition with little or no hematite exsolution, 4) in other samples there is extensive hematite exsolution. The analytical results are not yet sufficiently refined to identify with certainty those samples in which the silicates, principally pyroxenes and plagioclase have significant oxide exsolution, although the petrography does point the way, and in a few samples oxide lamellae within silicate grains were successfully analyzed. The chemical trends of the oxide lamellae in silicates strongly suggest that these were controlled by internal oxide-silicate phase relations during later stages of cooling that were independent of the equilibria controlling oxide compositions in the surrounding matrix.

5.6 Correlation of Mineral Chemistry with Magnetic Properties

Bulk magnetic properties of rocks are dependent on A) the chemical compositions of magnetic minerals, B) the grain size and exsolution features of the magnetic minerals, and C) the modal proportions of magnetic minerals. Based on the analytical results presented in this section, the chemical compositions of the magnetic minerals are now quite well known, and further manipulation of the analytical tables could provide further insights and the basis for further writing concerning chemical substitutional relationships. The qualitative petrography presented in section 4 gives a good insight into grain size relationships and the kinds of exsolution features present in the specimens, and hence a qualitative picture of the kinds of magnetic effects to be expected, but no attempt has yet been made to measure the proportions and sizes of different grains that would be needed to correlate directly with bulk magnetic properties. Similarly no measurements of the modal proportions of magnetic minerals have yet been made that would allow direct quantitative correlation to bulk magnetic properties, and, in fact, few studies have been published anywhere in which such a quantitative correlation has been attempted.

Thus the chemical relationships that have been explored in this section provide only the first step needed to obtain a full understanding of rock magnetism. Principally the analytical data and chemical plots show which samples contain ilmenite and which contain magnetite, and the chemical variations of these minerals. Probably the most significant observations are the following: 1) most of the magnetites are close to end member magnetites without significant ulvöspinel component, 2) certain magnetites in the Bakka and Mydland areas are extensively exsolved with very fine ilmenite in a cloth-like texture after ulvöspinel, 3) in some samples the ilmenite is also close to end member composition with little or no hematite exsolution, 4) in other samples there is extensive hematite exsolution and it is these samples, dominated by exsolved ilmenite, that are the samples showing very high Q values and strong reversed remanence. The analytical results are not yet sufficiently refined to identify with certainty those samples in which the silicates, principally pyroxenes and plagioclase have sufficient oxide exsolution to affect the bulk magnetic properties significantly, although the petrography does point the way, and in a few samples oxide lamellae within silicate grains were successfully analyzed. These samples had Q values high enough to cause a significant remanence effect on the aeromagnetic signature.

The effects of bulk chemical composition on net magnetic moments of ferrimagnetism within the magnetite-ulvöspinel series are quite well known (Lindsley, 1976). Specifically the moment is highest in end member magnetite and is zero in end member ulvöspinel, thus decreasing progressively with increasing ulvöspinel solid solution. This effect is probably of minor importance in the rocks of this study because the magnetites were either close to end member originally or have been changed to end member during exsolution and oxidation exsolution. A good example is in sample TE-29 in which original more Ti- and Al-rich magnetites have reacted with the hemo-ilmenite to produce exsolution lamellae of spinel and marginal replacements and lamellae of ilmenite by oxidation-exsolution. In the process the adjoining hemo-ilmenite has lost much of its hematite component, and there is no need to appeal to bulk oxidation of the rock as a whole.

The effects on net magnetic moments of magnetite of minor substitutions of elements such as Mg, Cr, and V are less well known, but can be calculated approximately provided one knows the site location of the substituting ion and its correct magnetic moment. The magnetic moments of some important ions are given in Table 5.1 and some calculations of magnetic moments of some hypothetical end members are given in Table 5.2.

Mg clearly substitutes for Fe^{2+} in the octahedral sites of the magnetite structure and if carried to an extreme in magnesioferrite should result in reducing the net magnetic moment to zero.

Cr has a very strong octahedral site preference in magnetite, hence Cr substitution for Fe^{3+} in the octahedral sites, if carried to the limit (Table 5.2) should cut the net magnetic moment about in half.

In the case of V one needs to know both its site preference and its valence. There is general agreement that in these oxides V is in the trivalent state, and hence the V ion would have a net magnetic moment of 2. The chemical plots show a concentration of V in the hematite exsolution lamellae in ilmenite and an even stronger concentration in magnetite, suggesting that V may substitute preferentially in the tetrahedral sites. If carried to an extreme, this would have the effect of raising the net magnetic of magnetite from 4 to 7. On the other hand, substitution of V for Fe^{3+} in octahedral sites would lower the net magnetic moment more than Cr.

Table 5.1 Magnetic Moments of Paramagnetic Ions

Magnetic moments are identical to the number of unpaired 3d electrons and are expressed in Bohr magnetons.

Ion	Unpaired 3d Electrons = Magnetic Moments
Mg^{2+}	0
Ti^{4+}	0
V^{3+}	2
Cr^{3+}	3
Mn^{2+}, Fe^{3+}	5
Fe^{2+}	4

Table 5.2 Net Magnetic Moments of Magnetic Minerals Per Formula Unit

		Occupancy	Moments	Sum
CUBIC OXIDES (3 CATIONS, 4 OXYGENS)				
Magnetite	Octahedral	$Fe^{2+}Fe^{3+}$	4 + 5	9
	Tetrahedral	Fe^{3+}	5	5
	Net Moment			**4**
Ulvöspinel	Octahedral	$Fe^{2+}Ti^{4+}$	4 + 0	4
	Tetrahedral	Fe^{2+}	4	4
	Net Moment			**0**
Magnesio-ferrite	Octahedral	$Mg^{2+}Fe^{3+}$	0 + 5	5
	Tetrahedral	Fe^{3+}	5	5
	Net Moment			**0**
Cr Magnetite	Octahedral	$Fe^{2+}Cr^{3+}$	4 + 3	7
	Tetrahedral	Fe^{3+}	5	5
	Net Moment			**2**
V Magnetite (improbable)	Octahedral	$Fe^{2+}V^{3+}$	4 + 2	6
	Tetrahedral	Fe^{3+}	5	5
	Net Moment			**1**
V Magnetite (probable)	Octahedral	$Fe^{2+}Fe^{3+}$	4 + 5	9
	Tetrahedral	V^{3+}	2	2
	Net Moment			7
RHOMBOHEDRAL OXIDES (2 CATIONS, 3 OXYGENS)				
Hematite	Octahedral	Fe^{3+}	5	5
	Octahedral	Fe^{3+}	5	5
	Net Moment			**0**
Ilmenite	Octahedral	Fe^{2+}	4	4
	Octahedral	Ti^{4+}	0	0
	Octahedral	Fe^{2+}	4	4
	Octahedral	Ti^{4+}	0	0
	Net Moment			**0**
Ilmenite 70	Octahedral	$0.7Fe^{2+}, 0.3Fe^{3+}$	2.8 + 1.5	4.3
Hematite 30	Octahedral	$0.7Ti^{4+}, 0.3Fe^{3+}$	0 + 1.5	1.5
	Net Moment			**2.8***

*This is the value per 3 oxygen formula unit. When normalized to 4 oxygens for comparison with magnetite, the net magnetic moment is 3.733 which is **93.3%** of the value of end-member magnetite.

Overall the minor elemental substitutions in magnetites are likely to have a small effect on the bulk magnetic properties and probably a much smaller effect than those of grain size. It should also be remembered that the chemical effects on the net magnetic moment only reflect directly on magnetic susceptibility and tell little about the intensity and stability of remanence.

End-member hematite and end-member ilmenite are both ideally anti-ferromagnetic and would show no net magnetic moment (Table 5.2). (Lindsley, 1976) In addition, end-member ilmenite only becomes anti-ferromagnetic at its Néel temperature of 55°K, as compared to the Néel temperature of hematite of about 675°C. This is because, in ordered end-member ilmenite, magnetic "superexchange" takes place between iron-bearing layers separated by Ti-bearing layers that have no magnetic interaction (Table 5.2). Natural end-member hematite is not perfectly anti-ferromagnetic due to "spin canting" and hence does have a weak net magnetic moment that is of key importance in paleomagnetism, and can be of importance in producing magnetic anomalies if there is no coexisting magnetite in the assemblage.

Despite these properties of the end members, it is known that ordered intermediate members of the hematite-ilmenite solid solution series can be quite strong ferrimagnets. This property is best known in the classic study of self-reversal in high temperature hemo-ilmenite (Nord and Lawson, 1992). Their most thoroughly studied sample consisted predominantly of ultrafine twinned domains of ordered ilmenite of composition $ilmenite_{70}$, $hematite_{30}$ separated by very thin disordered walls of much more hematite-rich composition. Their theory is that the hematite-rich walls acquired a normal remanent magnetization during rapid cooling through about 650°C, and that the local field of the walls then forced the twinned $ilmenite_{70}$ domains into reversed remanence on passing the Curie temperature fairly close to room temperature. It is easy to show that their ordered $ilmenite_{70}$ composition below its Curie temperature is a ferrimagnet with a magnetic moment over 90% of that of pure magnetite (Table 5.2). Nord and Lawson proved that the self reversal mechanism they discovered only works when the twin domains are very small and close to the disordered hematite-rich walls in rapidly chilled samples. They did this by coarsening experiments in which the domains enlarge and the proportion of hematite-like domain walls decreases dramatically over a period of annealing of less than one hour. Thus, we can say unequivocally that the self-reversal mechanism described by Nord and Lawson cannot apply directly to ilmenites in the Tellnes region, in fact we do not know whether the reversed remanence in the ilmenite-rich rocks is due to self-reversal, or only magnetic blocking at a different temperature and time from some of the surrounding magnetite rocks. Another mechanism, as yet undiscovered, must explain the observed relationship of strong susceptibility, strong remanence and high unblocking temperature in the exsolved ilmenites of many hemo-ilmenite deposits associated with anorthosites, as pointed out by Hargraves (1959). This is a subject for future fundamental research. What Nord and Lawson do show is how ordered intermediate ilmenite can be a strong ferrimagnet.

6. General Summary

The understanding of the rock-magnetic properties of the various oxide ores and country rocks in the vicinity of the Tellnes Deposit is a first step toward a successful interpretation of the aeromagnetic maps (NGU report 96.059). Specifically it has been made obvious that the region contains rocks with very high magnetic susceptibility and low remanence giving rise to positive induced aeromagnetic anomalies, and it also contains rocks with very strong reversed remanent magnetization giving rise to large negative magnetic anomalies. Measured Q values in the region from 0.1 to 159, support the interpretation that both remanent and induced aeromagnetic anomalies were recorded in the region. Samples from selected anomalies were further measured and their rock magnetic properties characterized to aid in identifying the magnetic minerals in different rock bodies that create the magnetic anomalies. In selected samples detailed reflected-light microscopy was performed to identify the magnetic minerals. A subset of these samples was chosen for analyses. Chemical compositions and variations found in the samples were correlated with the mineral phases, and exsolution and oxidation-exsolution features. A very strong correlation was found between remanence-controlled aeromagnetic signatures and the presence of hematite exsolution in the ilmenite if there is no coexisting magnetite. The coexisting assemblage of magnetite plus ilmenite with hematite exsolution produces an array of anomalies from slightly positive to very slightly negative. When magnetite is the dominant oxide and the ilmenite lacks hematite exsolution lamellae, the magnetic response is strongly positive, representing a strong induced signature parallel to the present day earth's magnetic field. In addition, an understanding of the role of magnetite-ilmenite and ilmenite-hematite exsolution in the silicates is fundamental to an accurate aeromagnetic interpretation to this region. It appears that when there are abundant magnetite-ilmenite exsolution lamellae in the silicates, primarily in the pyroxenes, these very fine lamellae are the dominant contributors to the aeromagnetic signature within the mafic igneous bodies of the region.

7. SUGGESTIONS FOR FUTURE WORK

The magnetic properties derived here and in the future should be used to produce a detailed three-dimensional interpretation of the magnetic bodies. It is proposed then to take the aeromagnetic map and strip away the magnetic ranges that are not of interest, which would be accounted for by the anorthosites, quartz mangerites, and mangerites, and enhance the image of the remaining portions. These proposed areas would include the norites, and some of the existing known occurrences of ores, such as the Tellnes, Blåfjell, and Storgangen deposits. Tellnes has a slightly positive anomaly at the northern end which many coincide with the low topography of the mine, and in the southeast a negative anomaly, but there is much yet to be learned about the causes of the Tellnes anomaly, which will contribute to understanding the nature of other exploration targets. Given the subdued nature of the aeromagnetic signature of known ilmenite deposits, image-enhancement of the data set will be very useful when coupled with understanding of the rock-magnetic properties in the search for further ilmenite reserves. Once the areas of exploration are well defined, a well constrained gravity survey would be of use to estimate the depth and size of the ore bodies of interest.

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Rock-magnetic properties, oxide mineralogy, and mineral chemistry in relation to aeromagnetic interpretation and the search for ilmenite reserves

Part II Appendix

CONTENTS

APPENDIX A: Plots of Microprobe Analyses of V_2O_3 versus TiO_2

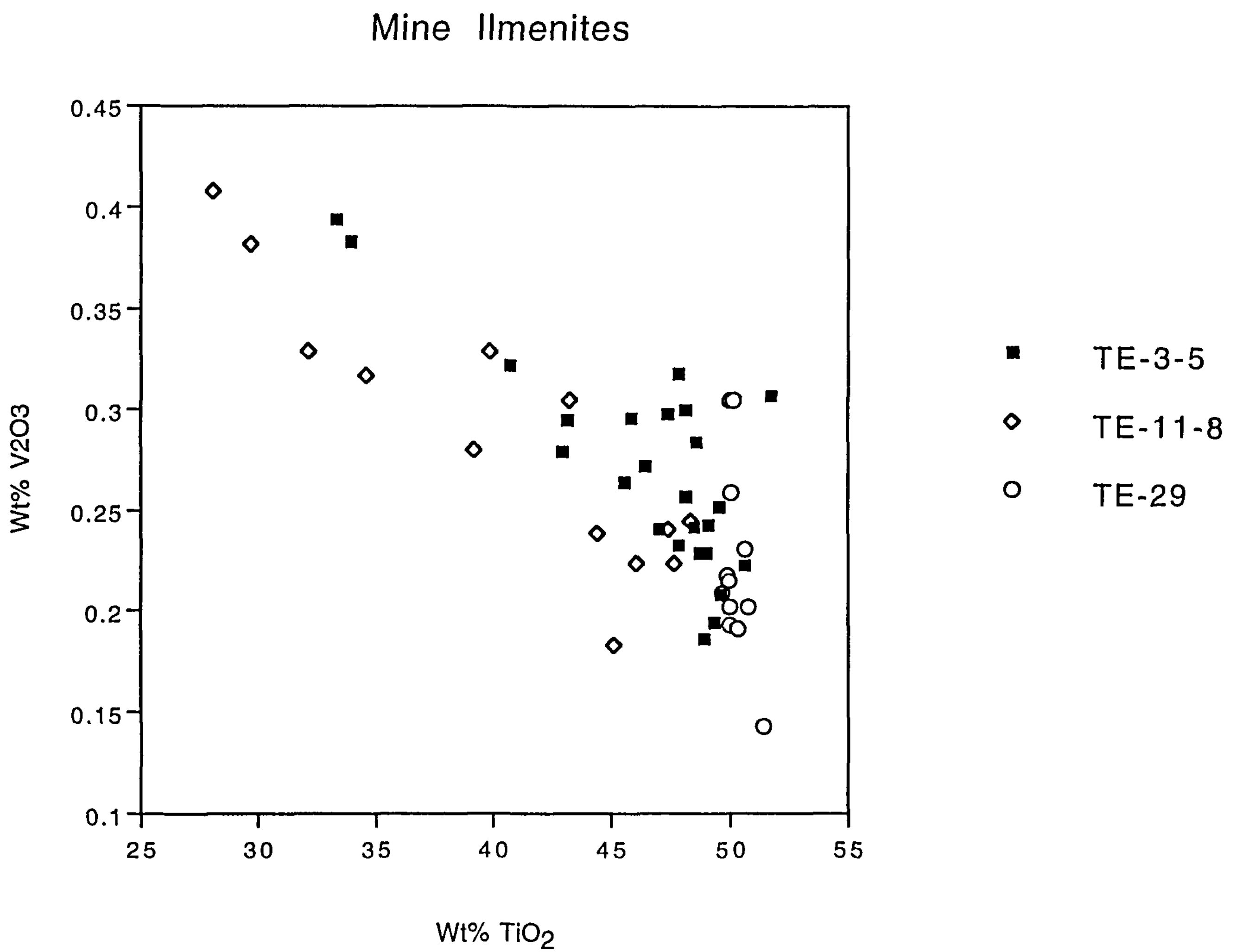


Figure 5.5V. Plot of ilmenite and hemo-ilmenite analyses from the Tellnes Mine area in terms of weight % V_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. Such lamellae are lacking in sample TE-29. High V_2O_3 content of low-Ti analyses compared to high-Ti analyses suggests that there is a V_2O_3 component in the exsolved hematite. The quantitative analysis of V_2O_3 in ilmenite is complicated by a partial overlap of the Ti and V X-ray peaks. However, this figure shows that V_2O_3 increases as TiO_2 decreases, so that true V_2O_3 content of the Ti-rich ilmenites may be lower than shown. One cannot say how much V_2O_3 is in ilmenite, but it is likely below 0.3 weight %. V_2O_3 perhaps as high as 0.5 weight % is in hematite.

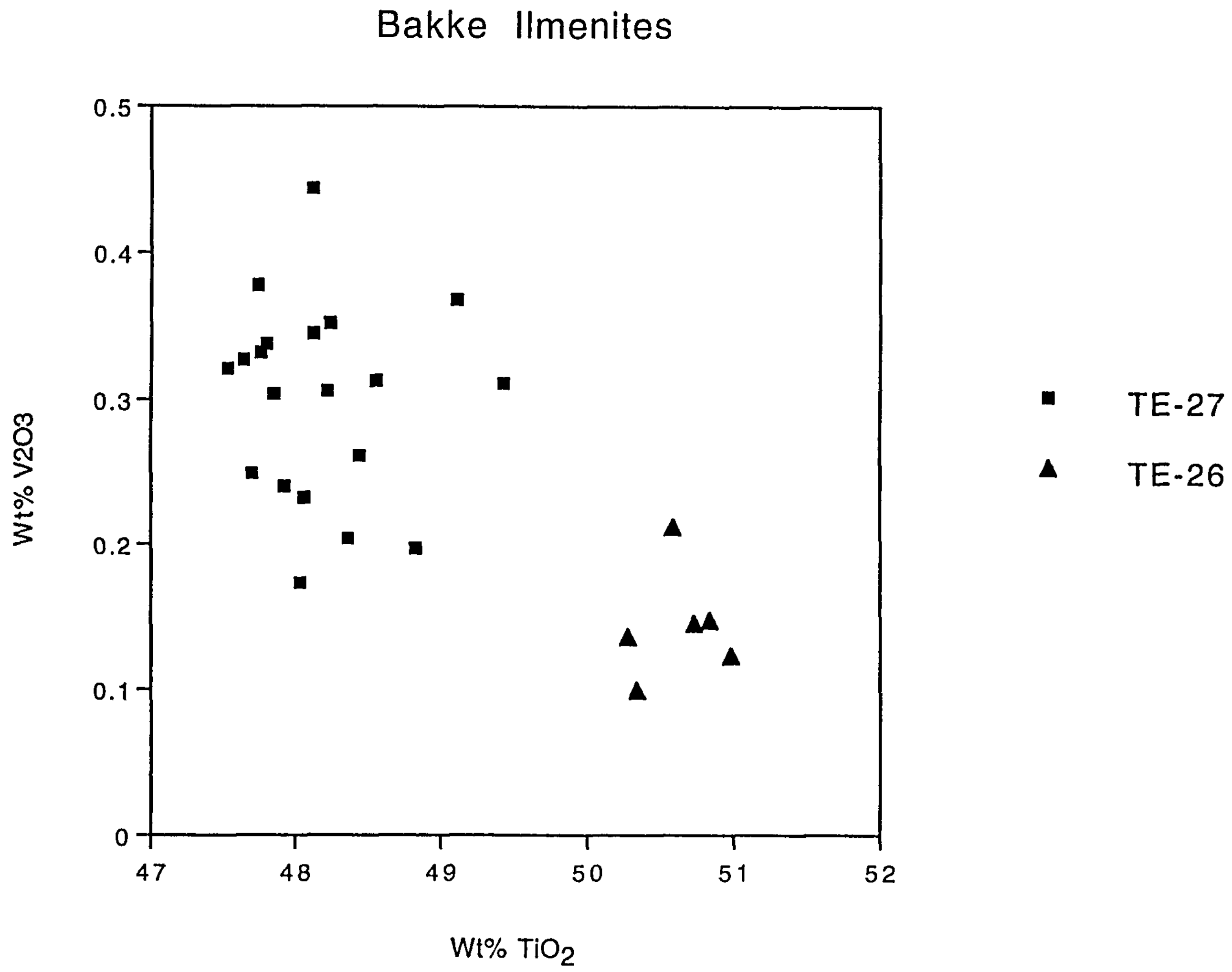


Figure 5.7V. Plot of ilmenite and hemo-ilmenite analyses from the Bakke area of the Bjerkrem-Sokndal lopolith in terms of weight % V_2O_3 versus weight % TiO_2. These ilmenites coexist with magnetite. They show a very small variation in TiO_2. content indicating a lack of significant hematite exsolution lamellae. The quantitative analysis of V_2O_3 in ilmenite is complicated by a partial overlap of the Ti and V X-ray peaks. Note the the slightly lower range of Ti contents as compared to earlier analyses from the same samples in Figures 5.6 and 5.7, which could be related to this overlap. One cannot say how much V_2O_3 is in ilmenite, but it is likely below 0.2 weight % in TE-26 and below 0.4% in TE-27. The reason for the difference between the two samples is presently unclear. The low V content of ilmenites in these magnetite-rich samples from the Bakke area suggests they precipitated from the magma well after the initial primary precipitation of magnetite which drastically lowered the v content of the magma.

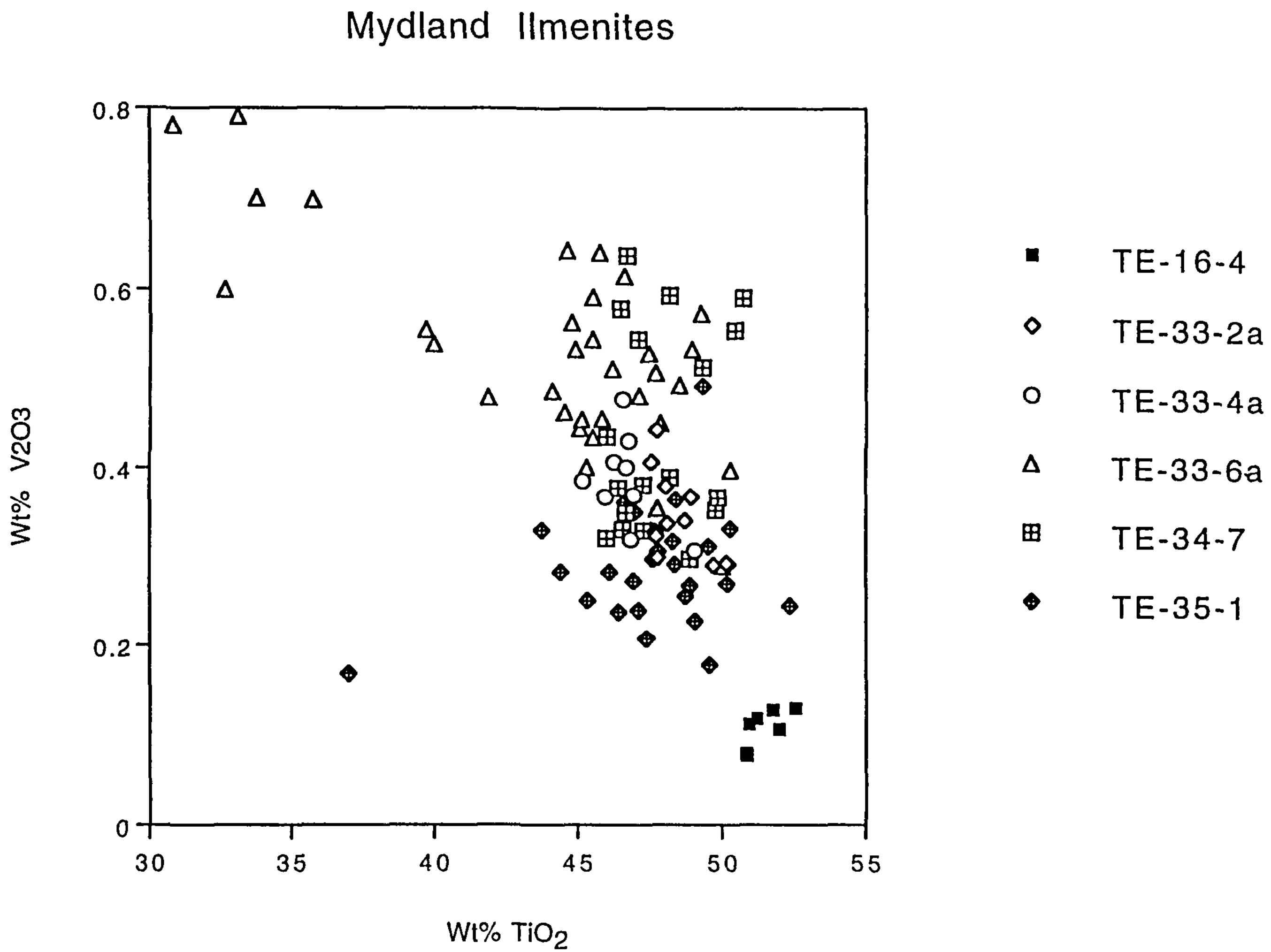


Figure 5.11V. Plot of ilmenite and hemo-ilmenite analyses from the Mydland area of the Bjerkrem-Sokndal lopolith in terms of weight % V_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses particularly in sample TE-33-6a, represent analyses including abundant hematite exsolution lamellae. High V_2O_3 content of low-Ti analyses compared to high-Ti analyses suggests that there is a V_2O_3 component in the exsolved hematite in this sample. The quantitative analysis of V_2O_3 in ilmenite is complicated by a partial overlap of the Ti and V X-ray peaks. However, this figure shows that V_2O_3 increases as TiO_2 decreases, so that true V_2O_3 content of the Ti-rich ilmenites may be lower than shown. The lowest V contents are in sample TE-16-4, a magnetite-rich norite from the Mydland magnetic low, postulated to have precipitated from the magma much later than initial magnetite precipitation. Low V content is also shown in sample TE-35-1, a more primitive anorthosite xenolith. The remaining Mydland samples, from the vicinity of the magnetic low, have ilmenites with V_2O_3 contents in the range 0.6 to 0.3, higher than the "more primitive" ilmenites from the Tellnes Mine (Figure 5.5V), also higher than the "more evolved" ilmenites from the Bakke area (Figure 5.7V). This suggests that these samples crystallized during early magnetite precipitation, confirmed by the presence of up to 1.25 weight % V_2O_3 in coexisting magnetite (Figure 5.33).

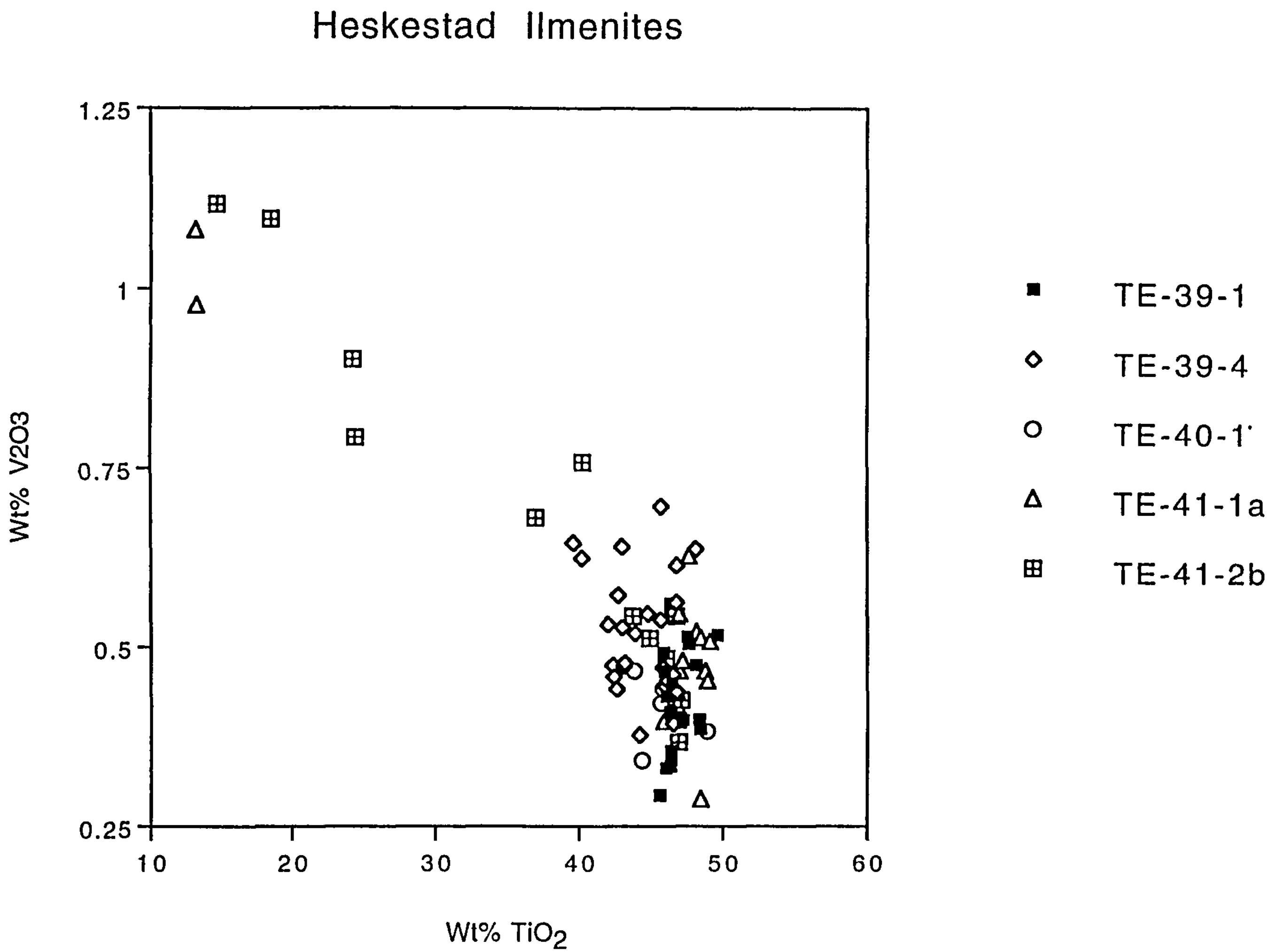


Figure 5.15V. Plot of ilmenite and hemo-ilmenite analyses from the Heskestad area of the Bjerkrem-Sokndal lopolith in terms of weight % V_2O_3 versus weight % TiO_2. Highest Ti analyses represent approximate bulk composition of ilmenite grains; low Ti analyses represent analyses including abundant hematite exsolution lamellae. High V_2O_3 content of low-Ti analyses compared to high-Ti analyses suggests that there is a V_2O_3 component in the exsolved hematite. The quantitative analysis of V_2O_3 in ilmenite is complicated by a partial overlap of the Ti and V X-ray peaks. However, this figure shows that V_2O_3 increases as TiO_2 decreases, so that true V_2O_3 content of the Ti-rich ilmenites may be lower than shown. One cannot say how much V_2O_3 is in ilmenite, but it is likely below 0.7 weight %. V_2O_3 perhaps as high as 1.1 weight % is in hematite. Magnetite in the same samples (Figure 5.35) has up to 1.37 weight % V_2O_3. These data suggest that these ilmenites are like the high V ilmenites from the Mydland area (Figure 5.11V) crystallized during early magnetite precipitation.

APPENDIX B
Petrophysical Data and Calculated Q-values from the Sokndal Region (Map sheet 13114)

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
1	014A	13114	32	350060	6475880	M41	EAP	ti-feenr.layer norit	3596	0.25348	0.19	LPN	95
2	016A	13114	32	349210	6475490	I56	EAP	ti-feenr.layer norit	3290	0.19604	0.70	LPN	95
3	029A	13114	32	342360	6470500	M41	EAP	norite	3674	0.55581	0.26	LPN	95
4	052A	13114	32	353910	6467000	I28	EAP	mangerite	2793	0.05252	6.20	LPN	95
5	053A	13114	32	353750	6467430	I28	EAP	coarsegr.mangerite	2781	0.05986	0.68	LPN	95
6	078A	13114	32	348390	6466440	I80	EAP	leuconorite	2719	0.00111	24.92	LPN	95
7	160A	13114	32	340200	6471250	M41	EAP	ti-feenr.layer.norit	3360	0.08884	0.38	LPN	95
8	029B	13114	32	342360	6470600	I56	EAP	norite high mag sus	3254	0.25216	0.17	LPN	95
9	052B	13114	32	353900	6467000	I28	EAP	finegr.mangerit dike	2710	0.05119	0.85	LPN	95
10	053B	13114	32	353750	6467430	I28	EAP	fingr.mangerite dike	2974	0.00652	0.44	LPN	95
11	078B	13114	32	348390	6466440	I80	EAP	altered leuconorite	2798	0.00035	6.10	LPN	95
12	160B	13114	32	340200	6471250	M41	EAP	ti-feenr.layer.norit	3551	0.14152	0.13	LPN	95
13	161B	13114	32	340290	6471120	M41	EAP	ti-feenr.layer.norit	3341	0.22385	0.19	LPN	95
14	052C	13114	32	353900	6467000	I28	EAP	finegr.mangerit dike	2990	0.03746	0.22	LPN	95
15	053C	13114	32	353750	6467430	I28	EAP	very fingr. diabse	2914	0.00518	0.26	LPN	95
16	159-B	13114	32	340280	6470880	M41	EAP	ti-feenr.layer.norit	3412	0.25813	0.34	LPN	95
17	047-1A	13114	32	348600	6469750	M41	EAP	tellnes ti-fe ore	3424	0.05196	1.84	LPN	95
18	047-2A	13114	32	348900	6469050	M41	EAP	tellnes ti-fe ore	3371	0.04017	8.02	LPN	95
19	047-1B	13114	32	348600	6469750	M41	EAP	tellnes ti-fe ore	3347	0.03593	3.84	LPN	95
20	047-2B	13114	32	348900	6469050	M41	EAP	tellnes ti-fe ore	3347	0.03960	5.58	LPN	95
21	148-11A	13114	32	342710	6469020	I00	EAP	felsite	2768	0.00744	1.65	LPN	95
22	148-11B	13114	32	342710	6469020	I00	EAP	felsite	2729	0.00825	3.61	LPN	95
23	148-11C	13114	32	342710	6469020	I56	EAP	rusty norite	2962	0.03007	0.12	LPN	95
24	002-1	13114	32	344900	6475720	M41	EAP	st.ålgå.ti-fe.ore	4583	0.01473	37.98	LPN	95
25	002-2	13114	32	344900	6475720	M41	EAP	st.ålgå.ti-fe.ore	4259	0.01251	25.79	LPN	95
26	002-3	13114	32	344900	6475720	M41	EAP	st.ålgå.ti-fe.ore	4569	0.02462	28.28	LPN	95
27	003	13114	32	346400	6468300	M41	EAP	bølstølstype ti-fe o	4587	0.84618	0.76	LPN	95
28	004-1	13114	32	345600	6473600	M41	EAP	frøytlog ti-fe ore	4580	0.00711	97.41	LPN	95
29	004-2	13114	32	345600	6473600	M41	EAP	frøytlog ti-fe ore	4559	0.01343	30.70	LPN	95
30	004-3	13114	32	345600	6473600	M41	EAP	frøytlog ti-fe ore	4498	0.01181	50.34	LPN	95
31	005-1	13114	32	343820	6471910	M41	EAP	storgangen ti-fe ore	4025	0.43072	0.38	LPN	95
32	005-2	13114	32	343820	6471910	M41	EAP	storgangen ti-fe ore	3772	0.40683	0.25	LPN	95
33	006-1	13114	32	347000	6471550	M41	EAP	blåfjel titanium ore	4608	0.01288	47.57	LPN	95
34	006-2	13114	32	347000	6471550	M41	EAP	blåfjel titanium ore	4619	0.01097	86.21	LPN	95
35	006-3	13114	32	347000	6471550	M41	EAP	blåfjel titanium ore	4581	0.01042	38.62	LPN	95
36	006-4	13114	32	347000	6471550	M41	EAP	blåfjel titanium ore	4559	0.01378	58.52	LPN	95
37	006-5	13114	32	347000	6471550	M41	EAP	blåfjel titanium ore	3514	0.00559	18.36	LPN	95
38	006-6	13114	32	347000	6471550	M41	EAP	blåfjel titanium ore	4594	0.01371	66.15	LPN	95
39	010	13114	32	342730	6473550	I56	EAP	norite	2971	0.07552	0.17	LPN	95
40	012	13114	32	342800	6473000	M41	EAP	ti-feenr.layer.norit	3534	0.31060	0.76	LPN	95
41	013	13114	32	350360	6475100	I56	EAP	norite	3092	0.10482	2.34	LPN	95
42	014	13114	32	350060	6475880	M41	EAP	ti-feenr.layer norit	3475	0.06159	3.48	LPN	95
43	015	13114	32	349430	6475710	I56	EAP	norite	3157	0.16061	0.44	LPN	95
44	016	13114	32	349210	6475500	M41	EAP	norite	3631	0.37774	0.50	LPN	95
45	017	13114	32	348930	6475930	I56	EAP	massive norite	3182	0.12218	3.30	LPN	95
46	019	13114	32	348240	6476200	M41	EAP	ti-feenr.layer norit	3832	0.46080	1.13	LPN	95
47	020	13114	32	348220	6476300	I56	EAP	ti-feenr.layer norit	3175	0.09586	0.49	LPN	95
48	021	13114	32	346190	6477050	I56	EAP	ti-feenr.layer norit	2969	0.07223	0.43	LPN	95
49	022	13114	32	346720	6476770	I56	EAP	norite weakly lamin.	3091	0.02680	12.17	LPN	95
50	023	13114	32	347320	6476170	I28	EAP	mangerite	2777	0.04051	0.31	LPN	95
51	024	13114	32	343430	6472900	I56	EAP	norite weakly lamin.	2977	0.10112	0.09	LPN	95
52	027	13114	32	342550	6472760	I56	EAP	norite laminated	3033	0.14369	0.08	LPN	95
53	030	13114	32	344920	6469950	I80	EAP	anorthosite	2683	0.00071	37.16	LPN	95
54	032	13114	32	345400	6469950	I80	EAP	anorthosite	2753	0.00072	83.98	LPN	95
55	033	13114	32	345000	6470100	I80	EAP	anorthosite	2701	0.00198	25.88	LPN	95
56	034	13114	32	345720	6470210	I80	EAP	anorthosite	2627	0.00050	103.50	LPN	95
57	036	13114	32	346100	6470600	I80	EAP	anorthosite	2807	0.01989	4.96	LPN	95
58	037-1	13114	32	346380	6470400	I60	EAP	mafic dike rock	2827	0.15414	0.27	LPN	95
59	037-2	13114	32	346380	6470400	I80	EAP	anorthosite	2862	0.02242	0.98	LPN	95
60	038-1	13114	32	346480	6470400	M41	EAP	ti-fe rich layer	3725	0.61666	0.40	LPN	95
61	038-2	13114	32	346480	6470400	I80	EAP	anorthosite	2822	0.01280	0.48	LPN	95
62	038-3	13114	32	346480	6470400	I80	EAP	anorthosite w oxide	2936	0.06142	0.29	LPN	95
63	039-1	13114	32	346630	6470310	I56	EAP	norite pegmatite	2822	0.00106	14.97	LPN	95
64	039-2	13114	32	346630	6470310	I56	EAP	norite pegmatite	2885	0.00225	29.06	LPN	95
65	040-1	13114	32	346880	6470140	I56	EAP	norite	2801	0.13324	0.25	LPN	95
66	040-2	13114	32	346880	6470140	I80	EAP	anorthosite	2697	0.00107	47.19	LPN	95
67	041-	13114	32	346990	6469970	I80	EAP	coarsegr.anorthosite	2694	0.00085	42.99	LPN	95
68	042	13114	32	350280	6468990	I80	EAP	anorthosite	2719	0.00102	13.83	LPN	95
69	044	13114	32	348870	6466940	I80	EAP	anorthosite	2700	0.00262	6.23	LPN	95
70	046	13114	32	348600	6469750	I80	EAP	anorthosite	2680	0.00000	-99.99	LPN	95
71	047-3	13114	32	348550	6469300	I80	EAP	anorthosite	2695	0.00340	33.98	LPN	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
72	047-4	13114	32	349500	6468700	I62	EAP	diabase dike	2946	0.02763	0.71	LPN	95
73	048	13114	32	347220	6469850	V25	EAP	diabase dike	2818	0.12589	0.07	LPN	95
74	049	13114	32	353880	6466880	I28	EAP	mangerite	2727	0.01877	6.43	LPN	95
75	051	13114	32	353840	6467000	I28	EAP	mangerite	2816	0.03604	0.17	LPN	95
76	054	13114	32	346880	6467460	I80	EAP	anorthosite	2699	0.00119	81.54	LPN	95
77	055	13114	32	346900	6467470	I80	EAP	anorthosite	2636	0.00099	281.28	LPN	95
78	056	13114	32	347020	6467530	I80	EAP	anorthosite	2677	0.00188	54.78	LPN	95
79	057	13114	32	347050	6467480	I80	EAP	anorthosite	2773	0.00152	72.05	LPN	95
80	058	13114	32	347110	6467500	I80	EAP	anorthosite	2709	0.00119	61.10	LPN	95
81	060	13114	32	347260	6467450	I80	EAP	anorthosite	2711	0.00145	79.69	LPN	95
82	061	13114	32	347340	6467400	I80	EAP	anorthosite	2721	0.00197	83.17	LPN	95
83	063	13114	32	347430	6467340	I80	EAP	anorthosite	2694	0.00111	57.64	LPN	95
84	064	13114	32	347390	6467270	I80	EAP	anorthosite	2678	0.00708	33.08	LPN	95
85	065	13114	32	347500	6467240	I80	EAP	anorthosite	2649	0.00054	47.46	LPN	95
86	066	13114	32	347600	6467240	I80	EAP	anorthosite	2823	0.00190	32.85	LPN	95
87	067	13114	32	347660	6467170	I80	EAP	anorthosite	2668	0.00014	301.34	LPN	95
88	068	13114	32	347660	6467090	I80	EAP	anorthosite	2666	0.00195	34.18	LPN	95
89	069	13114	32	347720	6466980	I80	EAP	anorthosite	2734	0.00030	52.33	LPN	95
90	070	13114	32	347800	6466950	I80	EAP	anorthosite	2656	0.00097	32.79	LPN	95
91	071	13114	32	347900	6466870	I80	EAP	anorthosite	2630	0.00129	16.75	LPN	95
92	072	13114	32	347960	6466770	I80	EAP	anorthosite	2665	0.00064	68.24	LPN	95
93	073	13114	32	348040	6466670	I80	EAP	anorthosite	2662	0.00026	49.72	LPN	95
94	074	13114	32	348170	6466680	I80	EAP	anorthosite	2678	0.00206	10.11	LPN	95
95	075	13114	32	348240	6466600	I80	EAP	leuconorite	2743	0.00115	65.17	LPN	95
96	076	13114	32	348250	6466540	I80	EAP	leuconorite	2702	0.00135	46.36	LPN	95
97	077	13114	32	348330	6466420	I80	EAP	leuconorite	2731	0.00058	62.90	LPN	95
98	079	13114	32	348460	6466430	I80	EAP	altered anorthosite	2672	0.00011	79.14	LPN	95
99	080	13114	32	348500	6466390	I56	EAP	leuconorite	2718	0.00048	20.62	LPN	95
100	081	13114	32	348480	6466240	I80	EAP	anorthosite	2681	0.00028	21.35	LPN	95
101	085-10	13114	32	343390	6473790	M41	EAP	ti-feenr.layer.norit	3777	3.05800	0.08	LPN	95
102	091	13114	32	342920	6474540	M41	EAP	nori-mang.trans.zone	3755	0.49266	0.69	LPN	95
103	092	13114	32	342930	6474540	M41	EAP	norite-manger.tr.zo.	3611	0.30575	1.38	LPN	95
104	093	13114	32	342950	6474510	M41	EAP	norite-manger.tr.zo.	3662	0.32234	1.34	LPN	95
105	094	13114	32	342980	6474480	M41	EAP	norite-manger.tr.zo.	3630	0.33425	1.17	LPN	95
106	095-1	13114	32	342990	6474840	M41	EAP	norite-manger.tr.zo.	3745	0.26634	1.16	LPN	95
107	095-2/5	13114	32	342990	6474840	M41	EAP	norite-manger.tr.zo.	3560	0.28099	1.60	LPN	95
108	106	13114	32	342980	6475190	M41	EAP	norite-manger.tr.zo.	3920	0.47780	0.73	LPN	95
109	107-12	13114	32	343150	6475700	M41	EAP	ti-feenr.layer.norit	3594	0.45679	0.28	LPN	95
110	113	13114	32	342870	6474110	M41	EAP	ti-feenr.layer.norit	3729	0.51258	0.62	LPN	95
111	120-7	13114	32	343250	6473180	M41	EAP	ti-feenr.layer.norit	3557	0.36973	0.26	LPN	95
112	126	13114	32	349320	6475480	M41	EAP	ti-feenr.layer.norit	3561	0.33080	0.95	LPN	95
113	127-9	13114	32	349320	6475600	M41	EAP	ti-feenr.layer.norit	3489	0.26187	0.90	LPN	95
114	129-1	13114	32	349250	6475560	M41	EAP	ti-feenr.layer.norit	3647	0.31190	0.19	LPN	95
115	132-4	13114	32	349410	6475680	M41	EAP	ti-feenr.layer.norit	3584	0.28553	0.43	LPN	95
116	133-7	13114	32	349440	6475570	M41	EAP	ti-feenr.layer.norit	3505	0.33181	0.64	LPN	95
117	136-	13114	32	349800	6475790	M41	EAP	ti-feenr.layer.norit	3388	0.20379	1.93	LPN	95
118	137-4/5	13114	32	349840	6475660	M41	EAP	ti-feenr.layer.norit	3268	0.20095	0.46	LPN	95
119	137-6	13114	32	349840	6475660	M41	EAP	ti-feenr.layer.norit	3709	0.38550	0.75	LPN	95
120	139-3/7	13114	32	343180	6472880	M41	EAP	ti-feenr.layer.norit	3550	0.26601	0.45	LPN	95
121	139-7/3	13114	32	343180	6472880	M41	EAP	ti-feenr.layer.norit	3540	0.24823	0.40	LPN	95
122	140-4	13114	32	343160	6472880	M41	EAP	ti-feenr.layer.norit	3797	0.69362	0.91	LPN	95
123	141-1/2/3	13114	32	343070	6472880	M41	EAP	ti-feenr.layer.norit	3974	0.81092	0.42	LPN	95
124	142-1/3	13114	32	343010	6472900	M41	EAP	ti-feenr.layer.norit	3635	0.31474	0.28	LPN	95
125	142-4/6	13114	32	343070	6472880	M41	EAP	ti-feenr.layer.norit	3538	0.26272	0.50	LPN	95
126	143-2/3	13114	32	342970	6472920	M41	EAP	ti-feenr.layer.norit	3647	0.45201	0.67	LPN	95
127	144-10	13114	32	341090	6470010	M41	EAP	ti-feenr.layer.norit	4331	1.03814	0.45	LPN	95
128	145-3/4	13114	32	342950	6472920	M41	EAP	ti-feenr.layer.norit	3615	0.25960	0.19	LPN	95
129	146-12	13114	32	342780	6473010	M41	EAP	ti-feenr.layer.norit	3473	0.26487	0.45	LPN	95
130	148-28	13114	32	342710	6469020	M41	EAP	ti-fe ore	4452	2.58654	0.03	LPN	95
131	148-4/5	13114	32	342710	6469020	M41	EAP	ti-feenr.layer.norit	3978	1.85201	0.13	LPN	95
132	148-5/4	13114	32	342710	6469020	M41	EAP	ti-feenr.layer.norit	4348	2.68769	0.06	LPN	95
133	151	13114	32	342770	6470150	M41	EAP	ti-feenr.layer.norit	3563	0.41597	0.95	LPN	95
134	155-5	13114	32	342320	6470440	M41	EAP	ti-feenr.layer.norit	3541	0.25768	29.25	LPN	95
135	157-5	13114	32	342420	6470360	M41	EAP	ti-feenr.layer.norit	3605	0.38547	0.90	LPN	95
136	157-9	13114	32	342420	6470360	M41	EAP	ti-feenr.layer.norit	3637	0.32776	0.66	LPN	95
137	159-9	13114	32	340410	6470730	I56	EAP	norite	2953	0.06452	0.05	LPN	95
138	162-2	13114	32	340830	6470240	M41	EAP	ti-feenr.layer.norit	3303	0.44406	1.30	LPN	95
139	163	13114	32	340740	6469420	I56	EAP	norite	2710	0.02095	0.33	LPN	95
140	166	13114	32	340480	6469630	M41	EAP	ti-feenr.layer.norit	3596	0.02463	15.37	LPN	95
141	167-1	13114	32	341270	6469030	M41	EAP	ti-feenr.layer.norit	3684	0.27289	0.44	LPN	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
142	168	13114	32	341210	6468600	M41	EAP	ti-feenr.layer.norit	3222	0.00412	7.01	LPN	95
143	170	13114	32	341500	6468110	I56	EAP	norite	3092	0.00413	0.78	LPN	95
144	171-13	13114	32	342610	6470860	I56	EAP	banded norite	3029	0.08500	0.77	LPN	95
145	174-4	13114	32	342370	6470590	M41	EAP	ti-feenr.layer.norit	3307	0.25846	0.21	LPN	95
146	175	13114	32	342350	6470650	M41	EAP	ti-feenr.layer.norit	3654	0.34597	0.28	LPN	95
147	176	13114	32	342240	6471770	M41	EAP	ti-feenr.layer.norit	3397	0.37018	0.83	LPN	95
148	177	13114	32	342310	6471900	M41	EAP	ti-feenr.layer.norit	3463	0.04775	2.52	LPN	95
149	183	13114	32	341050	6475600	M41	EAP	ti-feenr.layer.norit	3261	0.14585	0.62	LPN	95
150	184	13114	32	341050	6475540	M41	EAP	ti-feenr.layer.norit	3590	0.33720	0.47	LPN	95
151	186	13114	32	342400	6471870	I56	EAP	norite	3487	0.37841	2.21	LPN	95
152	187	13114	32	342390	6472010	M41	EAP	ti-feenr.layer.norit	3500	0.84863	0.51	LPN	95
153	189	13114	32	343410	6472880	M41	EAP	ti-feenr.layer.norit	3286	0.23061	0.19	LPN	95
154	191-1	13114	32	343140	6472760	M41	EAP	ti-feenr.layer.norit	3677	0.35736	0.13	LPN	95
155	192-7	13114	32	343130	6472660	M41	EAP	ti-feenr.layer.norit	3801	0.58576	0.79	LPN	95
156	193	13114	32	343040	6472750	M41	EAP	ti-feenr.layer.norit	3399	0.22057	0.63	LPN	95
157	194	13114	32	343760	6473600	M41	EAP	ti-feenr.layer.norit	3502	0.49500	0.98	LPN	95
158	196	13114	32	349310	6474910	M41	EAP	ti-feenr.layer.norit	3413	0.19573	0.95	LPN	96
159	197	13114	32	349150	6475420	M41	EAP	ti-feenr.layer.norit	3495	0.33657	0.35	LPN	96
160	198	13114	32	349230	6475750	I56	EAP	leuconorite.porl.lay	2988	0.06210	0.28	LPN	96
161	199	13114	32	350110	6475780	M41	EAP	ti-feenr.layer.norit	3401	0.30815	0.85	LPN	96
162	203	13114	32	348860	6475470	M41	EAP	ti-feenr.layer.norit	3700	0.48275	1.74	LPN	96
163	204	13114	32	348900	6475700	M41	EAP	ti-feenr.layer.norit	3504	0.26328	0.99	LPN	96
164	205	13114	32	342940	6473480	M41	EAP	ti-feenr.layer.norit	3439	0.27548	0.42	LPN	96
165	206	13114	32	343130	6473750	M41	EAP	ti-feenr.layer.norit	3418	0.37055	0.87	LPN	96
166	207	13114	32	343110	6472750	M41	EAP	ti-feenr.layer.norit	3382	0.23978	0.25	LPN	96
167	208	13114	32	342850	6472810	M41	EAP	ti-feenr.layer.norit	3251	0.25857	0.30	LPN	96
168	209	13114	32	343220	6472320	M41	EAP	ti-feenr.layer.norit	3088	0.01514	0.49	LPN	96
169	210	13114	32	342770	6472450	M41	EAP	ti-feenr.layer.norit	3308	0.22280	0.61	LPN	96
170	211	13114	32	342700	6472380	M41	EAP	ti-feenr.layer.norit	3588	0.52077	0.73	LPN	96
171	212	13114	32	342680	6472400	M41	EAP	ti-feenr.layer.norit	3358	0.16794	0.74	LPN	96
172	213	13114	32	343170	6474390	M41	EAP	ti-feenr.layer.norit	3672	0.41960	0.18	LPN	96
173	214	13114	32	343200	6474380	M41	EAP	ti-feenr.layer.norit	3556	0.22660	1.63	LPN	96
174	215	13114	32	343150	6474390	M41	EAP	ti-feenr.layer.norit	3680	0.43145	1.80	LPN	96
175	216	13114	32	342280	6472150	M41	EAP	ti-feenr.layer.norit	3811	0.68986	0.67	LPN	96
176	217	13114	32	343160	6472880	M41	EAP	ti-feenr.layer.norit	3967	0.76857	0.20	LPN	96
177	218	13114	32	343010	6472900	M41	EAP	ti-feenr.layer.norit	3551	0.33279	0.63	LPN	96
178	Te40-07s	13114	32	345970	6486570	I56	EAP	norite	9999	0.10000	3.25	SAM	95
179	TE27-04a	13114	32	343390	6473790	I56	EAP	norite	9999	0.19200	1.03	SAM	95
180	TE33-01a	13114	32	350100	6475180	I56	EAP	norite	9999	0.02430	0.73	SAM	95
181	TE33-02a	13114	32	350100	6475180	I56	EAP	norite	9999	0.02020	12.81	SAM	95
182	TE33-03a	13114	32	350100	6475180	I56	EAP	norite	9999	0.02150	11.44	SAM	95
183	TE33-04a	13114	32	350100	6475180	I56	EAP	norite	9999	0.01890	13.15	SAM	95
184	TE33-05a	13114	32	350100	6475180	I56	EAP	norite	9999	0.02250	10.93	SAM	95
185	TE33-06a	13114	32	350100	6475180	I56	EAP	norite	9999	0.01670	15.49	SAM	95
186	TE34-01a	13114	32	350250	6475300	I56	EAP	norite	9999	0.04540	2.96	SAM	95
187	TE34-02a	13114	32	350250	6475300	I56	EAP	norite	9999	0.03690	2.75	SAM	95
188	TE37-03a	13114	32	345600	6486900	I56	EAP	norite	9999	0.04640	6.72	SAM	95
189	TE37-04a	13114	32	345600	6486900	I56	EAP	norite	9999	0.05340	1.00	SAM	95
190	TE37-05a	13114	32	345600	6486900	I56	EAP	norite	9999	0.07300	0.45	SAM	95
191	TE39-01a	13114	32	345870	6486400	I56	EAP	norite	9999	0.07220	10.26	SAM	95
192	TE39-02a	13114	32	345870	6486400	I56	EAP	norite	9999	0.07230	9.37	SAM	95
193	TE40-01a	13114	32	345970	6486570	I56	EAP	norite	9999	0.11400	6.07	SAM	95
194	TE41-01a	13114	32	346230	6486750	I56	EAP	norite	9999	0.09420	0.94	SAM	95
195	TE41-02a	13114	32	346230	6486750	I56	EAP	norite	9999	0.09650	0.79	SAM	95
196	TE41-03a	13114	32	346230	6486750	I56	EAP	norite	9999	0.10400	1.02	SAM	95
197	TE41-04a	13114	32	346230	6486750	I56	EAP	norite	9999	0.08650	1.08	SAM	95
198	TE41-05a	13114	32	346230	6486750	I56	EAP	norite	9999	0.09350	6.35	SAM	95
199	TE51-01a	13114	32	348100	6473250	I80	EAP	anorthosite	9999	0.00520	23.90	SAM	95
200	TE51-02a	13114	32	348100	6473250	I80	EAP	anorthosite	9999	0.00560	17.21	SAM	95
201	TE53-01a	13114	32	346820	6474000	I80	EAP	anorthosite	9999	0.00230	91.52	SAM	95
202	TE59-01a	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.09390	4.24	SAM	95
203	TE60-01a	13114	32	343940	6471950	M41	EAP	storganen	9999	0.11700	1.54	SAM	95
204	TE60-02a	13114	32	343940	6471950	M41	EAP	storganen	9999	0.10400	7.41	SAM	95
205	TE60-03a	13114	32	343940	6471950	M41	EAP	storganen	9999	0.08360	0.58	SAM	95
206	TE60-04a	13114	32	343940	6471950	M41	EAP	storganen	9999	0.15000	0.73	SAM	95
207	TE61-01a	13114	32	344040	6471950	M41	EAP	storganen	9999	0.19400	0.81	SAM	95
208	TE62-01a	13114	32	343820	6471910	M41	EAP	storganen	9999	0.31300	8.13	SAM	95
209	TE62-02a	13114	32	343820	6471910	M41	EAP	storganen	9999	0.25100	7.24	SAM	95
210	TE63-01a	13114	32	344240	6472050	M41	EAP	storganen	9999	0.25600	8.70	SAM	95
211	TE63-02a	13114	32	344240	6472050	M41	EAP	storganen	9999	0.16400	0.62	SAM	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
212	TE63-04a	13114	32	344240	6472050	M41	EAP	storganen	9999	0.26700	8.59	SAM	95
213	TE33-01b	13114	32	350100	6475180	I56	EAP	norite	9999	0.01770	7.59	SAM	95
214	TE33-02b	13114	32	350100	6475180	I56	EAP	norite	9999	0.01820	11.84	SAM	95
215	TE33-03b	13114	32	350100	6475180	I56	EAP	norite	9999	0.02380	9.38	SAM	95
216	TE33-04b	13114	32	350100	6475180	I56	EAP	norite	9999	0.02090	13.11	SAM	95
217	TE33-05b	13114	32	350100	6475180	I56	EAP	norite	9999	0.01870	13.83	SAM	95
218	TE33-06b	13114	32	350100	6475180	I56	EAP	norite	9999	0.02240	11.77	SAM	95
219	TE34-01b	13114	32	350250	6475300	I56	EAP	norite	9999	0.04140	2.76	SAM	95
220	TE34-02b	13114	32	350250	6475300	I56	EAP	norite	9999	0.04570	4.50	SAM	95
221	TE37-03b	13114	32	345600	6486900	I56	EAP	norite	9999	0.06750	4.32	SAM	95
222	TE37-04b	13114	32	345600	6486900	I56	EAP	norite	9999	0.05450	1.49	SAM	95
223	TE39-01b	13114	32	345870	6486400	I56	EAP	norite	9999	0.08010	10.86	SAM	95
224	TE39-02b	13114	32	345870	6486400	I56	EAP	norite	9999	0.07930	7.61	SAM	95
225	TE41-01b	13114	32	346230	6486750	I56	EAP	norite	9999	0.09030	0.93	SAM	95
226	TE41-02b	13114	32	346230	6486750	I56	EAP	norite	9999	0.06820	1.38	SAM	95
227	TE41-03b	13114	32	346230	6486750	I56	EAP	norite	9999	0.11700	0.61	SAM	95
228	TE41-04b	13114	32	346230	6486750	I56	EAP	norite	9999	0.11000	0.78	SAM	95
229	TE41-05b	13114	32	346230	6486750	I56	EAP	norite	9999	0.08500	6.89	SAM	95
230	TE51-01b	13114	32	348100	6473250	I80	EAP	anorthosite	9999	0.00160	131.56	SAM	95
231	TE51-02b	13114	32	348100	6473250	I80	EAP	anorthosite	9999	0.00190	105.45	SAM	95
232	TE53-01b	13114	32	346820	6474000	I80	EAP	anorthosite	9999	0.00220	85.31	SAM	95
233	TE59-01b	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.11400	4.67	SAM	95
234	TE60-01b	13114	32	343940	6471950	M41	EAP	storganen	9999	0.15900	1.16	SAM	95
235	TE60-02b	13114	32	343940	6471950	M41	EAP	storganen	9999	0.15700	4.64	SAM	95
236	TE60-03b	13114	32	343940	6471950	M41	EAP	storganen	9999	0.04730	2.68	SAM	95
237	TE60-04b	13114	32	343940	6471950	M41	EAP	storganen	9999	0.09600	2.46	SAM	95
238	TE61-01b	13114	32	344040	6471950	M41	EAP	storganen	9999	0.24500	0.77	SAM	95
239	TE62-02b	13114	32	343820	6471910	M41	EAP	storganen	9999	0.23200	10.07	SAM	95
240	TE63-01b	13114	32	344240	6472050	M41	EAP	storganen	9999	0.16700	10.72	SAM	95
241	TE63-02b	13114	32	344240	6472050	M41	EAP	storganen	9999	0.16200	0.52	SAM	95
242	TE63-04b	13114	32	344240	6472050	M41	EAP	storganen	9999	0.26400	7.01	SAM	95
243	TE41-01c	13114	32	346230	6486750	I56	EAP	norite	9999	0.10400	0.76	SAM	95
244	TE41-05c	13114	32	346230	6486750	I56	EAP	norite	9999	0.09760	5.27	SAM	95
245	TE60-02c	13114	32	343940	6471950	M41	EAP	storganen	9999	0.18500	0.49	SAM	95
246	TE60-04c	13114	32	343940	6471950	M41	EAP	storganen	9999	0.13400	21.24	SAM	95
247	TE42-01A	13114	32	347250	6468300	I80	EAP	anorthosite	9999	0.00140	-99.99	SAM	95
248	TE02-01	13114	32	345900	6468050	I80	EAP	anorthosite	9999	0.00110	159.08	SAM	95
249	TE02-02	13114	32	345900	6468050	I80	EAP	anorthosite	9999	0.00120	107.78	SAM	95
250	TE02-03	13114	32	345900	6468050	I80	EAP	anorthosite	9999	0.00250	33.48	SAM	95
251	TE03-01	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.04540	5.64	SAM	95
252	TE03-02	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03280	5.26	SAM	95
253	TE03-03	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03770	4.57	SAM	95
254	TE03-04	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03500	5.72	SAM	95
255	TE03-05	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03840	4.23	SAM	95
256	TE03-06	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03520	4.61	SAM	95
257	TE03-07	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.04100	5.07	SAM	95
258	TE03-08	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03010	5.39	SAM	95
259	TE03-09	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03900	3.71	SAM	95
260	TE03-10	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.07430	2.36	SAM	95
261	TE04-01	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.02880	2.91	SAM	95
262	TE04-02	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03130	3.89	SAM	95
263	TE04-03	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03150	2.98	SAM	95
264	TE04-04	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03000	3.89	SAM	95
265	TE04-05	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03110	3.34	SAM	95
266	TE04-06	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03040	3.42	SAM	95
267	TE04-07	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.03080	3.05	SAM	95
268	TE04-08	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.02990	4.33	SAM	95
269	TE04-09	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.02150	6.72	SAM	95
270	TE04-10	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.02560	3.07	SAM	95
271	TE10-02	13114	32	348550	6469300	I80	EAP	anorthosite	9999	0.00240	14.79	SAM	95
272	TE10-03	13114	32	348550	6469300	I80	EAP	anorthosite	9999	0.00110	43.81	SAM	95
273	TE11-01	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01790	7.37	SAM	95
274	TE11-02	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01530	31.00	SAM	95
275	TE11-03	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01830	26.19	SAM	95
276	TE11-04	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01620	26.14	SAM	95
277	TE11-05	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01510	10.58	SAM	95
278	TE11-06	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01800	11.69	SAM	95
279	TE11-07	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01450	6.65	SAM	95
280	TE11-08	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.00160	120.46	SAM	95
281	TE11-09	13114	32	348900	6469050	M41	EAP	tellnes ore	9999	0.01400	5.98	SAM	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
282	TE16-01	13114	32	349840	6475660	I56	EAP	norite weakly lam	9999	0.18900	0.34	SAM	95
283	TE16-02	13114	32	349840	6475660	I56	EAP	norite weakly lam	9999	0.17400	0.67	SAM	95
284	TE16-03	13114	32	349840	6475660	I56	EAP	norite weakly lam	9999	0.11600	0.94	SAM	95
285	TE16-04	13114	32	349840	6475660	I56	EAP	norite weakly lam	9999	0.19300	0.59	SAM	95
286	TE16-05	13114	32	349840	6475660	I56	EAP	norite weakly lam	9999	0.18500	1.23	SAM	95
287	TE16-06	13114	32	349840	6475660	I56	EAP	norite weakly lam	9999	0.23100	0.47	SAM	95
288	TE26-01	13114	32	343100	6474400	I56	EAP	norite weakly lam	9999	0.37100	0.70	SAM	95
289	TE26-02	13114	32	343100	6474400	I56	EAP	norite	9999	0.37000	0.56	SAM	95
290	TE26-03	13114	32	343100	6474400	I56	EAP	norite	9999	0.37200	1.07	SAM	95
291	TE26-04	13114	32	343100	6474400	I56	EAP	norite	9999	0.39700	1.00	SAM	95
292	TE26-05	13114	32	343100	6474400	I56	EAP	norite	9999	0.37300	0.71	SAM	95
293	TE26-06	13114	32	343100	6474400	I56	EAP	norite	9999	0.37800	6.15	SAM	95
294	TE27-01	13114	32	343390	6473790	I56	EAP	norite	9999	0.22400	1.20	SAM	95
295	TE27-02	13114	32	343390	6473790	I56	EAP	norite	9999	0.22500	1.06	SAM	95
296	TE27-03	13114	32	343390	6473790	I56	EAP	norite	9999	0.17100	1.53	SAM	95
297	TE27-04	13114	32	343390	6473790	I56	EAP	norite	9999	0.21300	1.13	SAM	95
298	TE27-05	13114	32	343390	6473790	I56	EAP	norite	9999	0.22400	1.04	SAM	95
299	TE27-06	13114	32	343390	6473790	I56	EAP	norite	9999	0.20800	1.12	SAM	95
300	TE27-07	13114	32	343390	6473790	I56	EAP	norite	9999	0.26800	1.17	SAM	95
301	TE27-08	13114	32	343390	6473790	I56	EAP	norite	9999	0.26700	0.49	SAM	95
302	TE29-01	13114	32	348600	6469750	M41	EAP	tellnes ore	9999	0.10400	4.73	SAM	95
303	TE29-02	13114	32	348600	6469750	M41	EAP	tellnes ore	9999	0.09500	5.39	SAM	95
304	TE29-03	13114	32	348600	6469750	M41	EAP	tellnes ore	9999	0.11000	4.52	SAM	95
305	TE29-04	13114	32	348600	6469750	M41	EAP	tellnes ore	9999	0.09500	3.92	SAM	95
306	TE34-03	13114	32	350250	6475300	I56	EAP	norite	9999	0.03850	2.96	SAM	95
307	TE34-04	13114	32	350250	6475300	I56	EAP	norite	9999	0.04250	3.10	SAM	95
308	TE34-05	13114	32	350250	6475300	I56	EAP	norite	9999	0.04270	4.10	SAM	95
309	TE34-06	13114	32	350250	6475300	I56	EAP	norite	9999	0.04360	4.36	SAM	95
310	TE34-07	13114	32	350250	6475300	I56	EAP	norite	9999	0.08670	7.81	SAM	95
311	TE34-08	13114	32	350250	6475300	I56	EAP	norite	9999	0.04460	2.62	SAM	95
312	TE34-09	13114	32	350250	6475300	I56	EAP	norite	9999	0.05220	2.43	SAM	95
313	TE34-10	13114	32	350250	6475300	I56	EAP	norite	9999	0.04080	2.80	SAM	95
314	TE35-01	13114	32	350560	6475470	I56	EAP	norite	9999	0.02730	4.83	SAM	95
315	TE35-02	13114	32	350560	6475470	I56	EAP	norite	9999	0.01720	0.44	SAM	95
316	TE35-03	13114	32	350560	6475470	I56	EAP	norite	9999	0.02880	0.53	SAM	95
317	TE35-07	13114	32	350560	6475470	I56	EAP	norite	9999	0.02080	0.24	SAM	95
318	TE35-08	13114	32	350560	6475470	I56	EAP	norite	9999	0.03500	0.22	SAM	95
319	TE36-01	13114	32	345630	6486750	I56	EAP	norite	9999	0.08990	0.79	SAM	95
320	TE36-02	13114	32	345630	6486750	I56	EAP	norite	9999	0.07880	2.90	SAM	95
321	TE36-03	13114	32	345630	6486750	I56	EAP	norite	9999	0.07690	2.37	SAM	95
322	TE36-04	13114	32	345630	6486750	I56	EAP	norite	9999	0.09570	0.61	SAM	95
323	TE36-05	13114	32	345630	6486750	I56	EAP	norite	9999	0.08070	2.89	SAM	95
324	TE36-06	13114	32	345630	6486750	I56	EAP	norite	9999	0.08760	0.69	SAM	95
325	TE37-01	13114	32	345600	6486900	I56	EAP	norite	9999	0.05020	0.96	SAM	95
326	TE37-02	13114	32	345600	6486900	I56	EAP	norite	9999	0.05270	0.91	SAM	95
327	TE37-05	13114	32	345600	6486900	I56	EAP	norite	9999	0.05390	0.75	SAM	95
328	TE38-01	13114	32	345650	6487080	I56	EAP	norite	9999	0.07250	0.35	SAM	95
329	TE39-03	13114	32	345870	6486400	I56	EAP	norite	9999	0.08840	8.64	SAM	95
330	TE39-04	13114	32	345870	6486400	I56	EAP	norite	9999	0.07700	9.42	SAM	95
331	TE39-05	13114	32	345870	6486400	I56	EAP	norite	9999	0.08450	9.90	SAM	95
332	TE39-06	13114	32	345870	6486400	I56	EAP	norite	9999	0.08440	9.95	SAM	95
333	TE39-07	13114	32	345870	6486400	I56	EAP	norite	9999	0.06380	7.87	SAM	95
334	TE39-08	13114	32	345870	6486400	I56	EAP	norite	9999	0.08030	9.00	SAM	95
335	TE39-09	13114	32	345870	6486400	I56	EAP	norite	9999	0.07740	7.50	SAM	95
336	TE40-01	13114	32	345970	6486570	I56	EAP	norite	9999	0.11500	7.30	SAM	95
337	TE40-02	13114	32	345970	6486570	I56	EAP	norite	9999	0.09010	5.74	SAM	95
338	TE40-03	13114	32	345970	6486570	I56	EAP	norite	9999	0.11900	-99.99	SAM	95
339	TE40-04	13114	32	345970	6486570	I56	EAP	norite	9999	0.07990	4.79	SAM	95
340	TE40-06	13114	32	345970	6486570	I56	EAP	norite	9999	0.11200	3.33	SAM	95
341	TE40-07	13114	32	345970	6486570	I56	EAP	norite	9999	0.12000	3.76	SAM	95
342	TE40-08	13114	32	345970	6486570	I56	EAP	norite	9999	0.12000	2.71	SAM	95
343	TE42-01	13114	32	347250	6468300	I80	EAP	anorthosite	9999	0.00370	-99.99	SAM	95
344	TE42-03	13114	32	347250	6468300	I80	EAP	anorthosite	9999	0.00380	-99.99	SAM	95
345	TE42-04	13114	32	347250	6468300	I80	EAP	anorthosite	9999	0.00600	-99.99	SAM	95
346	TE42-05	13114	32	347250	6468300	I80	EAP	anorthosite	9999	0.00180	-99.99	SAM	95
347	TE42-06	13114	32	347250	6468300	I80	EAP	anorthosite	9999	0.00250	-99.99	SAM	95
348	TE43-01	13114	32	350800	6482200	I80	EAP	anorthosite	9999	0.00160	122.05	SAM	95
349	TE43-02	13114	32	350800	6482200	I80	EAP	anorthosite	9999	0.00310	45.81	SAM	95
350	TE43-03	13114	32	350800	6482200	I80	EAP	anorthosite	9999	0.00170	-99.99	SAM	95
351	TE43-04	13114	32	350800	6482200	I80	EAP	anorthosite	9999	0.00310	-99.99	SAM	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
352	TE43-05	13114	32	350800	6482200	180	EAP	anorthosite	9999	0.00240	-99.99	SAM	95
353	TE44-01	13114	32	350800	6470950	180	EAP	anorthosite	9999	0.00200	-99.99	SAM	95
354	TE44-02	13114	32	346800	6470950	180	EAP	anorthosite	9999	0.00170	-99.99	SAM	95
355	TE44-03	13114	32	346800	6470950	180	EAP	anorthosite	9999	0.00180	-99.99	SAM	95
356	TE44-04	13114	32	346800	6470950	180	EAP	anorthosite	9999	0.00930	-99.99	SAM	95
357	TE44-05	13114	32	346800	6470950	180	EAP	anorthosite	9999	0.01100	-99.99	SAM	95
358	TE44-06	13114	32	346800	6470950	180	EAP	anorthosite	9999	0.01000	-99.99	SAM	95
359	TE45-01	13114	32	346800	6470750	180	EAP	anorthosite	9999	0.00040	114.12	SAM	95
360	TE45-02	13114	32	350800	6470750	180	EAP	anorthosite	9999	0.00060	84.54	SAM	95
361	TE45-03	13114	32	350800	6470750	180	EAP	anorthosite	9999	0.00080	69.74	SAM	95
362	TE46-01	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00160	-99.99	SAM	95
363	TE46-02	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00120	-99.99	SAM	95
364	TE46-03	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00140	-99.99	SAM	95
365	TE46-04	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.01700	-99.99	SAM	95
366	TE46-05	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00170	-99.99	SAM	95
367	TE46-06	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00270	-99.99	SAM	95
368	TE46-07	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00420	-99.99	SAM	95
369	TE46-08	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00120	-99.99	SAM	95
370	TE46-09	13114	32	350270	6471430	180	EAP	anorthosite	9999	0.00140	-99.99	SAM	95
371	TE47-01	13114	32	350300	6471200	180	EAP	anorthosite	9999	0.00150	-99.99	SAM	95
372	TE47-02	13114	32	350300	6471200	180	EAP	anorthosite	9999	0.00140	-99.99	SAM	95
373	TE47-03	13114	32	350300	6471200	180	EAP	anorthosite	9999	0.00190	-99.99	SAM	95
374	TE47-04	13114	32	350300	6471200	180	EAP	anorthosite	9999	0.00080	-99.99	SAM	95
375	TE47-05	13114	32	350300	6471200	180	EAP	anorthosite	9999	0.00070	-99.99	SAM	95
376	TE48-01	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00440	-99.99	SAM	95
377	TE48-02	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00280	-99.99	SAM	95
378	TE48-03	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00320	-99.99	SAM	95
379	TE48-04	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00300	-99.99	SAM	95
380	TE48-05	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00300	-99.99	SAM	95
381	TE48-06	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00230	-99.99	SAM	95
382	TE48-07	13114	32	348430	6472660	180	EAP	anorthosite	9999	0.00260	-99.99	SAM	95
383	TE49-01	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00350	-99.99	SAM	95
384	TE49-02	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00270	-99.99	SAM	95
385	TE49-03	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00540	-99.99	SAM	95
386	TE49-04	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.01100	-99.99	SAM	95
387	TE49-05	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00280	-99.99	SAM	95
388	TE49-06	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00440	-99.99	SAM	95
389	TE49-07	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00350	-99.99	SAM	95
390	TE49-08	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00280	-99.99	SAM	95
391	TE49-09	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00320	-99.99	SAM	95
392	TE49-10	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00560	-99.99	SAM	95
393	TE49-11	13114	32	349400	6472750	180	EAP	anorthosite	9999	0.00280	-99.99	SAM	95
394	TE50-01	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.00690	-99.99	SAM	95
395	TE50-02	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01420	-99.99	SAM	95
396	TE50-03	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01480	-99.99	SAM	95
397	TE50-04	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01560	-99.99	SAM	95
398	TE50-05	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01520	-99.99	SAM	95
399	TE50-06	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.00460	-99.99	SAM	95
400	TE50-07	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.00100	-99.99	SAM	95
401	TE50-08	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01040	-99.99	SAM	95
402	TE50-09	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01210	-99.99	SAM	95
403	TE50-10	13114	32	348300	6473450	180	EAP	anorthosite	9999	0.01520	-99.99	SAM	95
404	TE51-03	13114	32	348100	6473250	180	EAP	anorthosite	9999	0.00330	79.93	SAM	95
405	TE51-04	13114	32	348100	6473250	180	EAP	anorthosite	9999	0.00200	105.25	SAM	95
406	TE51-05	13114	32	348100	6473250	180	EAP	anorthosite	9999	0.00590	27.08	SAM	95
407	TE53-02	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00100	-99.99	SAM	95
408	TE53-03	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00110	-99.99	SAM	95
409	TE53-04	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00070	-99.99	SAM	95
410	TE53-05	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00130	-99.99	SAM	95
411	TE53-06	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00060	-99.99	SAM	95
412	TE53-07	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00060	-99.99	SAM	95
413	TE53-08	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00800	-99.99	SAM	95
414	TE53-09	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00120	-99.99	SAM	95
415	TE53-10	13114	32	346820	6474000	180	EAP	anorthosite	9999	0.00050	-99.99	SAM	95
416	TE54-01	13114	32	345900	6474080	180	EAP	anorthosite	9999	0.00260	-99.99	SAM	95
417	TE54-02	13114	32	345900	6474080	180	EAP	anorthosite	9999	0.01020	-99.99	SAM	95
418	TE54-03	13114	32	345900	6474080	180	EAP	anorthosite	9999	0.00440	-99.99	SAM	95
419	TE54-04	13114	32	345900	6474080	180	EAP	anorthosite	9999	0.01630	-99.99	SAM	95
420	TE54-05	13114	32	345900	6474080	180	EAP	anorthosite	9999	0.00240	-99.99	SAM	95
421	TE54-06	13114	32	345900	6474080	180	EAP	anorthosite	9999	0.00140	-99.99	SAM	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
422	TE56-01	13114	32	351050	6475810	I28	EAP	qtz mangerite	9999	0.05170	-99.99	SAM	95
423	TE56-02	13114	32	351050	6475810	I28	EAP	qtz mangerite	9999	0.04950	-99.99	SAM	95
424	TE56-03	13114	32	351050	6475810	I28	EAP	qtz mangerite	9999	0.05350	-99.99	SAM	95
425	TE56-04	13114	32	351050	6475810	I28	EAP	qtz mangerite	9999	0.05220	-99.99	SAM	95
426	TE56-05	13114	32	351050	6475810	I28	EAP	qtz mangerite	9999	0.05790	-99.99	SAM	95
427	TE56-06	13114	32	351050	6475810	I28	EAP	qtz mangerite	9999	0.05380	-99.99	SAM	95
428	TE57-01	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.00900	-99.99	SAM	95
429	TE57-02	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.01780	-99.99	SAM	95
430	TE57-03	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.03880	-99.99	SAM	95
431	TE57-04	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.02940	-99.99	SAM	95
432	TE57-05	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.03410	-99.99	SAM	95
433	TE57-06	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.00540	-99.99	SAM	95
434	TE57-07	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.01110	-99.99	SAM	95
435	TE57-08	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.00860	-99.99	SAM	95
436	TE57-09	13114	32	351210	6475810	I28	EAP	qtz mangerite	9999	0.02260	-99.99	SAM	95
437	TE58-01	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.06760	-99.99	SAM	95
438	TE58-02	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.06220	-99.99	SAM	95
439	TE58-03	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.06820	-99.99	SAM	95
440	TE58-04	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.05860	-99.99	SAM	95
441	TE58-05	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.08030	-99.99	SAM	95
442	TE58-06	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.06250	-99.99	SAM	95
443	TE58-07	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.05110	-99.99	SAM	95
444	TE58-08	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.05950	-99.99	SAM	95
445	TE58-09	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.06260	-99.99	SAM	95
446	TE58-10	13114	32	339670	6474400	I28	EAP	mangerite	9999	0.06440	-99.99	SAM	95
447	TE59-02	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.00850	-99.99	SAM	95
448	TE59-03	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.02480	-99.99	SAM	95
449	TE59-04	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.01840	-99.99	SAM	95
450	TE59-05	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.07840	-99.99	SAM	95
451	TE59-06	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.02790	-99.99	SAM	95
452	TE59-07	13114	32	339960	6473460	I56	EAP	jotunite	9999	0.08230	-99.99	SAM	95
453	TE61-02*	13114	32	344040	6471950	M41	EAP	storganen	9999	0.32600	8.60	SAM	95
454	TE61-03	13114	32	344040	6471950	M41	EAP	storganen	9999	0.04100	-99.99	SAM	95
455	TE61-04	13114	32	344040	6471950	M41	EAP	storganen	9999	0.08230	-99.99	SAM	95
456	TE61-05	13114	32	344040	6471950	M41	EAP	storganen	9999	0.08040	-99.99	SAM	95
457	TE61-06	13114	32	344040	6471950	M41	EAP	storganen	9999	0.05730	-99.99	SAM	95
458	TE62-01	13114	32	343820	6471910	M41	EAP	storganen	9999	0.25700	6.98	SAM	95
459	TE62-03	13114	32	343820	6471910	M41	EAP	storganen	9999	0.40900	1.58	SAM	95
460	TE62-04	13114	32	343820	6471910	M41	EAP	storganen	9999	0.29200	1.29	SAM	95
461	TE62-05	13114	32	343820	6471910	M41	EAP	storganen	9999	0.43600	1.27	SAM	95
462	TE63-03	13114	32	344240	6472050	M41	EAP	storganen	9999	0.28300	1.50	SAM	95
463	1001.01.01	13114	32	344600	6472300	M41		norite	4256	0.35311	0.32	SCH	95
464	1001.01.02	13114	32	344600	6472300	M41		norite	3902	0.43489	0.45	SCH	95
465	1001.01.03	13114	32	344600	6472300	M41		norite	3965	0.45601	0.40	SCH	95
466	1001.02.01	13114	32	344950	6472350	I80		anorthositic layer	2695	0.00578	32.66	SCH	95
467	1001.02.02	13114	32	344950	6472350	M41		layered	3928	0.37463	0.43	SCH	95
468	1001.03.01	13114	32	346500	6472050	M41		norite	3666	0.04098	6.56	SCH	95
469	1001.03.02	13114	32	346500	6472050	M41		norite	3995	0.41441	0.30	SCH	95
470	1001.04.01	13114	32	345850	6472400	M41		norite	3433	0.01174	46.36	SCH	95
471	1001.05.01	13114	32	344400	6472250	I80		anorthositic layer	2822	0.02733	0.68	SCH	95
472	1001.05.02	13114	32	344400	6472250	M41		norite	3474	0.18895	0.35	SCH	95
473	1001.05.03	13114	32	344400	6472300	M41		norite	3402	0.14787	0.61	SCH	95
474	1001.05.05	13114	32	344500	6472300	M41		norite	3572	0.26184	0.49	SCH	95
475	1001.05.06	13114	32	344600	6472300	M41		norite	4191	0.31976	0.18	SCH	95
476	1001.06.01	13114	32	343550	6471850	I56		layered	2960	0.06083	0.29	SCH	95
477	1002.01.01	13114	32	350050	6476000	I56		layered	3344	0.20694	2.61	SCH	95
478	1002.01.02	13114	32	350500	6475700	M41		norite	3649	0.26138	5.34	SCH	95
479	1002.01.03	13114	32	350050	6475300	I56		layered	2771	0.04988	0.60	SCH	95
480	1002.01.04	13114	32	349900	6475800	M41		norite	3287	0.21560	0.88	SCH	95
481	1002.02.01	13114	32	349450	6475800	I56		layered	3398	0.23909	0.62	SCH	95
482	1002.02.02	13114	32	349500	6475450	I56		leucocratic	2904	0.07751	1.68	SCH	95
483	1002.02.03	13114	32	349600	6476400	I28		hangerite?	2732	0.02691	0.45	SCH	95
484	1002.02.04	13114	32	349750	6476250	I56		leucocratic	3025	0.06513	0.54	SCH	95
485	1002.02.05	13114	32	349700	6476200	I56		layered	3311	0.15029	0.43	SCH	95
486	1002.02.06	13114	32	349600	6476050	I56		layered	3278	0.16229	1.10	SCH	95
487	1002.02.07	13114	32	348900	6475750	I56		layered	3398	0.30495	0.74	SCH	95
488	1003.01.02	13114	32	354800	6463000	I56		layered	2960	0.02900	1.71	SCH	95
489	1003.01.03	13114	32	354950	6463300	M41		norite	3467	0.67250	0.45	SCH	95
490	1004.01.01	13114	32	346750	6470500	I56		pegmatite	3016	0.00241	45.86	SCH	95
491	1004.01.02	13114	32	346850	6470450	M41		norite	4608	0.00844	124.87	SCH	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
492	1004.01.03	13114	32	347000	6470700	I56		pegmatite	2786	0.00389	7.86	SCH	95
493	1004.01.04	13114	32	346950	6470950	M41		pegmatite	4074	0.15257	2.51	SCH	95
494	1004.01.05	13114	32	347100	6471500	M41		pegmatite	4488	0.00990	79.42	SCH	95
495	1004.01.06	13114	32	347100	6471750	M41		pegmatite	4541	0.00880	40.19	SCH	95
496	1004.02.01	13114	32	346400	6470400	I56		pegmatite	2938	0.00460	8.63	SCH	95
497	1004.02.02	13114	32	346550	6470350	M41		pegmatite	3782	1.44703	0.95	SCH	95
498	1005.01.01	13114	32	346400	6470550	M41		layered	3934	0.14289	0.29	SCH	95
499	1006.01.01	13114	32	340550	6470500	I56		levcocratic	2880	0.05143	0.67	SCH	95
500	1006.01.02	13114	32	340550	6470500	M41		layered	3637	0.30535	0.27	SCH	95
501	1006.01.03	13114	32	340600	6470450	I56		layered	3439	0.26939	2.99	SCH	95
502	1006.01.05	13114	32	340850	6470200	I56		layered	3074	0.13774	0.45	SCH	95
503	1006.01.06	13114	32	340950	6470200	I56		layered	2911	0.09194	0.30	SCH	95
504	1006.01.07	13114	32	340850	6470300	I56		levcocratic	2804	0.03812	0.49	SCH	95
505	1006.01.08	13114	32	340650	6470550	I56		layered	2909	0.04433	0.64	SCH	95
506	1006.01.09	13114	32	340350	6471050	I56		layered	2999	0.06685	0.24	SCH	95
507	1006.02.01	13114	32	341350	6469050	I56		layered	3147	0.13546	0.16	SCH	95
508	1006.03.01	13114	32	343300	6474200	I56		layered	3147	0.18203	0.27	SCH	95
509	1006.03.02	13114	32	343300	6474150	I56		layered	3132	0.14215	0.40	SCH	95
510	1006.03.03	13114	32	343350	6474150	I56		layered	3343	0.24076	0.29	SCH	95
511	1006.03.04	13114	32	343350	6474100	I56		layered	3055	0.15445	0.34	SCH	95
512	1006.03.05	13114	32	343400	6474100	M41		layered	3615	0.26841	0.68	SCH	95
513	1006.03.06	13114	32	343400	6474050	M41		layered	3610	0.41753	0.32	SCH	95
514	1006.03.07	13114	32	343450	6474050	I56		layered	3307	0.21117	0.27	SCH	95
515	1006.03.08	13114	32	343450	6470000	I56		layered	3495	0.33159	0.78	SCH	95
516	1006.03.09	13114	32	343100	6474100	I56		layered	2928	0.10989	0.37	SCH	95
517	1006.03.10	13114	32	342950	6474100	I56		layered	2906	0.10292	0.22	SCH	95
518	1006.03.11	13114	32	342800	6475150	I56		layered	2890	0.06555	0.20	SCH	95
519	1006.04.01	13114	32	343500	6471950	I56		layered	2999	0.09245	0.20	SCH	95
520	1006.05.01	13114	32	341400	6468350	I56		layered	2762	0.00105	22.61	SCH	95
521	1006.05.02	13114	32	341500	6468150	I56		levcocratic	3280	0.07296	0.32	SCH	95
522	1006.06.01	13114	32	342750	6470050	I56		layered	3276	0.31659	0.56	SCH	95
523	1006.06.02	13114	32	342750	6470000	M41		layered	3660	0.11184	1.86	SCH	95
524	1006.06.03	13114	32	342750	6469950	I56		layered	3056	0.12815	0.53	SCH	95
525	1006.06.04	13114	32	342750	6469900	M41		layered	3593	0.35023	2.55	SCH	95
526	1006.06.05	13114	32	342800	6469800	I56		layered	3266	0.13945	0.68	SCH	95
527	1006.06.06	13114	32	342950	6469600	I56		layered	3298	0.00598	5.57	SCH	95
528	1006.06.07	13114	32	342750	6469350	I56		layered	3190	0.00406	8.20	SCH	95
529	1006.06.08	13114	32	342950	6469100	I56		troctolite	3103	0.09337	0.78	SCH	95
530	1006.06.09	13114	32	342850	6469200	M41		layered	4321	2.62515	0.20	SCH	95
531	1006.06.10	13114	32	342900	6470200	I56		layered	3374	0.25702	0.60	SCH	95
532	1006.06.11	13114	32	342850	6469100	I56		troctolite	3062	0.03828	1.28	SCH	95
533	1006.08.01	13114	32	342500	6470650	I56		layered	3279	0.22536	0.92	SCH	95
534	1006.08.02	13114	32	342400	6470900	I56		layered	3414	0.27994	0.46	SCH	95
535	1006.08.03	13114	32	342450	6471300	I56		levcocratic	2958	0.04241	1.79	SCH	95
536	1006.08.04	13114	32	342650	6471550	I56		levcocratic	3236	0.00738	10.31	SCH	95
537	1006.08.05	13114	32	342250	6470650	I56		levcocratic	2973	0.08023	0.21	SCH	95
538	1006.08.06	13114	32	342100	6470750	I28		jotunite	2812	0.08238	0.15	SCH	95
539	1006.08.07	13114	32	341950	6470700	I56		jotunite	2910	0.09890	0.20	SCH	95
540	1006.08.08	13114	32	340750	6470900	I56		jotunite	2841	0.02342	0.33	SCH	95
541	1006.08.09	13114	32	341000	6470700	I56		jotunite	3051	0.10159	0.30	SCH	95
542	1006.08.10	13114	32	341300	6470600	I56		jotunite	2923	0.09819	0.53	SCH	95
543	1006.09.01	13114	32	341000	6472650	I56		levcocratic	3022	0.10366	0.35	SCH	95
544	1006.09.02	13114	32	340450	6472900	I56		levcocratic	2964	0.00282	2.79	SCH	95
545	1006.09.03	13114	32	340250	6472700	I56		levcocratic	3206	0.00944	9.83	SCH	95
546	1007.01.01	13114	32	345000	6475950	M41		levcocratic	3886	0.00775	68.15	SCH	95
547	1007.01.02	13114	32	344650	6476450	M41		levcocratic	4563	0.01306	95.55	SCH	95
548	1008.01.01	13114	32	345000	6473300	M41		levcocratic	3871	0.45799	0.27	SCH	95
549	1008.01.02	13114	32	344400	6472500	I56		layered	2943	0.06059	4.45	SCH	95
550	1009.01.01	13114	32	346700	6469450	M41		layered	3749	0.60964	0.95	SCH	95
551	1009.01.02	13114	32	346550	6469250	M41		layered	3829	0.69621	0.30	SCH	95
552	1009.01.03	13114	32	346700	6469200	M41		layered	4152	0.79712	1.55	SCH	95
553	1009.01.04	13114	32	346550	6469100	M41		layered	4622	0.98701	0.27	SCH	95
554	1009.01.05	13114	32	346950	6469050	M41		layered	4622	0.00805	228.72	SCH	95
555	1009.01.06	13114	32	346900	6468350	M41		layered	4504	0.20777	2.28	SCH	95
556	1010.01.01	13114	32	346350	6468600	I80		layered	2664	0.00031	126.04	SCH	95
557	1010.01.02	13114	32	346350	6468600	M41		layered	2892	0.11033	0.62	SCH	95
558	1010.01.03	13114	32	346400	6468550	M41		layered	3666	0.91565	0.27	SCH	95
559	1010.01.04	13114	32	346900	6469450	I56		pegmatite	2850	0.00586	32.89	SCH	95
560	1010.01.05	13114	32	346850	6468350	M41		pegmatite	4365	0.16838	6.82	SCH	95
561	1010.01.06	13114	32	346800	6468100	M41		pegmatite	4351	0.03459	5.72	SCH	95
562	1010.01.07	13114	32	346750	6467850	M41		pegmatite	4616	0.53995	0.35	SCH	95

NO.	SAMPLE NO.	KARTBL. NO.	UTM-ZONE	UTM-COORD. EAST	NORTH	LIT. CODE	STRAT. CODE	ROCK TYPE	DENSITY KG/M**3	SUSCEPT. SI (lab)	Q-VALUE	GEOL. ID.	YR
563	1010.01.08	13114	32	346850	6467700	M41		pegmatite	3785	0.05361	8.48	SCH	95
564	1011.01.01	13114	32	347600	6466000	I56		pegmatite	3364	0.00751	38.56	SCH	95
565	1012.01.01	13114	32	354400	6462460	M41		pegmatite	4390	0.02222	3.87	SCH	95
566	1012.01.02	13114	32	354850	6462650	I56		layered	3320	0.25825	0.39	SCH	95
567	1013.01.01	13114	32	344350	6472150	I80		layered	2706	0.00143	145.43	SCH	95
568	1013.01.02	13114	32	344350	6472150	I56		layered	3490	0.18400	0.17	SCH	95
569	1013.01.04	13114	32	344350	6472150	I56		layered	2974	0.04817	0.05	SCH	95
570	1013.01.05	13114	32	344350	6472200	M41		layered	3646	0.33043	0.16	SCH	95
571	1013.01.06	13114	32	344350	6472200	I80		anorthositic layer	2870	0.03994	1.60	SCH	95
572	1013.01.07	13114	32	344350	6472200	M41		norite	3597	0.27001	0.49	SCH	95
573	1013.01.08	13114	32	344350	6472250	M41		norite	3690	0.35600	0.87	SCH	95
574	1013.01.09	13114	32	344350	6472250	M41		norite	4019	0.63556	0.35	SCH	95
575	1013.01.10	13114	32	344350	6472250	I56		norite	3087	0.12056	0.48	SCH	95
576	1013.01.11	13114	32	344350	6472300	I56		norite	3305	0.26083	0.63	SCH	95
577	1013.01.12	13114	32	344350	6472300	I56		layered	3500	0.49656	0.52	SCH	95
578	1013.01.13	13114	32	344350	6472300	I56		layered	3225	0.18949	0.75	SCH	95
579	1013.01.14	13114	32	344350	6472350	I56		layered	3178	0.14580	0.45	SCH	95
580	1013.01.15	13114	32	344350	6472350	M41		norite	3631	0.30102	0.60	SCH	95

APPENDIX C
Microprobe Analytical Data Corrected to Mineral Formulas

TE-3-5 new: magnetite core into symplectite rim against ilmenite
Corrected probe data (page 1)

Point #	1	2	3	4	5	6	7	8	9	16	Point #
Comment	mt core	mt	mt	mt	mt	mt	mt	mt	mt	mt	Comment
Wt% oxide	trav starts->										Wt% oxide
SiO2	0.002	0.023	0.003	0.016	0.013	0.000	0.016	0.002	0.013	0.023	SiO2
TiO2	0.059	0.045	0.107	0.056	0.023	0.054	0.084	0.079	0.213	0.010	TiO2
Al2O3	0.212	0.231	0.256	0.163	0.198	0.186	0.164	0.154	0.157	0.186	Al2O3
Cr2O3	1.252	1.335	1.365	1.257	1.284	1.345	1.318	1.228	1.335	1.304	Cr2O3
V2O3	0.702	0.668	0.737	0.675	0.669	0.704	0.707	0.737	0.675	0.630	V2O3
Fe2O3	66.849	66.187	66.463	66.438	66.794	66.892	66.790	66.778	65.853	66.743	Fe2O3
FeO	30.700	30.583	30.926	30.752	30.926	30.862	30.978	30.849	30.809	30.796	FeO
MgO	0.279	0.205	0.180	0.165	0.154	0.242	0.195	0.175	0.152	0.204	MgO
CaO	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	MnO
ZnO	0.087	0.101	0.038	0.027	0.000	0.014	0.000	0.092	0.041	0.000	ZnO
total	100.142	99.378	100.083	99.551	100.061	100.299	100.251	100.094	99.249	99.896	total
Corrected cations/4"O"(mt); 3"O"(ilm)											Cor. cations
Si	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.001	Si
Ti	0.002	0.001	0.003	0.002	0.001	0.002	0.002	0.002	0.006	0.000	Ti
Al	0.010	0.011	0.012	0.007	0.009	0.008	0.007	0.007	0.007	0.008	Al
Cr	0.038	0.041	0.041	0.038	0.039	0.041	0.040	0.037	0.041	0.040	Cr
V3+	0.022	0.021	0.023	0.021	0.021	0.022	0.022	0.023	0.021	0.019	V3+
Fe 3+	1.927	1.923	1.918	1.929	1.929	1.926	1.925	1.928	1.917	1.930	Fe 3+
Fe 2+	0.984	0.988	0.992	0.992	0.993	0.988	0.992	0.990	0.997	0.990	Fe 2+
Mg	0.016	0.012	0.010	0.009	0.009	0.014	0.011	0.010	0.009	0.012	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Mn
Zn	0.002	0.003	0.001	0.001	0.000	0.000	0.000	0.003	0.001	0.000	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.003	0.001	RO2
R2O3	0.499	0.498	0.498	0.498	0.499	0.499	0.498	0.498	0.495	0.499	R2O3
RO	0.501	0.501	0.501	0.501	0.500	0.500	0.501	0.501	0.502	0.500	RO
TiO2	0.001	0.001	0.002	0.001	0.000	0.001	0.001	0.001	0.003	0.000	TiO2
Fe2O3	0.494	0.493	0.491	0.492	0.493	0.493	0.492	0.493	0.489	0.494	Fe2O3
FeO	0.505	0.506	0.508	0.507	0.507	0.506	0.507	0.506	0.508	0.506	FeO

TE-3-5 new: magnetite core into symplectite rim against ilmenite								
Corrected probe data (page 2)								
Point #	17	18	19	20	22	23	27	Point #
Comment	mt	mt	mt	mt by sym	ilm in sym	ilm in sym	ilm in sym	Comment
Wt% oxide				<-trav ends	border	border	border	Wt% oxide
SiO2	0.010	0.002	0.037	0.004	0.005	0.000	0.424	SiO2
TiO2	0.093	0.048	0.064	0.145	51.729	45.569	50.598	TiO2
Al2O3	0.485	0.174	0.170	0.187	0.404	8.322	1.986	Al2O3
Cr2O3	1.278	1.341	1.275	1.374	0.064	0.436	0.083	Cr2O3
V2O3	0.645	0.622	0.603	0.644	0.307	0.264	0.223	V2O3
Fe2O3	66.178	66.413	66.444	65.755	3.739	9.521	3.771	Fe2O3
FeO	30.626	30.555	30.668	30.510	38.409	29.076	36.775	FeO
MgO	0.278	0.269	0.232	0.208	4.438	6.114	4.963	MgO
CaO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.000	0.000	0.024	0.000	0.203	0.314	0.277	MnO
ZnO	0.122	0.000	0.014	0.082	0.000	0.780	0.122	ZnO
total	99.715	99.425	99.531	98.909	99.298	100.396	99.222	total
Corrected cations/4"O"(mt); 3"O"(ilm)								Cor. cations
Si	0.000	0.000	0.001	0.000	0.000	0.000	0.010	Si
Ti	0.003	0.001	0.002	0.004	0.956	0.796	0.924	Ti
Al	0.022	0.008	0.008	0.009	0.012	0.228	0.057	Al
Cr	0.039	0.041	0.039	0.042	0.001	0.008	0.002	Cr
V3+	0.020	0.019	0.019	0.020	0.006	0.005	0.004	V3+
Fe 3+	1.913	1.929	1.928	1.920	0.069	0.166	0.069	Fe 3+
Fe 2+	0.984	0.986	0.989	0.990	0.789	0.565	0.747	Fe 2+
Mg	0.016	0.015	0.013	0.012	0.163	0.212	0.180	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.000	0.000	0.001	0.000	0.004	0.006	0.006	Mn
Zn	0.003	0.000	0.000	0.002	0.000	0.013	0.002	Zn
total	3.000	3.000	3.000	3.000	2.000	2.000	2.000	total
RO2	0.002	0.001	0.002	0.002	0.489	0.443	0.483	RO2
R2O3	0.498	0.499	0.497	0.497	0.023	0.113	0.034	R2O3
RO	0.501	0.500	0.501	0.501	0.489	0.443	0.483	RO
TiO2	0.001	0.001	0.001	0.002	0.537	0.551	0.542	TiO2
Fe2O3	0.492	0.494	0.493	0.491	0.019	0.058	0.020	Fe2O3
FeO	0.506	0.505	0.506	0.507	0.443	0.391	0.438	FeO

TE-3-5 new: hematite exsolution in ilmenite									
Corrected probe data									
Point #	1	2	3	4	5	6	7	8	Point #
Corrected oxide wt %									Oxide wt %
SiO2	0.015	0.005	0.009	0.023	0.020	0.024	0.018	0.006	SiO2
TiO2	48.566	48.132	43.173	42.949	47.822	40.722	33.945	33.318	TiO2
Al2O3	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.148	Al2O3
Cr2O3	0.069	0.033	0.087	0.053	0.005	0.147	0.168	0.214	Cr2O3
V2O3	0.284	0.257	0.295	0.279	0.233	0.322	0.383	0.394	V2O3
Fe2O3	10.313	11.698	20.033	20.583	11.299	24.740	37.297	38.253	Fe2O3
FeO	35.734	34.998	32.507	32.540	35.007	31.155	26.222	25.445	FeO
MgO	4.282	4.440	3.396	3.249	4.355	2.899	2.306	2.424	MgO
CaO	0.015	0.011	0.028	0.010	0.019	0.021	0.020	0.014	CaO
MnO	0.296	0.360	0.236	0.236	0.233	0.193	0.187	0.164	MnO
ZnO	0.008	0.000	0.000	0.077	0.000	0.118	0.000	0.022	ZnO
total	99.582	99.933	99.771	99.998	98.993	100.341	100.546	100.402	total
Corrected cations/3"O"									Cor. cations
Si	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	Si
Ti	0.900	0.889	0.808	0.803	0.892	0.763	0.641	0.630	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	Al
Cr	0.001	0.001	0.002	0.001	0.000	0.003	0.003	0.004	Cr
V3+	0.006	0.005	0.006	0.006	0.005	0.006	0.008	0.008	V3+
Fe3+	0.191	0.216	0.375	0.385	0.211	0.464	0.705	0.724	Fe3+
Fe2+	0.737	0.719	0.677	0.677	0.726	0.649	0.551	0.535	Fe2+
Mg	0.157	0.162	0.126	0.120	0.161	0.108	0.086	0.091	Mg
Ca	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.000	Ca
Mn	0.006	0.007	0.005	0.005	0.005	0.004	0.004	0.003	Mn
Zn	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.000	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.474	0.471	0.447	0.446	0.472	0.433	0.391	0.386	RO2
R2O3	0.052	0.059	0.106	0.109	0.057	0.134	0.218	0.227	R2O3
RO	0.474	0.471	0.447	0.446	0.472	0.433	0.391	0.386	RO
TiO2	0.520	0.518	0.483	0.480	0.518	0.464	0.415	0.413	TiO2
Fe2O3	0.055	0.063	0.112	0.115	0.061	0.141	0.228	0.237	Fe2O3
FeO	0.425	0.419	0.405	0.405	0.421	0.395	0.357	0.350	FeO

TE-3-5 new traverse: from ilm core to rim by spinel symplectite										
Corrected probe data (page 1)										
Point #	1	2	3	4	6	7	8	9	10	Point #
Comment	ilm core	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	Comment
Wt% oxide	trav starts->									**Wt% oxide**
SiO2	0.000	0.013	0.000	0.010	0.010	0.010	0.000	0.000	0.000	SiO2
TiO2	47.042	49.074	47.379	48.132	48.991	48.692	46.435	45.865	47.799	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.000	Al2O3
Cr2O3	0.125	0.096	0.081	0.054	0.124	0.062	0.117	0.124	0.069	Cr2O3
V2O3	0.241	0.243	0.298	0.300	0.229	0.229	0.272	0.296	0.318	V2O3
Fe2O3	13.959	9.183	12.578	10.955	9.578	10.765	15.123	16.694	13.297	Fe2O3
FeO	33.929	35.563	34.413	34.758	35.497	35.381	33.697	33.320	34.542	FeO
MgO	4.498	4.601	4.379	4.598	4.645	4.531	4.296	4.261	4.534	MgO
CaO	0.001	0.006	0.008	0.000	0.021	0.004	0.013	0.000	0.015	CaO
MnO	0.352	0.346	0.343	0.339	0.262	0.334	0.342	0.295	0.338	MnO
ZnO	0.000	0.028	0.036	0.000	0.000	0.000	0.047	0.036	0.000	ZnO
total	100.147	99.154	99.515	99.146	99.357	100.007	100.341	100.936	100.912	total
Corrected cations/3"O"										**Cor. cations**
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.868	0.911	0.879	0.894	0.908	0.898	0.857	0.842	0.875	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Al
Cr	0.002	0.002	0.002	0.001	0.002	0.001	0.002	0.002	0.001	Cr
V3+	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.006	0.006	V3+
Fe3+	0.258	0.171	0.234	0.204	0.178	0.199	0.279	0.307	0.243	Fe3+
Fe2+	0.696	0.734	0.710	0.718	0.731	0.725	0.691	0.680	0.703	Fe2+
Mg	0.164	0.169	0.161	0.169	0.171	0.166	0.157	0.155	0.164	Mg
Ca	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	Ca
Mn	0.007	0.007	0.007	0.007	0.005	0.007	0.007	0.006	0.007	Mn
Zn	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.000	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.465	0.477	0.468	0.472	0.476	0.473	0.461	0.457	0.467	RO2
R2O3	0.071	0.046	0.064	0.056	0.048	0.054	0.077	0.086	0.067	R2O3
RO	0.465	0.477	0.468	0.472	0.476	0.473	0.461	0.457	0.467	RO
TiO2	0.513	0.526	0.515	0.522	0.525	0.521	0.508	0.503	0.515	TiO2
Fe2O3	0.076	0.049	0.068	0.059	0.051	0.058	0.083	0.092	0.072	Fe2O3
FeO	0.411	0.424	0.416	0.419	0.423	0.421	0.410	0.406	0.414	FeO

TE-3-5 new traverse: from ilm core to rim by spinel symplectite						
Corrected probe data (page 2)						
Point #	11	12	13	14	15	Point #
Comment	ilm	ilm	ilm	ilm	ilm by sym	Comment
Wt% oxide					<-trav ends	**Wt% oxide**
SiO2	0.012	0.000	0.014	0.029	0.022	SiO2
TiO2	48.497	49.324	48.886	49.550	49.603	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.098	0.140	0.094	0.056	0.062	Cr2O3
V2O3	0.242	0.194	0.186	0.252	0.208	V2O3
Fe2O3	10.428	8.906	10.220	8.718	8.288	Fe2O3
FeO	35.396	36.200	35.720	36.752	36.840	FeO
MgO	4.432	4.297	4.374	4.238	4.143	MgO
CaO	0.005	0.011	0.018	0.011	0.000	CaO
MnO	0.318	0.429	0.343	0.271	0.365	MnO
ZnO	0.003	0.055	0.105	0.000	0.044	ZnO
total	99.431	99.556	99.960	99.876	99.575	total
Corrected cations/3"O"						**Cor. cations**
Si	0.000	0.000	0.000	0.001	0.001	Si
Ti	0.900	0.914	0.903	0.916	0.920	Ti
Al	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.002	0.003	0.002	0.001	0.001	Cr
V3+	0.005	0.004	0.004	0.005	0.004	V3+
Fe3+	0.194	0.165	0.189	0.161	0.154	Fe3+
Fe2+	0.730	0.746	0.733	0.755	0.760	Fe2+
Mg	0.163	0.158	0.160	0.155	0.152	Mg
Ca	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.007	0.009	0.007	0.006	0.008	Mn
Zn	0.000	0.001	0.002	0.000	0.001	Zn
total	2.000	2.000	2.000	2.000	2.000	total
RO2	0.474	0.478	0.474	0.478	0.479	RO2
R2O3	0.053	0.045	0.051	0.044	0.041	R2O3
RO	0.474	0.478	0.474	0.478	0.479	RO
TiO2	0.521	0.525	0.522	0.523	0.524	TiO2
Fe2O3	0.056	0.047	0.055	0.046	0.044	Fe2O3
FeO	0.423	0.428	0.424	0.431	0.433	FeO

TE 3-5 spinel							
Point #	1 (TE 3-5)	2 (TE 3-5)	4 (TE 3-5)	6 (TE 3-5)	7 (TE 3-5)	8 (TE 3-5)	Point #
Comment	rim by sulfide	rm by mt	rim by sulfide	at sul-mt-ilm	between ilm	spi-ilm sym	Comment
Wt % corrected probe data							
SiO2	0.013	0.013	0.003	0.005	0.001	0.055	SiO2
TiO2	0.000	0.010	0.008	0.020	0.270	0.529	TiO2
Al2O3	63.188	63.756	62.834	63.655	63.893	63.685	Al2O3
Cr2O3	1.380	1.333	1.405	1.531	1.477	1.498	Cr2O3
V2O5	0.044	0.051	0.066	0.075	0.056	0.029	V2O5
Fe2O3	2.489	2.342	2.387	2.495	1.394	0.961	Fe2O3
FeO	8.546	8.444	7.789	9.151	9.778	8.582	FeO
MgO	18.238	18.637	18.328	18.179	17.867	18.370	MgO
CaO	0.033	0.024	0.030	0.033	0.020	0.033	CaO
MnO	0.000	0.000	0.000	0.000	0.002	0.000	MnO
ZnO	5.972	5.673	6.332	5.898	5.923	6.529	ZnO
total	99.903	100.283	99.182	101.042	100.681	100.271	total
Cations/4"O" corrected probe data (output)							
Si	0.000	0.000	0.000	0.000	0.000	0.001	Si
Ti	0.000	0.000	0.000	0.000	0.005	0.010	Ti
Al	1.922	1.926	1.923	1.918	1.932	1.927	Al
Cr	0.028	0.027	0.029	0.031	0.030	0.030	Cr
V5+	0.001	0.001	0.001	0.002	0.001	0.001	V5+
Fe 3+	0.048	0.045	0.047	0.048	0.027	0.019	Fe 3+
Fe 2+	0.184	0.181	0.169	0.196	0.210	0.184	Fe 2+
Mg	0.701	0.712	0.709	0.693	0.683	0.703	Mg
Ca	0.001	0.001	0.001	0.001	0.001	0.001	Ca
Mn	0.000	0.000	0.000	0.000	0.000	0.000	Mn
Zn	0.114	0.107	0.121	0.111	0.112	0.124	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.000	0.000	0.000	0.000	0.003	0.006	RO2
R2O3	0.500	0.500	0.500	0.500	0.496	0.491	R2O3
RO	0.500	0.500	0.500	0.500	0.501	0.503	RO
TiO2	0.000	0.001	0.001	0.002	0.023	0.050	TiO2
Fe2O3	0.116	0.111	0.121	0.109	0.059	0.046	Fe2O3
FeO	0.884	0.888	0.878	0.889	0.918	0.904	FeO

TE 3-5 hem exsol in ilm: Traverse 1											
Corrected probe data (page 1)											**Corrected**
x	3240	3242	3248	3251	3254	3257	3260	3263	3266	3269	x
y	-27995	-27996	-27998	-27999	-28001	-28002	-28003	-28004	-28005	-28007	y
Point #	1	2	4	5	6	7	8	9	10	11	Point #
Comment	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	Comment
Wt% oxide											**Wt% oxide**
SiO2	0.010	0.021	0.000	0.005	0.018	0.000	0.019	0.020	0.026	0.013	SiO2
TiO2	49.221	42.471	44.995	49.636	44.386	42.190	47.121	44.302	45.482	49.609	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.012	0.130	0.146	0.045	0.106	0.133	0.121	0.079	0.098	0.068	Cr2O3
Fe2O3	11.099	23.040	18.202	9.703	19.860	23.322	14.763	18.906	16.084	9.749	Fe2O3
FeO	36.002	30.907	33.604	36.063	32.056	31.998	34.528	31.957	33.230	36.435	FeO
MgO	4.507	3.960	3.698	4.605	4.264	3.174	4.263	4.269	4.157	4.429	MgO
CaO	0.006	0.019	0.014	0.018	0.020	0.018	0.007	0.024	0.027	0.019	CaO
MnO	0.230	0.226	0.247	0.345	0.252	0.259	0.259	0.264	0.255	0.271	MnO
total	101.087	100.775	100.905	100.420	100.963	101.094	101.082	99.821	99.359	100.593	total
Cations/3"O"											**Cation/3"O"**
Si	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Si
Ti	0.898	0.785	0.830	0.910	0.816	0.782	0.863	0.823	0.848	0.910	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.003	0.003	0.001	0.002	0.003	0.002	0.002	0.002	0.001	Cr
Fe3+	0.203	0.426	0.336	0.178	0.365	0.433	0.271	0.351	0.300	0.179	Fe3+
Fe2+	0.731	0.635	0.690	0.736	0.655	0.660	0.703	0.660	0.689	0.743	Fe2+
Mg	0.163	0.145	0.135	0.167	0.155	0.117	0.155	0.157	0.154	0.161	Mg
Ca	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	Ca
Mn	0.005	0.005	0.005	0.007	0.005	0.005	0.005	0.006	0.005	0.006	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.473	0.440	0.454	0.477	0.449	0.439	0.463	0.452	0.459	0.476	RO2
R2O3	0.053	0.120	0.093	0.047	0.101	0.122	0.073	0.097	0.082	0.047	R2O3
RO	0.473	0.440	0.454	0.477	0.449	0.439	0.463	0.452	0.459	0.476	RO
TiO2	0.519	0.481	0.492	0.525	0.493	0.472	0.507	0.496	0.503	0.522	TiO2
Fe2O3	0.059	0.130	0.100	0.051	0.110	0.130	0.080	0.106	0.089	0.051	Fe2O3
FeO	0.422	0.389	0.409	0.424	0.396	0.398	0.413	0.398	0.408	0.426	FeO

TE 3-5 hem exsol in ilm: Traverse 1										
Corrected probe data (page 2)										Corrected
x	3272	3275	3278	3281	3284	3287	3290	3293	3328	3410 x
y	-28008	-28009	-28010	-28011	-28013	-28014	-28015	-28016	-27850	-28046 y
Point #	12	13	14	15	16	17	18	19	22	23 Point #
Comment	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1	trav 1 Comment
Wt% oxide										Wt% oxide
SiO2	0.009	0.000	0.018	0.023	0.020	0.026	0.015	0.014	0.006	0.013 SiO2
TiO2	48.917	42.543	44.775	39.219	48.699	42.458	45.712	49.283	39.486	47.896 TiO2
Al2O3	0.000	0.000	0.088	0.000	0.000	0.000	0.000	0.000	0.000	0.000 Al2O3
Cr2O3	0.042	0.106	0.095	0.191	0.031	0.109	0.071	0.057	0.170	0.101 Cr2O3
Fe2O3	11.036	22.047	17.821	28.312	11.225	22.406	16.969	10.304	27.942	12.994 Fe2O3
FeO	35.730	32.215	33.498	29.989	35.586	32.240	33.872	35.936	30.356	35.002 FeO
MgO	4.435	3.232	3.651	2.823	4.404	3.211	3.875	4.511	2.786	4.340 MgO
CaO	0.024	0.020	0.015	0.034	0.030	0.007	0.031	0.029	0.008	0.001 CaO
MnO	0.331	0.253	0.259	0.229	0.340	0.237	0.304	0.319	0.182	0.344 MnO
total	100.524	100.416	100.220	100.821	100.335	100.695	100.849	100.453	100.936	100.691 total
Cations/3"O"										Cation/3"O"
Si	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000 Si
Ti	0.898	0.793	0.832	0.733	0.896	0.790	0.842	0.904	0.737	0.879 Ti
Al	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000 Al
Cr	0.001	0.002	0.002	0.004	0.001	0.002	0.001	0.001	0.003	0.002 Cr
Fe3+	0.203	0.411	0.331	0.529	0.207	0.417	0.313	0.189	0.522	0.239 Fe3+
Fe2+	0.729	0.668	0.692	0.623	0.728	0.667	0.694	0.733	0.630	0.715 Fe2+
Mg	0.161	0.119	0.134	0.105	0.161	0.118	0.142	0.164	0.103	0.158 Mg
Ca	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.000 Ca
Mn	0.007	0.005	0.005	0.005	0.007	0.005	0.006	0.007	0.004	0.007 Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000 total
RO2	0.473	0.442	0.454	0.423	0.473	0.441	0.457	0.475	0.424	0.468 RO2
R2O3	0.054	0.115	0.092	0.154	0.055	0.117	0.085	0.050	0.151	0.064 R2O3
RO	0.473	0.442	0.454	0.423	0.473	0.441	0.457	0.475	0.424	0.468 RO
TiO2	0.519	0.476	0.492	0.452	0.519	0.474	0.498	0.522	0.453	0.513 TiO2
Fe2O3	0.059	0.123	0.098	0.163	0.060	0.125	0.092	0.055	0.160	0.070 Fe2O3
FeO	0.422	0.401	0.410	0.385	0.421	0.400	0.410	0.423	0.387	0.417 FeO

TE 3-5 hem exsol in ilm					
Corrected probe data					**Corrected**
x	3286	3367	3367	334	x
y	-28010	-27979	-27981	-28006	y
Point #	34(12)	35(13)	36(14)	37(15)	Point #
Comment					Comment
Oxide wt%					**Wt% oxide**
SiO2	0.000	0.000	0.000	0.000	SiO2
TiO2	42.119	43.707	46.415	48.553	TiO2
Al2O3	0.031	0.000	0.000	0.000	Al2O3
Cr2O3	0.070	0.098	0.078	0.038	Cr2O3
Fe2O3	23.221	20.315	15.581	11.693	Fe2O3
FeO	31.748	32.763	34.404	35.521	FeO
MgO	3.336	3.588	4.016	4.434	MgO
CaO	0.012	0.000	0.001	0.015	CaO
MnO	0.165	0.145	0.175	0.217	MnO
total	100.703	100.616	100.670	100.471	total
Cations/3"O"					**Cation/3"O"**
Si	0.000	0.000	0.000	0.000	Si
Ti	0.783	0.811	0.856	0.892	Ti
Al	0.001	0.000	0.000	0.000	Al
Cr	0.001	0.002	0.002	0.001	Cr
Fe3+	0.432	0.377	0.287	0.215	Fe3+
Fe2+	0.656	0.676	0.705	0.726	Fe2+
Mg	0.123	0.132	0.147	0.161	Mg
Ca	0.000	0.000	0.000	0.000	Ca
Mn	0.003	0.003	0.004	0.004	Mn
total	2.000	2.000	2.000	2.000	total
RO2	0.439	0.448	0.461	0.471	RO2
R2O3	0.122	0.105	0.078	0.057	R2O3
RO	0.439	0.448	0.461	0.471	RO
TiO2	0.473	0.484	0.502	0.517	TiO2
Fe2O3	0.130	0.113	0.084	0.062	Fe2O3
FeO	0.397	0.403	0.414	0.421	FeO

TE 3-5 hem exsol in ilm; traverse 3											
Corrected probe data (page 1)											Correct data
Point #	1	2	3	4	5	6	7	8	9	10	Point #
Comment	trav 3	trav 3	trav 3	trav 3	trav 3	trav 3	trav 3	trav 3	trav 3	trav 3	Comment
Oxide wt %											Oxide wt %
SiO2	0.000	0.001	0.012	0.004	0.002	0.019	0.022	0.008	0.014	0.014	SiO2
TiO2	46.730	44.557	46.114	46.726	48.385	40.219	42.693	48.724	48.989	49.033	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.054	0.058	0.050	0.014	0.026	0.124	0.087	0.012	0.000	0.056	Cr2O3
Fe2O3	15.162	19.205	16.394	15.215	11.623	27.010	22.568	11.704	11.301	10.361	Fe2O3
FeO	34.198	32.615	33.987	34.094	35.507	29.480	31.069	35.767	35.723	35.817	FeO
MgO	4.258	4.045	4.099	4.277	4.363	3.618	3.958	4.352	4.482	4.482	MgO
CaO	0.012	0.018	0.009	0.014	0.007	0.016	0.029	0.004	0.026	0.009	CaO
MnO	0.218	0.220	0.177	0.286	0.219	0.239	0.255	0.293	0.323	0.290	MnO
total	100.632	100.719	100.842	100.630	100.132	100.727	100.682	100.865	100.857	100.062	total
Cations/3O											Cations/3O
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	Si
Ti	0.860	0.822	0.848	0.860	0.892	0.747	0.790	0.892	0.896	0.904	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.001	0.001	0.001	0.000	0.001	0.002	0.002	0.000	0.000	0.001	Cr
Fe3+	0.279	0.355	0.302	0.280	0.215	0.502	0.418	0.215	0.207	0.191	Fe3+
Fe2+	0.700	0.669	0.695	0.698	0.728	0.609	0.639	0.729	0.727	0.734	Fe2+
Mg	0.155	0.148	0.149	0.156	0.159	0.133	0.145	0.158	0.162	0.164	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	Ca
Mn	0.005	0.005	0.004	0.006	0.005	0.005	0.005	0.006	0.007	0.006	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.462	0.451	0.459	0.462	0.472	0.428	0.441	0.472	0.473	0.475	RO2
R2O3	0.075	0.098	0.082	0.075	0.057	0.144	0.117	0.057	0.055	0.050	R2O3
RO	0.462	0.451	0.459	0.462	0.472	0.428	0.441	0.472	0.473	0.475	RO
TiO2	0.506	0.493	0.501	0.507	0.516	0.465	0.482	0.516	0.519	0.521	TiO2
Fe2O3	0.082	0.106	0.089	0.083	0.062	0.156	0.128	0.062	0.060	0.055	Fe2O3
FeO	0.412	0.401	0.410	0.411	0.421	0.379	0.390	0.422	0.421	0.424	FeO

TE 3-5 hem exsol in ilm; traverse 3		
Corrected probe data (page 2)		
Point #	12	13
Comment	trav 3	trav 3
Oxide wt %		
SiO2	0.012	0.000
TiO2	49.647	46.674
Al2O3	0.000	0.000
Cr2O3	0.033	0.048
Fe2O3	9.510	15.456
FeO	36.402	34.186
MgO	4.462	4.249
CaO	0.019	0.002
MnO	0.278	0.209
total	100.364	100.823
Cations/3O		
Si	0.000	0.000
Ti	0.912	0.857
Al	0.000	0.000
Cr	0.001	0.001
Fe3+	0.175	0.284
Fe2+	0.744	0.698
Mg	0.162	0.155
Ca	0.000	0.000
Mn	0.006	0.004
total	2.000	2.000
RO2	0.477	0.462
R2O3	0.046	0.077
RO	0.477	0.462
TiO2	0.523	0.505
Fe2O3	0.050	0.084
FeO	0.427	0.411

TE 3-5 hem exsol in ilm; traverse 4												
Corrected probe data (page 1)												Corrected data
Point #	1	2	3	4	5	6	7	8	9	10	11	Point #
Comment	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	Comment
Oxide wt %												Oxide wt %
SiO2	0.000	0.000	0.016	0.007	0.016	0.020	0.005	0.020	0.010	0.023	0.026	SiO2
TiO2	48.964	49.799	49.880	49.900	49.656	46.695	44.376	41.900	42.924	44.019	42.727	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.000	0.000	0.066	0.000	Al2O3
Cr2O3	0.066	0.038	0.098	0.110	0.051	0.102	0.082	0.136	0.094	0.111	0.097	Cr2O3
Fe2O3	10.934	9.719	9.365	9.379	9.551	15.443	19.359	23.578	21.347	19.485	22.319	Fe2O3
FeO	35.567	36.302	36.462	36.201	36.131	34.108	33.283	31.754	32.307	32.866	32.262	FeO
MgO	4.579	4.583	4.584	4.678	4.619	4.253	3.617	3.202	3.413	3.630	3.337	MgO
CaO	0.023	0.013	0.024	0.030	0.028	0.024	0.026	0.027	0.015	0.030	0.029	CaO
MnO	0.271	0.292	0.210	0.301	0.271	0.293	0.147	0.205	0.201	0.235	0.205	MnO
total	100.405	100.747	100.639	100.607	100.323	100.938	100.970	100.822	100.311	100.465	101.002	total
Cations/3O												Cations/3O
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	Si
Ti	0.899	0.911	0.913	0.913	0.911	0.857	0.819	0.779	0.800	0.817	0.792	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000	Al
Cr	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.002	0.002	Cr
Fe3+	0.201	0.178	0.172	0.172	0.175	0.284	0.358	0.439	0.398	0.362	0.414	Fe3+
Fe2+	0.726	0.738	0.742	0.737	0.737	0.696	0.683	0.656	0.669	0.678	0.665	Fe2+
Mg	0.167	0.166	0.166	0.170	0.168	0.155	0.132	0.118	0.126	0.133	0.123	Mg
Ca	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	Ca
Mn	0.006	0.006	0.004	0.006	0.006	0.006	0.003	0.004	0.004	0.005	0.004	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.473	0.477	0.477	0.477	0.477	0.462	0.450	0.438	0.444	0.450	0.442	RO2
R2O3	0.053	0.047	0.045	0.045	0.046	0.077	0.099	0.124	0.111	0.101	0.116	R2O3
RO	0.473	0.477	0.477	0.477	0.477	0.462	0.450	0.438	0.444	0.450	0.442	RO
TiO2	0.521	0.524	0.524	0.526	0.525	0.506	0.487	0.471	0.479	0.487	0.476	TiO2
Fe2O3	0.058	0.051	0.049	0.049	0.051	0.084	0.106	0.133	0.119	0.108	0.124	Fe2O3
FeO	0.421	0.425	0.426	0.424	0.425	0.411	0.406	0.397	0.401	0.405	0.400	FeO

TE 3-5 hem exsol in ilm; traverse 4											
Corrected probe data (page 2)											Corrected data
Point #	12	13	15	18	19	20	21	22	23	24	25	Point #
Comment	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	trav 4	Comment
Oxide wt %												Oxide wt %
SiO2	0.025	0.044	0.030	0.006	0.019	0.018	0.024	0.005	0.012	0.031	0.030	SiO2
TiO2	41.403	40.456	42.504	40.511	43.786	44.383	45.941	48.652	48.461	48.759	48.939	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.167	0.114	0.165	0.171	0.109	0.053	0.119	0.064	0.057	0.082	0.052	Cr2O3
Fe2O3	23.857	24.799	22.496	26.364	20.326	19.360	16.499	11.373	11.912	11.046	11.413	Fe2O3
FeO	31.428	30.713	31.768	30.763	32.539	32.604	33.289	35.661	35.278	35.653	35.665	FeO
MgO	3.138	3.087	3.493	3.043	3.673	3.974	4.373	4.387	4.510	4.453	4.496	MgO
CaO	0.024	0.024	0.032	0.034	0.030	0.012	0.036	0.017	0.035	0.036	0.044	CaO
MnO	0.208	0.185	0.221	0.205	0.271	0.229	0.211	0.253	0.230	0.246	0.307	MnO
total	100.251	99.422	100.709	101.097	100.753	100.633	100.492	100.412	100.495	100.306	100.946	total
Cations/3O												Cations/3O
Si	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001	Si
Ti	0.774	0.764	0.789	0.753	0.810	0.820	0.846	0.895	0.890	0.897	0.894	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.003	0.002	0.003	0.003	0.002	0.001	0.002	0.001	0.001	0.002	0.001	Cr
Fe3+	0.447	0.468	0.418	0.490	0.376	0.358	0.304	0.209	0.219	0.203	0.209	Fe3+
Fe2+	0.654	0.645	0.656	0.636	0.670	0.670	0.682	0.729	0.720	0.729	0.725	Fe2+
Mg	0.116	0.115	0.128	0.112	0.135	0.146	0.160	0.160	0.164	0.162	0.163	Mg
Ca	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.001	Ca
Mn	0.004	0.004	0.005	0.004	0.006	0.005	0.004	0.005	0.005	0.005	0.006	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.437	0.433	0.441	0.430	0.448	0.451	0.459	0.472	0.471	0.473	0.472	RO2
R2O3	0.127	0.133	0.118	0.141	0.105	0.099	0.083	0.056	0.058	0.054	0.055	R2O3
RO	0.437	0.433	0.441	0.430	0.448	0.451	0.459	0.472	0.471	0.473	0.472	RO
TiO2	0.469	0.465	0.477	0.461	0.486	0.491	0.504	0.518	0.517	0.519	0.519	TiO2
Fe2O3	0.135	0.143	0.126	0.150	0.113	0.107	0.090	0.061	0.064	0.059	0.061	Fe2O3
FeO	0.396	0.393	0.397	0.389	0.401	0.401	0.406	0.422	0.419	0.422	0.421	FeO

TE 3-5: Non-traverse point											
Corrected probe data (page 1)											
Point #	2 (area 1)	3 (area 1)	5 (area 1)	6 (area 1)	7 (area 1)	8 (area 2)	9 (area 2)	10 (area 2)	11 (area 3)	12 (area 3)	Point #
Comment:	ilm ex in px	ilm ex in px	********small ilm grain in px*********			###another ilm grain: rim by silicate###			hem ex in ilm	ilm grain	Comment:
Oxide wt %											**Oxide wt %**
SiO2	0.145	0.603	0.002	0.022	0.013	0.000	0.000	0.000	0.011	0.000	SiO2
TiO2	48.786	48.171	47.783	47.787	45.039	49.773	49.739	50.576	30.524	51.040	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.197	0.000	Al2O3
Cr2O3	0.000	0.055	0.000	0.034	0.077	0.000	0.042	0.005	0.236	0.000	Cr2O3
Fe2O3	8.357	9.077	9.895	10.516	16.292	8.864	8.603	7.075	44.321	7.051	Fe2O3
FeO	39.487	38.958	39.368	39.420	37.117	37.336	37.261	37.660	23.784	37.781	FeO
MgO	2.383	2.678	1.723	1.732	1.646	3.943	3.971	4.186	1.975	4.421	MgO
CaO	0.042	0.041	0.202	0.159	0.154	0.102	0.090	0.099	0.010	0.004	CaO
MnO	0.254	0.254	0.271	0.284	0.265	0.261	0.272	0.232	0.144	0.232	MnO
total	99.453	99.837	99.244	99.954	100.602	100.280	99.978	99.833	101.201	100.528	total
Cations/3"O"(ilm, hem); 4"O"(mt)											**Cations**
Si	0.004	0.015	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.918	0.900	0.906	0.900	0.846	0.918	0.920	0.935	0.576	0.935	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	Al
Cr	0.000	0.001	0.000	0.001	0.002	0.000	0.001	0.000	0.005	0.000	Cr
Fe3+	0.157	0.170	0.188	0.198	0.306	0.164	0.159	0.131	0.837	0.129	Fe3+
Fe2+	0.826	0.809	0.830	0.826	0.775	0.766	0.766	0.774	0.499	0.770	Fe2+
Mg	0.089	0.099	0.065	0.065	0.061	0.144	0.146	0.153	0.074	0.161	Mg
Ca	0.001	0.001	0.005	0.004	0.004	0.003	0.002	0.003	0.000	0.000	Ca
Mn	0.005	0.005	0.006	0.006	0.006	0.005	0.006	0.005	0.003	0.005	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.480	0.478	0.475	0.474	0.458	0.479	0.479	0.483	0.366	0.483	RO2
R2O3	0.041	0.045	0.049	0.052	0.083	0.043	0.042	0.034	0.269	0.033	R2O3
RO	0.480	0.478	0.475	0.474	0.458	0.479	0.479	0.483	0.366	0.483	RO
TiO2	0.504	0.502	0.495	0.493	0.477	0.520	0.521	0.527	0.386	0.528	TiO2
Fe2O3	0.043	0.047	0.051	0.054	0.086	0.046	0.045	0.037	0.280	0.037	Fe2O3
FeO	0.453	0.451	0.454	0.452	0.437	0.434	0.434	0.436	0.334	0.435	FeO

TE 3-5: Non-traverse point										
Corrected probe data (page 2)										
Point #	14 (area 4)	14 (again)	15 (area 4)	16 (area 4)	16 (again)	17 (area 4)	19 (area 5)	20 (area 5)	21 (area 5)	Point #
Comment:	? exsol in px	calc as mt	ilm ex in px	? exsol in px	calc as mt	ilm ex in px	**********large ilm grain***********			Comment:
Oxide wt %							center	rim	center	**Oxide wt %**
SiO2	0.033	0.033	1.796	0.047	0.047	4.186	0.000	0.014	0.000	SiO2
TiO2	1.060	1.060	48.119	0.525	0.525	47.412	47.786	46.305	48.029	TiO2
Al2O3	0.655	0.655	0.706	0.508	0.508	0.024	0.000	0.000	0.000	Al2O3
Cr2O3	0.599	0.599	0.040	0.574	0.574	0.000	0.055	0.024	0.040	Cr2O3
Fe2O3	100.638	65.805	6.460	102.229	67.329	4.866	12.868	15.780	12.958	Fe2O3
FeO	0.366	31.719	38.043	0.000	31.413	39.131	35.568	34.508	35.713	FeO
MgO	0.242	0.242	3.847	0.268	0.268	4.515	3.980	3.806	4.070	MgO
CaO	0.129	0.129	0.127	0.045	0.045	0.109	0.008	0.116	0.025	CaO
MnO	0.029	0.029	0.353	0.040	0.040	0.319	0.296	0.215	0.190	MnO
total	103.751	100.270	99.493	104.235	100.748	100.562	100.562	100.768	101.024	total
Cations/3"O"(ilm, hem); 4"O"(mt)										**Cations**
Si	0.001	0.001	0.044	0.001	0.002	0.100	0.000	0.000	0.000	Si
Ti	0.020	0.030	0.886	0.010	0.015	0.855	0.881	0.854	0.881	Ti
Al	0.020	0.030	0.020	0.015	0.023	0.001	0.000	0.000	0.000	Al
Cr	0.012	0.018	0.001	0.012	0.017	0.000	0.001	0.000	0.001	Cr
Fe3+	1.926	1.889	0.119	1.950	1.926	0.088	0.237	0.291	0.238	Fe3+
Fe2+	0.008	1.012	0.779	0.000	0.999	0.785	0.729	0.708	0.728	Fe2+
Mg	0.009	0.014	0.140	0.010	0.015	0.161	0.145	0.139	0.148	Mg
Ca	0.004	0.005	0.003	0.001	0.002	0.003	0.000	0.003	0.001	Ca
Mn	0.001	0.001	0.007	0.001	0.001	0.006	0.006	0.004	0.004	Mn
total	2.000	3.000	2.000	2.000	3.000	2.000	2.000	2.000	2.000	total
RO2	0.021	0.016	0.482	0.011	0.008	0.489	0.468	0.461	0.468	RO2
R2O3	0.959	0.477	0.036	0.977	0.487	0.023	0.063	0.079	0.063	R2O3
RO	0.021	0.508	0.482	0.012	0.504	0.489	0.468	0.461	0.468	RO
TiO2	0.020	0.015	0.514	0.010	0.008	0.508	0.510	0.500	0.510	TiO2
Fe2O3	0.972	0.475	0.035	0.990	0.487	0.026	0.069	0.085	0.069	Fe2O3
FeO	0.008	0.509	0.452	0.000	0.505	0.466	0.422	0.415	0.421	FeO

TE 3-5: Non-traverse point											
Corrected probe data (page 3)											
Point #	27 (area 2.1)	30 (area 3.1)	30 again	31 (area 3.1)	31 again	32 (area 3.1)	33 (area 3.1)	36 (area 3.2)	1 (area 1)	2 (area 1)	Point #
Comment:	hem ex in ilm	#rim on large sulfide grain#		interior phase in same sulfide		**ilm by same sulfide grain*		ilm grain	Ilm by opx	Ilm by opx	Comment:
Oxide wt %			calc as mt		calc as mt						**Oxide wt %**
SiO2	0.004	0.027	0.027	0.018	0.018	0.000	0.000	0.099	0.015	0.039	SiO2
TiO2	50.404	0.045	0.045	0.000	0.000	49.334	46.304	49.720	47.980	48.817	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.169	0.000	0.000	Al2O3
Cr2O3	0.021	0.011	0.011	0.000	0.000	0.028	0.069	0.007	0.078	0.082	Cr2O3
Fe2O3	7.454	104.498	69.640	104.586	69.752	9.455	13.824	9.111	11.498	10.624	Fe2O3
FeO	37.346	0.000	31.375	0.000	31.353	38.490	36.314	37.508	36.414	37.374	FeO
MgO	4.220	0.034	0.034	0.011	0.011	3.126	2.848	3.766	3.678	3.523	MgO
CaO	0.129	0.043	0.043	0.049	0.049	0.031	0.011	0.247	0.018	0.002	CaO
MnO	0.295	0.000	0.000	0.000	0.000	0.260	0.233	0.290	0.170	0.287	MnO
total	99.872	104.657	101.174	104.663	101.183	100.724	99.603	100.916	99.852	100.748	total
Cations/3"O"(ilm, hem); 4"O"(mt)											**Cations**
Si	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.002	0.000	0.001	Si
Ti	0.931	0.001	0.001	0.000	0.000	0.912	0.869	0.912	0.892	0.900	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.002	0.002	Cr
Fe3+	0.138	1.996	1.995	1.998	1.999	0.175	0.260	0.167	0.214	0.196	Fe3+
Fe2+	0.767	0.000	0.999	0.000	0.998	0.791	0.758	0.765	0.753	0.766	Fe2+
Mg	0.154	0.001	0.002	0.000	0.001	0.115	0.106	0.137	0.135	0.129	Mg
Ca	0.003	0.001	0.002	0.001	0.002	0.001	0.000	0.006	0.000	0.000	Ca
Mn	0.006	0.000	0.000	0.000	0.000	0.005	0.005	0.006	0.004	0.006	Mn
total	2.000	2.000	3.000	2.000	3.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.482	0.002	0.001	0.000	0.000	0.477	0.465	0.478	0.472	0.474	RO2
R2O3	0.036	0.996	0.498	0.998	0.499	0.046	0.070	0.045	0.057	0.052	R2O3
RO	0.482	0.002	0.501	0.002	0.500	0.477	0.465	0.478	0.472	0.474	RO
TiO2	0.527	0.001	0.001	0.000	0.000	0.509	0.495	0.518	0.509	0.510	TiO2
Fe2O3	0.039	0.999	0.499	1.000	0.500	0.049	0.074	0.047	0.061	0.056	Fe2O3
FeO	0.434	0.000	0.500	0.000	0.500	0.442	0.431	0.435	0.430	0.434	FeO

TE 11-8 Magnetite: wormy mt symplectite in same pyroxene as ilm symplectite						
Point #	5	6	7	10	11	Point #
Comment	wormy mt	wormy mt	wormy mt	wormy mt	wormy mt	Comment
Wt% oxide						Wt% oxide
SiO2	0.042	0.044	0.025	0.047	0.054	SiO2
TiO2	0.066	0.019	0.069	0.037	0.134	TiO2
Al2O3	0.328	0.077	0.435	0.089	0.229	Al2O3
Cr2O3	1.059	1.080	1.128	0.950	1.037	Cr2O3
V2O3	0.624	0.680	0.777	0.706	0.689	V2O3
Fe2O3	67.289	67.664	66.742	67.717	66.561	Fe2O3
FeO	30.725	30.620	30.331	30.593	30.384	FeO
MgO	0.066	0.058	0.166	0.050	0.094	MgO
CaO	0.036	0.065	0.047	0.046	0.048	CaO
MnO	0.000	0.000	0.000	0.008	0.000	MnO
ZnO	0.719	0.754	0.834	0.845	0.776	ZnO
total	100.954	101.061	100.555	101.088	100.005	total
Cations/4"O"						Cations/4"O"
Si	0.002	0.002	0.001	0.002	0.002	Si
Ti	0.002	0.001	0.002	0.001	0.004	Ti
Al	0.015	0.003	0.020	0.004	0.010	Al
Cr	0.032	0.033	0.034	0.029	0.032	Cr
V3+	0.019	0.021	0.024	0.022	0.021	V3+
Fe 3+	1.927	1.939	1.917	1.940	1.925	Fe 3+
Fe 2+	0.978	0.975	0.968	0.974	0.977	Fe 2+
Mg	0.004	0.003	0.009	0.003	0.005	Mg
Ca	0.001	0.003	0.002	0.002	0.002	Ca
Mn	0.000	0.000	0.000	0.000	0.000	Mn
Zn	0.020	0.021	0.024	0.024	0.022	Zn
total	3.000	3.000	3.000	3.000	3.000	total
RO2	0.002	0.001	0.001	0.001	0.003	RO2
R2O3	0.497	0.498	0.498	0.498	0.496	R2O3
RO	0.501	0.501	0.501	0.501	0.501	RO
TiO2	0.001	0.000	0.001	0.001	0.002	TiO2
Fe2O3	0.496	0.498	0.497	0.499	0.495	Fe2O3
FeO	0.503	0.501	0.502	0.501	0.503	FeO

TE11-8 Ilmenites: discrete grains and exsolution in pyroxene												
Corrected probe data (page 1)												
Point #	1	2	3	12	13	14	15	16	17	18	19	Point #
Comment	ilmenite sym in px with visible hem exsol			small equant grain in px		small equant grain in px		center of a much larger ilm		same ilm	same ilm	Comment
Cor. Wt% oxide				no hem exsolution		with hem exsolution				edge by biotite	edge by sulfide	Wt% oxide
SiO2	0.019	0.011	0.005	0.021	0.073	0.052	0.051	0.019	0.022	0.022	0.026	SiO2
TiO2	48.136	45.120	47.138	47.519	47.303	46.832	45.854	46.806	47.429	46.629	46.226	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.087	0.111	0.106	0.062	0.065	0.094	0.117	0.083	0.079	0.095	0.048	Cr2O3
Fe2O3	10.314	15.846	12.697	10.293	10.805	11.571	13.077	12.950	12.214	12.704	14.198	Fe2O3
FeO	39.024	36.603	38.237	39.228	39.041	38.871	38.003	37.294	37.790	37.321	36.784	FeO
MgO	2.160	2.035	2.095	1.802	1.820	1.691	1.646	2.519	2.566	2.420	2.480	MgO
CaO	0.048	0.025	0.043	0.033	0.026	0.025	0.039	0.030	0.018	0.031	0.095	CaO
MnO	0.370	0.322	0.365	0.272	0.303	0.256	0.305	0.288	0.287	0.281	0.271	MnO
total	100.158	100.073	100.686	99.230	99.436	99.392	99.092	99.989	100.406	99.502	100.128	total
Corrected cations/3"O"												Cations/3O
Si	0.000	0.000	0.000	0.001	0.002	0.001	0.001	0.000	0.001	0.001	0.001	Si
Ti	0.902	0.849	0.880	0.901	0.895	0.888	0.873	0.877	0.885	0.879	0.866	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	Cr
Fe3+	0.193	0.298	0.237	0.195	0.205	0.220	0.249	0.243	0.228	0.240	0.266	Fe3+
Fe2+	0.813	0.766	0.794	0.827	0.822	0.820	0.805	0.777	0.784	0.782	0.766	Fe2+
Mg	0.080	0.076	0.078	0.068	0.068	0.064	0.062	0.094	0.095	0.090	0.092	Mg
Ca	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.003	Ca
Mn	0.008	0.007	0.008	0.006	0.006	0.005	0.007	0.006	0.006	0.006	0.006	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.474	0.459	0.468	0.474	0.473	0.471	0.466	0.467	0.470	0.468	0.464	RO2
R2O3	0.051	0.081	0.064	0.052	0.054	0.059	0.067	0.065	0.061	0.064	0.072	R2O3
RO	0.474	0.459	0.468	0.474	0.473	0.471	0.466	0.467	0.470	0.468	0.464	RO
TiO2	0.498	0.481	0.491	0.493	0.492	0.489	0.484	0.494	0.496	0.493	0.491	TiO2
Fe2O3	0.053	0.085	0.066	0.053	0.056	0.060	0.069	0.068	0.064	0.067	0.075	Fe2O3
FeO	0.449	0.434	0.443	0.453	0.452	0.451	0.446	0.438	0.440	0.439	0.434	FeO

TE11-8 Ilmenites: discrete grains and exsolution in pyroxene (cont'd)											
Corrected probe data (page 2)											
Point #	20	22	23	24	26	27	28	29	30	31	Point #
Comment	same ilm	**********	**********	**these points are attempts to hit hem exsolution in ilm***				**********	**********	**********	Comment
Wt% oxide	edge by sulfid	hem exsol	ilm by hem	ilm by hem	hem exsol	ilm	hem exsol	ilm	hem exsol	ilm	Wt% oxide
SiO2	0.016	0.015	0.019	0.029	0.011	0.017	0.023	0.020	0.012	0.002	SiO2
TiO2	48.166	32.000	49.925	45.083	23.720	49.309	39.202	48.430	31.754	48.883	TiO2
Al2O3	0.000	0.022	0.000	0.000	0.037	0.000	0.051	0.000	0.025	0.000	Al2O3
Cr2O3	0.029	0.242	0.059	0.060	0.268	0.055	0.112	0.059	0.271	0.045	Cr2O3
Fe2O3	10.335	41.003	6.993	15.947	56.211	8.489	27.835	10.084	41.698	9.843	Fe2O3
FeO	38.234	26.697	39.464	35.442	19.754	38.874	31.375	38.225	24.870	38.624	FeO
MgO	2.624	1.161	2.865	2.732	0.803	2.918	2.058	2.818	1.924	2.814	MgO
CaO	0.075	0.041	0.015	0.028	0.037	0.020	0.030	0.028	0.056	0.042	CaO
MnO	0.322	0.137	0.325	0.226	0.110	0.259	0.197	0.288	0.196	0.265	MnO
total	99.801	101.318	99.665	99.547	100.951	99.940	100.883	99.952	100.806	100.518	total
Corrected cations/3"O"											Cations/3O
Si	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	Si
Ti	0.902	0.607	0.934	0.849	0.456	0.920	0.736	0.905	0.601	0.908	Ti
Al	0.000	0.001	0.000	0.000	0.001	0.000	0.002	0.000	0.001	0.000	Al
Cr	0.001	0.005	0.001	0.001	0.005	0.001	0.002	0.001	0.005	0.001	Cr
Fe3+	0.194	0.779	0.131	0.300	1.081	0.158	0.523	0.188	0.790	0.183	Fe3+
Fe2+	0.797	0.560	0.821	0.742	0.422	0.806	0.655	0.794	0.524	0.798	Fe2+
Mg	0.097	0.044	0.106	0.102	0.031	0.108	0.077	0.104	0.072	0.104	Mg
Ca	0.002	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.001	Ca
Mn	0.007	0.003	0.007	0.005	0.002	0.005	0.004	0.006	0.004	0.006	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.474	0.378	0.483	0.459	0.313	0.479	0.424	0.475	0.376	0.476	RO2
R2O3	0.051	0.244	0.034	0.082	0.373	0.042	0.152	0.050	0.249	0.048	R2O3
RO	0.474	0.378	0.483	0.459	0.313	0.479	0.424	0.475	0.376	0.476	RO
TiO2	0.502	0.390	0.513	0.488	0.321	0.509	0.445	0.505	0.396	0.505	TiO2
Fe2O3	0.054	0.250	0.036	0.086	0.381	0.044	0.158	0.053	0.260	0.051	Fe2O3
FeO	0.444	0.360	0.451	0.426	0.298	0.447	0.396	0.443	0.345	0.444	FeO

TE-11-8 hematite exsolution in ilmenite					
Corrected probe data					
Point #	1	2	4	5	Point #
Comment	ilm-hem	ilm-hem	ilm-hem	ilm-hem	Comment
Cor. oxide wt %					
SiO2	0.000	0.010	0.000	0.009	SiO2
TiO2	32.123	28.048	29.688	34.556	TiO2
Al2O3	0.000	0.109	0.026	0.060	Al2O3
Cr2O3	0.256	0.223	0.188	0.214	Cr2O3
V2O3	0.329	0.408	0.382	0.317	V2O3
Fe2O3	39.959	47.214	43.857	34.579	Fe2O3
FeO	25.384	22.428	23.398	27.182	FeO
MgO	1.386	1.105	1.406	1.628	MgO
CaO	0.015	0.022	0.031	0.030	CaO
MnO	0.207	0.126	0.144	0.164	MnO
ZnO	0.911	0.772	0.688	0.903	ZnO
total	100.570	100.465	99.809	99.643	total
Corrected cations/3"O"					
Si	0.000	0.000	0.000	0.000	Si
Ti	0.613	0.538	0.571	0.662	Ti
Al	0.000	0.003	0.001	0.002	Al
Cr	0.005	0.004	0.004	0.004	Cr
V3+	0.007	0.008	0.008	0.006	V3+
Fe3+	0.763	0.907	0.845	0.663	Fe3+
Fe2+	0.538	0.479	0.501	0.579	Fe2+
Mg	0.052	0.042	0.054	0.062	Mg
Ca	0.000	0.001	0.001	0.001	Ca
Mn	0.004	0.003	0.003	0.004	Mn
Zn	0.017	0.015	0.013	0.017	Zn
total	2.000	2.000	2.000	2.000	total
RO2	0.380	0.350	0.364	0.398	RO2
R2O3	0.240	0.300	0.273	0.203	R2O3
RO	0.380	0.350	0.364	0.398	RO
TiO2	0.400	0.366	0.382	0.421	TiO2
Fe2O3	0.249	0.308	0.283	0.211	Fe2O3
FeO	0.351	0.326	0.335	0.368	FeO

TE-11-8 new: ilmenite and magnetite data												
Corrected probe data												
Point #	2	5	6	7	9	13	14	15	16	17	19	Point #
Comment	ilm in sym	ilm in sym	mt in sym	mt in sym	large ilm trav	large ilm trav	large ilm trav	large ilm trav	large ilm trav	large ilm trav	large ilm trav	Comment
Wt% oxide	with opx	with opx	with opx	with opx	interior						rim	Wt% oxide
SiO2	0.033	0.029	0.062	0.061	0.007	0.016	0.000	0.000	0.017	0.000	0.006	SiO2
TiO2	44.421	45.095	0.000	0.000	47.626	43.249	47.392	39.193	39.854	48.326	46.054	TiO2
Al2O3	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.051	0.000	0.000	0.009	Al2O3
Cr2O3	0.111	0.122	1.276	1.191	0.067	0.089	0.051	0.190	0.171	0.101	0.079	Cr2O3
V2O3	0.239	0.183	0.558	0.489	0.224	0.305	0.241	0.280	0.329	0.245	0.224	V2O3
Fe2O3	17.080	14.620	66.602	66.754	10.434	18.719	11.745	26.815	25.835	9.517	13.747	Fe2O3
FeO	35.146	36.136	30.258	30.086	36.850	33.144	36.314	29.950	30.645	36.953	35.305	FeO
MgO	2.176	1.986	0.040	0.066	2.924	2.754	3.072	2.479	2.484	3.114	2.939	MgO
CaO	0.039	0.024	0.040	0.056	0.018	0.029	0.031	0.025	0.020	0.027	0.055	CaO
MnO	0.352	0.332	0.091	0.083	0.265	0.257	0.314	0.260	0.204	0.251	0.241	MnO
ZnO	0.629	0.616	0.589	0.733	0.548	0.636	0.534	0.659	0.629	0.755	0.639	ZnO
total	100.226	99.143	99.515	99.549	98.963	99.198	99.694	99.901	100.188	99.288	99.298	total
Corrected cations/3"O"(ilm); 4"O"(mt)												Cor. cations
Si	0.001	0.001	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.835	0.857	0.000	0.000	0.898	0.818	0.887	0.741	0.751	0.907	0.867	Ti
Al	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.002	0.000	0.000	0.000	Al
Cr	0.002	0.002	0.039	0.036	0.001	0.002	0.001	0.004	0.003	0.002	0.002	Cr
V3+	0.005	0.004	0.017	0.015	0.005	0.006	0.005	0.006	0.007	0.005	0.004	V3+
Fe3+	0.321	0.278	1.939	1.942	0.197	0.354	0.220	0.507	0.487	0.179	0.259	Fe3+
Fe2+	0.735	0.764	0.979	0.973	0.773	0.697	0.756	0.630	0.642	0.771	0.739	Fe2+
Mg	0.081	0.075	0.002	0.004	0.109	0.103	0.114	0.093	0.093	0.116	0.110	Mg
Ca	0.001	0.001	0.002	0.002	0.000	0.001	0.001	0.001	0.001	0.001	0.001	Ca
Mn	0.007	0.007	0.003	0.003	0.006	0.005	0.007	0.006	0.004	0.005	0.005	Mn
Zn	0.012	0.011	0.017	0.021	0.010	0.012	0.010	0.012	0.012	0.014	0.012	Zn
total	2.000	2.000	3.000	3.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.455	0.462	0.001	0.001	0.473	0.450	0.470	0.426	0.429	0.476	0.464	RO2
R2O3	0.089	0.076	0.498	0.498	0.053	0.100	0.060	0.149	0.142	0.049	0.071	R2O3
RO	0.455	0.462	0.501	0.501	0.473	0.450	0.470	0.426	0.429	0.476	0.464	RO
TiO2	0.483	0.487	0.000	0.000	0.508	0.483	0.506	0.456	0.459	0.513	0.500	TiO2
Fe2O3	0.093	0.079	0.498	0.500	0.056	0.105	0.063	0.156	0.149	0.051	0.075	Fe2O3
FeO	0.425	0.434	0.502	0.500	0.437	0.412	0.431	0.388	0.392	0.436	0.426	FeO

TE 3-5: Traverse across an orthopyroxene grain											
Probe wt% oxide (page 1 or 2)											**Wt % oxide**
Point #	3	4	6	7	8	9	10	11	12	13	Point #
Comment:	Opx by ilm	Opx	Opx	Opx	Opx	Opx	Opx	Opx	Opx	Opx	Comment
SiO2	55.304	54.729	54.931	54.964	54.830	54.801	53.941	54.597	54.682	54.532	SiO2
TiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Al2O3	2.133	2.029	1.813	1.962	1.955	1.975	1.945	1.936	1.884	1.971	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr2O3
Fe2O3	0.000	0.060	0.074	0.429	0.030	0.471	2.612	0.267	0.823	0.000	Fe2O3
FeO	14.025	14.738	15.406	15.046	15.240	15.202	13.372	14.984	14.883	14.719	FeO
MgO	28.612	27.804	27.660	27.875	27.672	27.654	28.090	27.522	27.764	27.840	MgO
MnO	0.092	0.192	0.149	0.163	0.120	0.134	0.137	0.130	0.115	0.071	MnO
CaO	0.573	0.724	0.622	0.618	0.652	0.704	0.696	0.803	0.692	0.599	CaO
Na2O	0.017	0.006	0.007	0.009	0.010	0.000	0.007	0.019	0.004	0.003	Na2O
K2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	K2O
Total	100.756	100.282	100.662	101.066	100.509	100.941	100.800	100.258	100.847	99.735	Total
Cations/6"O"											**Cations**
Si	1.958	1.957	1.961	1.953	1.959	1.952	1.924	1.956	1.950	1.959	Si
Al	0.042	0.043	0.039	0.047	0.041	0.048	0.076	0.044	0.050	0.041	Al
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Ti											Ti
Al	0.047	0.043	0.037	0.035	0.041	0.035	0.006	0.038	0.029	0.042	Al
Cr											Cr
Fe3+		0.002	0.002	0.011	0.001	0.013	0.070	0.007	0.022		Fe3+
Fe2+	0.415	0.441	0.460	0.447	0.455	0.453	0.399	0.449	0.444	0.442	Fe2+
Mg	1.510	1.482	1.472	1.477	1.473	1.468	1.494	1.470	1.475	1.490	Mg
Mn	0.003	0.006	0.004	0.005	0.004	0.004	0.004	0.004	0.003	0.002	Mn
Ca	0.022	0.028	0.024	0.024	0.025	0.027	0.027	0.031	0.026	0.023	Ca
Na	0.001		0.001	0.001	0.001		0.001	0.001			Na
K											K
total	1.998	2.002	2.000	2.000	2.000	2.000	2.001	2.000	1.999	1.999	total

TE 3-5: Traverse from ilmenite across an area of orthopyroxene to plagioclase (continued)					
Probe wt% oxide (page 2 or 2)					**Wt % oxide**
Point #	14	15	16	18	Point #
Comment:	Opx	Opx	Opx	Opx by plag	Comment
SiO2	54.233	54.054	53.308	53.631	SiO2
TiO2	0.000	0.000	0.000	0.000	TiO2
Al2O3	1.977	2.069	2.032	2.033	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	Cr2O3
Fe2O3	0.795	1.219	2.763	2.078	Fe2O3
FeO	14.343	14.064	13.282	13.874	FeO
MgO	27.831	27.865	27.733	27.670	MgO
MnO	0.091	0.103	0.093	0.093	MnO
CaO	0.618	0.608	0.710	0.608	CaO
Na2O	0.004	0.005	0.007	0.014	Na2O
K2O	0.000	0.000	0.000	0.000	K2O
Total	99.892	99.987	99.928	100.001	Total
Cations/6"O"					**Cations**
Si	1.948	1.940	1.920	1.929	Si
Al	0.052	0.060	0.080	0.071	Al
total	2.000	2.000	2.000	2.000	total
Ti					Ti
Al	0.032	0.028	0.006	0.015	Al
Cr					Cr
Fe3+	0.021	0.033	0.075	0.056	Fe3+
Fe2+	0.431	0.422	0.400	0.417	Fe2+
Mg	1.490	1.491	1.489	1.484	Mg
Mn	0.003	0.003	0.003	0.003	Mn
Ca	0.024	0.023	0.027	0.023	Ca
Na				0.001	Na
K					K
total	2.001	2.000	2.000	1.999	total

TE 16-4 Ilmenite Traverse 1: Going from ilmenite center across a spinel symplectite edge to magnetite											
Corrected probe data											
Point #	1	2	3	4	5	6	7	8	9	10	Point #
Comment	Ilm center										Comment
Corr Wt% oxide											Cor Wt% oxide
SiO2	0.006	0.000	0.035	0.002	0.004	0.004	0.043	0.001	0.024	0.004	SiO2
TiO2	51.267	51.189	51.621	51.604	51.712	52.057	51.821	51.807	51.845	52.110	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.000	0.016	0.022	0.019	0.000	0.002	0.012	0.005	0.000	0.000	Cr2O3
Fe2O3	4.026	4.687	4.207	3.125	3.279	1.935	2.128	2.722	1.849	2.253	Fe2O3
FeO	42.785	42.764	43.064	43.306	43.579	44.064	43.711	43.880	43.808	44.347	FeO
MgO	1.564	1.528	1.563	1.403	1.245	1.180	1.252	1.083	1.100	1.018	MgO
CaO	0.008	0.000	0.000	0.000	0.005	0.003	0.000	0.000	0.003	0.009	CaO
MnO	0.520	0.538	0.605	0.593	0.694	0.638	0.700	0.769	0.867	0.683	MnO
total	100.176	100.722	101.117	100.053	100.518	99.883	99.668	100.267	99.496	100.425	total
Corr cat/3"O" (ilm); cat/4"O" (spi+mt)											Corrected cat
Si	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	Si
Ti	0.962	0.956	0.960	0.970	0.969	0.982	0.979	0.974	0.982	0.979	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
Fe3+	0.076	0.088	0.078	0.059	0.061	0.037	0.040	0.051	0.035	0.042	Fe3+
Fe2+	0.893	0.888	0.890	0.906	0.908	0.924	0.918	0.918	0.923	0.926	Fe2+
Mg	0.058	0.057	0.058	0.052	0.046	0.044	0.047	0.040	0.041	0.038	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.011	0.011	0.013	0.013	0.015	0.014	0.015	0.016	0.018	0.014	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.490	0.489	0.490	0.492	0.492	0.495	0.495	0.494	0.496	0.495	RO2
R2O3	0.019	0.022	0.020	0.015	0.016	0.009	0.010	0.013	0.009	0.011	R2O3
RO	0.490	0.489	0.490	0.492	0.492	0.495	0.495	0.494	0.496	0.495	RO
TiO2	0.508	0.506	0.508	0.509	0.508	0.510	0.511	0.508	0.511	0.508	TiO2
Fe2O3	0.020	0.023	0.021	0.015	0.016	0.009	0.010	0.013	0.009	0.011	Fe2O3
FeO	0.472	0.470	0.471	0.475	0.476	0.480	0.479	0.479	0.480	0.481	FeO

TE 16-4 Ilmenite Traverse 1, continued					
Corrected probe data					
Point #	11	12	13	15	Point #
Comment	approaching rim		ilm rim	magnetite	Comment
Corr Wt% oxide					Cor Wt% oxide
SiO2	0.008	0.009	0.015	0.199	SiO2
TiO2	51.906	51.914	50.471	3.849	TiO2
Al2O3	0.000	0.000	2.019	1.092	Al2O3
Cr2O3	0.000	0.000	0.017	0.000	Cr2O3
Fe2O3	1.766	1.244	3.405	60.803	Fe2O3
FeO	44.371	44.388	42.688	35.230	FeO
MgO	0.909	0.819	1.067	0.115	MgO
CaO	0.000	0.000	0.000	0.015	CaO
MnO	0.686	0.836	0.804	0.078	MnO
total	99.647	99.210	100.486	101.381	total
Corr cat/3"O" (ilm); cat/4"O" (spi+mt)					Corrected cat
Si	0.000	0.000	0.000	0.007	Si
Ti	0.983	0.988	0.938	0.109	Ti
Al	0.000	0.000	0.059	0.048	Al
Cr	0.000	0.000	0.000	0.000	Cr
Fe3+	0.033	0.024	0.063	1.719	Fe3+
Fe2+	0.935	0.939	0.883	1.107	Fe2+
Mg	0.034	0.031	0.039	0.006	Mg
Ca	0.000	0.000	0.000	0.001	Ca
Mn	0.015	0.018	0.017	0.002	Mn
total	2.000	2.000	2.000	3.000	total
RO2	0.496	0.497	0.484	0.055	RO2
R2O3	0.008	0.006	0.032	0.418	R2O3
RO	0.496	0.497	0.484	0.528	RO
TiO2	0.508	0.509	0.507	0.052	TiO2
Fe2O3	0.009	0.006	0.017	0.414	Fe2O3
FeO	0.483	0.484	0.476	0.533	FeO

TE 16-4 Magnetite										
Corrected probe data										
Point #	1	2	3	4	5	6	7	8	9	Point #
Comment	magnetite by symplectite		magnetite by symplectite		mt center	mt center	mt center	### edge by silicate ###		Comment
Corr Wt% oxide										Cor Wt% oxide
SiO2	0.036	0.881	0.018	0.014	0.057	0.035	0.047	0.032	0.166	SiO2
TiO2	8.958	8.729	4.059	20.392	19.809	18.690	7.650	6.109	18.649	TiO2
Al2O3	1.559	2.471	0.898	1.375	3.661	9.307	1.735	1.460	6.798	Al2O3
Cr2O3	0.000	0.047	0.027	0.027	0.035	0.031	0.000	0.015	0.027	Cr2O3
V2O3	0.363	0.382	0.272	0.293	0.436	0.400	0.288	0.322	0.377	V2O3
Fe2O3	48.637	43.720	59.948	24.872	25.894	17.897	51.613	56.072	23.633	Fe2O3
FeO	38.456	37.920	34.435	47.528	48.831	46.817	37.597	36.635	48.362	FeO
MgO	0.214	0.344	0.103	0.363	0.318	0.533	0.216	0.165	0.258	MgO
CaO	0.022	0.017	0.002	0.000	0.020	0.009	0.000	0.000	0.000	CaO
MnO	0.144	0.177	0.038	0.401	0.306	0.440	0.104	0.101	0.331	MnO
ZnO	0.389	0.783	0.489	0.505	0.556	0.337	0.417	0.512	0.456	ZnO
total	98.778	95.470	100.289	95.770	99.923	94.496	99.667	101.423	99.058	total
Corr cat/4"O"										Corr cat/4"O"
Si	0.001	0.035	0.001	0.001	0.002	0.001	0.002	0.001	0.006	Si
Ti	0.258	0.257	0.116	0.598	0.551	0.531	0.218	0.172	0.515	Ti
Al	0.070	0.114	0.040	0.063	0.160	0.414	0.078	0.064	0.294	Al
Cr	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	Cr
V	0.011	0.012	0.008	0.009	0.013	0.012	0.009	0.010	0.011	V
Fe3+	1.400	1.289	1.717	0.730	0.720	0.509	1.474	1.579	0.653	Fe3+
Fe2+	1.230	1.242	1.096	1.550	1.510	1.478	1.193	1.147	1.484	Fe2+
Mg	0.012	0.020	0.006	0.021	0.018	0.030	0.012	0.009	0.014	Mg
Ca	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	Ca
Mn	0.005	0.006	0.001	0.013	0.010	0.014	0.003	0.003	0.010	Mn
Zn	0.011	0.023	0.014	0.015	0.015	0.009	0.012	0.014	0.012	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.115	0.127	0.055	0.230	0.217	0.210	0.099	0.080	0.207	RO2
R2O3	0.328	0.309	0.417	0.154	0.175	0.185	0.351	0.380	0.190	R2O3
RO	0.557	0.564	0.528	0.615	0.608	0.605	0.550	0.540	0.603	RO
TiO2	0.118	0.120	0.056	0.238	0.228	0.234	0.102	0.082	0.221	TiO2
Fe2O3	0.320	0.301	0.415	0.145	0.149	0.112	0.343	0.375	0.140	Fe2O3
FeO	0.562	0.579	0.529	0.617	0.624	0.653	0.555	0.544	0.638	FeO

TE 16-4 Magnetite							
Corrected probe data							
Point #	10	11	12	9a	10a	12a	Point #
Comment	********mt near spinel exsol ********			####clean mt by spinel exsolution###			Comment
Corr Wt% oxide							Cor Wt% oxide
SiO2	0.042	0.026	0.049	0.142	0.141	0.150	SiO2
TiO2	10.002	4.924	6.819	4.108	2.633	4.544	TiO2
Al2O3	3.485	0.902	1.303	0.000	0.068	0.496	Al2O3
Cr2O3	0.035	0.000	0.000	0.068	0.113	0.131	Cr2O3
V2O3	0.355	0.320	0.294	0.328	0.327	0.417	V2O3
Fe2O3	44.249	58.649	53.616	59.964	63.015	58.288	Fe2O3
FeO	39.837	35.519	36.973	33.855	32.710	34.278	FeO
MgO	0.133	0.096	0.064	0.000	0.000	0.000	MgO
CaO	0.013	0.001	0.014	0.081	0.054	0.089	CaO
MnO	0.161	0.079	0.093	0.225	0.143	0.187	MnO
ZnO	0.441	0.366	0.414	0.804	0.859	0.891	ZnO
total	98.753	100.882	99.639	99.575	100.063	99.470	total
Corr cat/4"O"							Corr cat/4"O"
Si	0.002	0.001	0.002	0.005	0.005	0.006	Si
Ti	0.285	0.140	0.195	0.119	0.076	0.131	Ti
Al	0.155	0.040	0.059	0.000	0.003	0.022	Al
Cr	0.001	0.000	0.000	0.002	0.003	0.004	Cr
V	0.011	0.010	0.009	0.010	0.010	0.013	V
Fe3+	1.260	1.668	1.538	1.739	1.821	1.686	Fe3+
Fe2+	1.261	1.123	1.179	1.091	1.050	1.102	Fe2+
Mg	0.008	0.005	0.004	0.000	0.000	0.000	Mg
Ca	0.001	0.000	0.001	0.003	0.002	0.004	Ca
Mn	0.005	0.003	0.003	0.007	0.005	0.006	Mn
Zn	0.012	0.010	0.012	0.023	0.024	0.025	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.125	0.066	0.090	0.059	0.039	0.064	RO2
R2O3	0.312	0.401	0.365	0.412	0.441	0.404	R2O3
RO	0.563	0.533	0.545	0.529	0.520	0.532	RO
TiO2	0.131	0.067	0.091	0.057	0.037	0.063	TiO2
Fe2O3	0.290	0.398	0.359	0.418	0.447	0.406	Fe2O3
FeO	0.580	0.535	0.550	0.525	0.516	0.531	FeO

TE 16-4: Spinels					
Corrected probe data					
Point #	1	3	4	5	Point #
Comment	spinel in sym	spinel in sym	spinel in sym	spinel in sym	Comment
Corrected Wt% oxide					Cor Wt% oxide
SiO2	0.065	0.041	1.199	0.203	SiO2
TiO2	0.562	0.632	0.677	0.566	TiO2
Al2O3	60.761	60.420	59.386	60.892	Al2O3
Cr2O3	0.048	0.020	0.000	0.045	Cr2O3
V2O3	0.071	0.000	0.050	0.024	V2O3
Fe2O3	2.093	2.270	0.000	1.735	Fe2O3
FeO	22.429	22.181	24.461	20.846	FeO
MgO	10.052	9.991	9.587	11.211	MgO
CaO	0.023	0.010	0.046	0.019	CaO
MnO	0.162	0.200	0.133	0.131	MnO
ZnO	5.046	5.268	4.355	4.818	ZnO
total	101.312	101.032	99.894	100.490	total
Corr cat/4"O"					Corr cat/4"O"
Si	0.002	0.001	0.033	0.005	Si
Ti	0.011	0.013	0.014	0.011	Ti
Al	1.929	1.925	1.910	1.930	Al
Cr	0.001	0.000	0.000	0.001	Cr
V3+	0.002	0.000	0.001	0.001	V3+
Fe3+	0.042	0.046	0.000	0.035	Fe3+
Fe2+	0.505	0.501	0.558	0.469	Fe2+
Mg	0.403	0.402	0.390	0.449	Mg
Ca	0.001	0.000	0.001	0.001	Ca
Mn	0.004	0.005	0.003	0.003	Mn
Zn	0.100	0.105	0.088	0.096	Zn
total	3.000	3.000	2.998	3.000	total
RO2	0.007	0.007	0.023	0.008	RO2
R2O3	0.490	0.490	0.466	0.487	R2O3
RO	0.503	0.503	0.511	0.504	RO
TiO2	0.021	0.024	0.024	0.023	TiO2
Fe2O3	0.039	0.043	0.000	0.035	Fe2O3
FeO	0.939	0.933	0.976	0.942	FeO

TE 16-4: Clean magnetite by spinel exsolution				
Corrected probe data				
Point #	9	10	12	Point #
Comment	clean mt by ex	clean mt by ex	clean mt by ex	Comment
Corrected Wt% oxide				Cor Wt% oxide
SiO2	0.142	0.141	0.150	SiO2
TiO2	4.108	2.633	4.544	TiO2
Al2O3	0.000	0.068	0.496	Al2O3
Cr2O3	0.068	0.113	0.131	Cr2O3
V2O3	0.328	0.327	0.417	V2O3
Fe2O3	59.964	63.015	58.288	Fe2O3
FeO	33.855	32.710	34.278	FeO
MgO	0.000	0.000	0.000	MgO
CaO	0.081	0.054	0.089	CaO
MnO	0.225	0.143	0.187	MnO
ZnO	0.804	0.859	0.891	ZnO
total	99.575	100.063	99.470	total
Corr cat/4"O"				Corr cat/4"O"
Si	0.005	0.005	0.006	Si
Ti	0.119	0.076	0.131	Ti
Al	0.000	0.003	0.022	Al
Cr	0.002	0.003	0.004	Cr
V3+	0.010	0.010	0.013	V3+
Fe3+	1.739	1.821	1.686	Fe3+
Fe2+	1.091	1.050	1.102	Fe2+
Mg	0.000	0.000	0.000	Mg
Ca	0.003	0.002	0.004	Ca
Mn	0.007	0.005	0.006	Mn
Zn	0.023	0.024	0.025	Zn
total	3.000	3.000	3.000	total
RO2	0.059	0.039	0.064	RO2
R2O3	0.412	0.441	0.404	R2O3
RO	0.529	0.520	0.532	RO
TiO2	0.057	0.037	0.063	TiO2
Fe2O3	0.418	0.447	0.406	Fe2O3
FeO	0.525	0.516	0.531	FeO

TE26 Traverse 1											
Corrected Probe Data (page 1)											
Point #	1	2	5	6	7	8	10	11	12	15	Point #
Comment	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	symplectite	Comment
Corrected wt% oxide											Oxide wt %
SiO2	0.000	0.000	0.014	0.004	0.000	0.002	0.007	0.026	0.000	0.059	SiO2
TiO2	51.130	51.053	50.513	51.016	50.988	50.694	51.120	51.774	51.480	33.103	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	21.821	Al2O3
Cr2O3	0.024	0.026	0.000	0.019	0.019	0.031	0.000	0.026	0.000	0.028	Cr2O3
Fe2O3	4.000	3.763	4.166	4.167	4.450	4.565	3.341	2.849	3.764	18.570	Fe2O3
FeO	43.119	43.122	42.512	42.804	42.755	42.814	43.318	43.595	43.328	20.331	FeO
MgO	1.222	1.205	1.352	1.373	1.370	1.208	1.034	1.346	1.308	5.055	MgO
CaO	0.000	0.021	0.000	0.026	0.022	0.003	0.029	0.010	0.016	0.003	CaO
MnO	0.673	0.605	0.513	0.589	0.618	0.611	0.770	0.575	0.606	0.489	MnO
total	100.168	99.795	99.070	99.998	100.223	99.927	99.620	100.201	100.502	99.459	total
Corrected cations/3"O"(ilm); cations/4"O" (mt,spi)											Cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	Si
Ti	0.962	0.964	0.960	0.960	0.958	0.957	0.968	0.972	0.965	0.556	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.574	Al
Cr	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	Cr
Fe3+	0.075	0.071	0.079	0.078	0.084	0.086	0.063	0.054	0.071	0.312	Fe3+
Fe2+	0.902	0.906	0.898	0.896	0.893	0.898	0.912	0.910	0.903	0.379	Fe2+
Mg	0.046	0.045	0.051	0.051	0.051	0.045	0.039	0.050	0.049	0.168	Mg
Ca	0.000	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000	Ca
Mn	0.014	0.013	0.011	0.012	0.013	0.013	0.016	0.012	0.013	0.009	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.490	0.491	0.490	0.490	0.489	0.489	0.492	0.493	0.491	0.358	RO2
R2O3	0.019	0.018	0.020	0.020	0.021	0.022	0.016	0.014	0.018	0.285	R2O3
RO	0.490	0.491	0.490	0.490	0.489	0.489	0.492	0.493	0.491	0.358	RO
TiO2	0.506	0.506	0.506	0.507	0.506	0.504	0.506	0.509	0.507	0.509	TiO2
Fe2O3	0.020	0.019	0.021	0.021	0.022	0.023	0.017	0.014	0.019	0.143	Fe2O3
FeO	0.474	0.475	0.473	0.473	0.472	0.473	0.477	0.477	0.474	0.348	FeO

TE26 Traverse 1							
Corrected Probe Data (page 2)							
Point #	16	17	19	20	21	22	Point #
Comment	symplectite	symplectite	mt	mt	mt	mt	Comment
Corrected wt% oxide							Oxide wt %
SiO2	0.029	0.032	0.183	0.061	0.045	0.048	SiO2
TiO2	11.228	17.024	6.278	13.330	5.287	9.706	TiO2
Al2O3	1.258	13.904	3.525	3.089	0.861	1.791	Al2O3
Cr2O3	0.033	0.055	0.006	0.023	0.026	0.040	Cr2O3
Fe2O3	46.131	20.864	52.626	39.361	58.333	48.662	Fe2O3
FeO	40.947	44.466	37.078	42.644	36.177	39.947	FeO
MgO	0.409	2.888	0.360	0.602	0.083	0.322	MgO
CaO	0.032	0.000	0.024	0.001	0.000	0.004	CaO
MnO	0.210	0.298	0.150	0.304	0.162	0.226	MnO
total	100.277	99.531	100.230	99.415	100.974	100.746	total
Corrected cations/3"O"(ilm); cations/4"O" (mt,spl)							Cations
Si	0.001	0.001	0.007	0.002	0.002	0.002	Si
Ti	0.318	0.443	0.176	0.375	0.150	0.273	Ti
Al	0.056	0.567	0.155	0.136	0.038	0.079	Al
Cr	0.001	0.002	0.000	0.001	0.001	0.001	Cr
Fe3+	1.306	0.543	1.478	1.108	1.657	1.370	Fe3+
Fe2+	1.288	1.287	1.158	1.334	1.142	1.250	Fe2+
Mg	0.023	0.149	0.020	0.034	0.005	0.018	Mg
Ca	0.001	0.000	0.001	0.000	0.000	0.000	Ca
Mn	0.007	0.009	0.005	0.010	0.005	0.007	Mn
total	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.137	0.182	0.084	0.159	0.071	0.121	RO2
R2O3	0.294	0.227	0.374	0.262	0.394	0.319	R2O3
RO	0.569	0.591	0.542	0.579	0.535	0.560	RO
TiO2	0.141	0.221	0.085	0.166	0.071	0.124	TiO2
Fe2O3	0.289	0.136	0.357	0.245	0.391	0.310	Fe2O3
FeO	0.570	0.643	0.558	0.589	0.539	0.566	FeO

TE 26 spinel											
Point #	9	10	11	12	14	15	17	18	19	21	Point #
Comment	ilm-spi sym	ilm-spi sym	ilm-spi sym	ilm-spi sym	ilm-spi sym	ilm-spi sym	exsol in mt	exsol in mt	exsol in mt	sp between mt	Comment
Wt % corrected probe data											Wt% corr
SiO2	0.089	0.231	0.140	0.133	0.086	0.133	0.096	0.090	0.089	0.108	SiO2
TiO2	0.510	1.458	0.701	0.811	0.908	0.659	1.148	0.652	1.086	0.391	TiO2
Al2O3	59.613	59.266	59.693	60.108	59.532	58.813	58.403	58.973	58.255	60.258	Al2O3
Cr2O3	0.039	0.036	0.000	0.050	0.000	0.037	0.062	0.044	0.035	0.023	Cr2O3
V2O5	0.016	0.014	0.049	0.016	0.000	0.000	0.051	0.030	0.042	0.002	V2O5
Fe2O3	2.443	0.981	1.923	1.982	1.848	2.272	2.137	2.573	3.056	2.254	Fe2O3
FeO	21.706	22.658	22.453	21.168	21.542	20.958	24.684	24.309	24.968	22.829	FeO
MgO	9.455	9.426	9.331	9.981	9.702	9.585	8.641	8.496	8.508	8.875	MgO
CaO	0.054	0.067	0.052	0.066	0.060	0.046	0.041	0.052	0.067	0.027	CaO
MnO	0.073	0.073	0.103	0.113	0.042	0.078	0.056	0.096	0.073	0.054	MnO
ZnO	6.314	6.567	6.010	6.697	6.433	6.592	4.850	5.135	4.925	6.485	ZnO
total	100.311	100.777	100.454	101.124	100.153	99.173	100.170	100.451	101.105	101.306	total
Cations/4"O" corrected probe data											Cat/4"O" corr
Si	0.002	0.006	0.004	0.004	0.002	0.004	0.003	0.002	0.002	0.003	Si
Ti	0.010	0.030	0.014	0.017	0.019	0.014	0.024	0.013	0.022	0.008	Ti
Al	1.923	1.906	1.923	1.918	1.920	1.917	1.900	1.913	1.885	1.931	Al
Cr	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.000	Cr
V5+	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.000	V5+
Fe 3+	0.050	0.020	0.040	0.040	0.038	0.047	0.044	0.053	0.063	0.046	Fe 3+
Fe 2+	0.497	0.517	0.513	0.479	0.493	0.485	0.570	0.559	0.573	0.519	Fe 2+
Mg	0.385	0.383	0.380	0.403	0.396	0.395	0.355	0.348	0.348	0.360	Mg
Ca	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.001	Ca
Mn	0.002	0.002	0.002	0.003	0.001	0.002	0.001	0.002	0.002	0.001	Mn
Zn	0.128	0.132	0.121	0.134	0.130	0.135	0.099	0.104	0.100	0.130	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.006	0.018	0.009	0.010	0.010	0.009	0.013	0.008	0.012	0.005	RO2
R2O3	0.490	0.473	0.486	0.485	0.484	0.487	0.480	0.488	0.482	0.492	R2O3
RO	0.503	0.509	0.505	0.505	0.505	0.504	0.507	0.504	0.506	0.503	RO
TiO2	0.020	0.054	0.026	0.032	0.035	0.026	0.039	0.023	0.036	0.015	TiO2
Fe2O3	0.047	0.018	0.036	0.039	0.036	0.045	0.036	0.044	0.050	0.042	Fe2O3
FeO	0.933	0.928	0.938	0.929	0.929	0.928	0.925	0.933	0.914	0.944	FeO

TE26 Traverse 2: Ilmenite across a simple boundary into magnetite											
Corrected probe data											
Point #	1	2	3	4	5	6	10	11	12	14	Point #
Comment	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	mt?	Comment
Corrected oxide wt %											Oxide wt %
SiO2	0.024	0.019	0.034	0.096	0.023	0.021	0.024	0.034	0.079	1.317	SiO2
TiO2	50.681	50.684	50.383	50.444	50.732	50.508	51.204	50.842	50.890	2.569	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.812	Al2O3
Cr2O3	0.002	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.011	Cr2O3
Fe2O3	5.087	4.145	4.235	3.731	4.346	4.540	3.666	4.412	3.467	60.519	Fe2O3
FeO	42.581	42.561	42.513	42.676	42.883	42.563	43.270	43.076	43.650	33.756	FeO
MgO	1.368	1.364	1.224	1.117	1.132	1.194	1.121	1.099	0.821	0.896	MgO
CaO	0.032	0.030	0.060	0.057	0.046	0.052	0.028	0.031	0.035	0.063	CaO
MnO	0.537	0.563	0.569	0.728	0.680	0.678	0.761	0.677	0.691	0.150	MnO
total	100.312	99.366	99.018	98.849	99.842	99.579	100.074	100.172	99.632	100.093	total
Corrected cations/3"O" (ilm); 4"O" (mt)											Cations
Si	0.001	0.000	0.001	0.002	0.001	0.001	0.001	0.001	0.002	0.050	Si
Ti	0.952	0.960	0.959	0.962	0.958	0.956	0.965	0.958	0.965	0.073	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
Fe3+	0.096	0.079	0.081	0.071	0.082	0.086	0.069	0.083	0.066	1.718	Fe3+
Fe2+	0.889	0.897	0.900	0.905	0.901	0.896	0.907	0.902	0.921	1.065	Fe2+
Mg	0.051	0.051	0.046	0.042	0.042	0.045	0.042	0.041	0.031	0.050	Mg
Ca	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.003	Ca
Mn	0.011	0.012	0.012	0.016	0.014	0.014	0.016	0.014	0.015	0.005	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	3.000	total
RO2	0.488	0.490	0.490	0.491	0.490	0.489	0.491	0.489	0.492	0.058	RO2
R2O3	0.024	0.020	0.021	0.018	0.021	0.022	0.018	0.021	0.017	0.413	R2O3
RO	0.488	0.490	0.490	0.491	0.490	0.489	0.491	0.489	0.492	0.529	RO
TiO2	0.504	0.506	0.505	0.506	0.504	0.505	0.506	0.504	0.503	0.036	TiO2
Fe2O3	0.025	0.021	0.021	0.019	0.022	0.023	0.018	0.022	0.017	0.430	Fe2O3
FeO	0.471	0.473	0.474	0.476	0.474	0.473	0.476	0.475	0.480	0.533	FeO

TE26 Traverse 2: ilmenite across a simple boundary into magnetite						
Corrected probe data						
Point #	15	16	18	20	24	Point #
Comment	ilm	ilm	ilm?	mt	mt	Comment
Corrected oxide wt %						Oxide wt %
SiO2	0.025	0.018	1.814	0.087	0.053	SiO2
TiO2	51.197	50.899	46.653	5.139	3.825	TiO2
Al2O3	0.000	0.000	1.786	1.465	0.806	Al2O3
Cr2O3	0.000	0.028	0.000	0.030	0.031	Cr2O3
Fe2O3	2.905	4.626	7.862	57.851	61.187	Fe2O3
FeO	43.171	43.084	37.597	35.884	34.790	FeO
MgO	1.060	1.004	3.034	0.247	0.090	MgO
CaO	0.022	0.026	0.096	0.035	0.036	CaO
MnO	0.968	0.875	0.983	0.163	0.129	MnO
total	99.349	100.559	99.825	100.901	100.947	total
Corrected cations/3"O" (ilm); 4"O" (mt)						Cations
Si	0.001	0.000	0.044	0.003	0.002	Si
Ti	0.972	0.956	0.858	0.145	0.109	Ti
Al	0.000	0.000	0.051	0.065	0.036	Al
Cr	0.000	0.001	0.000	0.001	0.001	Cr
Fe3+	0.055	0.087	0.145	1.637	1.741	Fe3+
Fe2+	0.911	0.900	0.769	1.128	1.100	Fe2+
Mg	0.040	0.037	0.111	0.014	0.005	Mg
Ca	0.001	0.001	0.003	0.001	0.001	Ca
Mn	0.021	0.019	0.020	0.005	0.004	Mn
total	2.000	2.000	2.000	3.000	3.000	total
RO2	0.493	0.489	0.474	0.069	0.052	RO2
R2O3	0.014	0.022	0.052	0.396	0.421	R2O3
RO	0.493	0.489	0.474	0.535	0.526	RO
TiO2	0.509	0.503	0.505	0.069	0.052	TiO2
Fe2O3	0.014	0.023	0.043	0.391	0.419	Fe2O3
FeO	0.477	0.474	0.452	0.539	0.529	FeO

TE 26 Short traverse from ilmenite across symplectite into magnetite					
Corrected probe data					
Point #	2	15	16	11	Point #
Comment	ilm	ilm-spi mix	ilm-spi mix	mt near sym	Comment
Corr wt% oxide					
SiO2	0.024	0.239	0.068	0.061	SiO2
TiO2	51.238	33.053	45.152	4.714	TiO2
Al2O3	0.000	25.245	9.141	1.076	Al2O3
Cr2O3	0.000	0.000	0.000	0.004	Cr2O3
Fe2O3	3.053	0.000	7.989	57.932	Fe2O3
FeO	43.364	35.804	34.958	34.911	FeO
MgO	1.130	5.175	2.824	0.228	MgO
CaO	0.033	0.037	0.047	0.048	CaO
MnO	0.676	0.491	0.626	0.078	MnO
total	99.517	100.044	100.805	99.052	total
Corrected cat/4"O" (mt&spl), cat/3"O" (ilm)					
Si	0.001	0.006	0.002	0.002	Si
Ti	0.970	0.561	0.801	0.136	Ti
Al	0.000	0.672	0.254	0.049	Al
Cr	0.000	0.000	0.000	0.000	Cr
Fe 3+	0.058	0.000	0.142	1.674	Fe 3+
Fe 2+	0.913	0.676	0.689	1.121	Fe 2+
Mg	0.042	0.174	0.099	0.013	Mg
Ca	0.001	0.001	0.001	0.002	Ca
Mn	0.014	0.010	0.013	0.003	Mn
total	2.000	2.098	2.000	3.000	total
RO2	0.493	0.321	0.445	0.065	RO2
R2O3	0.015	0.191	0.110	0.403	R2O3
RO	0.493	0.488	0.445	0.532	RO
TiO2	0.507	0.454	0.513	0.065	TiO2
Fe2O3	0.015	0.000	0.045	0.400	Fe2O3
FeO	0.478	0.546	0.442	0.535	FeO

TE27 Ilmenites (page 1)								TE27 Ilmenite
Point #	38	39	40	37	34	35	36	Point #
Comment	ilm by silicate	ilm by silicate	ilm by silicate	ilmbysym&sil	ilm near sym	ilm near sym	ilm near sym	Comment
Corr wt% oxide								Cor wt% oxide
SiO2	0.022	0.005	0.012	0.024	0.014	0.017	0.017	SiO2
TiO2	49.349	49.056	48.961	51.286	52.015	51.908	51.567	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.016	0.000	0.000	0.002	0.000	0.026	0.000	Cr2O3
Fe2O3	7.710	8.419	8.244	3.746	3.125	2.935	3.648	Fe2O3
FeO	40.480	40.255	42.479	42.692	43.198	43.014	42.983	FeO
MgO	1.834	1.957	0.644	1.594	1.752	1.744	1.667	MgO
CaO	0.270	0.035	0.040	0.167	0.022	0.042	0.013	CaO
MnO	0.305	0.328	0.360	0.396	0.437	0.516	0.416	MnO
total	99.986	100.055	100.740	99.907	100.563	100.202	100.311	total
Corrected cations/3"O"								Corr cat/3"O"
Si	0.001	0.000	0.000	0.001	0.000	0.000	0.000	Si
Ti	0.927	0.921	0.922	0.964	0.970	0.972	0.965	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Cr
Fe3+	0.145	0.158	0.155	0.070	0.058	0.055	0.068	Fe3+
Fe2+	0.845	0.840	0.890	0.893	0.896	0.896	0.895	Fe2+
Mg	0.068	0.073	0.024	0.059	0.065	0.065	0.062	Mg
Ca	0.007	0.001	0.001	0.004	0.001	0.001	0.000	Ca
Mn	0.006	0.007	0.008	0.008	0.009	0.011	0.009	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.481	0.479	0.480	0.491	0.493	0.493	0.491	RO2
R2O3	0.038	0.041	0.040	0.018	0.015	0.014	0.017	R2O3
RO	0.481	0.479	0.480	0.491	0.493	0.493	0.491	RO
TiO2	0.502	0.500	0.488	0.510	0.512	0.513	0.510	TiO2
Fe2O3	0.039	0.043	0.041	0.019	0.015	0.015	0.018	Fe2O3
FeO	0.458	0.457	0.471	0.472	0.473	0.473	0.472	FeO

TE27 Ilmenites (page 2)													TE27 Ilmenite
Point #	44	45	46	47	48	49	50	51	52	41	42	43	Point #
Comment	********************starting near symplectite and moving toward center of ilmenite grain*************************									ilm center	ilm center	ilm center	Comment
Cor wt% oxide	ilm near sym								toward center				Cor wt% oxide
SiO2	0.043	0.000	0.023	0.018	0.020	0.012	0.012	0.011	0.008	0.014	0.000	0.004	SiO2
TiO2	52.082	51.510	51.239	51.038	51.191	50.566	50.273	50.143	50.033	49.793	49.864	49.579	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.002	0.057	0.007	0.000	0.069	0.000	0.000	0.046	0.034	0.009	0.000	0.000	Cr2O3
Fe2O3	2.897	3.133	4.435	5.134	4.614	5.627	6.438	6.987	6.502	6.606	6.628	7.227	Fe2O3
FeO	43.321	42.793	42.470	42.342	42.393	41.705	41.479	41.229	41.145	41.055	40.871	40.521	FeO
MgO	1.723	1.710	1.752	1.737	1.774	1.830	1.868	1.878	1.888	1.883	1.937	2.019	MgO
CaO	0.023	0.056	0.040	0.012	0.024	0.027	0.031	0.038	0.016	0.011	0.016	0.041	CaO
MnO	0.459	0.403	0.455	0.459	0.466	0.479	0.370	0.474	0.466	0.364	0.491	0.412	MnO
total	100.551	99.662	100.421	100.740	100.551	100.246	100.472	100.806	100.092	99.735	99.806	99.803	total
Corrected cations/3"O"													Corr cat/3"O"
Si	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.972	0.970	0.958	0.952	0.956	0.947	0.940	0.934	0.938	0.937	0.938	0.932	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	Cr
Fe3+	0.054	0.059	0.083	0.096	0.086	0.105	0.120	0.130	0.122	0.124	0.125	0.136	Fe3+
Fe2+	0.899	0.896	0.883	0.878	0.880	0.869	0.862	0.854	0.858	0.859	0.855	0.847	Fe2+
Mg	0.064	0.064	0.065	0.064	0.066	0.068	0.069	0.069	0.070	0.070	0.072	0.075	Mg
Ca	0.001	0.002	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.001	Ca
Mn	0.010	0.009	0.010	0.010	0.010	0.010	0.008	0.010	0.010	0.008	0.010	0.009	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.493	0.492	0.489	0.488	0.489	0.486	0.484	0.483	0.484	0.484	0.484	0.482	RO2
R2O3	0.014	0.015	0.021	0.025	0.022	0.027	0.031	0.034	0.032	0.032	0.032	0.035	R2O3
RO	0.493	0.492	0.489	0.488	0.489	0.486	0.484	0.483	0.484	0.484	0.484	0.482	RO
TiO2	0.512	0.512	0.509	0.507	0.509	0.507	0.505	0.504	0.505	0.504	0.506	0.505	TiO2
Fe2O3	0.014	0.016	0.022	0.026	0.023	0.028	0.032	0.035	0.033	0.033	0.034	0.037	Fe2O3
FeO	0.474	0.473	0.469	0.468	0.468	0.465	0.463	0.461	0.462	0.462	0.461	0.459	FeO

TE27 Magnetite						
Point #	21	26	16	17	18	Point #
Comment	magnetite by spinel exsolutior		magnetite edge against silicat		magnetite core	Comment
Corr wt% oxide						Cor wt% oxide
SiO2	1.527	0.475	0.030	0.046	0.009	SiO2
TiO2	3.216	0.937	0.269	0.158	0.139	TiO2
Al2O3	2.921	1.118	0.698	0.387	0.291	Al2O3
Cr2O3	0.017	0.022	0.000	0.004	0.047	Cr2O3
V2O3	0.780	0.856	0.778	0.785	0.804	V2O3
Fe2O3	56.332	64.882	67.570	67.881	68.278	Fe2O3
FeO	34.354	31.139	31.142	30.878	30.874	FeO
MgO	1.269	0.743	0.056	0.038	0.048	MgO
CaO	0.016	0.051	0.017	0.050	0.038	CaO
MnO	0.030	0.038	0.008	0.000	0.002	MnO
ZnO	0.629	0.741	0.622	0.652	0.671	ZnO
total	101.091	101.001	101.190	100.878	101.202	total
Corr cat/4"O"						
Si	0.056	0.018	0.001	0.002	0.000	Si
Ti	0.089	0.026	0.008	0.005	0.004	Ti
Al	0.127	0.050	0.031	0.017	0.013	Al
Cr	0.000	0.001	0.000	0.000	0.001	Cr
V3+	0.023	0.026	0.024	0.024	0.024	V3+
Fe 3+	1.560	1.835	1.928	1.946	1.952	Fe 3+
Fe 2+	1.057	0.979	0.987	0.984	0.981	Fe 2+
Mg	0.070	0.042	0.003	0.002	0.003	Mg
Ca	0.001	0.002	0.001	0.002	0.002	Ca
Mn	0.001	0.001	0.000	0.000	0.000	Mn
Zn	0.017	0.021	0.017	0.018	0.019	Zn
total	3.000	3.000	3.000	3.000	3.000	total
RO2	0.068	0.022	0.004	0.003	0.002	RO2
R2O3	0.399	0.467	0.493	0.495	0.497	R2O3
RO	0.534	0.511	0.502	0.502	0.501	RO
TiO2	0.046	0.014	0.004	0.002	0.002	TiO2
Fe2O3	0.405	0.477	0.492	0.496	0.498	Fe2O3
FeO	0.549	0.509	0.504	0.502	0.500	FeO

TE-27 Spinel in symplectite between ilmenite and magnetite						
Point #	1	3	5	6	9	Point #
Comment						Comment
Corr wt% oxide						Cor wt% oxide
SiO2	0.026	1.208	0.037	0.040	0.297	SiO2
TiO2	0.419	0.493	0.651	0.545	0.387	TiO2
Al2O3	63.693	62.642	64.884	63.806	64.555	Al2O3
Cr2O3	0.015	0.011	0.000	0.005	0.000	Cr2O3
V2O3	0.041	0.060	0.098	0.148	0.029	V2O3
Fe2O3	1.240	0.000	0.000	0.731	0.000	Fe2O3
FeO	17.371	16.907	16.275	17.536	15.743	FeO
MgO	13.888	15.004	14.489	13.928	15.153	MgO
CaO	0.047	0.033	0.041	0.027	0.024	CaO
MnO	0.105	0.065	0.079	0.055	0.074	MnO
ZnO	4.539	4.190	4.247	4.536	4.102	ZnO
total	101.384	100.613	100.801	101.357	100.364	total
Corr cat/4"O"						
Si	0.001	0.031	0.001	0.001	0.008	Si
Ti	0.008	0.010	0.013	0.011	0.008	Ti
Al	1.957	1.922	1.982	1.959	1.974	Al
Cr	0.000	0.000	0.000	0.000	0.000	Cr
V3+	0.001	0.001	0.002	0.003	0.001	V3+
Fe 3+	0.024	0.000	0.000	0.014	0.000	Fe 3+
Fe 2+	0.379	0.368	0.353	0.382	0.341	Fe 2+
Mg	0.539	0.582	0.560	0.541	0.586	Mg
Ca	0.001	0.001	0.001	0.001	0.001	Ca
Mn	0.002	0.001	0.002	0.001	0.002	Mn
Zn	0.087	0.081	0.081	0.087	0.079	Zn
total	3.000	2.997	2.995	3.000	2.998	total
RO2	0.004	0.020	0.007	0.006	0.008	RO2
R2O3	0.493	0.472	0.495	0.491	0.491	R2O3
RO	0.502	0.507	0.498	0.503	0.501	RO
TiO2	0.021	0.026	0.036	0.027	0.022	TiO2
Fe2O3	0.030	0.000	0.000	0.018	0.000	Fe2O3
FeO	0.949	0.974	0.964	0.955	0.978	FeO

TE 29 ilmenite grains											
Corrected probe data											
Point #	1	2	4	16	17	20	21	22	23	24	Point #
Comment				near symplect	near symplect	near symplect			rim by silicat		Comment
Oxide wt %											Oxide wt %
SiO2	0.000	0.020	0.000	0.000	0.000	0.000	0.013	0.011	0.000	0.007	SiO2
TiO2	50.941	50.678	51.769	51.967	52.024	52.128	51.011	50.320	50.179	50.129	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.028	0.043	0.000	0.000	0.045	0.035	0.002	0.009	0.000	0.059	Cr2O3
Fe2O3	5.880	6.376	4.036	3.109	2.623	2.831	4.541	6.010	6.534	7.244	Fe2O3
FeO	41.050	41.005	41.698	41.848	41.925	42.095	41.339	40.674	40.441	40.512	FeO
MgO	2.414	2.315	2.440	2.436	2.432	2.399	2.329	2.303	2.363	2.363	MgO
CaO	0.012	0.022	0.027	0.008	0.009	0.019	0.014	0.014	0.080	0.010	CaO
MnO	0.436	0.430	0.468	0.526	0.505	0.476	0.375	0.461	0.366	0.347	MnO
total	100.761	100.889	100.437	99.892	99.563	99.983	99.623	99.802	99.963	100.671	total
Corrected cations/3"O"											Cations/3"O"
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.945	0.940	0.962	0.971	0.975	0.973	0.957	0.943	0.939	0.932	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001	Cr
Fe3+	0.109	0.118	0.075	0.058	0.049	0.053	0.085	0.113	0.122	0.135	Fe3+
Fe2+	0.847	0.846	0.862	0.869	0.874	0.874	0.862	0.848	0.841	0.837	Fe2+
Mg	0.089	0.085	0.090	0.090	0.090	0.089	0.087	0.086	0.088	0.087	Mg
Ca	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.002	0.000	Ca
Mn	0.009	0.009	0.010	0.011	0.011	0.010	0.008	0.010	0.008	0.007	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.486	0.485	0.490	0.493	0.494	0.493	0.489	0.485	0.484	0.482	RO2
R2O3	0.028	0.031	0.019	0.015	0.013	0.014	0.022	0.029	0.032	0.035	R2O3
RO	0.486	0.485	0.490	0.493	0.494	0.493	0.489	0.485	0.484	0.482	RO
TiO2	0.512	0.509	0.517	0.519	0.520	0.519	0.514	0.511	0.510	0.507	TiO2
Fe2O3	0.030	0.032	0.020	0.016	0.013	0.014	0.023	0.031	0.033	0.037	Fe2O3
FeO	0.459	0.458	0.463	0.465	0.466	0.466	0.463	0.459	0.457	0.456	FeO

TE 29 ilm in symplectite									
Corrected probe data									
Point #	25	11	12	13	14	15	18	19	Point #
Comment									Comment
Oxide wt %									Oxide wt %
SiO2	0.007	0.000	0.000	0.002	0.000	0.049	0.000	0.006	SiO2
TiO2	50.223	52.480	52.943	53.403	51.753	52.032	51.800	51.193	TiO2
Al2O3	0.000	0.210	0.000	0.000	0.105	1.310	0.151	1.355	Al2O3
Cr2O3	0.045	0.026	0.000	0.000	0.030	0.042	0.000	0.019	Cr2O3
Fe2O3	6.860	1.822	0.926	0.000	4.567	2.141	3.464	3.328	Fe2O3
FeO	40.637	41.884	42.341	42.888	40.679	41.424	41.336	40.585	FeO
MgO	2.325	2.676	2.675	2.572	2.977	2.731	2.648	2.809	MgO
CaO	0.020	0.021	0.012	0.021	0.021	0.003	0.026	0.023	CaO
MnO	0.361	0.506	0.479	0.491	0.521	0.547	0.487	0.417	MnO
total	100.478	99.626	99.376	99.377	100.654	100.279	99.913	99.734	total
Cations/3"O"									Cations/3"O"
Si	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	Si
Ti	0.935	0.980	0.991	1.000	0.956	0.960	0.965	0.949	Ti
Al	0.000	0.006	0.000	0.000	0.003	0.038	0.004	0.039	Al
Cr	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	Cr
Fe3+	0.128	0.034	0.017	0.000	0.084	0.040	0.065	0.062	Fe3+
Fe2+	0.842	0.869	0.882	0.893	0.836	0.850	0.857	0.837	Fe2+
Mg	0.086	0.099	0.099	0.095	0.109	0.100	0.098	0.103	Mg
Ca	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	Ca
Mn	0.008	0.011	0.010	0.010	0.011	0.011	0.010	0.009	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.483	0.495	0.498	0.500	0.489	0.490	0.491	0.487	RO2
R2O3	0.033	0.010	0.004	0.000	0.023	0.020	0.018	0.026	R2O3
RO	0.483	0.495	0.498	0.500	0.489	0.490	0.491	0.487	RO
TiO2	0.508	0.525	0.527	0.528	0.521	0.525	0.521	0.522	TiO2
Fe2O3	0.035	0.009	0.005	0.000	0.023	0.011	0.017	0.017	Fe2O3
FeO	0.457	0.466	0.469	0.472	0.456	0.465	0.462	0.461	FeO

TE-29 traverse 1: from opx rim through opx and cpx to ilm										
Probe data (page 1 of 2)										
Point #	5	6	9	10	11	12	13		14	Point #
Comment	opx by plag	opx	opx	opx	opx	opx	opx		**cpx**	Comment
Wt% oxide										Wt% oxide
SiO2	53.401	54.121	53.825	52.868	53.467	51.794	53.387		52.321	SiO2
TiO2	0.171	0.216	0.174	0.260	0.184	0.492	0.333		0.473	TiO2
Al2O3	1.005	0.992	0.923	0.932	0.998	1.088	0.934		2.179	Al2O3
Cr2O3	0.000	0.009	0.000	0.000	0.000	0.055	0.000		0.000	Cr2O3
Fe2O3	1.826	0.206	1.046	2.684	1.586	4.387	1.292		2.975	Fe2O3
FeO	18.215	19.856	19.433	18.116	18.921	17.336	19.129		5.726	FeO
MgO	24.595	24.608	24.531	24.678	24.524	24.008	24.598		14.657	MgO
MnO	0.263	0.260	0.352	0.321	0.328	0.330	0.267		0.204	MnO
CaO	1.273	0.678	0.765	0.722	0.831	1.482	0.677		21.853	CaO
Na2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.623	Na2O
K2O	0.020	0.021	0.009	0.034	0.024	0.006	0.009		0.015	K2O
total	100.769	100.967	101.058	100.615	100.863	100.978	100.626		101.026	total
Cations/ 4"O" (plag); 6"O"(pyr); 3"O"(i										Cations
Si	1.949	1.970	1.961	1.937	1.952	1.902	1.953		1.921	Si
Al	0.043	0.030	0.039	0.040	0.043	0.047	0.040		0.079	Al
Fe3+	0.008	0.000	0.000	0.023	0.005	0.051	0.007		0.000	Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000		2.000	total
Al	0.000	0.013	0.001	0.000	0.000	0.000	0.000	Al	0.015	Al
Ti	0.005	0.006	0.005	0.007	0.005	0.014	0.009	Ti	0.013	Ti
Fe3+	0.042	0.006	0.029	0.052	0.039	0.070	0.029	Fe3+	0.082	Fe3+
Cr	0.000	0.000	0.000	0.000	0.000	0.002	0.000	Cr	0.000	Cr
Fe2+	0.556	0.605	0.592	0.555	0.578	0.532	0.585	Fe2+	0.176	Fe2+
Mn	0.008	0.008	0.011	0.010	0.010	0.010	0.008	Mn	0.006	Mn
Mg	1.338	1.335	1.332	1.347	1.335	1.314	1.341	Mg	0.708	Mg
Ca	0.050	0.026	0.030	0.028	0.033	0.058	0.027	Ca	1.000	total
Na	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Na		
K	0.001	0.001	0.000	0.002	0.001	0.000	0.000	K	0.094	Mg
total	2.000	2.000	2.000	2.000	2.001	2.000	1.999	total	0.860	Ca
									0.044	Na
									0.001	K
									0.999	total

TE-29 traverse 1: from opx rim through opx and cpx to ilm												
Probe data (page 2 of 2)												
Point #	15	16	17	18	19	20	22	23	Point #	Point #	24	25
Comment	opx	opx	opx	opx	opx	opx	opx	opx by ilm	Comment	Comment	ilm by opx	ilm
Wt% oxide									wt% oxide	**Wt% oxide**		
SiO2	52.866	53.121	52.354	52.523	48.942	52.229	52.042	51.853	SiO2	SiO2	0.000	0.000
TiO2	0.216	0.230	0.230	0.230	1.096	0.238	0.269	0.458	TiO2	TiO2	50.948	50.483
Al2O3	1.005	0.933	0.992	1.033	0.986	0.986	0.984	1.408	Al2O3	Al2O3	0.000	0.000
Cr2O3	0.011	0.000	0.000	0.015	0.002	0.000	0.011	0.011	Cr2O3	Cr2O3	0.106	0.090
Fe2O3	0.957	1.663	2.386	2.590	9.193	3.432	4.026	3.250	Fe2O3	Fe2O3	5.137	5.841
FeO	19.189	18.805	17.512	17.615	16.011	17.515	16.935	16.433	FeO	FeO	41.393	40.870
MgO	23.991	24.484	23.899	23.929	23.296	24.326	24.941	25.174	MgO	MgO	2.198	2.245
MnO	0.372	0.345	0.370	0.333	0.376	0.367	0.326	0.366	MnO	CaO	0.026	0.051
CaO	0.807	0.691	1.793	1.881	1.223	1.042	0.578	0.582	CaO	MnO	0.466	0.455
Na2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Na2O	total	100.274	100.035
K2O	0.017	0.016	0.010	0.000	0.010	0.029	0.004	0.000	K2O			
total	99.431	100.288	99.546	100.149	101.135	100.164	100.116	99.535	total	**Cations/3"O"(ilm)**		
										Si	0.000	0.000
Cations/ 4"O" (plag); 6"O"(pyr); 3"O"(ilm)									Cations	Ti	0.951	0.944
Si	1.959	1.951	1.939	1.935	1.819	1.925	1.915	1.911	Si	Al	0.000	0.000
Al	0.041	0.040	0.043	0.045	0.043	0.043	0.043	0.061	Al	Cr	0.002	0.002
Fe3+	0.000	0.009	0.018	0.020	0.138	0.032	0.042	0.028	Fe3+	Fe3+	0.096	0.109
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total	Fe2+	0.859	0.850
										Mg	0.081	0.083
Al	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al	Ca	0.001	0.001
Ti	0.006	0.006	0.006	0.006	0.031	0.007	0.007	0.013	Ti	Mn	0.010	0.010
Fe3+	0.027	0.037	0.048	0.052	0.119	0.063	0.070	0.062	Fe3+	total	2.000	2.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr			
Fe2+	0.595	0.578	0.542	0.543	0.498	0.540	0.521	0.507	Fe2+	RO2	0.487	0.486
Mn	0.012	0.011	0.012	0.010	0.012	0.011	0.010	0.011	Mn	R2O3	0.025	0.029
Mg	1.325	1.340	1.319	1.314	1.291	1.336	1.368	1.383	Mg	RO	0.487	0.486
Ca	0.032	0.027	0.071	0.074	0.049	0.041	0.023	0.023	Ca			
Na	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Na	TiO2	0.512	0.511
K	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000	K	Fe2O3	0.026	0.030
total	2.001	2.000	1.998	1.999	2.000	1.999	1.999	1.999	total	FeO	0.462	0.460

TE-29 Second traverse: orthopyroxene; rim by plag into interior								
Point #	4	5	6	8	9	10	16	Point #
Comment	opx by plag	opx	opx	opx	opx	opx	opx	Comment
Wt% oxide								Wt% oxide
SiO2	53.558	53.388	53.379	53.230	53.172	52.561	50.341	SiO2
TiO2	0.164	0.181	0.179	0.214	0.188	0.895	0.000	TiO2
Al2O3	0.943	1.003	0.957	1.023	0.997	0.949	0.000	Al2O3
Cr2O3	0.024	0.013	0.000	0.006	0.007	0.007	0.000	Cr2O3
Fe2O3	1.226	1.677	1.174	1.747	1.788	1.495	9.624	Fe2O3
FeO	19.197	19.133	18.972	17.780	18.826	19.115	13.163	FeO
MgO	24.544	24.446	24.368	24.020	24.411	24.081	25.720	MgO
MnO	0.357	0.321	0.389	0.288	0.324	0.363	0.000	MnO
CaO	0.688	0.761	0.909	2.290	0.850	0.978	0.930	CaO
Na2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Na2O
K2O	0.001	0.000	0.009	0.009	0.000	0.000	0.000	K2O
Total	100.702	100.923	100.336	100.607	100.563	100.444	99.778	Total
Cations/8"O"(plag) or 6"O"(pyr)								Cations/8"O"(plag) or 6"O"(pyr)
Si	1.958	1.950	1.958	1.948	1.949	1.934	1.866	Si
Al	0.041	0.043	0.041	0.044	0.043	0.041		Al
Fe3+	0.001	0.007	0.001	0.008	0.008	0.025	0.134	Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Al								Al
Ti	0.004	0.005	0.005	0.006	0.005	0.025		Ti
Fe3+	0.033	0.039	0.031	0.040	0.041	0.016	0.134	Fe3+
Cr	0.001							Cr
Fe2+	0.587	0.584	0.582	0.544	0.577	0.588	0.408	Fe2+
Mn	0.011	0.010	0.012	0.009	0.010	0.011		Mn
Mg	1.337	1.331	1.333	1.310	1.333	1.321	1.421	Mg
Ca	0.027	0.030	0.036	0.090	0.033	0.039	0.037	Ca
Na								Na
K								K
total	2.000	1.999	1.999	1.999	1.999	2.000	2.000	total

TE 29 Traverse 2											
This traverse starts in magnetite passes through symplectite to the ilmenite core											
Corrected probe data (page 1)											
Point #	1	2	3	5	6	7	8	9	10	13	Point #
Comment	mt	mt	mt	ilm in sym	ilm in sym	ilm	ilm	ilm	ilm	ilm	Comment
Corrected wt% oxide											Oxide wt %
SiO2	0.010	0.015	0.000	0.021	0.009	0.003	0.000	0.000	0.008	0.000	SiO2
TiO2	0.395	0.638	1.275	52.042	51.021	51.052	50.808	50.556	50.914	50.064	TiO2
Al2O3	0.449	0.344	1.388	0.017	0.021	0.029	0.022	0.040	0.047	0.040	Al2O3
Cr2O3	0.195	0.193	0.190	0.000	0.000	0.000	0.000	0.000	0.002	0.009	Cr2O3
Fe2O3	67.278	66.792	65.191	1.741	3.680	4.468	4.649	4.922	4.231	5.536	Fe2O3
FeO	31.234	31.409	31.433	42.105	41.369	41.516	41.165	40.984	41.367	40.509	FeO
MgO	0.105	0.094	0.711	2.414	2.343	2.278	2.336	2.312	2.328	2.358	MgO
CaO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.000	0.000	0.000	0.412	0.343	0.332	0.357	0.354	0.275	0.305	MnO
total	99.666	99.486	100.188	98.751	98.786	99.679	99.336	99.168	99.171	98.821	total
Corrected cations/4"O" (mt); cat/3"O" (ilm)											Cor. cations
Si	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.011	0.019	0.036	0.983	0.965	0.958	0.956	0.953	0.959	0.947	Ti
Al	0.020	0.016	0.062	0.001	0.001	0.001	0.001	0.001	0.001	0.001	Al
Cr	0.006	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
Fe 3+	1.950	1.940	1.859	0.033	0.070	0.084	0.088	0.093	0.080	0.105	Fe 3+
Fe 2+	1.006	1.014	0.996	0.884	0.870	0.866	0.861	0.859	0.867	0.852	Fe 2+
Mg	0.006	0.005	0.040	0.090	0.088	0.085	0.087	0.086	0.087	0.088	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.000	0.000	0.000	0.009	0.007	0.007	0.008	0.008	0.006	0.006	Mn
total	3.000	3.000	3.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.006	0.009	0.018	0.496	0.491	0.489	0.489	0.488	0.490	0.486	RO2
R2O3	0.491	0.486	0.473	0.008	0.018	0.022	0.023	0.024	0.021	0.027	R2O3
RO	0.503	0.505	0.509	0.496	0.491	0.489	0.489	0.488	0.490	0.486	RO
TiO2	0.006	0.009	0.019	0.522	0.516	0.513	0.514	0.513	0.514	0.511	TiO2
Fe2O3	0.489	0.484	0.474	0.009	0.019	0.022	0.024	0.025	0.021	0.028	Fe2O3
FeO	0.505	0.506	0.508	0.469	0.465	0.464	0.463	0.462	0.465	0.460	FeO

TE 29 Traverse 2								
This traverse starts in magnetite passes through symplectite to the ilmenite core								
Corrected probe data (page 2)								
Point #	14	15	16	17	18	19	20	Point #
Comment	ilm	ilm	ilm	ilm	ilm	ilm	ilm	Comment
Corrected wt% oxide								Oxide wt %
SiO2	0.000	0.003	0.000	0.003	0.000	0.004	0.000	SiO2
TiO2	50.055	50.292	50.550	50.548	50.310	50.261	50.411	TiO2
Al2O3	0.057	0.037	0.024	0.036	0.035	0.034	0.036	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr2O3
Fe2O3	6.506	5.720	5.572	5.576	5.803	5.677	5.941	Fe2O3
FeO	40.555	40.829	41.111	40.915	40.746	40.670	40.913	FeO
MgO	2.367	2.291	2.284	2.382	2.355	2.329	2.320	MgO
CaO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.236	0.313	0.272	0.295	0.295	0.377	0.281	MnO
total	99.776	99.485	99.814	99.755	99.544	99.352	99.903	total
Corrected cations/4"O" (mt); cat/3"O" (ilm)								Cor. cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.938	0.946	0.947	0.947	0.945	0.946	0.944	Ti
Al	0.002	0.001	0.001	0.001	0.001	0.001	0.001	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
Fe 3+	0.122	0.108	0.104	0.105	0.109	0.107	0.111	Fe 3+
Fe 2+	0.845	0.854	0.857	0.853	0.851	0.851	0.852	Fe 2+
Mg	0.088	0.085	0.085	0.088	0.088	0.087	0.086	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.005	0.007	0.006	0.006	0.006	0.008	0.006	Mn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.484	0.486	0.486	0.486	0.486	0.486	0.486	RO2
R2O3	0.032	0.028	0.027	0.027	0.028	0.028	0.029	R2O3
RO	0.484	0.486	0.486	0.486	0.486	0.486	0.486	RO
TiO2	0.509	0.510	0.510	0.511	0.511	0.511	0.510	TiO2
Fe2O3	0.033	0.029	0.028	0.028	0.029	0.029	0.030	Fe2O3
FeO	0.458	0.461	0.462	0.460	0.460	0.460	0.460	FeO

TE-29 third traverse: from ilm through cpx										
Probe data (page 1 of 3)										
Point #	1		4	5	6	7	8	9	10	Point #
Comment	ilm		cpx by ilm	cpx	cpx	cpx	cpx	cpx	cpx	Comment
Wt% oxide										Wt% oxide
SiO2	0.000		51.967	51.791	52.206	52.083	52.377	52.045	52.121	SiO2
TiO2	51.066		0.267	0.160	0.050	0.197	0.214	0.192	0.234	TiO2
Al2O3	0.000		2.273	2.220	2.094	2.351	2.356	2.332	2.404	Al2O3
Cr2O3	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr2O3
Fe2O3	4.103		3.043	3.919	3.408	3.754	2.501	3.500	3.099	Fe2O3
FeO	41.710		5.392	4.364	4.705	4.460	6.404	4.901	6.708	FeO
MgO	2.033		14.832	14.564	15.138	14.330	14.637	14.349	14.867	MgO
MnO	0.432		0.040	0.071	0.063	0.119	0.053	0.076	0.058	MnO
CaO	0.012		20.830	21.725	21.199	22.032	20.671	21.753	20.039	CaO
Na2O	0.024		0.825	0.830	0.768	0.886	0.819	0.860	0.776	Na2O
K2O	0.006		0.000	0.000	0.000	0.000	0.000	0.000	0.000	K2O
total	99.386		99.469	99.644	99.631	100.212	100.032	100.008	100.306	total
Raw cations/3"O"(ilm); 6"O"										Cations
Si	0.000	Si	1.930	1.922	1.933	1.923	1.937	1.926	1.926	Si
Ti	0.962	Al	0.070	0.078	0.067	0.077	0.063	0.074	0.074	Al
Al	0.000	total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Cr	0.000									
Fe3+	0.078	Al	0.029	0.019	0.024	0.025	0.040	0.028	0.031	Al
Fe2+	0.874	Ti	0.007	0.004	0.001	0.005	0.006	0.005	0.007	Ti
Mg	0.076	Fe3+	0.085	0.109	0.095	0.104	0.070	0.097	0.086	Fe3+
Mn	0.009	Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
Ca	0.001	Mg	0.821	0.806	0.835	0.789	0.807	0.791	0.819	Mg
Na	0.001	Fe2+	0.058	0.062	0.045	0.077	0.077	0.079	0.057	Fe2+
K	0.000	total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	total
total	2.000									
		Fe2+	0.109	0.073	0.101	0.061	0.121	0.073	0.150	Fe2+
RO2	0.491	Mn	0.001	0.002	0.002	0.004	0.002	0.002	0.002	Mn
R2O3	0.019	Ca	0.829	0.864	0.841	0.872	0.819	0.862	0.793	Ca
RO	0.491	Na	0.059	0.060	0.055	0.063	0.059	0.062	0.056	Na
		total	0.998	0.999	0.999	1.000	1.001	0.999	1.001	total
TiO2	0.513									
Fe2O3	0.020									
FeO	0.467									

TE-29 third traverse: from ilm through cpx											
Probe data (page 2 of 3)											
Point #	11	12	13	14	15	16	17	18	19	20	Point #
Comment	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	Comment
Wt% oxide											Wt% oxide
SiO2	51.901	52.786	52.142	52.245	51.940	52.441	52.163	52.420	52.195	52.593	SiO2
TiO2	0.267	0.279	0.325	0.272	0.267	0.239	0.260	0.293	0.270	0.255	TiO2
Al2O3	2.483	2.362	2.458	2.587	2.466	2.403	2.407	2.409	2.432	2.393	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr2O3
Fe2O3	3.456	0.904	2.676	2.062	2.870	2.714	2.950	2.844	2.320	2.374	Fe2O3
FeO	5.361	7.364	7.697	6.877	5.876	5.860	5.778	5.974	6.260	6.147	FeO
MgO	14.120	14.697	14.866	13.892	14.276	14.186	14.167	14.516	14.363	14.368	MgO
MnO	0.076	0.068	0.038	0.066	0.066	0.066	0.088	0.068	0.043	0.086	MnO
CaO	21.624	20.121	19.471	21.077	21.129	21.591	21.493	21.104	20.861	21.328	CaO
Na2O	0.861	0.855	0.747	0.865	0.839	0.874	0.853	0.861	0.868	0.852	Na2O
K2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	K2O
total	100.149	99.436	100.420	99.943	99.729	100.374	100.159	100.489	99.612	100.396	total
Cations/3"O"(ilm); 6"O"											Cations
Si	1.921	1.959	1.927	1.938	1.929	1.935	1.930	1.931	1.938	1.938	Si
Al	0.079	0.041	0.073	0.062	0.071	0.065	0.070	0.069	0.062	0.062	Al
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Al	0.029	0.062	0.034	0.051	0.037	0.039	0.035	0.036	0.044	0.042	Al
Ti	0.007	0.008	0.009	0.008	0.007	0.007	0.007	0.008	0.008	0.007	Ti
Fe3+	0.096	0.025	0.074	0.058	0.080	0.075	0.082	0.079	0.065	0.066	Fe3+
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
Mg	0.779	0.813	0.819	0.768	0.790	0.780	0.781	0.797	0.795	0.789	Mg
Fe2+	0.089	0.092	0.064	0.115	0.086	0.099	0.095	0.080	0.088	0.096	Fe2+
total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	total
Fe2+	0.077	0.137	0.174	0.098	0.096	0.082	0.084	0.104	0.106	0.093	Fe2+
Mn	0.002	0.002	0.001	0.002	0.002	0.002	0.003	0.002	0.001	0.003	Mn
Ca	0.858	0.800	0.771	0.838	0.841	0.853	0.852	0.833	0.830	0.842	Ca
Na	0.062	0.062	0.054	0.062	0.060	0.062	0.061	0.062	0.063	0.061	Na
total	0.999	1.001	1.000	1.000	0.999	0.999	1.000	1.001	1.000	0.999	total

TE-29 third traverse: from ilm through cpx						
Raw probe data (page 3 of 3)						
Point #	21	22	23	24	25	Point #
Comment	cpx	cpx	cpx	cpx	cpx	Comment
Wt% oxide						Wt% oxide
SiO2	52.668	52.562	52.304	52.639	52.552	SiO2
TiO2	0.278	0.284	0.305	0.250	0.255	TiO2
Al2O3	2.397	2.427	2.395	2.375	2.371	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	0.000	Cr2O3
Fe2O3	2.229	2.258	2.974	1.884	2.388	Fe2O3
FeO	6.398	6.188	6.228	7.480	5.940	FeO
MgO	14.084	13.931	14.466	14.701	14.079	MgO
MnO	0.066	0.061	0.088	0.119	0.104	MnO
CaO	21.463	21.894	20.948	20.028	21.729	CaO
Na2O	0.898	0.858	0.836	0.800	0.883	Na2O
K2O	0.000	0.000	0.000	0.000	0.000	K2O
total	100.481	100.463	100.544	100.276	100.301	total
Cations/3"O"(ilm); 6"O"						Cations
Si	1.941	1.939	1.928	1.944	1.940	Si
Al	0.059	0.061	0.072	0.056	0.060	Al
total	2.000	2.000	2.000	2.000	2.000	total
Al	0.045	0.045	0.032	0.047	0.043	Al
Ti	0.008	0.008	0.008	0.007	0.007	Ti
Fe3+	0.062	0.063	0.083	0.052	0.066	Fe3+
Cr	0.000	0.000	0.000	0.000	0.000	Cr
Mg	0.774	0.766	0.795	0.809	0.775	Mg
Fe2+	0.111	0.118	0.082	0.085	0.109	Fe2+
total	1.000	1.000	1.000	1.000	1.000	total
Fe2+	0.086	0.073	0.110	0.146	0.074	Fe2+
Mn	0.002	0.002	0.003	0.004	0.003	Mn
Ca	0.848	0.865	0.827	0.792	0.859	Ca
Na	0.064	0.061	0.060	0.057	0.063	Na
total	1.000	1.001	1.000	0.999	0.999	total

TE-33-2a traverse 1 across composite ilm-mt grain; fine-grained spinel symplectite at ilm-mt contact											
From ilm edge by silicate, across ilm through mt into silicate; traverse hit a lot of inclusions in mt											
Corrected probe data (page 1 of 2)											
x	12093	12108	12123	12139	12154	12201	12216	12232	12262	12278	x
y	-34095	-34079	-34064	-34049	-34033	-33988	-33972	-33957	-33926	-33911	y
Point#	1	2	3	4	5	8	9	10	12	13	Point#
Comment	ilm edge	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm by sym	mt by sym	Comment
Wt% oxide	by silicate								edge with mt	edge with ilm	Wt% oxide
SiO2	0.010	0.005	0.006	0.006	0.006	0.024	0.000	0.023	0.027	0.296	SiO2
TiO2	47.741	47.684	47.531	48.066	47.703	47.646	48.033	48.676	50.141	0.470	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.127	Al2O3
Cr2O3	0.024	0.000	0.000	0.012	0.005	0.002	0.000	0.043	0.009	0.131	Cr2O3
V2O3	0.300	0.324	0.407	0.338	0.444	0.329	0.380	0.341	0.293	0.554	V2O3
Fe2O3	9.103	8.997	9.920	9.872	9.396	9.496	9.168	8.273	4.325	65.878	Fe2O3
FeO	41.336	41.205	41.134	41.447	41.068	41.261	41.568	42.302	43.825	31.247	FeO
MgO	0.618	0.601	0.591	0.640	0.637	0.519	0.547	0.528	0.342	0.034	MgO
CaO	0.074	0.017	0.031	0.015	0.018	0.015	0.003	0.016	0.028	0.070	CaO
MnO	0.498	0.530	0.546	0.527	0.548	0.567	0.562	0.503	0.583	0.035	MnO
ZnO	0.186	0.058	0.050	0.102	0.139	0.108	0.088	0.030	0.069	0.211	ZnO
total	99.890	99.421	100.216	101.025	99.964	99.966	100.349	100.735	99.642	99.053	total
Corrected cations/3"O"(ilm & pyr); 4"O"(mt)											Cations
Si	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.011	Si
Ti	0.908	0.911	0.901	0.904	0.906	0.906	0.909	0.918	0.955	0.014	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.004	Cr
V	0.006	0.007	0.008	0.007	0.009	0.007	0.008	0.007	0.006	0.017	V
Fe3+	0.173	0.172	0.188	0.186	0.179	0.181	0.174	0.156	0.082	1.922	Fe3+
Fe2+	0.874	0.875	0.867	0.866	0.867	0.872	0.875	0.887	0.928	1.013	Fe2+
Mg	0.023	0.023	0.022	0.024	0.024	0.020	0.021	0.020	0.013	0.002	Mg
Ca	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.003	Ca
Mn	0.011	0.011	0.012	0.011	0.012	0.012	0.012	0.011	0.013	0.001	Mn
Zn	0.003	0.001	0.001	0.002	0.003	0.002	0.002	0.001	0.001	0.006	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	3.000	total
RO2	0.476	0.477	0.474	0.475	0.475	0.475	0.476	0.479	0.489	0.012	RO2
R2O3	0.049	0.047	0.052	0.051	0.049	0.049	0.047	0.043	0.023	0.481	R2O3
RO	0.476	0.477	0.474	0.475	0.475	0.475	0.476	0.479	0.489	0.506	RO
TiO2	0.487	0.487	0.484	0.485	0.486	0.485	0.486	0.487	0.496	0.007	TiO2
Fe2O3	0.048	0.046	0.051	0.050	0.048	0.048	0.046	0.041	0.021	0.483	Fe2O3
FeO	0.466	0.468	0.465	0.465	0.466	0.467	0.468	0.471	0.482	0.510	FeO

TE-33-2a traverse 1 across composite ilm-mt grain; fine-grained spinel symplectite at ilm-mt contact
From ilm edge by silicate, across ilm through mt into silicate; traverse hit a lot of inclusions in mt
Corrected probe data (page 2 of 2)

x	12293	12309	12324	12340	12355	12417	12432	12463	12494	x
y	-33896	-33881	-33865	-33850	-33835	-33774	-33758	-33728	-33697	y
Point#	14	15	16	17	18	22	23	25	27	Point#
Comment	mt	mt	mt	mt/inclusion	mt	mt	mt	mt	mt	Comment
Corrected wt% oxide										Wt% oxide
SiO2	0.108	0.032	0.018	0.429	0.034	0.034	0.026	0.073	0.046	SiO2
TiO2	0.103	0.000	0.000	0.000	0.000	0.000	0.038	0.000	0.000	TiO2
Al2O3	0.108	0.122	0.049	0.317	0.204	0.181	0.466	0.167	0.225	Al2O3
Cr2O3	0.139	0.120	0.139	0.142	0.138	0.106	0.112	0.143	0.127	Cr2O3
V2O3	0.528	0.501	0.567	0.516	0.526	0.583	0.490	0.578	0.584	V2O3
Fe2O3	68.542	68.856	68.756	66.692	68.818	68.303	68.374	68.649	68.330	Fe2O3
FeO	31.601	31.251	31.150	30.398	31.328	31.066	31.339	31.139	31.169	FeO
MgO	0.000	0.016	0.000	0.495	0.009	0.000	0.000	0.084	0.000	MgO
CaO	0.036	0.016	0.028	0.129	0.024	0.027	0.020	0.032	0.043	CaO
MnO	0.000	0.020	0.028	0.053	0.038	0.028	0.036	0.022	0.018	MnO
ZnO	0.044	0.144	0.163	0.090	0.114	0.169	0.133	0.204	0.133	ZnO
total	101.208	101.078	100.898	99.261	101.233	100.497	101.034	101.091	100.675	total
Corrected cations/3"O"(ilm & pyr); 4"O"(mt)										Cations
Si	0.004	0.001	0.001	0.017	0.001	0.001	0.001	0.003	0.002	Si
Ti	0.003	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	Ti
Al	0.005	0.005	0.002	0.014	0.009	0.008	0.021	0.007	0.010	Al
Cr	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.004	0.004	Cr
V	0.016	0.015	0.017	0.016	0.016	0.018	0.015	0.018	0.018	V
Fe3+	1.961	1.973	1.975	1.932	1.968	1.968	1.956	1.965	1.964	Fe3+
Fe2+	1.005	0.995	0.994	0.979	0.996	0.995	0.997	0.990	0.996	Fe2+
Mg	0.000	0.001	0.000	0.028	0.001	0.000	0.000	0.005	0.000	Mg
Ca	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.002	Ca
Mn	0.000	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	Mn
Zn	0.001	0.004	0.005	0.003	0.003	0.005	0.004	0.006	0.004	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.004	0.001	0.000	0.008	0.001	0.001	0.001	0.001	0.001	RO2
R2O3	0.495	0.499	0.499	0.488	0.499	0.499	0.498	0.498	0.499	R2O3
RO	0.502	0.500	0.500	0.504	0.500	0.500	0.501	0.501	0.501	RO
TiO2	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	TiO2
Fe2O3	0.493	0.498	0.498	0.497	0.497	0.497	0.495	0.498	0.497	Fe2O3
FeO	0.505	0.502	0.502	0.503	0.503	0.503	0.504	0.502	0.503	FeO

TE-33-2a more: resuming traverse 1 on composite ilm/mt grain.											
Corrected probe data (page 1)											
Point #	1	2	4	6	7	8	9	10	12	13	Point #
Comment	ilm at sym	mt/spinel?	mt	mt	mt	mt	mt	mt	mt/inclusion?	mt	Comment
Wt% oxide	edge with mt										Wt% oxide
SiO2	0.011	1.801	0.046	0.024	0.060	0.031	0.025	0.057	3.984	0.087	SiO2
TiO2	49.688	0.693	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Al2O3	0.000	14.701	0.213	0.156	0.189	0.193	0.168	0.208	6.531	0.211	Al2O3
Cr2O3	0.016	0.121	0.167	0.135	0.120	0.112	0.117	0.103	0.111	0.124	Cr2O3
V2O3	0.291	0.371	0.518	0.500	0.604	0.517	0.578	0.505	0.509	0.531	V2O3
Fe2O3	5.432	46.841	68.350	68.524	68.454	68.392	67.979	68.329	52.106	68.124	Fe2O3
FeO	43.151	34.729	31.020	31.023	31.198	31.036	30.881	30.986	33.461	31.033	FeO
MgO	0.403	1.290	0.070	0.011	0.010	0.000	0.009	0.003	2.394	0.009	MgO
CaO	0.007	0.052	0.005	0.028	0.030	0.033	0.021	0.032	0.015	0.028	CaO
MnO	0.689	0.068	0.056	0.062	0.031	0.032	0.060	0.095	0.070	0.053	MnO
ZnO	0.135	0.078	0.158	0.191	0.164	0.204	0.136	0.223	0.072	0.215	ZnO
total	99.822	100.745	100.603	100.655	100.861	100.550	99.974	100.541	99.253	100.415	total
Corrected cations/3"O"(ilm); 4"O"(mt)											Cor. cations
Si	0.000	0.063	0.002	0.001	0.002	0.001	0.001	0.002	0.144	0.003	Si
Ti	0.945	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ti
Al	0.000	0.602	0.010	0.007	0.008	0.009	0.008	0.009	0.278	0.010	Al
Cr	0.000	0.003	0.005	0.004	0.004	0.003	0.004	0.003	0.003	0.004	Cr
V3+	0.006	0.010	0.016	0.015	0.018	0.016	0.018	0.015	0.015	0.016	V3+
Fe 3+	0.103	1.223	1.966	1.972	1.965	1.969	1.969	1.967	1.416	1.964	Fe 3+
Fe 2+	0.913	1.008	0.991	0.992	0.995	0.993	0.994	0.992	1.011	0.994	Fe 2+
Mg	0.015	0.067	0.004	0.001	0.001	0.000	0.001	0.000	0.129	0.001	Mg
Ca	0.000	0.002	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	Ca
Mn	0.015	0.002	0.002	0.002	0.001	0.001	0.002	0.003	0.002	0.002	Mn
Zn	0.003	0.002	0.004	0.005	0.005	0.006	0.004	0.006	0.002	0.006	Zn
total	2.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.486	0.039	0.001	0.000	0.001	0.001	0.000	0.001	0.067	0.002	RO2
R2O3	0.028	0.442	0.499	0.499	0.498	0.499	0.499	0.498	0.399	0.497	R2O3
RO	0.486	0.519	0.501	0.500	0.501	0.500	0.500	0.501	0.534	0.501	RO
TiO2	0.495	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Fe2O3	0.027	0.373	0.498	0.498	0.497	0.498	0.498	0.498	0.412	0.497	Fe2O3
FeO	0.478	0.615	0.502	0.502	0.503	0.502	0.502	0.502	0.588	0.503	FeO

TE-33-2a more: resuming traverse 1 on composite ilm/mt grain.				
Corrected probe data (page 2)				
Point #	16	17	24	Point #
Comment	mt	mt edge	mt	Comment
Wt% oxide			another grain	Wt% oxide
SiO2	0.055	0.089	0.038	SiO2
TiO2	0.000	0.000	0.000	TiO2
Al2O3	0.215	0.126	0.035	Al2O3
Cr2O3	0.101	0.086	0.095	Cr2O3
V2O3	0.568	0.581	0.401	V2O3
Fe2O3	68.244	68.114	67.893	Fe2O3
FeO	31.011	30.990	30.520	FeO
MgO	0.000	0.005	0.000	MgO
CaO	0.020	0.034	0.084	CaO
MnO	0.083	0.070	0.070	MnO
ZnO	0.221	0.183	0.237	ZnO
total	100.519	100.279	99.372	total
Corrected cations/3"O"(ilm); 4"O"(mt)				Cor. cations
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fe 3+	1.965	1.967	1.980	Fe 3+
Fe 2+	0.993	0.994	0.989	Fe 2+
Mg	0.000	0.000	0.000	Mg
Ca	0.001	0.001	0.003	Ca
Mn	0.003	0.002	0.002	Mn
Zn	0.006	0.005	0.007	Zn
total	3.000	3.000	3.000	total
RO2	0.001	0.002	0.001	RO2
R2O3	0.498	0.497	0.499	R2O3
RO	0.501	0.501	0.500	RO
TiO2	0.000	0.000	0.000	TiO2
Fe2O3	0.498	0.497	0.500	Fe2O3
FeO	0.502	0.503	0.500	FeO

TE-33-4a traverse 1: from ilmenite core to rim with magnetite				
Corrected probe data				
Point #	6	7	8	12
Comment	ilm	ilm	ilm	ilm rim w/mt
Corrected oxide wt%				
SiO2	0.008	0.000	0.005	0.000
TiO2	46.550	46.738	46.672	49.034
Al2O3	0.000	0.000	0.000	0.000
Cr2O3	0.000	0.000	0.005	0.000
V2O3	0.478	0.431	0.401	0.307
Fe2O3	10.145	9.680	10.344	5.747
FeO	41.149	41.311	41.296	43.413
MgO	0.107	0.079	0.082	0.052
CaO	0.015	0.000	0.005	0.003
MnO	0.489	0.490	0.492	0.577
ZnO	0.017	0.092	0.033	0.000
total	98.959	98.821	99.334	99.133
Corrected cations/3"O"				
Si	0.000	0.000	0.000	0.000
Ti	0.897	0.902	0.896	0.942
Al	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000
V3+	0.010	0.009	0.008	0.006
Fe3+	0.196	0.187	0.199	0.110
Fe2+	0.882	0.887	0.882	0.927
Mg	0.004	0.003	0.003	0.002
Ca	0.000	0.000	0.000	0.000
Mn	0.011	0.011	0.011	0.012
Zn	0.000	0.002	0.001	0.000
total	2.000	2.000	2.000	2.000
Corrected probe data				
RO2	0.473	0.474	0.473	0.485
R2O3	0.054	0.051	0.055	0.030
RO	0.473	0.474	0.473	0.485
TiO2	0.478	0.479	0.477	0.489
Fe2O3	0.052	0.050	0.053	0.029
FeO	0.470	0.471	0.470	0.482

TE-33-4a traverse 2: from a magnetite core to its rim with ilmenite													
Corrected probe data													
Point #	13	14	15	16	17	18	19	20	21	22	23	24	Point #
Comment	mt core	mt	mt	mt	mt	mt	mt	mt	mt	mt	mt	mt rim w/ilm	Comment
Corrected oxide wt%													Cor. ox. wt%
SiO2	0.037	0.299	0.046	0.032	0.030	0.031	0.026	0.030	0.054	0.013	0.026	0.011	SiO2
TiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.025	0.085	0.437	TiO2
Al2O3	0.027	6.700	0.036	0.077	0.112	0.075	0.108	0.000	0.069	0.075	0.036	0.059	Al2O3
Cr2O3	0.032	0.057	0.038	0.032	0.039	0.000	0.000	0.064	0.000	0.069	0.054	0.037	Cr2O3
V2O3	0.502	0.580	0.593	0.641	0.636	0.557	0.582	0.634	0.610	0.517	0.567	0.500	V2O3
Fe2O3	68.010	61.021	67.889	68.267	68.174	68.285	68.482	68.182	68.190	68.424	68.459	67.771	Fe2O3
FeO	30.794	32.848	30.859	30.985	30.862	30.970	31.054	30.967	31.056	30.896	31.203	31.508	FeO
MgO	0.000	0.066	0.000	0.020	0.023	0.000	0.026	0.000	0.000	0.047	0.016	0.000	MgO
CaO	0.021	0.047	0.007	0.016	0.047	0.028	0.021	0.014	0.027	0.022	0.005	0.032	CaO
MnO	0.064	0.046	0.010	0.000	0.055	0.048	0.010	0.019	0.058	0.017	0.004	0.054	MnO
ZnO	0.097	0.150	0.127	0.153	0.155	0.081	0.113	0.098	0.025	0.202	0.119	0.008	ZnO
total	99.584	101.814	99.605	100.223	100.133	100.075	100.422	100.008	100.096	100.306	100.574	100.417	total
Corrected cations/4"O"													Cor. cations
Si	0.001	0.011	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.000	0.001	0.000	Si
Ti	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.013	Ti
Al	0.001	0.288	0.002	0.003	0.005	0.003	0.005	0.000	0.003	0.003	0.002	0.003	Al
Cr	0.001	0.002	0.001	0.001	0.001	0.000	0.000	0.002	0.000	0.002	0.002	0.001	Cr
V3+	0.016	0.017	0.018	0.020	0.020	0.017	0.018	0.020	0.019	0.016	0.017	0.015	V3+
Fe 3+	1.979	1.672	1.975	1.973	1.972	1.977	1.975	1.976	1.973	1.976	1.972	1.955	Fe 3+
Fe 2+	0.996	1.000	0.998	0.995	0.992	0.996	0.995	0.997	0.999	0.992	0.999	1.010	Fe 2+
Mg	0.000	0.004	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.003	0.001	0.000	Mg
Ca	0.001	0.002	0.000	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.000	0.001	Ca
Mn	0.002	0.001	0.000	0.000	0.002	0.002	0.000	0.001	0.002	0.001	0.000	0.002	Mn
Zn	0.003	0.004	0.004	0.004	0.004	0.002	0.003	0.003	0.001	0.006	0.003	0.000	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.001	0.005	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.002	0.006	RO2
R2O3	0.499	0.492	0.499	0.499	0.499	0.499	0.499	0.499	0.498	0.499	0.497	0.490	R2O3
RO	0.500	0.503	0.501	0.500	0.500	0.500	0.500	0.500	0.501	0.500	0.501	0.503	RO
TiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	TiO2
Fe2O3	0.498	0.455	0.497	0.498	0.498	0.498	0.498	0.498	0.497	0.499	0.496	0.489	Fe2O3
FeO	0.502	0.545	0.503	0.502	0.502	0.502	0.502	0.502	0.503	0.501	0.503	0.505	FeO

TE-33-4a traverse 3: from ilm core to mt core											
Corrected probe data (page 1)											Corrected data
Point #	25	26	27	28	29	30	31	32	33	34	Point #
Comment	ilm core	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm rim w/mt	mt rim w/ilm	Comment
Corrected oxide wt %											Cor. ox. wt %
SiO2	0.016	0.005	0.009	0.002	0.008	0.000	0.000	0.012	0.010	0.053	SiO2
TiO2	45.774	45.940	45.171	46.245	46.224	46.825	46.913	47.870	50.422	0.632	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.000	0.016	0.009	0.000	0.013	0.011	0.000	0.000	0.000	0.029	Cr2O3
V2O3	0.454	0.368	0.386	0.407	0.347	0.320	0.370	0.302	0.267	0.557	V2O3
Fe2O3	11.104	11.141	13.245	10.975	10.354	9.848	9.602	7.495	2.483	66.395	Fe2O3
FeO	40.556	40.613	40.003	40.991	40.928	41.393	41.492	42.314	44.646	31.274	FeO
MgO	0.047	0.073	0.054	0.038	0.046	0.047	0.037	0.051	0.022	0.011	MgO
CaO	0.009	0.014	0.018	0.000	0.001	0.010	0.000	0.018	0.021	0.001	CaO
MnO	0.523	0.488	0.502	0.523	0.487	0.561	0.540	0.625	0.634	0.026	MnO
ZnO	0.000	0.071	0.000	0.000	0.082	0.056	0.092	0.000	0.000	0.118	ZnO
total	98.483	98.729	99.397	99.181	98.490	99.071	99.047	98.688	98.505	99.096	total
Corrected cations/3"O"(ilm); 4"O"(mt)											Cor. cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	Si
Ti	0.887	0.888	0.868	0.890	0.896	0.902	0.904	0.924	0.973	0.018	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	Cr
V3+	0.009	0.008	0.008	0.008	0.007	0.007	0.008	0.006	0.005	0.017	V3+
Fe3+	0.215	0.216	0.255	0.211	0.201	0.190	0.185	0.145	0.048	1.941	Fe3+
Fe2+	0.874	0.873	0.855	0.877	0.882	0.886	0.889	0.908	0.958	1.016	Fe2+
Mg	0.002	0.003	0.002	0.001	0.002	0.002	0.001	0.002	0.001	0.001	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Ca
Mn	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.014	0.014	0.001	Mn
Zn	0.000	0.001	0.000	0.000	0.002	0.001	0.002	0.000	0.000	0.003	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	3.000	total
RO2	0.470	0.470	0.465	0.471	0.473	0.474	0.475	0.480	0.493	0.010	RO2
R2O3	0.060	0.059	0.070	0.058	0.055	0.052	0.051	0.039	0.014	0.485	R2O3
RO	0.470	0.470	0.465	0.471	0.473	0.474	0.475	0.480	0.493	0.505	RO
TiO2	0.475	0.475	0.469	0.475	0.477	0.479	0.479	0.485	0.498	0.009	TiO2
Fe2O3	0.058	0.058	0.069	0.056	0.053	0.050	0.049	0.038	0.012	0.484	Fe2O3
FeO	0.468	0.467	0.462	0.468	0.470	0.471	0.472	0.477	0.490	0.507	FeO

TE-33-4a traverse 3: from ilm core to mt core											
Corrected probe data (page 2)											Corrected data
Point #	35	36	37	38	39	40	41	42	43	44	Point #
Comment	mt	mt	mt	mt	mt	mt	mt	mt	mt	mt core	Comment
Corrected oxide wt %											Cor. ox. wt %
SiO2	0.106	0.025	0.024	0.210	0.041	0.032	0.039	1.685	0.016	0.024	SiO2
TiO2	0.043	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Al2O3	0.000	0.014	0.275	0.082	0.071	0.090	0.050	0.607	0.090	0.136	Al2O3
Cr2O3	0.018	0.014	0.043	0.033	0.049	0.020	0.045	0.046	0.036	0.051	Cr2O3
V2O3	0.770	0.730	0.852	0.854	0.766	0.832	0.812	0.772	0.798	0.751	V2O3
Fe2O3	67.504	68.477	67.661	67.604	67.774	68.016	68.180	64.686	67.569	68.139	Fe2O3
FeO	30.954	31.018	30.979	31.073	30.875	31.025	31.149	32.415	30.802	30.983	FeO
MgO	0.000	0.000	0.000	0.107	0.000	0.000	0.000	0.777	0.000	0.000	MgO
CaO	0.049	0.048	0.025	0.028	0.019	0.033	0.017	0.084	0.013	0.024	CaO
MnO	0.054	0.076	0.035	0.070	0.000	0.083	0.000	0.016	0.000	0.047	MnO
ZnO	0.019	0.115	0.095	0.045	0.159	0.008	0.059	0.044	0.104	0.161	ZnO
total	99.517	100.525	99.989	100.106	99.754	100.139	100.351	101.132	99.428	100.316	total
Corrected cations/3"O"(ilm); 4"O"(mt)											Cor. cations
Si	0.004	0.001	0.001	0.008	0.002	0.001	0.001	0.063	0.001	0.001	Si
Ti	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ti
Al	0.000	0.001	0.012	0.004	0.003	0.004	0.002	0.027	0.004	0.006	Al
Cr	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	Cr
V3+	0.024	0.022	0.026	0.026	0.024	0.026	0.025	0.023	0.025	0.023	V3+
Fe3+	1.965	1.974	1.958	1.953	1.968	1.967	1.968	1.822	1.969	1.967	Fe3+
Fe2+	1.001	0.994	0.996	0.997	0.996	0.997	0.999	1.015	0.997	0.994	Fe2+
Mg	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.043	0.000	0.000	Mg
Ca	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	Ca
Mn	0.002	0.002	0.001	0.002	0.000	0.003	0.000	0.001	0.000	0.002	Mn
Zn	0.001	0.003	0.003	0.001	0.005	0.000	0.002	0.001	0.003	0.005	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.003	0.001	0.000	0.004	0.001	0.001	0.001	0.031	0.000	0.000	RO2
R2O3	0.496	0.499	0.499	0.494	0.499	0.499	0.499	0.454	0.499	0.499	R2O3
RO	0.501	0.500	0.500	0.502	0.500	0.500	0.500	0.515	0.500	0.500	RO
TiO2	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Fe2O3	0.495	0.498	0.496	0.495	0.497	0.497	0.496	0.473	0.497	0.497	Fe2O3
FeO	0.504	0.502	0.504	0.505	0.503	0.503	0.504	0.527	0.503	0.503	FeO

TE-33-6a pyroxene: points from a pyroxene with ilm exsolution									
Probe data									
Point #	1	3	4	5	8			2	Point #
Comment	cpx by opx	cpx by opx	cpx	cpx	cpx			opx by cpx	Comment
Oxide wt%									Oxide wt%
SiO2	50.346	50.635	50.679	50.515	51.180	SiO2		49.771	SiO2
TiO2	0.231	0.276	0.258	0.258	0.285	TiO2		0.124	TiO2
Al2O3	1.898	1.787	1.715	1.851	1.897	Al2O3		1.091	Al2O3
Cr2O3	0.000	0.006	0.000	0.012	0.000	Cr2O3		0.011	Cr2O3
Fe2O3	4.597	5.047	5.188	4.604	3.816	Fe2O3		3.159	Fe2O3
FeO	6.901	5.709	5.829	9.124	7.863	FeO		24.995	FeO
MgO	12.731	13.367	13.246	13.278	12.842	MgO		18.736	MgO
MnO	0.203	0.176	0.319	0.242	0.162	MnO		0.500	MnO
CaO	22.227	22.701	22.765	20.033	22.284	CaO		0.534	CaO
Na2O	0.451	0.424	0.411	0.412	0.429	Na2O		0.000	Na2O
K2O	0.015	0.011	0.000	0.008	0.000	K2O		0.015	K2O
total	99.600	100.139	100.410	100.337	100.758	total		98.936	total
Cations/6"O"						Cations/6"O"			Cations/6"O"
Si	1.903	1.897	1.897	1.902	1.912	Si		1.926	C
Al	0.085	0.079	0.076	0.082	0.084	Al		0.050	#REF!
Fe3+	0.012	0.024	0.027	0.016	0.004	Fe3+		0.024	Fe3+
total	2.000	2.000	2.000	2.000	2.000	total		2.000	total
Al						Al			Al
Fe3+	0.119	0.118	0.119	0.114	0.103	Fe3+		0.068	Fe3+
Ti	0.007	0.008	0.007	0.007	0.008	Ti		0.004	Ti
Mg	0.717	0.746	0.739	0.745	0.715	Mg		1.081	Mg
Fe2+	0.157	0.128	0.135	0.134	0.174	Fe2+		0.809	Fe2+
total	1.000	1.000	1.000	1.000	1.000	total		0.016	Mn
								0.022	Ca
Fe2+	0.061	0.051	0.047	0.153	0.072	Fe2+			Na
Mn	0.007	0.006	0.010	0.008	0.005	Mn		0.001	K
Ca	0.900	0.911	0.913	0.808	0.892	Ca		2.001	total
Na	0.033	0.031	0.030	0.030	0.031	Na			
K	0.001	0.001				K			
total	1.002	1.000	1.000	0.999	1.000	total			

TE-33-6a: traverses across ilm and mt grains								
Corrected probe data (page 1)								
Point #	1	2	3	4	5	6	7	8
Comment	ilm core	ilm	ilm	ilm	ilm	ilm	ilm	ilm
Cor. wt% ox.	trav 1 starts							
SiO2	0.017	0.000	0.000	0.007	0.000	0.007	0.000	0.000
TiO2	44.106	45.305	45.810	45.496	47.428	44.508	47.717	45.040
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr2O3	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000
V2O3	0.487	0.401	0.456	0.435	0.529	0.463	0.355	0.445
Fe2O3	15.186	13.812	13.176	13.849	9.468	15.263	9.247	13.954
FeO	38.463	39.528	39.946	39.679	41.396	38.956	41.820	39.522
MgO	0.476	0.500	0.501	0.485	0.474	0.418	0.387	0.370
CaO	0.000	0.000	0.000	0.000	0.007	0.000	0.005	0.000
MnO	0.334	0.279	0.346	0.351	0.391	0.327	0.365	0.317
ZnO	0.038	0.044	0.006	0.025	0.004	0.000	0.027	0.000
total	99.106	99.886	100.241	100.326	99.697	99.942	99.923	99.648
Corrected cations/3"O"(ilm); 4"O"(mt)								
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.848	0.864	0.870	0.864	0.904	0.849	0.908	0.862
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V3+	0.010	0.008	0.009	0.009	0.011	0.009	0.007	0.009
Fe3+	0.292	0.264	0.250	0.263	0.181	0.291	0.176	0.267
Fe2+	0.823	0.838	0.844	0.838	0.878	0.827	0.885	0.841
Mg	0.018	0.019	0.019	0.018	0.018	0.016	0.015	0.014
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mn	0.007	0.006	0.007	0.008	0.008	0.007	0.008	0.007
Zn	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000

RO2	0.459	0.464	0.465	0.464	0.475	0.459	0.476	0.463
R2O3	0.082	0.073	0.069	0.073	0.050	0.081	0.048	0.074
RO	0.459	0.464	0.465	0.464	0.475	0.459	0.476	0.463
TiO2	0.467	0.471	0.473	0.471	0.483	0.466	0.483	0.469
Fe2O3	0.080	0.072	0.068	0.072	0.048	0.080	0.047	0.073
FeO	0.453	0.457	0.459	0.457	0.469	0.454	0.470	0.458

			TE-33-6a: traverses across ilm and mt grains					
			Corrected probe data (page 2)					
9	10	Point #	Point #	11	12	13	15	17
ilm	ilm	Comment	Comment	ilm	ilm rim w/sil	ilm by mt	mt	mt
		Cor. wt% ox.	**Cor. wt% ox.**		trav 1 ends	trav 2 starts		
0.000	0.004	SiO2	SiO2	0.000	0.009	0.018	0.037	0.035
44.896	45.114	TiO2	TiO2	41.872	39.959	50.285	0.017	0.000
0.000	0.000	Al2O3	Al2O3	0.000	0.000	0.000	0.134	0.143
0.000	0.000	Cr2O3	Cr2O3	0.000	0.000	0.000	0.201	0.287
0.534	0.455	V2O3	V2O3	0.480	0.540	0.398	1.229	1.251
14.689	13.639	Fe2O3	Fe2O3	21.198	23.170	3.557	67.028	66.891
39.354	39.612	FeO	FeO	36.335	35.110	44.732	30.986	31.008
0.364	0.324	MgO	MgO	0.465	0.289	0.022	0.013	0.000
0.000	0.000	CaO	CaO	0.081	0.000	0.000	0.009	0.000
0.309	0.354	MnO	MnO	0.353	0.253	0.463	0.000	0.010
0.065	0.029	ZnO	ZnO	0.032	0.071	0.000	0.049	0.006
100.210	99.531	total	total	100.816	99.401	99.476	99.703	99.631
		Cor. cations	**Corrected cations/3"O"(ilm); 4"O"(mt)**					
0.000	0.000	Si	Si	0.000	0.000	0.000	0.001	0.001
0.855	0.864	Ti	Ti	0.794	0.771	0.961	0.000	0.000
0.000	0.000	Al	Al	0.000	0.000	0.000	0.006	0.007
0.000	0.000	Cr	Cr	0.000	0.000	0.000	0.006	0.009
0.011	0.009	V3+	V3+	0.010	0.011	0.008	0.038	0.039
0.280	0.262	Fe3+	Fe3+	0.402	0.447	0.068	1.946	1.943
0.833	0.844	Fe2+	Fe2+	0.766	0.753	0.951	1.000	1.001
0.014	0.012	Mg	Mg	0.017	0.011	0.001	0.001	0.000
0.000	0.000	Ca	Ca	0.002	0.000	0.000	0.000	0.000
0.007	0.008	Mn	Mn	0.008	0.005	0.010	0.000	0.000
0.001	0.001	Zn	Zn	0.001	0.001	0.000	0.001	0.000
2.000	2.000	total	total	2.000	2.000	2.000	3.000	3.000

0.461	0.464	RO2	RO2	0.443	0.435	0.490	0.001	0.001
0.078	0.073	R2O3	R2O3	0.115	0.129	0.019	0.498	0.499
0.461	0.464	RO	RO	0.443	0.435	0.490	0.501	0.500
0.468	0.470	TiO2	TiO2	0.451	0.441	0.494	0.000	0.000
0.077	0.071	Fe2O3	Fe2O3	0.114	0.128	0.017	0.493	0.493
0.456	0.459	FeO	FeO	0.435	0.431	0.489	0.507	0.507

						TE-33-6a: traverses across ilm and mt gr		
						Corrected probe data (page 3)		
18	19	20	23	24	Point #	Point #	25	26
mt	mt	mt	mt interior	mt	Comment	Comment	mt	mt
			trav 3 starts		Cor. wt% ox.	**Cor. wt% ox.**		
0.024	0.032	0.009	0.027	0.034	SiO2	SiO2	0.028	0.028
0.000	0.000	0.000	0.000	0.000	TiO2	TiO2	0.000	0.000
1.100	0.127	0.229	0.254	0.199	Al2O3	Al2O3	0.164	0.181
0.205	0.208	0.209	0.216	0.193	Cr2O3	Cr2O3	0.215	0.236
1.004	1.258	1.134	1.198	1.073	V2O3	V2O3	1.123	1.081
66.049	66.929	67.062	67.122	66.795	Fe2O3	Fe2O3	67.266	67.423
30.946	30.885	30.896	31.027	30.737	FeO	FeO	30.930	31.057
0.065	0.005	0.005	0.017	0.000	MgO	MgO	0.000	0.000
0.000	0.000	0.007	0.008	0.002	CaO	CaO	0.010	0.015
0.047	0.009	0.060	0.010	0.026	MnO	MnO	0.032	0.079
0.030	0.097	0.036	0.057	0.139	ZnO	ZnO	0.136	0.013
99.470	99.550	99.647	99.936	99.198	total	total	99.903	100.113
					Cor. cations	**Corrected cations/3"O"(ilm); 4"O"(mt)**		
0.001	0.001	0.000	0.001	0.001	Si	Si	0.001	0.001
0.000	0.000	0.000	0.000	0.000	Ti	Ti	0.000	0.000
0.050	0.006	0.010	0.012	0.009	Al	Al	0.007	0.008
0.006	0.006	0.006	0.007	0.006	Cr	Cr	0.007	0.007
0.031	0.039	0.035	0.037	0.033	V3+	V3+	0.035	0.033
1.911	1.946	1.947	1.943	1.949	Fe3+	Fe3+	1.949	1.949
0.995	0.998	0.997	0.998	0.997	Fe2+	Fe2+	0.996	0.998
0.004	0.000	0.000	0.001	0.000	Mg	Mg	0.000	0.000
0.000	0.000	0.000	0.000	0.000	Ca	Ca	0.000	0.001
0.002	0.000	0.002	0.000	0.001	Mn	Mn	0.001	0.003
0.001	0.003	0.001	0.002	0.004	Zn	Zn	0.004	0.000
3.000	3.000	3.000	3.000	3.000	total	total	3.000	3.000

0.000	0.001	0.000	0.001	0.001	RO2	RO2	0.001	0.001
0.499	0.499	0.500	0.499	0.499	R2O3	R2O3	0.499	0.499
0.500	0.500	0.500	0.500	0.500	RO	RO	0.500	0.500
0.000	0.000	0.000	0.000	0.000	TiO2	TiO2	0.000	0.000
0.490	0.494	0.494	0.493	0.494	Fe2O3	Fe2O3	0.495	0.494
0.510	0.506	0.506	0.507	0.506	FeO	FeO	0.505	0.506

ains								
27	28	29	30	34	36	37	39	Point #
mt	mt	mt	mt	mt	mt	mt	mt	Comment
								Cor. wt% ox.
0.012	0.004	0.021	0.017	0.438	0.024	0.544	0.027	SiO2
0.000	0.000	0.000	0.006	0.063	0.021	0.000	0.000	TiO2
0.231	0.193	0.192	0.173	0.376	0.157	0.383	0.202	Al2O3
0.219	0.269	0.186	0.254	0.192	0.187	0.217	0.217	Cr2O3
1.167	1.159	1.224	1.092	1.186	1.165	1.186	1.156	V2O3
67.148	67.001	66.680	67.397	65.797	67.609	66.390	67.063	Fe2O3
30.868	30.802	30.730	31.055	31.335	31.107	31.461	30.899	FeO
0.003	0.000	0.000	0.005	0.177	0.000	0.289	0.000	MgO
0.011	0.001	0.000	0.005	0.000	0.000	0.021	0.007	CaO
0.035	0.041	0.047	0.020	0.041	0.058	0.078	0.000	MnO
0.171	0.155	0.104	0.066	0.006	0.129	0.044	0.155	ZnO
99.866	99.626	99.184	100.090	99.611	100.458	100.613	99.726	total
								Cor. cations
0.000	0.000	0.001	0.001	0.017	0.001	0.021	0.001	Si
0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000	Ti
0.010	0.009	0.009	0.008	0.017	0.007	0.017	0.009	Al
0.007	0.008	0.006	0.008	0.006	0.006	0.007	0.007	Cr
0.036	0.036	0.038	0.034	0.037	0.036	0.036	0.036	V3+
1.946	1.947	1.946	1.949	1.903	1.948	1.899	1.946	Fe3+
0.994	0.995	0.996	0.998	1.007	0.996	1.000	0.997	Fe2+
0.000	0.000	0.000	0.000	0.010	0.000	0.016	0.000	Mg
0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Ca
0.001	0.001	0.002	0.001	0.001	0.002	0.003	0.000	Mn
0.005	0.004	0.003	0.002	0.000	0.004	0.001	0.004	Zn
3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total

0.000	0.000	0.000	0.000	0.009	0.001	0.010	0.001	RO2
0.500	0.500	0.499	0.499	0.486	0.499	0.485	0.499	R2O3
0.500	0.500	0.500	0.500	0.505	0.500	0.505	0.500	RO
0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	TiO2
0.495	0.495	0.494	0.494	0.485	0.494	0.487	0.494	Fe2O3
0.505	0.505	0.506	0.506	0.514	0.505	0.513	0.506	FeO

TE-33-6a: traverses across ilm and mt grains				
Corrected probe data (page 4)				
Point #	40	41	42	Point #
Comment	mt	mt	toward mt rim	Comment
Cor. wt% ox.			trav 3 ends	Cor. wt% ox.
SiO2	0.017	0.021	0.009	SiO2
TiO2	0.000	0.000	0.000	TiO2
Al2O3	0.240	0.149	0.782	Al2O3
Cr2O3	0.197	0.193	0.242	Cr2O3
V2O3	1.099	1.063	1.126	V2O3
Fe2O3	67.479	67.834	66.408	Fe2O3
FeO	30.990	31.180	30.979	FeO
MgO	0.000	0.003	0.020	MgO
CaO	0.000	0.000	0.000	CaO
MnO	0.038	0.022	0.000	MnO
ZnO	0.193	0.087	0.112	ZnO
total	100.253	100.553	99.678	total
Corrected cations/3"O"(ilm); 4"O"(mt)				Cor. cations
Si	0.001	0.001	0.000	Si
Ti	0.000	0.000	0.000	Ti
Al	0.011	0.007	0.035	Al
Cr	0.006	0.006	0.007	Cr
V3+	0.034	0.033	0.035	V3+
Fe3+	1.948	1.953	1.922	Fe3+
Fe2+	0.994	0.998	0.996	Fe2+
Mg	0.000	0.000	0.001	Mg
Ca	0.000	0.000	0.000	Ca
Mn	0.001	0.001	0.000	Mn
Zn	0.005	0.002	0.003	Zn
total	3.000	3.000	3.000	total

RO2	0.000	0.000	0.000	RO2
R2O3	0.499	0.499	0.500	R2O3
RO	0.500	0.500	0.500	RO
TiO2	0.000	0.000	0.000	TiO2
Fe2O3	0.495	0.495	0.491	Fe2O3
FeO	0.505	0.505	0.509	FeO

TE-33-6a traverse 4: across a broad mt lamellae in ilm													
Corrected probe data													
Point #	1	2	3	4	5	6	7	8	9	10	11	12	Point #
Comment	ilm interior	ilm	ilm by mt	mt by ilm	mt	mt	mt by ilm	ilm by mt	ilm	ilm	ilm	ilm interior	Comment
Corrected oxide wt%				***************	mt lamellae	****************							Cor. ox. wt%
SiO2	0.022	0.000	0.011	0.072	0.037	0.034	0.062	0.023	0.016	0.000	0.463	0.012	SiO2
TiO2	44.616	45.493	45.744	1.165	0.135	0.047	0.151	46.597	44.760	46.186	45.064	45.512	TiO2
Al2O3	0.000	0.000	0.000	0.004	0.094	0.063	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.064	0.081	0.043	0.213	0.279	0.307	0.281	0.033	0.058	0.032	0.000	0.082	Cr2O3
V2O3	0.643	0.545	0.641	0.676	0.693	0.762	0.753	0.615	0.564	0.512	0.528	0.592	V2O3
Fe2O3	13.676	12.984	12.074	65.407	67.979	67.417	67.876	10.961	13.990	11.655	10.757	12.301	Fe2O3
FeO	39.604	40.320	40.699	31.885	31.112	30.875	31.447	41.295	39.638	40.841	40.031	40.328	FeO
MgO	0.051	0.048	0.037	0.021	0.026	0.018	0.000	0.120	0.137	0.145	0.291	0.178	MgO
CaO	0.000	0.007	0.000	0.017	0.009	0.020	0.011	0.000	0.027	0.000	0.046	0.015	CaO
MnO	0.447	0.484	0.379	0.067	0.076	0.038	0.000	0.362	0.348	0.428	0.463	0.273	MnO
ZnO	0.000	0.006	0.000	0.135	0.236	0.102	0.000	0.061	0.000	0.000	0.000	0.000	ZnO
total	99.122	99.968	99.628	99.662	100.675	99.683	100.581	100.067	99.539	99.799	97.643	99.293	total
Corrected cations/3"O"(ilm); 4"O"(mt)													Cor. cations
Si	0.001	0.000	0.000	0.003	0.001	0.001	0.002	0.001	0.000	0.000	0.012	0.000	Si
Ti	0.860	0.869	0.877	0.034	0.004	0.001	0.004	0.888	0.859	0.883	0.878	0.875	Ti
Al	0.000	0.000	0.000	0.000	0.004	0.003	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.001	0.002	0.001	0.006	0.008	0.009	0.009	0.001	0.001	0.001	0.000	0.002	Cr
V3+	0.013	0.011	0.013	0.021	0.021	0.024	0.023	0.012	0.012	0.010	0.011	0.012	V3+
Fe3+	0.264	0.248	0.232	1.899	1.955	1.959	1.955	0.209	0.269	0.223	0.210	0.237	Fe3+
Fe2+	0.849	0.857	0.868	1.029	0.995	0.997	1.006	0.875	0.846	0.868	0.867	0.862	Fe2+
Mg	0.002	0.002	0.001	0.001	0.001	0.001	0.000	0.005	0.005	0.005	0.011	0.007	Mg
Ca	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	Ca
Mn	0.010	0.010	0.008	0.002	0.002	0.001	0.000	0.008	0.008	0.009	0.010	0.006	Mn
Zn	0.000	0.000	0.000	0.004	0.007	0.003	0.000	0.001	0.000	0.000	0.000	0.000	Zn
total	2.000	2.000	2.000	3.000	3.000	3.000	3.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.463	0.465	0.467	0.018	0.003	0.001	0.003	0.471	0.462	0.469	0.471	0.467	RO2
R2O3	0.075	0.070	0.065	0.473	0.496	0.498	0.495	0.059	0.076	0.062	0.058	0.067	R2O3
RO	0.463	0.465	0.467	0.509	0.501	0.501	0.502	0.471	0.462	0.469	0.471	0.467	RO
TiO2	0.467	0.470	0.471	0.017	0.002	0.001	0.002	0.475	0.467	0.474	0.475	0.472	TiO2
Fe2O3	0.072	0.067	0.062	0.472	0.495	0.495	0.492	0.056	0.073	0.060	0.057	0.064	Fe2O3
FeO	0.461	0.463	0.466	0.511	0.503	0.504	0.506	0.469	0.460	0.466	0.469	0.465	FeO

TE-33-6a traverse 5a & b: across coarse hematite lamellae in ilmenite											
Corrected probe data (page 1)											Corrected data
Point #	18a	19a	20a	21a	22a	24b	25b	27b	28b	29b	Point #
Corrected oxide wt%											Cor. oxide wt%
SiO2	0.005	0.021	0.021	0.006	0.020	0.027	0.011	0.009	0.018	0.000	SiO2
TiO2	47.817	47.666	32.633	33.104	33.757	47.106	48.492	35.730	39.678	30.825	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.034	0.085	0.118	0.139	0.108	0.083	0.050	0.100	0.087	0.146	Cr2O3
V2O3	0.451	0.508	0.600	0.791	0.702	0.482	0.494	0.700	0.556	0.781	V2O3
Fe2O3	7.778	8.556	36.942	35.693	34.790	9.239	6.444	31.339	23.218	40.352	Fe2O3
FeO	41.921	41.781	28.693	29.030	29.570	41.229	42.601	31.452	34.866	27.137	FeO
MgO	0.308	0.334	0.202	0.197	0.198	0.275	0.270	0.183	0.198	0.174	MgO
CaO	0.062	0.068	0.047	0.043	0.044	0.189	0.149	0.106	0.071	0.078	CaO
MnO	0.381	0.420	0.206	0.322	0.279	0.337	0.342	0.224	0.387	0.170	MnO
ZnO	0.079	0.000	0.055	0.015	0.134	0.102	0.000	0.000	0.000	0.000	ZnO
total	98.837	99.439	99.516	99.340	99.601	99.069	98.853	99.843	99.079	99.663	total
Corrected cations/3"O"(ilm,hem)											Cor. cat/3"O"
Si	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000	Si
Ti	0.920	0.912	0.633	0.643	0.654	0.905	0.932	0.689	0.768	0.598	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.001	0.002	0.002	0.003	0.002	0.002	0.001	0.002	0.002	0.003	Cr
V3+	0.009	0.010	0.012	0.016	0.014	0.010	0.010	0.014	0.011	0.016	V3+
Fe3+	0.150	0.164	0.717	0.694	0.674	0.178	0.124	0.605	0.450	0.784	Fe3+
Fe2+	0.897	0.889	0.619	0.627	0.637	0.881	0.911	0.675	0.751	0.586	Fe2+
Mg	0.012	0.013	0.008	0.008	0.008	0.010	0.010	0.007	0.008	0.007	Mg
Ca	0.002	0.002	0.001	0.001	0.001	0.005	0.004	0.003	0.002	0.002	Ca
Mn	0.008	0.009	0.005	0.007	0.006	0.007	0.007	0.005	0.008	0.004	Mn
Zn	0.001	0.000	0.001	0.000	0.003	0.002	0.000	0.000	0.000	0.000	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.479	0.477	0.388	0.392	0.396	0.475	0.483	0.408	0.435	0.374	RO2
R2O3	0.042	0.046	0.224	0.217	0.209	0.050	0.035	0.184	0.131	0.251	R2O3
RO	0.479	0.477	0.388	0.392	0.396	0.475	0.483	0.408	0.435	0.374	RO
TiO2	0.486	0.484	0.393	0.398	0.402	0.483	0.489	0.414	0.441	0.380	TiO2
Fe2O3	0.040	0.044	0.223	0.215	0.207	0.047	0.033	0.182	0.129	0.249	Fe2O3
FeO	0.474	0.472	0.384	0.388	0.391	0.470	0.478	0.405	0.430	0.372	FeO

TE-33-6a traverse 6: exsolutions in pyroxene											
Corrected probe data											Corrected data
Point #	48	49	52	53	54	55	56	58	60	61	Point #
Comment	mt? hem?	mt? hem?	mt? hem?	mt? hem?	mt? hem?	mt? hem?	ilm	mt? hem?	ilm	ilm	Comment
Cor. ox. wt%	calc as mt	calc as mt	calc as hem	calc as mt	calc as mt	calc as mt		calc as mt			Cor. ox. wt%
SiO2	0.049	0.064	2.260	0.056	0.066	0.048	0.034	0.139	0.191	0.030	SiO2
TiO2	0.561	0.463	0.183	0.000	0.010	0.206	50.014	0.303	48.921	49.233	TiO2
Al2O3	0.068	0.177	0.070	0.058	0.085	0.094	0.000	0.088	0.000	0.000	Al2O3
Cr2O3	0.109	0.130	0.140	0.107	0.156	0.117	0.068	0.234	0.056	0.058	Cr2O3
V2O3	0.742	0.827	0.833	0.591	0.611	0.736	0.290	1.120	0.534	0.574	V2O3
Fe2O3	66.839	66.210	94.736	67.384	67.272	67.117	3.486	66.821	5.579	5.496	Fe2O3
FeO	31.418	31.042	1.589	30.489	30.585	30.735	44.434	31.146	43.249	43.523	FeO
MgO	0.000	0.000	0.502	0.000	0.000	0.000	0.024	0.014	0.111	0.021	MgO
CaO	0.162	0.163	0.250	0.191	0.172	0.146	0.109	0.262	0.214	0.243	CaO
MnO	0.000	0.040	0.062	0.000	0.000	0.054	0.394	0.042	0.493	0.384	MnO
ZnO	0.042	0.085	0.000	0.114	0.082	0.214	0.000	0.125	0.000	0.054	ZnO
total	99.990	99.201	100.625	98.990	99.039	99.466	98.853	100.295	99.348	99.616	total
Corrected cations/4"O"(mt); 3"O"(ilm, hem)											Cor. cations
Si	0.002	0.002	0.059	0.002	0.003	0.002	0.001	0.005	0.005	0.001	Si
Ti	0.016	0.013	0.004	0.000	0.000	0.006	0.962	0.009	0.936	0.940	Ti
Al	0.003	0.008	0.002	0.003	0.004	0.004	0.000	0.004	0.000	0.000	Al
Cr	0.003	0.004	0.003	0.003	0.005	0.004	0.001	0.007	0.001	0.001	Cr
V3+	0.023	0.026	0.017	0.018	0.019	0.023	0.006	0.034	0.011	0.012	V3+
Fe 3+	1.934	1.930	1.853	1.971	1.966	1.953	0.067	1.926	0.107	0.105	Fe 3+
Fe 2+	1.010	1.006	0.035	0.991	0.994	0.994	0.950	0.998	0.920	0.924	Fe 2+
Mg	0.000	0.000	0.019	0.000	0.000	0.000	0.001	0.001	0.004	0.001	Mg
Ca	0.007	0.007	0.007	0.008	0.007	0.006	0.003	0.011	0.006	0.007	Ca
Mn	0.000	0.001	0.001	0.000	0.000	0.002	0.009	0.001	0.011	0.008	Mn
Zn	0.001	0.002	0.000	0.003	0.002	0.006	0.000	0.004	0.000	0.001	Zn
total	3.000	3.000	2.000	3.000	3.000	3.000	2.000	3.000	2.000	2.000	total
RO2	0.009	0.008	0.059	0.001	0.001	0.004	0.491	0.007	0.485	0.485	RO2
R2O3	0.486	0.488	0.883	0.498	0.498	0.494	0.019	0.489	0.031	0.030	R2O3
RO	0.505	0.504	0.059	0.501	0.501	0.502	0.491	0.504	0.485	0.485	RO
TiO2	0.008	0.007	0.004	0.000	0.000	0.003	0.494	0.004	0.490	0.490	TiO2
Fe2O3	0.485	0.486	0.960	0.499	0.497	0.494	0.017	0.489	0.028	0.027	Fe2O3
FeO	0.507	0.507	0.036	0.501	0.503	0.503	0.488	0.507	0.482	0.482	FeO

TE-34-7 more traverses: from center of mt to center of ilm							
Corrected probe data (page 1)							Cor. data
Point #	1	5	6	9	10	11	Point #
Comment	mt core	mt	mt	mt	mt	mt	Comment
Cor. ox. wt%	trav starts->						Cor. ox. wt%
SiO2	0.029	0.019	0.039	0.021	0.010	0.031	SiO2
TiO2	0.071	0.069	0.064	0.099	0.089	0.147	TiO2
Al2O3	0.278	0.384	0.351	0.261	0.308	0.343	Al2O3
Cr2O3	0.000	0.022	0.004	0.032	0.024	0.017	Cr2O3
V2O3	1.023	1.043	1.056	1.024	0.945	1.057	V2O3
Fe2O3	67.966	67.962	67.859	68.077	68.234	67.848	Fe2O3
FeO	31.277	31.462	31.367	31.556	31.437	31.433	FeO
MgO	0.032	0.042	0.044	0.000	0.006	0.038	MgO
CaO	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.000	0.000	0.000	0.000	0.000	0.004	MnO
ZnO	0.156	0.000	0.066	0.000	0.143	0.141	ZnO
total	100.832	101.003	100.850	101.070	101.197	101.059	total
Cations/4"O" (mt); 3"O" (ilm)							Cor. cations
Si	0.001	0.001	0.001	0.001	0.000	0.001	Si
Ti	0.002	0.002	0.002	0.003	0.003	0.004	Ti
Al	0.012	0.017	0.016	0.012	0.014	0.015	Al
Cr	0.000	0.001	0.000	0.001	0.001	0.001	Cr
V3+	0.031	0.032	0.032	0.031	0.029	0.032	V3+
Fe 3+	1.950	1.945	1.945	1.949	1.951	1.941	Fe 3+
Fe 2+	0.997	1.001	0.999	1.004	0.999	0.999	Fe 2+
Mg	0.002	0.002	0.002	0.000	0.000	0.002	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.000	0.000	0.000	0.000	0.000	0.000	Mn
Zn	0.004	0.000	0.002	0.000	0.004	0.004	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.002	0.001	0.002	0.002	0.001	0.003	RO2
R2O3	0.498	0.498	0.497	0.497	0.498	0.496	R2O3
RO	0.501	0.501	0.501	0.501	0.501	0.501	RO
TiO2	0.001	0.001	0.001	0.001	0.001	0.002	TiO2
Fe2O3	0.494	0.492	0.493	0.492	0.493	0.492	Fe2O3
FeO	0.505	0.507	0.506	0.507	0.505	0.506	FeO

TE-34-7 more traverses: from center of mt to center of ilm								
Corrected probe data (page 2)								
Point #	22	21	19	18	15	14	13	Point #
Comment	ilm rim w/mt	ilm	ilm	ilm	ilm	ilm	ilm core	Comment
Cor. ox. wt%							<-trav ends	Cor. ox. wt%
SiO2	0.014	0.013	0.005	0.000	0.000	0.000	0.000	SiO2
TiO2	50.711	50.425	49.293	48.149	46.691	47.070	46.473	TiO2
Al2O3	0.021	0.013	0.011	0.027	0.154	0.026	0.032	Al2O3
Cr2O3	0.000	0.007	0.000	0.000	0.000	0.000	0.000	Cr2O3
V2O3	0.591	0.555	0.514	0.594	0.638	0.545	0.579	V2O3
Fe2O3	2.828	3.385	5.965	8.288	10.435	9.862	10.855	Fe2O3
FeO	44.892	44.688	43.639	42.517	41.207	41.624	41.036	FeO
MgO	0.066	0.117	0.105	0.124	0.182	0.143	0.186	MgO
CaO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.559	0.458	0.500	0.476	0.450	0.443	0.418	MnO
ZnO	0.048	0.000	0.000	0.088	0.000	0.000	0.000	ZnO
total	99.730	99.660	100.032	100.264	99.757	99.713	99.579	total
Cations/4"O" (mt); 3"O" (ilm)								Cor. cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.966	0.961	0.938	0.915	0.892	0.900	0.890	Ti
Al	0.001	0.000	0.000	0.001	0.005	0.001	0.001	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
V3+	0.012	0.011	0.010	0.012	0.013	0.011	0.012	V3+
Fe 3+	0.054	0.065	0.114	0.158	0.199	0.189	0.208	Fe 3+
Fe 2+	0.951	0.948	0.923	0.898	0.875	0.885	0.874	Fe 2+
Mg	0.002	0.004	0.004	0.005	0.007	0.005	0.007	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.012	0.010	0.011	0.010	0.010	0.010	0.009	Mn
Zn	0.001	0.000	0.000	0.002	0.000	0.000	0.000	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.492	0.490	0.484	0.478	0.471	0.474	0.471	RO2
R2O3	0.017	0.019	0.032	0.044	0.057	0.053	0.058	R2O3
RO	0.492	0.490	0.484	0.478	0.471	0.474	0.471	RO
TiO2	0.497	0.495	0.489	0.484	0.478	0.479	0.476	TiO2
Fe2O3	0.014	0.017	0.030	0.042	0.053	0.050	0.056	Fe2O3
FeO	0.489	0.488	0.481	0.475	0.469	0.471	0.468	FeO

TE-34-7 traverse 1&1a: from ilm interior to rim with mt												
Corrected probe data												
Point #	1	2	3	4	5	6	7	8	9	10	1a	Point #
Comment	ilm core	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm by mt	Comment
Corrected oxide wt%												Oxide wt%
SiO2	0.016	0.022	0.023	0.046	0.010	0.039	0.036	0.024	0.037	0.020	0.000	SiO2
TiO2	45.990	45.986	46.554	46.656	46.409	47.248	47.259	48.172	48.857	49.835	49.752	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr2O3
V2O3	0.321	0.436	0.331	0.350	0.378	0.381	0.330	0.390	0.298	0.367	0.353	V2O3
Fe2O3	12.931	13.317	12.163	11.668	11.935	9.955	9.454	8.643	7.175	5.211	5.693	Fe2O3
FeO	40.605	40.575	41.232	41.203	41.045	41.715	41.752	42.635	43.368	43.991	43.955	FeO
MgO	0.166	0.184	0.120	0.186	0.134	0.177	0.183	0.124	0.078	0.111	0.089	MgO
CaO	0.015	0.005	0.008	0.025	0.010	0.020	0.011	0.007	0.004	0.001	0.000	CaO
MnO	0.450	0.464	0.430	0.438	0.443	0.472	0.443	0.476	0.461	0.595	0.611	MnO
ZnO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.008	ZnO
total	100.494	100.989	100.861	100.572	100.364	100.007	99.468	100.472	100.278	100.182	100.461	total
Corrected cations/3"O"												Cor. cations
Si	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	Si
Ti	0.873	0.869	0.881	0.885	0.882	0.900	0.905	0.913	0.928	0.946	0.942	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
V	0.006	0.009	0.007	0.007	0.008	0.008	0.007	0.008	0.006	0.007	0.007	V
Fe3+	0.246	0.252	0.230	0.221	0.227	0.190	0.181	0.164	0.136	0.099	0.108	Fe3+
Fe2+	0.858	0.853	0.868	0.869	0.868	0.884	0.889	0.899	0.916	0.929	0.926	Fe2+
Mg	0.006	0.007	0.004	0.007	0.005	0.007	0.007	0.005	0.003	0.004	0.003	Mg
Ca	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.010	0.010	0.009	0.009	0.009	0.010	0.010	0.010	0.010	0.013	0.013	Mn
Zn	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.466	0.465	0.469	0.470	0.469	0.474	0.475	0.478	0.482	0.486	0.485	RO2
R2O3	0.067	0.070	0.063	0.061	0.062	0.052	0.049	0.045	0.037	0.027	0.030	R2O3
RO	0.466	0.465	0.469	0.470	0.469	0.474	0.475	0.478	0.482	0.486	0.485	RO
TiO2	0.471	0.470	0.473	0.475	0.473	0.479	0.480	0.482	0.485	0.492	0.490	TiO2
Fe2O3	0.066	0.068	0.062	0.059	0.061	0.051	0.048	0.043	0.036	0.026	0.028	Fe2O3
FeO	0.463	0.462	0.466	0.466	0.466	0.470	0.472	0.475	0.479	0.483	0.482	FeO

TE-35-1 Traverse 1: from ilm core to a simple contact with mt									
Corrected probe data (page 1)									**Probe data**
x	6079	6017	5956	5833	5771	5710	5648	5587	x
y	-3266	-3337	-3408	-3551	-3622	-3693	-3764	-3836	y
Point #	1	2	3	5	6	7	8	9	Point #
Comment	ilm core	ilm	ilm	ilm	ilm	ilm	ilm	ilm	Comment
Oxide wt%	trav begins->								**Oxide wt%**
SiO2	0.000	0.000	0.000	0.005	0.001	0.010	0.000	0.000	SiO2
TiO2	46.706	44.400	45.309	46.099	43.738	48.687	47.077	47.366	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.034	0.018	0.000	0.000	0.000	0.000	0.011	0.000	Cr2O3
V2O3	0.354	0.283	0.251	0.283	0.330	0.256	0.240	0.208	V2O3
Fe2O3	12.235	17.065	15.039	14.487	18.071	9.302	12.380	11.024	Fe2O3
FeO	38.631	36.732	37.354	38.275	36.208	40.492	39.130	39.250	FeO
MgO	1.591	1.388	1.579	1.484	1.461	1.502	1.479	1.495	MgO
CaO	0.002	0.000	0.002	0.004	0.000	0.016	0.000	0.000	CaO
MnO	0.541	0.561	0.566	0.527	0.511	0.603	0.549	0.669	MnO
ZnO	0.033	0.173	0.000	0.047	0.019	0.008	0.014	0.000	ZnO
total	100.127	100.620	100.100	101.211	100.339	100.876	100.880	100.012	total
Corrected cations/3"O"(ilm); 4"O"(mt)									**Cations**
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.880	0.836	0.855	0.861	0.826	0.910	0.882	0.894	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Cr
V3+	0.007	0.006	0.005	0.006	0.007	0.005	0.005	0.004	V3+
Fe3+	0.231	0.322	0.284	0.271	0.341	0.174	0.232	0.208	Fe3+
Fe2+	0.810	0.769	0.784	0.795	0.760	0.842	0.815	0.824	Fe2+
Mg	0.059	0.052	0.059	0.055	0.055	0.056	0.055	0.056	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.011	0.012	0.012	0.011	0.011	0.013	0.012	0.014	Mn
Zn	0.001	0.003	0.000	0.001	0.000	0.000	0.000	0.000	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Corrected probe data									**Probe data**
RO2	0.468	0.455	0.461	0.463	0.452	0.477	0.469	0.472	RO2
R2O3	0.064	0.089	0.078	0.074	0.095	0.047	0.063	0.056	R2O3
RO	0.468	0.455	0.461	0.463	0.452	0.477	0.469	0.472	RO
TiO2	0.488	0.473	0.480	0.481	0.470	0.495	0.486	0.491	TiO2
Fe2O3	0.064	0.091	0.080	0.076	0.097	0.047	0.064	0.057	Fe2O3
FeO	0.448	0.436	0.440	0.443	0.433	0.458	0.450	0.452	FeO

TE-35-1 Traverse 1: from ilm core to a simple contact with mt					
Corrected probe data (page 2)					Probe data
x	5525	5464	5218	5522	x
y	-3907	-3978	-4295	-3878	y
Point #	10	11	16	17	Point #
Comment	ilm	ilm by mt	mt	ilm	Comment
Oxide wt%		<-trav ends	individual pt	individual pt	**Oxide wt%**
SiO2	0.003	0.000	0.023	0.015	SiO2
TiO2	48.335	49.539	0.136	48.363	TiO2
Al2O3	0.000	0.000	0.454	0.000	Al2O3
Cr2O3	0.009	0.017	0.093	0.000	Cr2O3
V2O3	0.292	0.178	0.659	0.365	V2O3
Fe2O3	9.523	6.858	67.260	8.476	Fe2O3
FeO	40.265	41.160	30.997	40.426	FeO
MgO	1.482	1.563	0.097	1.423	MgO
CaO	0.000	0.000	0.000	0.022	CaO
MnO	0.554	0.578	0.000	0.521	MnO
ZnO	0.017	0.019	0.090	0.000	ZnO
total	100.480	99.913	99.809	99.611	total
Corrected cations/3"O"(ilm); 4"O"(mt)					**Cations**
Si	0.000	0.000	0.001	0.000	Si
Ti	0.907	0.933	0.004	0.916	Ti
Al	0.000	0.000	0.021	0.000	Al
Cr	0.000	0.000	0.003	0.000	Cr
V3+	0.006	0.004	0.020	0.007	V3+
Fe3+	0.179	0.129	1.947	0.161	Fe3+
Fe2+	0.841	0.862	0.997	0.851	Fe2+
Mg	0.055	0.058	0.006	0.053	Mg
Ca	0.000	0.000	0.000	0.001	Ca
Mn	0.012	0.012	0.000	0.011	Mn
Zn	0.000	0.000	0.003	0.000	Zn
total	2.000	2.000	3.000	2.000	total
Corrected probe data					**Probe data**
RO2	0.476	0.483	0.002	0.478	RO2
R2O3	0.049	0.034	0.496	0.044	R2O3
RO	0.476	0.483	0.501	0.478	RO
TiO2	0.494	0.502	0.002	0.496	TiO2
Fe2O3	0.049	0.035	0.493	0.044	Fe2O3
FeO	0.457	0.464	0.505	0.461	FeO

TE-35-1misc: two traverses (page 1)									
Corrected probe data									
Point#	1	2	3	4	7	8	9	10	Point#
Comment	ilm core	ilm	ilm	ilm	ilm	ilm	ilm	ilm	Comment
Oxide wt%	trav starts ->								Oxide wt%
SiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	SiO2
TiO2	46.399	46.612	46.916	47.349	49.035	47.747	47.587	46.948	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	Al2O3
Cr2O3	0.000	0.021	0.000	0.013	0.000	0.007	0.060	0.000	Cr2O3
V2O3	0.238	0.362	0.273	0.208	0.228	0.307	0.298	0.351	V2O3
Fe2O3	14.052	12.168	11.977	11.711	7.966	10.827	10.756	11.715	Fe2O3
FeO	38.094	38.614	38.783	38.937	40.352	39.240	39.183	38.799	FeO
MgO	1.604	1.549	1.568	1.625	1.664	1.618	1.586	1.562	MgO
CaO	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.557	0.535	0.532	0.518	0.606	0.614	0.598	0.510	MnO
ZnO	0.198	0.000	0.083	0.250	0.185	0.217	0.201	0.135	ZnO
total	101.168	99.861	100.132	100.611	100.036	100.577	100.270	100.053	total
Corrected cations/3"O"(ilm,hem); 4"O"(mt)									Cor. Cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.866	0.881	0.884	0.888	0.923	0.895	0.895	0.885	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Cr
V3+	0.005	0.007	0.005	0.004	0.005	0.006	0.006	0.007	V3+
Fe3+	0.263	0.230	0.226	0.220	0.150	0.203	0.202	0.221	Fe3+
Fe2+	0.791	0.812	0.813	0.812	0.844	0.818	0.820	0.814	Fe2+
Mg	0.059	0.058	0.059	0.060	0.062	0.060	0.059	0.058	Mg
Ca	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.012	0.011	0.011	0.011	0.013	0.013	0.013	0.011	Mn
Zn	0.004	0.000	0.002	0.005	0.003	0.004	0.004	0.002	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.464	0.468	0.469	0.470	0.480	0.472	0.472	0.470	RO2
R2O3	0.072	0.063	0.061	0.059	0.040	0.055	0.055	0.061	R2O3
RO	0.464	0.468	0.469	0.470	0.480	0.472	0.472	0.470	RO
TiO2	0.484	0.487	0.489	0.491	0.501	0.493	0.493	0.489	TiO2
Fe2O3	0.073	0.064	0.062	0.061	0.041	0.056	0.056	0.061	Fe2O3
FeO	0.442	0.449	0.449	0.449	0.458	0.451	0.451	0.450	FeO

TE-35-1misc: two traverses (page 2)						
Corrected probe data						
Point#	11	12	14	17	20	Point#
Comment	ilm	ilm	mt by ilm	mt	mt core	Comment
Oxide wt%					<-trav ends	Oxide wt%
SiO2	0.000	0.000	0.009	0.000	0.002	SiO2
TiO2	48.865	49.500	0.128	0.092	0.000	TiO2
Al2O3	0.000	0.000	0.093	0.342	0.136	Al2O3
Cr2O3	0.040	0.020	0.128	0.108	0.130	Cr2O3
V2O3	0.268	0.312	0.395	0.450	0.481	V2O3
Fe2O3	7.609	6.786	68.933	68.185	68.929	Fe2O3
FeO	40.597	40.854	31.275	30.943	31.214	FeO
MgO	1.581	1.670	0.025	0.166	0.028	MgO
CaO	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.537	0.682	0.068	0.034	0.036	MnO
ZnO	0.094	0.163	0.228	0.098	0.128	ZnO
total	99.591	99.987	101.283	100.417	101.084	total
Corrected cations/3"O"(ilm,hem); 4"O"(mt)						Cor. Cations
Si	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.924	0.932	0.004	0.003	0.000	Ti
Al	0.000	0.000	0.004	0.015	0.006	Al
Cr	0.001	0.000	0.004	0.003	0.004	Cr
V3+	0.005	0.006	0.012	0.014	0.015	V3+
Fe3+	0.144	0.128	1.972	1.962	1.975	Fe3+
Fe2+	0.854	0.855	0.994	0.990	0.994	Fe2+
Mg	0.059	0.062	0.001	0.009	0.002	Mg
Ca	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.011	0.014	0.002	0.001	0.001	Mn
Zn	0.002	0.003	0.006	0.003	0.004	Zn
total	2.000	2.000	3.000	3.000	3.000	total
RO2	0.480	0.482	0.002	0.001	0.000	RO2
R2O3	0.040	0.036	0.497	0.498	0.500	R2O3
RO	0.480	0.482	0.501	0.501	0.500	RO
TiO2	0.500	0.504	0.002	0.001	0.000	TiO2
Fe2O3	0.040	0.035	0.497	0.497	0.498	Fe2O3
FeO	0.461	0.461	0.501	0.501	0.502	FeO

TE-35-1misc: two traverses (page 3)											
Corrected probe data											
Point#	21	22	23	25	26	28	29	32	33	34	Point#
Comment	mt	mt	mt	contact	ilm lamellae	ilm lamellae	ilm lamellae	mt/spinel	mt	mt	Comment
Oxide wt%	trav starts ->									<- trav ends	Oxide wt%
SiO2	0.128	0.018	0.019	0.491	0.012	0.000	0.000	6.232	0.007	0.000	SiO2
TiO2	0.366	0.372	0.511	14.061	50.191	50.158	50.257	0.552	0.443	0.378	TiO2
Al2O3	0.132	0.170	0.169	0.262	0.000	0.000	0.000	10.122	0.151	0.178	Al2O3
Cr2O3	0.163	0.167	0.176	0.090	0.041	0.033	0.028	0.135	0.127	0.143	Cr2O3
V2O3	0.466	0.574	0.606	0.457	0.292	0.270	0.332	0.408	0.543	0.577	V2O3
Fe2O3	67.404	67.339	66.882	39.251	6.105	5.041	5.366	41.143	67.545	67.836	Fe2O3
FeO	31.373	31.133	31.187	43.610	41.966	41.955	42.302	39.806	31.324	31.349	FeO
MgO	0.018	0.001	0.011	0.328	1.127	1.112	1.053	0.982	0.018	0.022	MgO
CaO	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.097	0.006	0.002	CaO
MnO	0.026	0.013	0.083	0.305	1.163	1.035	1.002	0.015	0.047	0.047	MnO
ZnO	0.296	0.389	0.267	0.085	0.184	0.135	0.000	0.130	0.258	0.272	ZnO
total	100.372	100.177	99.935	98.940	101.081	99.740	100.340	99.622	100.469	100.805	total
Corrected cations/3"O"(ilm,hem); 4"O"(mt)											Cor. Cations
Si	0.005	0.001	0.001	0.019	0.000	0.000	0.000	0.220	0.000	0.000	Si
Ti	0.011	0.011	0.015	0.403	0.938	0.949	0.946	0.015	0.013	0.011	Ti
Al	0.006	0.008	0.008	0.012	0.000	0.000	0.000	0.421	0.007	0.008	Al
Cr	0.005	0.005	0.005	0.003	0.001	0.001	0.001	0.004	0.004	0.004	Cr
V3+	0.014	0.018	0.019	0.014	0.006	0.005	0.007	0.012	0.017	0.018	V3+
Fe3+	1.944	1.946	1.937	1.127	0.114	0.095	0.101	1.093	1.946	1.948	Fe3+
Fe2+	1.005	1.000	1.004	1.391	0.872	0.883	0.885	1.176	1.003	1.001	Fe2+
Mg	0.001	0.000	0.001	0.019	0.042	0.042	0.039	0.052	0.001	0.001	Mg
Ca	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.004	0.000	0.000	Ca
Mn	0.001	0.000	0.003	0.010	0.024	0.022	0.021	0.000	0.002	0.002	Mn
Zn	0.008	0.011	0.008	0.002	0.003	0.003	0.000	0.003	0.007	0.008	Zn
total	3.000	3.000	3.000	3.000	2.000	2.000	2.000	3.000	3.000	3.000	total
RO2	0.008	0.006	0.008	0.174	0.484	0.487	0.486	0.105	0.006	0.005	RO2
R2O3	0.488	0.491	0.488	0.238	0.032	0.026	0.028	0.342	0.490	0.492	R2O3
RO	0.504	0.503	0.504	0.587	0.484	0.487	0.486	0.553	0.503	0.503	RO
TiO2	0.005	0.005	0.007	0.171	0.503	0.505	0.503	0.008	0.006	0.005	TiO2
Fe2O3	0.489	0.491	0.487	0.239	0.032	0.025	0.027	0.315	0.489	0.491	Fe2O3
FeO	0.506	0.504	0.505	0.590	0.466	0.470	0.470	0.677	0.504	0.504	FeO

TE-35-1new: two traverses across an ilm lamella in mt										
Corrected probe data (page 1)										
Point #	1	2	3	4	6	7	8	9	10	Point #
Comment	mt	mt	mt	mt	mt	mt	ilm lamella	mt	mt	Comment
Oxide w%	first trav->									Cor. oxide w%
SiO2	0.000	0.000	0.000	0.000	0.022	0.205	0.000	0.023	0.000	SiO2
TiO2	0.149	0.093	0.131	0.164	0.564	1.110	49.303	1.133	0.454	TiO2
Al2O3	0.309	0.257	0.339	0.304	0.307	0.346	0.023	0.281	0.354	Al2O3
Cr2O3	0.112	0.111	0.083	0.145	0.111	0.100	0.000	0.065	0.074	Cr2O3
V2O3	0.779	0.784	0.802	0.677	0.719	0.686	0.493	0.728	0.816	V2O3
Fe2O3	67.413	67.411	66.937	66.838	66.502	64.501	5.384	65.204	66.072	Fe2O3
FeO	31.150	30.892	30.959	30.820	31.474	31.942	41.322	31.866	31.140	FeO
MgO	0.040	0.050	0.030	0.070	0.034	0.082	0.980	0.064	0.042	MgO
CaO	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.009	0.000	CaO
MnO	0.029	0.056	0.010	0.032	0.060	0.047	1.235	0.007	0.013	MnO
ZnO	0.000	0.087	0.000	0.000	0.016	0.000	0.019	0.019	0.000	ZnO
total	99.981	99.741	99.291	99.054	99.809	99.018	98.758	99.400	98.965	total
Corrected cations/3"O"(ilm); 4"O"(mt)										Cations
Si	0.000	0.000	0.000	0.000	0.001	0.008	0.000	0.001	0.000	Si
Ti	0.004	0.003	0.004	0.005	0.016	0.032	0.943	0.033	0.013	Ti
Al	0.014	0.012	0.015	0.014	0.014	0.016	0.001	0.013	0.016	Al
Cr	0.003	0.003	0.003	0.004	0.003	0.003	0.000	0.002	0.002	Cr
V3+	0.024	0.024	0.025	0.021	0.022	0.021	0.010	0.023	0.025	V3+
Fe 3+	1.950	1.955	1.949	1.951	1.926	1.879	0.103	1.895	1.929	Fe 3+
Fe 2+	1.001	0.996	1.002	1.000	1.013	1.034	0.879	1.029	1.011	Fe 2+
Mg	0.002	0.003	0.002	0.004	0.002	0.005	0.037	0.004	0.002	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.001	0.002	0.000	0.001	0.002	0.002	0.027	0.000	0.000	Mn
Zn	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.000	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	2.000	3.000	3.000	total
RO2	0.002	0.001	0.002	0.002	0.009	0.020	0.485	0.017	0.007	RO2
R2O3	0.497	0.498	0.497	0.496	0.487	0.470	0.029	0.475	0.490	R2O3
RO	0.501	0.501	0.501	0.501	0.504	0.510	0.485	0.508	0.503	RO
TiO2	0.002	0.001	0.002	0.002	0.008	0.016	0.503	0.016	0.007	TiO2
Fe2O3	0.492	0.495	0.492	0.493	0.483	0.468	0.028	0.471	0.485	Fe2O3
FeO	0.506	0.504	0.506	0.505	0.508	0.516	0.469	0.512	0.508	FeO

TE-35-1new: two traverses across an ilm lamella in mt											
Corrected probe data (page 2)											
Point #	11	12	13	15	17	26	27	28	31	32	Point #
Comment	mt	mt	mt	mt	mt	mt	mt	mt	mt	mt	Comment
Oxide w%		<-first trav	second trav->							<-second trav	Cor. oxide w%
SiO2	0.315	0.000	0.049	0.008	0.213	0.608	0.000	0.017	0.009	0.015	SiO2
TiO2	0.263	0.218	0.473	0.741	1.084	1.332	0.903	0.747	0.467	0.415	TiO2
Al2O3	0.392	0.346	0.307	0.293	0.404	0.593	0.279	0.291	0.342	0.361	Al2O3
Cr2O3	0.056	0.066	0.123	0.086	0.132	0.094	0.138	0.086	0.101	0.072	Cr2O3
V2O3	0.717	0.691	0.730	0.779	0.690	0.651	0.713	0.661	0.768	0.746	V2O3
Fe2O3	66.703	67.042	66.619	66.280	64.899	63.777	65.592	66.369	66.163	66.466	Fe2O3
FeO	31.579	31.026	31.481	31.688	32.192	33.097	31.571	31.607	31.101	31.174	FeO
MgO	0.143	0.042	0.052	0.063	0.066	0.066	0.030	0.078	0.057	0.061	MgO
CaO	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.005	0.000	CaO
MnO	0.019	0.038	0.001	0.000	0.035	0.085	0.047	0.069	0.025	0.000	MnO
ZnO	0.041	0.035	0.000	0.000	0.000	0.030	0.085	0.000	0.068	0.066	ZnO
total	100.230	99.504	99.835	99.939	99.715	100.333	99.358	99.925	99.106	99.376	total
Corrected cations/3"O"(ilm); 4"O"(mt)											Cations
Si	0.012	0.000	0.002	0.000	0.008	0.023	0.000	0.001	0.000	0.001	Si
Ti	0.008	0.006	0.014	0.021	0.031	0.038	0.026	0.022	0.014	0.012	Ti
Al	0.018	0.016	0.014	0.013	0.018	0.027	0.013	0.013	0.016	0.016	Al
Cr	0.002	0.002	0.004	0.003	0.004	0.003	0.004	0.003	0.003	0.002	Cr
V3+	0.022	0.021	0.023	0.024	0.021	0.020	0.022	0.020	0.024	0.023	V3+
Fe 3+	1.919	1.948	1.928	1.916	1.877	1.828	1.908	1.919	1.929	1.933	Fe 3+
Fe 2+	1.010	1.002	1.013	1.018	1.035	1.054	1.021	1.016	1.008	1.007	Fe 2+
Mg	0.008	0.002	0.003	0.004	0.004	0.004	0.002	0.004	0.003	0.004	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.001	0.001	0.000	0.000	0.001	0.003	0.002	0.002	0.001	0.000	Mn
Zn	0.001	0.001	0.000	0.000	0.000	0.001	0.002	0.000	0.002	0.002	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.010	0.003	0.008	0.011	0.019	0.030	0.013	0.011	0.007	0.006	RO2
R2O3	0.485	0.495	0.488	0.484	0.471	0.455	0.480	0.483	0.490	0.491	R2O3
RO	0.505	0.502	0.504	0.505	0.510	0.515	0.507	0.506	0.504	0.503	RO
TiO2	0.004	0.003	0.007	0.011	0.016	0.019	0.013	0.011	0.007	0.006	TiO2
Fe2O3	0.485	0.491	0.484	0.480	0.468	0.456	0.477	0.481	0.486	0.487	Fe2O3
FeO	0.511	0.505	0.509	0.510	0.516	0.525	0.510	0.509	0.507	0.507	FeO

TE-35-1 pyroxene: small traverse across grain									
Point #	1	2	3	4	5	6	7	8	Point #
Comment	cpx	cpx	cpx	cpx	cpx	cpx	cpx?	cpx	Comment
Oxide wt%									Oxide wt%
SiO2	51.654	50.774	50.268	50.948	51.005	51.457	51.732	51.496	SiO2
TiO2	0.196	0.228	0.203	0.239	0.201	0.263	0.171	0.228	TiO2
Al2O3	1.649	1.734	1.605	1.576	1.669	1.763	1.479	1.758	Al2O3
Cr2O3	0	0	0	0	0	0	0	0	Cr2O3
Fe2O3	2.626	3.857	5.202	3.919	3.73	3.502	1.164	2.684	Fe2O3
FeO	9.145	7.927	6.351	10.993	8.248	8.138	19.411	8.992	FeO
MgO	12.424	12.248	12.404	12.913	12.401	12.28	14.866	12.393	MgO
MnO	0.249	0.258	0.268	0.413	0.299	0.256	0.393	0.224	MnO
CaO	22.23	22.389	23.138	19.405	22.097	22.756	11.398	22.157	CaO
Na2O	0.415	0.47	0.414	0.399	0.476	0.502	0.238	0.45	Na2O
K2O	0	0.012	0	0	0	0	0	0	K2O
total	100.588	99.897	99.853	100.805	100.126	100.917	100.852	100.382	total
Cations/6"O"									Cations/6"O"
Si	1.936	1.918	1.900	1.917	1.922	1.923	1.954	1.933	Si
Al	0.064	0.077	0.071	0.070	0.074	0.077	0.046	0.067	Al
Fe3+	0.000	0.005	0.029	0.013	0.004				Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Al	0.009					0.001	0.020	0.011	Al
Ti	0.006	0.006	0.006	0.007	0.006	0.007	0.005	0.006	Ti
Fe3+	0.074	0.105	0.119	0.098	0.102	0.098	0.033	0.076	Fe3+
Cr									Cr
Mg	0.694	0.689	0.699	0.724	0.696	0.684	0.837	0.693	Mg
Fe2+	0.217	0.200	0.176	0.171	0.196	0.210	0.105	0.214	Fe2+
total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	total
Fe2+	0.070	0.050	0.025	0.175	0.064	0.044	0.508	0.068	Fe2+
Mn	0.008	0.008	0.009	0.013	0.010	0.008	0.013	0.007	Mn
Ca	0.893	0.906	0.937	0.782	0.892	0.911	0.461	0.891	Ca
Na	0.030	0.034	0.030	0.029	0.035	0.036	0.017	0.033	Na
K		0.001							K
total	1.001	0.999	1.001	0.999	1.001	0.999	0.999	0.999	total

TE-39-1a: Ilmenite-magnetite traverse 1											
Corrected probe data											Corrected data
Point #	1	2	3	4	5	6	7	8	9	10	Point #
Comment	core of large	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm	ilm rim	Comment
Cor. oxide wt%	ilm										Oxide wt%
SiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	SiO2
TiO2	46.394	45.637	46.487	46.311	45.970	45.865	46.068	46.391	47.218	48.412	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.003	0.026	0.050	0.026	0.013	0.033	0.039	0.037	0.005	0.028	Cr2O3
V2O3	0.355	0.293	0.450	0.410	0.467	0.492	0.432	0.342	0.398	0.385	V2O3
Fe2O3	11.869	12.471	11.641	12.460	12.235	12.328	11.609	11.652	9.790	7.587	Fe2O3
FeO	40.906	40.198	40.865	40.710	40.507	40.378	40.454	40.908	41.597	42.669	FeO
MgO	0.129	0.151	0.164	0.156	0.171	0.196	0.192	0.170	0.180	0.114	MgO
CaO	0.016	0.013	0.016	0.012	0.013	0.000	0.021	0.007	0.009	0.000	CaO
MnO	0.575	0.507	0.599	0.441	0.504	0.487	0.596	0.516	0.525	0.603	MnO
ZnO	0.057	0.047	0.022	0.221	0.000	0.027	0.000	0.000	0.000	0.058	ZnO
total	100.304	99.344	100.294	100.747	99.879	99.805	99.411	100.023	99.721	99.856	total
Corrected cations/3"O"(ilm), 4"O"(mt, her)											Cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.883	0.877	0.884	0.877	0.878	0.877	0.884	0.885	0.902	0.923	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	Cr
V3+	0.007	0.006	0.009	0.008	0.010	0.010	0.009	0.007	0.008	0.008	V3+
Fe3+	0.226	0.240	0.222	0.236	0.234	0.236	0.223	0.222	0.187	0.145	Fe3+
Fe2+	0.866	0.859	0.864	0.858	0.861	0.858	0.863	0.868	0.884	0.905	Fe2+
Mg	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.006	0.007	0.004	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	Ca
Mn	0.012	0.011	0.013	0.009	0.011	0.010	0.013	0.011	0.011	0.013	Mn
Zn	0.001	0.001	0.000	0.004	0.000	0.001	0.000	0.000	0.000	0.001	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.469	0.467	0.469	0.467	0.468	0.467	0.469	0.469	0.474	0.480	RO2
R2O3	0.062	0.066	0.061	0.065	0.065	0.066	0.062	0.061	0.051	0.040	R2O3
RO	0.469	0.467	0.469	0.467	0.468	0.467	0.469	0.469	0.474	0.480	RO
TiO2	0.474	0.473	0.476	0.473	0.473	0.473	0.476	0.475	0.480	0.486	TiO2
Fe2O3	0.061	0.065	0.060	0.064	0.063	0.064	0.060	0.060	0.050	0.038	Fe2O3
FeO	0.464	0.463	0.465	0.463	0.464	0.463	0.464	0.465	0.470	0.476	FeO

TE-39-1a: ilmenite-magnetite traverse 1						
Corrected probe data						Corrected data
Point #	12	15	16	18	19	Point #
Comment	mt rim	mt	mt	mt	mt	Comment
Cor oxide wt%						Oxide wt%
SiO2	0.023	0.020	0.004	0.020	0.000	SiO2
TiO2	0.011	0.000	0.000	0.000	0.000	TiO2
Al2O3	0.348	0.218	0.150	0.098	0.252	Al2O3
Cr2O3	0.069	0.076	0.054	0.049	0.057	Cr2O3
V2O3	0.705	0.670	0.723	0.722	0.783	V2O3
Fe2O3	68.015	68.439	68.908	68.790	68.277	Fe2O3
FeO	31.001	31.204	31.391	31.192	31.100	FeO
MgO	0.047	0.042	0.000	0.000	0.000	MgO
CaO	0.017	0.010	0.021	0.023	0.017	CaO
MnO	0.041	0.036	0.080	0.057	0.030	MnO
ZnO	0.173	0.035	0.000	0.187	0.176	ZnO
total	100.450	100.750	101.331	101.138	100.692	total
Corrected cations/3"O"(ilm), 4"O"(mt, her)						Cations
Si	0.001	0.001	0.000	0.001	0.000	Si
Ti	0.000	0.000	0.000	0.000	0.000	Ti
Al	0.016	0.010	0.007	0.004	0.011	Al
Cr	0.002	0.002	0.002	0.001	0.002	Cr
V3+	0.022	0.021	0.022	0.022	0.024	V3+
Fe3+	1.958	1.966	1.969	1.970	1.963	Fe3+
Fe2+	0.992	0.996	0.997	0.993	0.994	Fe2+
Mg	0.003	0.002	0.000	0.000	0.000	Mg
Ca	0.001	0.000	0.001	0.001	0.001	Ca
Mn	0.001	0.001	0.003	0.002	0.001	Mn
Zn	0.005	0.001	0.000	0.005	0.005	Zn
total	3.000	3.000	3.000	3.000	3.000	total
RO2	0.001	0.000	0.000	0.000	0.000	RO2
R2O3	0.499	0.499	0.500	0.499	0.500	R2O3
RO	0.500	0.500	0.500	0.500	0.500	RO
TiO2	0.000	0.000	0.000	0.000	0.000	TiO2
Fe2O3	0.497	0.497	0.497	0.498	0.497	Fe2O3
FeO	0.503	0.503	0.503	0.502	0.503	FeO

TE-39-1a: traverse 2 across a mt/ilm contact											
Corrected probe data (page 1)											
Point #	1	2	3	4	6	7	9	10	13	15	Point #
Comment	mt interior	mt	mt	mt	mt	mt	mt	mt	ilm	ilm (+incl)	Comment
Cor. oxide wt%											Cor. Ox wt%
SiO2	0.031	0.000	0.007	0.029	0.004	0.008	0.026	0.013	0.000	6.644	SiO2
TiO2	0.115	0.163	0.081	0.077	0.098	0.109	0.249	0.457	49.602	36.604	TiO2
Al2O3	0.338	0.182	0.292	0.263	0.366	0.215	2.262	0.349	0.030	7.359	Al2O3
Cr2O3	0.007	0.041	0.000	0.029	0.015	0.010	0.000	0.003	0.000	0.000	Cr2O3
V2O3	0.715	0.821	0.734	0.733	0.762	0.781	0.680	0.642	0.517	0.298	V2O3
Fe2O3	67.381	68.222	68.359	68.044	68.155	68.095	65.850	67.720	4.235	11.657	Fe2O3
FeO	31.039	31.530	31.380	31.359	31.274	31.070	31.447	31.771	43.679	30.204	FeO
MgO	0.009	0.000	0.007	0.001	0.019	0.005	0.223	0.018	0.054	5.654	MgO
CaO	0.008	0.000	0.012	0.016	0.017	0.000	0.009	0.000	0.000	0.082	CaO
MnO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.697	0.470	MnO
ZnO	0.141	0.008	0.087	0.000	0.181	0.354	0.238	0.057	0.140	0.000	ZnO
total	99.784	100.967	100.959	100.552	100.891	100.647	100.984	101.061	98.954	98.972	total
Corrected cations/3"O"(Ilm); 4"O"(mt)											Cor. cations
Si	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.154	Si
Ti	0.003	0.005	0.002	0.002	0.003	0.003	0.007	0.013	0.954	0.640	Ti
Al	0.015	0.008	0.013	0.012	0.016	0.010	0.100	0.016	0.001	0.202	Al
Cr	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	Cr
V3+	0.022	0.025	0.022	0.022	0.023	0.024	0.020	0.020	0.011	0.006	V3+
Fe 3+	1.953	1.956	1.959	1.958	1.954	1.959	1.863	1.937	0.081	0.204	Fe 3+
Fe 2+	1.000	1.005	0.999	1.003	0.996	0.993	0.989	1.010	0.934	0.587	Fe 2+
Mg	0.001	0.000	0.000	0.000	0.001	0.000	0.012	0.001	0.002	0.196	Mg
Ca	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.002	Ca
Mn	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.015	0.009	Mn
Zn	0.004	0.000	0.002	0.000	0.005	0.010	0.007	0.002	0.003	0.000	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	2.000	2.000	total
Corrected data											Cor. data
RO2	0.002	0.002	0.001	0.002	0.001	0.002	0.004	0.007	0.488	0.443	RO2
R2O3	0.497	0.496	0.498	0.497	0.498	0.497	0.494	0.490	0.024	0.115	R2O3
RO	0.501	0.501	0.501	0.501	0.501	0.501	0.502	0.503	0.488	0.443	RO
TiO2	0.002	0.002	0.001	0.001	0.001	0.002	0.004	0.007	0.495	0.481	TiO2
Fe2O3	0.493	0.492	0.494	0.493	0.494	0.496	0.483	0.486	0.021	0.077	Fe2O3
FeO	0.505	0.506	0.504	0.505	0.504	0.503	0.513	0.507	0.484	0.442	FeO

TE-39-1a: traverse 2 across a mt/ilm contact					
Corrected probe data (page 2)					
Point #	16	18	19	20	Point #
Comment	ilm	ilm	ilm	ilm interior	Comment
Oxide wt%					**Cor. Ox wt%**
SiO2	0.000	0.000	0.000	0.001	SiO2
TiO2	48.342	48.140	47.623	47.551	TiO2
Al2O3	0.079	0.039	0.020	0.013	Al2O3
Cr2O3	0.000	0.000	0.000	0.000	Cr2O3
V2O3	0.399	0.475	0.505	0.515	V2O3
Fe2O3	6.923	7.016	8.276	8.876	Fe2O3
FeO	42.628	42.476	41.954	41.845	FeO
MgO	0.089	0.129	0.149	0.178	MgO
CaO	0.000	0.000	0.000	0.000	CaO
MnO	0.638	0.602	0.609	0.592	MnO
ZnO	0.044	0.055	0.000	0.000	ZnO
total	99.141	98.932	99.136	99.571	total
Corrected cations/3"O"(ilm); 4"O"(mt)					**Cor. cations**
Si	0.000	0.000	0.000	0.000	Si
Ti	0.928	0.926	0.915	0.910	Ti
Al	0.002	0.001	0.001	0.000	Al
Cr	0.000	0.000	0.000	0.000	Cr
V3+	0.008	0.010	0.010	0.011	V3+
Fe 3+	0.133	0.135	0.159	0.170	Fe 3+
Fe 2+	0.910	0.909	0.896	0.890	Fe 2+
Mg	0.003	0.005	0.006	0.007	Mg
Ca	0.000	0.000	0.000	0.000	Ca
Mn	0.014	0.013	0.013	0.013	Mn
Zn	0.001	0.001	0.000	0.000	Zn
total	2.000	2.000	2.000	2.000	total
Corrected data					**Cor. data**
RO2	0.481	0.481	0.478	0.476	RO2
R2O3	0.037	0.038	0.044	0.047	R2O3
RO	0.481	0.481	0.478	0.476	RO
TiO2	0.487	0.487	0.484	0.483	TiO2
Fe2O3	0.035	0.036	0.042	0.045	Fe2O3
FeO	0.478	0.477	0.474	0.472	FeO

TE-39-1a: traverse across the width of a large mt						
Corrected probe data (page 1)						
Point#	1	2	3	4	13	Point#
Comment	mt rim by sil	mt	mt	ilm incl/exsol	mt	Comment
Cor. oxide wt%						Cor. ox. wt%
SiO2	0.025	0.000	0.034	0.008	1.116	SiO2
TiO2	0.067	0.027	0.118	50.579	0.037	TiO2
Al2O3	0.293	0.240	0.293	0.305	1.648	Al2O3
Cr2O3	0.000	0.035	0.016	0.000	0.000	Cr2O3
V2O3	0.811	0.814	0.739	0.367	0.868	V2O3
Fe2O3	67.641	68.621	68.286	3.074	63.386	Fe2O3
FeO	31.100	31.478	31.539	44.760	32.509	FeO
MgO	0.000	0.000	0.000	0.061	0.186	MgO
CaO	0.051	0.008	0.000	0.001	0.000	CaO
MnO	0.051	0.019	0.000	0.817	0.000	MnO
ZnO	0.000	0.000	0.062	0.093	0.000	ZnO
total	100.039	101.242	101.087	100.065	99.749	total
Corrected cations/4"O"(mt); 3"O"(ilm)						Cor. cations
Si	0.001	0.000	0.001	0.000	0.042	Si
Ti	0.002	0.001	0.003	0.960	0.001	Ti
Al	0.013	0.011	0.013	0.009	0.074	Al
Cr	0.000	0.001	0.000	0.000	0.000	Cr
V3+	0.025	0.025	0.023	0.007	0.026	V3+
Fe 3+	1.956	1.962	1.954	0.058	1.813	Fe 3+
Fe 2+	0.999	1.000	1.003	0.945	1.033	Fe 2+
Mg	0.000	0.000	0.000	0.002	0.011	Mg
Ca	0.002	0.000	0.000	0.000	0.000	Ca
Mn	0.002	0.001	0.000	0.017	0.000	Mn
Zn	0.000	0.000	0.002	0.002	0.000	Zn
total	3.000	3.000	3.000	2.000	3.000	total
RO2	0.001	0.000	0.002	0.490	0.021	RO2
R2O3	0.498	0.499	0.496	0.021	0.468	R2O3
RO	0.501	0.500	0.501	0.490	0.511	RO
TiO2	0.001	0.000	0.002	0.497	0.001	TiO2
Fe2O3	0.494	0.495	0.493	0.017	0.467	Fe2O3
FeO	0.505	0.505	0.506	0.486	0.532	FeO

TE-39-1a: exsolution in pyroxene				
Corrected probe data				
Point #	4	5	8	Point #
Comment	ilm exsol	ilm exsol	ilm exsol	Comment
Oxide wt %				
SiO2	0.770	0.030	0.003	SiO2
TiO2	44.390	46.068	44.722	TiO2
Al2O3	0.000	0.000	0.000	Al2O3
Cr2O3	0.000	0.000	0.004	Cr2O3
V2O3	0.254	0.331	0.326	V2O3
Fe2O3	12.442	11.627	13.553	Fe2O3
FeO	39.795	40.637	38.811	FeO
MgO	0.157	0.049	0.026	MgO
CaO	0.084	0.030	0.588	CaO
MnO	0.638	0.692	0.601	MnO
ZnO	0.011	0.000	0.000	ZnO
total	98.541	99.464	98.635	total
Corrected cations/3O				
Si	0.020	0.001	0.000	Si
Ti	0.857	0.884	0.865	Ti
Al	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.000	Cr
V3+	0.005	0.007	0.007	V3+
Fe3+	0.240	0.223	0.262	Fe3+
Fe2+	0.855	0.867	0.835	Fe2+
Mg	0.006	0.002	0.001	Mg
Ca	0.002	0.001	0.016	Ca
Mn	0.014	0.015	0.013	Mn
Zn	0.000	0.000	0.000	Zn
total	2.000	2.000	2.000	total
RO2	0.467	0.469	0.464	RO2
R2O3	0.065	0.061	0.072	R2O3
RO	0.467	0.469	0.464	RO
TiO2	0.468	0.475	0.472	TiO2
Fe2O3	0.066	0.060	0.072	Fe2O3
FeO	0.466	0.466	0.456	FeO

TE-39-1a: nontraverse points								
Corrected probe points (page 1)								
Point #	1a	2a	3a	4a	5a	2b	1c	2c
Comment	ilm rim by	ilm rim by	ilm rim by mt	ilm rim by	ilm ex in mt	ilm ex in mt	ilm rim by mt	ilm rim by
Cor. wt% ox.	silicate	silicate		silicate				silicate
SiO2	0.007	0.000	0.009	0.000	0.041	0.004	0.000	0.000
TiO2	48.851	47.783	49.527	47.810	48.791	49.870	49.792	48.416
Al2O3	0.000	0.000	0.000	0.000	0.396	0.000	0.000	0.000
Cr2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.008
V2O3	0.303	0.316	0.255	0.307	0.257	0.335	0.347	0.298
Fe2O3	5.140	7.360	5.009	7.921	5.259	3.084	4.539	8.171
FeO	42.959	41.958	43.660	42.205	42.654	44.102	44.019	42.571
MgO	0.098	0.234	0.088	0.064	0.075	0.038	0.091	0.116
CaO	0.052	0.041	0.014	0.024	0.013	0.011	0.008	0.003
MnO	0.690	0.534	0.637	0.549	0.829	0.658	0.577	0.668
ZnO	0.044	0.000	0.077	0.099	0.318	0.000	0.000	0.091
total	98.144	98.227	99.276	98.979	98.633	98.102	99.394	100.342
Corrected cations/3"O"(ilm); 4"O"(mt)								
Si	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Ti	0.947	0.925	0.949	0.921	0.940	0.967	0.953	0.919
Al	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V3+	0.006	0.007	0.005	0.006	0.005	0.007	0.007	0.006
Fe3+	0.100	0.143	0.096	0.153	0.101	0.060	0.087	0.155
Fe2+	0.926	0.904	0.930	0.904	0.913	0.951	0.937	0.899
Mg	0.004	0.009	0.003	0.002	0.003	0.001	0.003	0.004
Ca	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000
Mn	0.015	0.012	0.014	0.012	0.018	0.014	0.012	0.014
Zn	0.001	0.000	0.001	0.002	0.006	0.000	0.000	0.002
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000

RO2	0.486	0.481	0.487	0.479	0.485	0.492	0.488	0.479
R2O3	0.027	0.039	0.026	0.041	0.031	0.017	0.024	0.042
RO	0.486	0.481	0.487	0.479	0.485	0.492	0.488	0.479
TiO2	0.492	0.487	0.492	0.484	0.494	0.496	0.493	0.485
Fe2O3	0.026	0.038	0.025	0.040	0.027	0.015	0.022	0.041
FeO	0.482	0.476	0.483	0.475	0.480	0.488	0.485	0.474

			TE-39-1a: nontraverse points					
			Corrected probe points (page 2)					
3c	4c	Point #	Point #	5c	6c	7c	8c	9c
ilm rim by	ilm along	Comment	Comment	ilm along	ilm ex in mt	ilm ex in mt	ilm ex in mt	mt by ilm ex
silicate	cleav in biot	**Cor. wt% ox.**	**Cor. wt% ox.**	cleav in biot				at point 7c
0.013	0.001	SiO2	SiO2	0.019	0.009	0.000	0.014	0.011
48.661	50.475	TiO2	TiO2	50.526	49.680	50.079	49.722	0.137
0.000	0.000	Al2O3	Al2O3	0.021	0.000	0.000	0.000	0.098
0.032	0.016	Cr2O3	Cr2O3	0.009	0.031	0.024	0.017	0.060
0.336	0.262	V2O3	V2O3	0.325	0.424	0.288	0.419	0.706
5.640	3.225	Fe2O3	Fe2O3	2.227	4.566	3.775	3.897	67.983
42.977	44.550	FeO	FeO	44.606	43.689	44.252	43.757	31.059
0.097	0.038	MgO	MgO	0.045	0.045	0.026	0.041	0.017
0.022	0.015	CaO	CaO	0.000	0.000	0.011	0.000	0.012
0.499	0.744	MnO	MnO	0.671	0.761	0.667	0.777	0.016
0.102	0.000	ZnO	ZnO	0.105	0.165	0.052	0.127	0.207
98.379	99.327	total	total	98.554	99.369	99.174	98.771	100.307
		Cor. cations	**Corrected cations/3"O"(ilm); 4"O"(mt)**					
0.000	0.000	Si	Si	0.000	0.000	0.000	0.000	0.000
0.941	0.966	Ti	Ti	0.974	0.951	0.961	0.958	0.004
0.000	0.000	Al	Al	0.001	0.000	0.000	0.000	0.004
0.001	0.000	Cr	Cr	0.000	0.001	0.000	0.000	0.002
0.007	0.005	V3+	V3+	0.007	0.009	0.006	0.009	0.022
0.109	0.062	Fe3+	Fe3+	0.043	0.087	0.072	0.075	1.963
0.924	0.948	Fe2+	Fe2+	0.956	0.930	0.944	0.937	0.997
0.004	0.001	Mg	Mg	0.002	0.002	0.001	0.002	0.001
0.001	0.000	Ca	Ca	0.000	0.000	0.000	0.000	0.000
0.011	0.016	Mn	Mn	0.015	0.016	0.014	0.017	0.001
0.002	0.000	Zn	Zn	0.002	0.003	0.001	0.002	0.006
2.000	2.000	total	total	2.000	2.000	2.000	2.000	3.000

0.485	0.491	RO2	RO2	0.494	0.488	0.490	0.489	0.002
0.030	0.017	R2O3	R2O3	0.013	0.025	0.020	0.021	0.497
0.485	0.491	RO	RO	0.494	0.488	0.490	0.489	0.501
0.490	0.497	TiO2	TiO2	0.499	0.494	0.495	0.496	0.002
0.028	0.016	Fe2O3	Fe2O3	0.011	0.023	0.019	0.019	0.495
0.481	0.487	FeO	FeO	0.490	0.483	0.486	0.485	0.503

10c	11c	12c	13c	14c	Point #
mt by ilm ex	ilm ex in mt	ilm ex in mt	mt by ilm ex	mt by ilm ex	Comment
at point 8c			at point 11c	at point 12c	**Cor. wt% ox.**
0.000	0.021	0.010	0.018	0.029	SiO2
0.850	49.628	49.551	0.293	0.291	TiO2
0.095	0.000	0.000	0.166	0.108	Al2O3
0.092	0.040	0.021	0.106	0.059	Cr2O3
0.580	0.387	0.325	0.718	0.686	V2O3
66.515	4.999	4.782	68.364	68.399	Fe2O3
31.609	43.661	43.481	31.692	31.590	FeO
0.000	0.045	0.077	0.000	0.016	MgO
0.039	0.003	0.009	0.004	0.016	CaO
0.063	0.825	0.859	0.000	0.035	MnO
0.147	0.082	0.080	0.171	0.152	ZnO
99.989	99.691	99.195	101.532	101.381	total
					Cor. cations
0.000	0.001	0.000	0.001	0.001	Si
0.025	0.947	0.950	0.008	0.008	Ti
0.004	0.000	0.000	0.007	0.005	Al
0.003	0.001	0.000	0.003	0.002	Cr
0.018	0.008	0.007	0.022	0.021	V3+
1.926	0.095	0.092	1.949	1.954	Fe3+
1.017	0.927	0.927	1.004	1.003	Fe2+
0.000	0.002	0.003	0.000	0.001	Mg
0.002	0.000	0.000	0.000	0.001	Ca
0.002	0.018	0.019	0.000	0.001	Mn
0.004	0.002	0.002	0.005	0.004	Zn
3.000	2.000	2.000	3.000	3.000	total

0.012	0.487	0.487	0.004	0.005	RO2
0.482	0.027	0.025	0.493	0.493	R2O3
0.506	0.487	0.487	0.502	0.502	RO
0.012	0.493	0.494	0.004	0.004	TiO2
0.480	0.025	0.024	0.490	0.491	Fe2O3
0.507	0.482	0.482	0.505	0.504	FeO

TE-39-4 traverse 1: across a mt-ilm composite grain								
Corrected probe data								
Point #	2	3	4	5	6	8	9	Point #
Comment	mt	mt	mt rim by ilm	ilm rim by mt	ilm	ilm	ilm	Comment
Corrected oxide wt%								Cor. ox. wt%
SiO2	0.000	0.000	0.025	0.009	0.000	0.000	0.000	SiO2
TiO2	0.098	0.067	0.172	48.085	46.785	45.691	45.683	TiO2
Al2O3	0.494	0.289	0.399	0.047	0.042	0.042	0.055	Al2O3
Cr2O3	0.141	0.116	0.140	0.000	0.000	0.000	0.000	Cr2O3
V2O3	1.142	1.081	1.073	0.639	0.616	0.698	0.539	V2O3
Fe2O3	67.494	67.744	67.355	8.058	10.093	12.388	12.751	Fe2O3
FeO	31.300	31.385	31.512	42.012	40.855	39.836	39.777	FeO
MgO	0.039	0.000	0.018	0.487	0.498	0.547	0.527	MgO
CaO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CaO
MnO	0.000	0.000	0.000	0.367	0.351	0.302	0.395	MnO
ZnO	0.164	0.000	0.000	0.000	0.000	0.000	0.000	ZnO
total	100.872	100.683	100.693	99.703	99.240	99.504	99.727	total
Corrected cations/4"O"(mt); 3"O"(ilm)								Cor. cations
Si	0.000	0.000	0.001	0.000	0.000	0.000	0.000	Si
Ti	0.003	0.002	0.005	0.916	0.896	0.874	0.872	Ti
Al	0.022	0.013	0.018	0.001	0.001	0.001	0.002	Al
Cr	0.004	0.004	0.004	0.000	0.000	0.000	0.000	Cr
V3+	0.035	0.033	0.033	0.013	0.013	0.014	0.011	V3+
Fe 3+	1.933	1.946	1.933	0.154	0.193	0.237	0.243	Fe 3+
Fe 2+	0.996	1.002	1.005	0.890	0.870	0.847	0.844	Fe 2+
Mg	0.002	0.000	0.001	0.018	0.019	0.021	0.020	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.000	0.000	0.000	0.008	0.008	0.006	0.008	Mn
Zn	0.005	0.000	0.000	0.000	0.000	0.000	0.000	Zn
total	3.000	3.000	3.000	2.000	2.000	2.000	2.000	total
RO2	0.001	0.001	0.003	0.478	0.473	0.466	0.466	RO2
R2O3	0.498	0.498	0.496	0.044	0.055	0.068	0.069	R2O3
RO	0.501	0.501	0.502	0.478	0.473	0.466	0.466	RO
TiO2	0.001	0.001	0.002	0.487	0.481	0.475	0.474	TiO2
Fe2O3	0.492	0.492	0.489	0.041	0.052	0.065	0.066	Fe2O3
FeO	0.507	0.507	0.509	0.473	0.467	0.460	0.459	FeO

TE-39-4 traverse 2a: across one ilm grain and into another									
Corrected probe data (page 1)									Corrected data
Point #	1a	2a	3a	4a	5a	6a	8a	10a	Point #
Comment	ilm rim by sil	ilm	ilm	ilm	ilm core	ilm core	ilm	ilm rim	Comment
Cor. ox. wt%	trav 2a starts							trav 2a ends	Cor. ox. wt%
SiO2	0.023	0.001	0.023	0.009	0.008	0.000	0.017	0.015	SiO2
TiO2	42.722	43.125	42.976	44.191	39.595	44.789	43.880	43.175	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	Al2O3
Cr2O3	0.021	0.004	0.000	0.007	0.030	0.000	0.018	0.000	Cr2O3
V2O3	0.573	0.474	0.642	0.377	0.647	0.547	0.520	0.478	V2O3
Fe2O3	17.625	17.731	17.779	15.008	23.611	14.758	16.147	17.032	Fe2O3
FeO	37.742	37.976	37.765	38.782	34.758	39.322	38.634	37.880	FeO
MgO	0.154	0.222	0.255	0.267	0.261	0.311	0.290	0.279	MgO
CaO	0.000	0.003	0.000	0.000	0.004	0.014	0.000	0.000	CaO
MnO	0.315	0.346	0.347	0.425	0.312	0.393	0.312	0.335	MnO
ZnO	0.124	0.063	0.116	0.069	0.080	0.084	0.076	0.143	ZnO
total	99.299	99.944	99.903	99.136	99.333	100.218	99.894	99.337	total
Corrected cations/3"O"									Cor. cations
Si	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.823	0.825	0.823	0.851	0.764	0.853	0.839	0.831	Ti
Al	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	Cr
V3+	0.012	0.010	0.013	0.008	0.013	0.011	0.011	0.010	V3+
Fe3+	0.340	0.340	0.341	0.289	0.456	0.281	0.309	0.328	Fe3+
Fe2+	0.809	0.808	0.804	0.831	0.746	0.833	0.822	0.811	Fe2+
Mg	0.006	0.008	0.010	0.010	0.010	0.012	0.011	0.011	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.007	0.007	0.007	0.009	0.007	0.008	0.007	0.007	Mn
Zn	0.002	0.001	0.002	0.001	0.002	0.002	0.001	0.003	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.452	0.452	0.452	0.460	0.433	0.460	0.456	0.454	RO2
R2O3	0.097	0.096	0.097	0.080	0.133	0.079	0.087	0.092	R2O3
RO	0.452	0.452	0.452	0.460	0.433	0.460	0.456	0.454	RO
TiO2	0.457	0.458	0.458	0.466	0.440	0.467	0.462	0.460	TiO2
Fe2O3	0.094	0.094	0.095	0.079	0.131	0.078	0.085	0.091	Fe2O3
FeO	0.449	0.448	0.447	0.455	0.429	0.455	0.452	0.449	FeO

TE-39-4 traverse 2b: across one ilm grain and into another											
Corrected probe data (page 2)											Corrected data
Point #	1b	2b	3b	4b	5b	6b	7b	8b	9b	10b	Point #
Comment	2nd ilm rim	2nd ilm	2nd ilm	2nd ilm	2nd ilm	2nd ilm	2nd ilm	2nd ilm	2nd ilm	2nd ilm core	Comment
Cor. ox. wt%	trav 2b starts									trav 2b ends	Cor. ox. wt%
SiO2	0.003	0.014	0.000	0.017	0.009	0.024	0.006	0.000	0.000	0.007	SiO2
TiO2	46.547	45.845	46.539	40.148	46.020	46.186	46.776	42.612	42.423	41.987	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.011	0.000	0.038	0.035	0.001	0.000	0.000	0.020	0.036	0.000	Cr2O3
V2O3	0.393	0.472	0.462	0.626	0.446	0.454	0.438	0.442	0.459	0.532	V2O3
Fe2O3	10.750	12.866	10.232	23.688	11.805	11.289	10.032	18.038	18.435	19.688	Fe2O3
FeO	40.864	40.104	40.861	35.226	40.305	40.583	40.942	37.260	37.114	36.574	FeO
MgO	0.308	0.318	0.347	0.318	0.393	0.359	0.446	0.388	0.375	0.398	MgO
CaO	0.005	0.015	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.005	CaO
MnO	0.441	0.401	0.382	0.323	0.372	0.311	0.321	0.370	0.274	0.371	MnO
ZnO	0.036	0.166	0.042	0.065	0.074	0.027	0.015	0.008	0.101	0.113	ZnO
total	99.358	100.201	98.917	100.446	99.425	99.233	98.976	99.138	99.217	99.675	total
Corrected cations/3"O"											Cor. cations
Si	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	Si
Ti	0.892	0.872	0.896	0.766	0.882	0.886	0.899	0.821	0.817	0.805	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	Cr
V3+	0.008	0.010	0.009	0.013	0.009	0.009	0.009	0.009	0.009	0.011	V3+
Fe3+	0.206	0.245	0.197	0.452	0.226	0.217	0.193	0.348	0.355	0.378	Fe3+
Fe2+	0.871	0.849	0.875	0.748	0.859	0.866	0.875	0.799	0.795	0.780	Fe2+
Mg	0.012	0.012	0.013	0.012	0.015	0.014	0.017	0.015	0.014	0.015	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.010	0.009	0.008	0.007	0.008	0.007	0.007	0.008	0.006	0.008	Mn
Zn	0.001	0.003	0.001	0.001	0.001	0.001	0.000	0.000	0.002	0.002	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.472	0.466	0.472	0.434	0.469	0.470	0.473	0.451	0.450	0.446	RO2
R2O3	0.057	0.068	0.055	0.132	0.063	0.060	0.053	0.098	0.101	0.108	R2O3
RO	0.472	0.466	0.472	0.434	0.469	0.470	0.473	0.451	0.450	0.446	RO
TiO2	0.478	0.473	0.479	0.440	0.476	0.476	0.481	0.458	0.457	0.454	TiO2
Fe2O3	0.055	0.066	0.053	0.130	0.061	0.058	0.052	0.097	0.099	0.106	Fe2O3
FeO	0.466	0.460	0.467	0.429	0.463	0.465	0.468	0.445	0.444	0.440	FeO

TE-39-4 traverse 3: from magnetite rim to core									
Corrected probe data									Corrected data
Point #	1	2	3	5	6	7	8	10	Point #
Comment	mt rim	mt	mt	mt	mt	mt	mt	mt core	Comment
Cor. ox. wt%	trav 3 starts							trav 3 ends	Cor. ox. wt%
SiO2	0.043	0.021	0.021	0.024	0.033	0.021	0.019	0.021	SiO2
TiO2	0.000	0.000	0.000	0.126	0.061	0.000	0.000	0.000	TiO2
Al2O3	0.156	0.122	0.215	0.134	0.099	0.179	0.219	0.207	Al2O3
Cr2O3	0.244	0.231	0.249	0.278	0.250	0.264	0.263	0.253	Cr2O3
V2O3	1.251	1.208	1.370	1.326	1.224	1.362	1.264	1.345	V2O3
Fe2O3	67.947	67.556	67.226	67.378	67.778	67.520	67.205	67.554	Fe2O3
FeO	31.276	30.993	30.986	31.325	31.338	31.041	31.018	31.214	FeO
MgO	0.000	0.000	0.001	0.009	0.000	0.007	0.002	0.000	MgO
CaO	0.093	0.031	0.019	0.020	0.030	0.031	0.013	0.007	CaO
MnO	0.023	0.089	0.042	0.022	0.000	0.063	0.034	0.000	MnO
ZnO	0.100	0.119	0.200	0.090	0.102	0.209	0.117	0.158	ZnO
total	101.133	100.369	100.328	100.732	100.914	100.697	100.154	100.760	total
Corrected cations/4"O"									Cor. cations
Si	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	Si
Ti	0.000	0.000	0.000	0.004	0.002	0.000	0.000	0.000	Ti
Al	0.007	0.006	0.010	0.006	0.004	0.008	0.010	0.009	Al
Cr	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	Cr
V3+	0.038	0.037	0.042	0.041	0.037	0.042	0.039	0.041	V3+
Fe 3+	1.944	1.949	1.939	1.936	1.944	1.940	1.942	1.940	Fe 3+
Fe 2+	0.995	0.993	0.993	1.000	0.999	0.991	0.996	0.996	Fe 2+
Mg	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	Mg
Ca	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.000	Ca
Mn	0.001	0.003	0.001	0.001	0.000	0.002	0.001	0.000	Mn
Zn	0.003	0.003	0.006	0.003	0.003	0.006	0.003	0.004	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.001	0.000	0.000	0.002	0.002	0.000	0.000	0.000	RO2
R2O3	0.499	0.499	0.499	0.497	0.498	0.499	0.499	0.499	R2O3
RO	0.500	0.500	0.500	0.501	0.501	0.500	0.500	0.500	RO
TiO2	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	TiO2
Fe2O3	0.494	0.495	0.494	0.491	0.493	0.495	0.494	0.493	Fe2O3
FeO	0.506	0.505	0.506	0.507	0.506	0.505	0.506	0.507	FeO

TE-39-4 exsolution in pyroxene							
Corrected probe data							Cor. data
Point #	1(31)	2(32)	3(33)	4(34)	5(35)	6(36)	Point #
Comment	mt? hem? ex	mt? hem? ex	mt? hem? ex	ilm ex	ilm ex	ilm ex	Comment
Cor. ox. wt%	calc as mt	calc as mt	calc as mt				Cor. ox. wt%
SiO2	0.035	0.118	0.038	0.046	0.015	0.042	SiO2
TiO2	0.011	0.017	0.000	46.769	42.352	42.992	TiO2
Al2O3	0.122	0.244	0.114	0.000	0.000	0.000	Al2O3
Cr2O3	0.161	0.159	0.204	0.000	0.004	0.000	Cr2O3
V2O3	0.980	1.006	0.662	0.563	0.475	0.528	V2O3
Fe2O3	67.770	67.113	68.399	9.638	18.988	17.133	Fe2O3
FeO	30.628	30.667	30.773	41.130	37.399	37.712	FeO
MgO	0.000	0.038	0.000	0.018	0.034	0.126	MgO
CaO	0.302	0.237	0.275	0.324	0.165	0.240	CaO
MnO	0.039	0.044	0.074	0.436	0.386	0.406	MnO
ZnO	0.204	0.185	0.189	0.105	0.046	0.063	ZnO
total	100.252	99.828	100.728	99.029	99.864	99.242	total
Corrected cations/3"O"							Cor. cations
Si	0.001	0.005	0.001	0.001	0.000	0.001	Si
Ti	0.000	0.000	0.000	0.900	0.812	0.828	Ti
Al	0.006	0.011	0.005	0.000	0.000	0.000	Al
Cr	0.005	0.005	0.006	0.000	0.000	0.000	Cr
V3+	0.030	0.031	0.020	0.012	0.010	0.011	V3+
Fe3+	1.956	1.943	1.965	0.186	0.364	0.330	Fe3+
Fe2+	0.982	0.987	0.983	0.880	0.798	0.808	Fe2+
Mg	0.000	0.002	0.000	0.001	0.001	0.005	Mg
Ca	0.012	0.010	0.011	0.009	0.005	0.007	Ca
Mn	0.001	0.001	0.002	0.009	0.008	0.009	Mn
Zn	0.006	0.005	0.005	0.002	0.001	0.001	Zn
total	3.000	3.000	3.000	2.000	2.000	2.000	total
RO2	0.001	0.003	0.001	0.474	0.448	0.453	RO2
R2O3	0.499	0.496	0.499	0.052	0.103	0.093	R2O3
RO	0.500	0.501	0.500	0.474	0.448	0.453	RO
TiO2	0.000	0.000	0.000	0.481	0.453	0.460	TiO2
Fe2O3	0.499	0.496	0.500	0.050	0.102	0.092	Fe2O3
FeO	0.501	0.504	0.500	0.470	0.445	0.449	FeO

TE-40-1 traverse: a: across ilm to contact with mt							
Corrected probe data (page 1)							
Point #	1	2	3	4	5	6	Point #
Comment	ilm	ilm	ilm	ilm	ilm	ilm by mt	Comment
Cor. ox. wt%	trav starts->						Cor. ox. wt%
SiO2	0.012	0.111	0.022	0.027	0.000	0.002	SiO2
TiO2	43.835	44.379	45.827	46.378	45.678	48.881	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.000	0.000	Al2O3
Cr2O3	0.051	0.066	0.000	0.022	0.041	0.041	Cr2O3
V2O3	0.467	0.341	0.442	0.438	0.422	0.382	V2O3
Fe2O3	16.248	18.280	12.564	12.052	12.930	7.030	Fe2O3
FeO	38.324	33.229	39.993	40.433	39.934	42.744	FeO
MgO	0.370	3.524	0.389	0.414	0.365	0.351	MgO
CaO	0.000	0.042	0.017	0.010	0.003	0.000	CaO
MnO	0.444	0.472	0.483	0.476	0.481	0.523	MnO
ZnO	0.000	0.000	0.044	0.082	0.000	0.067	ZnO
total	99.751	100.443	99.782	100.332	99.855	100.021	total
Corrected cations/3"O"(ilm); 4"O"(mt)							Cor. cations
Si	0.000	0.003	0.001	0.001	0.000	0.000	Si
Ti	0.839	0.824	0.875	0.880	0.872	0.929	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	Al
Cr	0.001	0.001	0.000	0.000	0.001	0.001	Cr
V3+	0.010	0.007	0.009	0.009	0.009	0.008	V3+
Fe3+	0.311	0.339	0.240	0.229	0.247	0.134	Fe3+
Fe2+	0.816	0.686	0.849	0.853	0.848	0.903	Fe2+
Mg	0.014	0.130	0.015	0.016	0.014	0.013	Mg
Ca	0.000	0.001	0.000	0.000	0.000	0.000	Ca
Mn	0.010	0.010	0.010	0.010	0.010	0.011	Mn
Zn	0.000	0.000	0.001	0.002	0.000	0.001	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.456	0.452	0.467	0.468	0.466	0.482	RO2
R2O3	0.087	0.095	0.066	0.063	0.068	0.037	R2O3
RO	0.456	0.452	0.467	0.468	0.466	0.482	RO
TiO2	0.463	0.491	0.474	0.476	0.473	0.489	TiO2
Fe2O3	0.086	0.101	0.065	0.062	0.067	0.035	Fe2O3
FeO	0.451	0.408	0.460	0.462	0.460	0.476	FeO

TE-40-1 traverse: b: across mt from ilm to silicate contact											
Corrected probe data (page2)											
Point #	7	8	9	10	11	12	13	14	15	16	Point #
Comment	mt by ilm	mt	mt	mt	mt	mt	mt	mt	mt	mt rim by sil	Comment
Cor. ox. wt%										<-trav ends	Cor. ox. wt%
SiO2	0.041	0.025	0.037	0.047	0.030	0.012	0.037	0.029	0.026	0.003	SiO2
TiO2	0.381	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Al2O3	0.123	0.106	0.165	0.262	0.231	0.255	0.185	0.028	0.137	0.156	Al2O3
Cr2O3	0.102	0.072	0.075	0.078	0.088	0.080	0.077	0.033	0.102	0.020	Cr2O3
V2O3	0.613	0.632	0.713	0.820	0.722	0.785	0.742	0.872	0.807	0.821	V2O3
Fe2O3	67.578	68.293	68.535	68.302	68.205	67.812	67.995	69.299	68.038	68.847	Fe2O3
FeO	31.502	31.011	31.340	31.118	31.081	30.937	30.937	31.345	31.006	31.248	FeO
MgO	0.017	0.000	0.000	0.021	0.000	0.011	0.001	0.000	0.000	0.000	MgO
CaO	0.000	0.013	0.019	0.004	0.012	0.016	0.004	0.030	0.027	0.058	CaO
MnO	0.052	0.065	0.061	0.125	0.077	0.060	0.097	0.183	0.151	0.075	MnO
ZnO	0.045	0.128	0.000	0.203	0.162	0.117	0.192	0.160	0.023	0.120	ZnO
total	100.454	100.344	100.945	100.979	100.609	100.085	100.267	101.980	100.317	101.348	total
Corrected cations/3"O"(ilm); 4"O"(mt)											Cor. cations
Si	0.002	0.001	0.001	0.002	0.001	0.000	0.001	0.001	0.001	0.000	Si
Ti	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ti
Al	0.006	0.005	0.007	0.012	0.010	0.012	0.008	0.001	0.006	0.007	Al
Cr	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.001	0.003	0.001	Cr
V3+	0.019	0.019	0.022	0.025	0.022	0.024	0.023	0.026	0.025	0.025	V3+
Fe3+	1.947	1.971	1.966	1.957	1.962	1.961	1.963	1.969	1.964	1.967	Fe3+
Fe2+	1.009	0.995	0.999	0.991	0.994	0.994	0.993	0.990	0.995	0.992	Fe2+
Mg	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	Mg
Ca	0.000	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.002	Ca
Mn	0.002	0.002	0.002	0.004	0.002	0.002	0.003	0.006	0.005	0.002	Mn
Zn	0.001	0.004	0.000	0.006	0.005	0.003	0.005	0.004	0.001	0.003	Zn
total	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.006	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.000	RO2
R2O3	0.491	0.499	0.499	0.499	0.499	0.500	0.499	0.499	0.499	0.500	R2O3
RO	0.503	0.500	0.500	0.501	0.500	0.500	0.500	0.500	0.500	0.500	RO
TiO2	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Fe2O3	0.488	0.498	0.496	0.497	0.497	0.497	0.497	0.499	0.497	0.498	Fe2O3
FeO	0.506	0.502	0.504	0.503	0.503	0.503	0.503	0.501	0.503	0.502	FeO

TE-40-1: magnetite or hematite exsolution in pyroxene					
Corrected probe data					
Point #	3	4	5	9	Point #
Comment	mt? hem?	mt? hem?	mt? hem?	mt? hem?	Comment
Cor. wt% ox.	calc as mt	calc as mt	calc as mt	calc as mt	Cor. wt % ox.
SiO2	0.090	0.058	0.063	0.170	SiO2
TiO2	0.421	0.949	0.063	0.080	TiO2
Al2O3	0.427	0.335	0.235	0.372	Al2O3
Cr2O3	0.086	0.063	0.150	0.061	Cr2O3
V2O3	0.968	0.804	0.860	0.720	V2O3
Fe2O3	66.120	65.727	67.803	67.518	Fe2O3
FeO	30.902	31.429	30.974	31.061	FeO
MgO	0.018	0.019	0.008	0.089	MgO
CaO	0.317	0.271	0.196	0.168	CaO
MnO	0.089	0.038	0.048	0.044	MnO
ZnO	0.119	0.259	0.158	0.106	ZnO
total	99.557	99.952	100.557	100.389	total
Corrected cations/4"O"					Cor. cations
Si	0.003	0.002	0.002	0.006	Si
Ti	0.012	0.027	0.002	0.002	Ti
Al	0.019	0.015	0.011	0.017	Al
Cr	0.003	0.002	0.005	0.002	Cr
V3+	0.030	0.025	0.026	0.022	V3+
Fe 3+	1.917	1.899	1.950	1.942	Fe 3+
Fe 2+	0.995	1.009	0.990	0.993	Fe 2+
Mg	0.001	0.001	0.000	0.005	Mg
Ca	0.013	0.011	0.008	0.007	Ca
Mn	0.003	0.001	0.002	0.001	Mn
Zn	0.003	0.007	0.004	0.003	Zn
total	3.000	3.000	3.000	3.000	total
RO2	0.008	0.015	0.002	0.004	RO2
R2O3	0.488	0.478	0.497	0.493	R2O3
RO	0.504	0.507	0.501	0.502	RO
TiO2	0.006	0.014	0.001	0.001	TiO2
Fe2O3	0.487	0.478	0.496	0.494	Fe2O3
FeO	0.506	0.508	0.503	0.505	FeO

TE-40-1 traverse across clinopyroxene									
Probe data									
Point #	1	2	3	4	5	6	8	10	Point #
Comment	rim by sil							by ilm exsol	Comment
Wt% oxide	trav starts							trav ends	Wt% oxide
SiO2	51.093	50.653	51.41	51.276	51.607	51.388	51.544	51.688	SiO2
TiO2	0.227	0.209	0.182	0.187	0.193	0.133	0.143	0.185	TiO2
Al2O3	1.442	1.503	1.469	1.522	1.55	1.466	1.355	1.38	Al2O3
Cr2O3	0	0.033	0.027	0	0	0.012	0	0.022	Cr2O3
Fe2O3	4.018	4.964	3.38	3.996	3.429	4.369	3.731	3.767	Fe2O3
FeO	7.375	7.907	8.191	7.936	7.802	6.541	7.691	7.412	FeO
MgO	12.865	13.088	12.948	13.077	12.956	13.225	13.105	13.097	MgO
MnO	0.309	0.214	0.232	0.271	0.261	0.275	0.228	0.189	MnO
CaO	22.39	21.227	21.989	21.929	22.42	22.94	22.414	22.897	CaO
Na2O	0.431	0.455	0.416	0.403	0.42	0.381	0.375	0.365	Na2O
K2O	0	0	0.011	0	0.018	0.007	0.01	0	K2O
total	100.15	100.253	100.255	100.597	100.656	100.737	100.596	101.002	total
Cations/6"O"									Cations/6"O"
Si	1.921	1.907	1.930	1.920	1.928	1.917	1.927	1.925	Si
Al	0.064	0.067	0.065	0.067	0.068	0.064	0.060	0.061	Al
Fe3+	0.015	0.026	0.005	0.013	0.004	0.019	0.013	0.014	Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Fe3+	0.099	0.115	0.090	0.100	0.092	0.104	0.092	0.092	Fe3+
Ti	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.005	Ti
Cr		0.001	0.001					0.001	Cr
Mg	0.721	0.734	0.724	0.730	0.721	0.735	0.730	0.727	Mg
Fe2+	0.174	0.144	0.180	0.165	0.182	0.157	0.174	0.175	Fe2+
total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	total
Fe2+	0.058	0.105	0.077	0.083	0.062	0.047	0.067	0.056	Fe2+
Mn	0.010	0.007	0.007	0.009	0.008	0.009	0.007	0.006	Mn
Ca	0.902	0.856	0.884	0.880	0.897	0.917	0.898	0.913	Ca
Na	0.031	0.033	0.030	0.029	0.030	0.028	0.027	0.026	Na
K			0.001		0.001				K
total	1.001	1.001	0.999	1.001	0.998	1.001	0.999	1.001	total

TE-41-1a pyroxene 1: short traverse across Cpx with ilmenite exsolution												
Probe data (page 1)												
Point #	1	2	3	4	7	8	9	10			5	Point #
Comment	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx			**opx in cpx**	Comment
Wt% oxide												Wt% oxide
SiO2	52.548	52.825	51.279	51.834	52.058	52.017	52.152	52.162			52.104	SiO2
TiO2	0.18	0.213	0.13	0.194	0.259	0.192	0.17	0.225			0.135	TiO2
Al2O3	1.53	1.696	1.378	1.679	1.63	1.62	1.41	1.674			0.85	Al2O3
Cr2O3	0	0.03	0	0	0	0	0.05	0			0.024	Cr2O3
Fe2O3	2.707	2.092	3.396	3.386	3.21	3.095	3.468	2.693			1.292	Fe2O3
FeO	6.652	7.33	8.377	6.588	7.43	7.155	6.062	6.751			23.965	FeO
MgO	13.604	13.573	14.886	13.687	13.807	13.72	13.814	13.693			20.942	MgO
MnO	0.241	0.288	0.253	0.252	0.292	0.262	0.222	0.221			0.487	MnO
CaO	23.302	22.925	19.281	22.551	21.798	22.123	23.116	22.75			0.488	CaO
Na2O	0.426	0.466	0.338	0.432	0.478	0.457	0.429	0.441			0	Na2O
K2O	0.009	0.005	0.001	0.008	0.001	0.012	0	0.002			0.005	K2O
total	101.199	101.443	99.319	100.611	100.963	100.653	100.893	100.612			100.292	total
Cations/6"O"												Cations/6"O"
Si	1.940	1.945	1.930	1.926	1.930	1.933	1.931	1.935			1.959	Si
Al	0.060	0.055	0.061	0.074	0.070	0.067	0.062	0.065			0.038	Al
Fe3+			0.009				0.007				0.003	Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000			2.000	total
Al	0.007	0.019			0.001	0.004		0.008	Al			Al
Fe3+	0.075	0.058	0.087	0.095	0.090	0.087	0.090	0.075	Fe3+		0.034	Fe3+
Ti	0.005	0.006	0.004	0.005	0.007	0.005	0.005	0.006	Ti		0.004	Ti
Cr		0.001					0.001		Cr		0.001	Cr
Mg	0.748	0.745	0.835	0.758	0.763	0.760	0.762	0.757	Mg		1.174	Mg
Fe2+	0.165	0.171	0.074	0.142	0.139	0.144	0.142	0.154	Fe2+		0.753	Fe2+
total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	total		0.016	Mn
											0.020	Ca
Fe2+	0.040	0.055	0.190	0.063	0.091	0.078	0.046	0.055	Fe2+			Na
Mn	0.008	0.009	0.008	0.008	0.009	0.008	0.007	0.007	Mn			K
Ca	0.922	0.904	0.777	0.898	0.866	0.881	0.917	0.904	Ca		2.002	total
Na	0.030	0.033	0.025	0.031	0.034	0.033	0.031	0.032	Na			
K						0.001			K			
total	1.000	1.001	1.000	1.000	1.000	1.001	1.001	0.998	total			

TE-41-1a pyroxene 2: individual points across a Cpx/Opx patch										
Probe data (page 2)										
Point #	11	12	16	17	19	20			23	Point #
Comment	Opx	Opx	Opx	Opx	Opx	Opx			**Cpx**	Comment
Wt% oxide										Wt% oxide
SiO2	52.034	52.633	51.593	51.543	51.626	51.457			51.835	SiO2
TiO2	0.075	0.085	0.122	0.074	0.07	0.097			0.226	TiO2
Al2O3	0.95	0.963	1.006	0.949	0.933	0.788			1.719	Al2O3
Cr2O3	0.031	0.014	0.021	0.06	0.082	0.019			0.046	Cr2O3
Fe2O3	1.756	1.668	2.456	2.93	3.33	2.706			3.912	Fe2O3
FeO	23.079	23.075	22.393	22.511	21.563	22.265			6.26	FeO
MgO	21.353	21.557	21.368	21.22	21.899	21.324			13.454	MgO
MnO	0.478	0.591	0.55	0.497	0.498	0.52			0.187	MnO
CaO	0.474	0.627	0.594	0.624	0.507	0.576			22.81	CaO
Na2O	0.013	0.022	0.001	0.012	0.01	0.014			0.546	Na2O
K2O	0	0.005	0.001	0.002	0	0.005			0.002	K2O
total	100.243	101.24	100.105	100.422	100.518	99.771			100.997	total
Cations/6"O"										Cations/6"O"
Si	1.952	1.954	1.939	1.935	1.930	1.942			1.921	Si
Al	0.042	0.042	0.045	0.042	0.041	0.035			0.075	Al
Fe3+	0.006	0.004	0.016	0.023	0.029	0.023			0.004	Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000			2.000	total
Al							Al			Al
Fe3+	0.044	0.043	0.053	0.060	0.065	0.054	Fe3+		0.105	Fe3+
Ti	0.002	0.002	0.003	0.002	0.002	0.003	Ti		0.006	Ti
Cr	0.001		0.001	0.002	0.002	0.001	Cr		0.001	Cr
Mg	1.194	1.193	1.197	1.187	1.22	1.199	Mg		0.743	Mg
Fe2+	0.724	0.716	0.704	0.707	0.674	0.703	Fe2+		0.145	Fe2+
Mn	0.015	0.019	0.017	0.016	0.016	0.017	Mn		1.000	total
Ca	0.019	0.025	0.024	0.025	0.02	0.023	Ca			
Na	0.001	0.002		0.001	0.001	0.001	Na		0.049	Fe2+
K							K		0.006	Mn
total	2.000	2.000	1.999	2.000	2.000	2.001	total		0.906	Ca
									0.039	Na
									0	K
									1.000	total

TE-41-2b pyroxene										
Probe data (page 1)										Raw data
Point #	1	2	3	4	6	7	9	10	11	Point #
Comment	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	Comment
Wt% oxide										Wt% oxide
SiO2	51.374	51.726	51.756	51.872	52.358	51.867	51.703	51.529	51.819	SiO2
TiO2	0.252	0.235	0.19	0.228	0.13	0.222	0.223	0.246	0.167	TiO2
Al2O3	1.705	1.727	1.743	1.805	1.569	1.88	1.818	1.754	1.843	Al2O3
Cr2O3	0.014	0	0	0.003	0	0.05	0	0.033	0	Cr2O3
Fe2O3	4.229	3.452	3.667	2.974	1.725	2.621	3.242	3.411	4.177	Fe2O3
FeO	4.972	6.376	6.144	6.316	13.447	6.644	6.368	8.537	5.535	FeO
MgO	13.926	13.734	13.864	13.592	16.18	13.772	13.567	14.443	14.041	MgO
MnO	0.199	0.209	0.212	0.193	0.267	0.145	0.174	0.242	0.188	MnO
CaO	22.919	22.564	22.521	22.766	14.651	22.36	22.757	19.785	22.782	CaO
Na2O	0.496	0.451	0.461	0.499	0.3	0.479	0.46	0.424	0.468	Na2O
K2O	0	0	0	0.005	0.003	0.006	0.004	0	0.001	K2O
total	100.086	100.474	100.558	100.253	100.63	100.046	100.316	100.404	101.021	total
Cations/6"O"										Cations/6"O"
Si	1.914	1.924	1.922	1.93	1.949	1.932	1.925	1.922	1.914	Si
Al	0.075	0.076	0.076	0.07	0.051	0.068	0.075	0.077	0.08	Al
Fe3+	0.011		0.002					0.001	0.006	Fe3+
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
Al				0.009	0.018	0.015	0.005			Al
Fe3+	0.108	0.097	0.100	0.083	0.048	0.073	0.091	0.095	0.11	Fe3+
Ti	0.007	0.007	0.005	0.006	0.004	0.006	0.006	0.007	0.005	Ti
Cr						0.001		0.001		Cr
Mg	0.773	0.761	0.767	0.754	0.898	0.765	0.753	0.803	0.773	Mg
Fe2+	0.112	0.135	0.128	0.148	0.032	0.14	0.145	0.094	0.112	Fe2+
Mn										Mn
total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	total
Fe2+	0.043	0.063	0.063	0.049	0.387	0.067	0.053	0.172	0.059	Fe2+
Mn	0.006	0.007	0.007	0.006	0.008	0.005	0.006	0.008	0.006	Mn
Ca	0.915	0.899	0.896	0.908	0.584	0.893	0.908	0.79	0.902	Ca
Na	0.036	0.032	0.033	0.036	0.022	0.035	0.033	0.031	0.034	Na
K										K
total	1.000	1.001	0.999	0.999	1.001	1.000	1.000	1.001	1.001	total

TE-41-1a traverse 1: from core of small ilm across symplectite border to large mt										
Corrected probe data										
Point #	1	2	3	6	7	8	9	11	12	Point #
Comment	ilm core	ilm rim by mt	mt rim by ilm	mt	mt	mt	mt	mt	mt	Comment
Corrected oxide wt %										Cor. ox. wt %
SiO2	0.000	0.000	0.077	1.737	0.006	0.017	0.035	0.020	0.020	SiO2
TiO2	47.616	48.436	0.082	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Al2O3	0.000	0.000	0.058	7.061	0.182	0.295	0.064	0.092	0.086	Al2O3
Cr2O3	0.001	0.000	0.052	0.071	0.051	0.054	0.038	0.050	0.034	Cr2O3
V2O3	0.630	0.514	1.029	1.008	1.052	0.972	1.139	0.980	1.229	V2O3
Fe2O3	8.911	7.816	68.094	56.427	67.578	67.258	68.218	68.423	68.175	Fe2O3
FeO	40.588	41.038	31.203	32.859	30.912	30.859	31.246	31.127	31.145	FeO
MgO	1.049	1.115	0.079	1.013	0.013	0.066	0.002	0.030	0.036	MgO
CaO	0.000	0.000	0.006	0.023	0.021	0.007	0.008	0.000	0.005	CaO
MnO	0.306	0.394	0.018	0.000	0.016	0.000	0.000	0.003	0.000	MnO
ZnO	0.058	0.149	0.188	0.396	0.120	0.027	0.152	0.245	0.204	ZnO
total	99.160	99.463	100.886	100.595	99.951	99.555	100.902	100.969	100.933	total
Corrected cations/3"O"(ilm); 4"O"(mt)										Cor. cations
Si	0.000	0.000	0.003	0.063	0.000	0.001	0.001	0.001	0.001	Si
Ti	0.909	0.920	0.002	0.000	0.000	0.000	0.000	0.000	0.000	Ti
Al	0.000	0.000	0.003	0.302	0.008	0.013	0.003	0.004	0.004	Al
Cr	0.000	0.000	0.002	0.002	0.002	0.002	0.001	0.002	0.001	Cr
V3+	0.013	0.010	0.031	0.029	0.032	0.030	0.035	0.030	0.038	V3+
Fe3+	0.170	0.149	1.954	1.540	1.957	1.953	1.958	1.963	1.956	Fe3+
Fe2+	0.861	0.867	0.995	0.997	0.995	0.996	0.997	0.992	0.993	Fe2+
Mg	0.040	0.042	0.004	0.055	0.001	0.004	0.000	0.002	0.002	Mg
Ca	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	Ca
Mn	0.007	0.008	0.001	0.000	0.001	0.000	0.000	0.000	0.000	Mn
Zn	0.001	0.003	0.005	0.011	0.003	0.001	0.004	0.007	0.006	Zn
total	2.000	2.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	total
RO2	0.476	0.479	0.003	0.031	0.000	0.000	0.001	0.000	0.000	RO2
R2O3	0.048	0.041	0.496	0.454	0.500	0.499	0.499	0.499	0.499	R2O3
RO	0.476	0.479	0.501	0.515	0.500	0.500	0.500	0.500	0.500	RO
TiO2	0.490	0.494	0.001	0.000	0.000	0.000	0.000	0.000	0.000	TiO2
Fe2O3	0.046	0.040	0.495	0.436	0.496	0.495	0.496	0.497	0.496	Fe2O3
FeO	0.464	0.466	0.504	0.564	0.504	0.505	0.504	0.503	0.504	FeO

TE-41-1a traverse 2: from ilmenite across a symplectite border into magnetite										
Corrected probe data										
Point #	1	2	3	4	6	7	10	11	12	Point #
Comment	ilm	ilm	ilm	ilm	hercynite	ilm	mt	mt	mt	Comment
Corrected oxide wt%					****symplectite	contact***				Cor. ox. wt%
SiO2	0.026	0.032	0.037	0.000	0.000	0.109	0.047	0.045	0.037	SiO2
TiO2	48.135	48.752	49.081	48.927	0.090	48.459	0.020	0.000	0.000	TiO2
Al2O3	0.000	0.000	0.000	0.000	53.739	1.245	0.145	0.114	0.154	Al2O3
Cr2O3	0.000	0.017	0.000	0.016	0.000	0.000	0.000	0.075	0.084	Cr2O3
V2O3	0.522	0.467	0.509	0.454	0.000	0.288	0.978	1.091	1.100	V2O3
Fe2O3	8.399	7.153	6.944	6.682	13.136	6.025	67.973	68.011	68.140	Fe2O3
FeO	40.993	41.380	41.696	41.794	13.552	41.294	30.993	31.194	31.163	FeO
MgO	1.064	1.073	1.084	0.968	10.336	0.972	0.013	0.004	0.000	MgO
CaO	0.000	0.000	0.000	0.010	0.000	0.000	0.024	0.014	0.031	CaO
MnO	0.422	0.514	0.481	0.460	0.008	0.501	0.058	0.069	0.096	MnO
ZnO	0.000	0.075	0.074	0.000	13.555	0.196	0.232	0.074	0.147	ZnO
total	99.561	99.463	99.906	99.311	104.416	99.089	100.483	100.691	100.953	total
Corrected cations/3"O"(ilm); 4"O"(mt, her)										Cor. cations
Si	0.001	0.001	0.001	0.000	0.000	0.003	0.002	0.002	0.001	Si
Ti	0.914	0.926	0.928	0.932	0.002	0.919	0.001	0.000	0.000	Ti
Al	0.000	0.000	0.000	0.000	1.727	0.037	0.007	0.005	0.007	Al
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	Cr
V3+	0.011	0.009	0.010	0.009	0.000	0.006	0.030	0.033	0.034	V3+
Fe3+	0.160	0.136	0.131	0.127	0.269	0.114	1.958	1.956	1.954	Fe3+
Fe2+	0.866	0.874	0.877	0.885	0.309	0.871	0.992	0.997	0.993	Fe2+
Mg	0.040	0.040	0.041	0.037	0.420	0.037	0.001	0.000	0.000	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	Ca
Mn	0.009	0.011	0.010	0.010	0.000	0.011	0.002	0.002	0.003	Mn
Zn	0.000	0.001	0.001	0.000	0.273	0.004	0.007	0.002	0.004	Zn
total	2.000	2.000	2.000	2.000	3.000	2.000	3.000	3.000	3.000	total
RO2	0.478	0.481	0.482	0.482	0.001	0.480	0.001	0.001	0.001	RO2
R2O3	0.044	0.038	0.037	0.035	0.499	0.041	0.498	0.499	0.499	R2O3
RO	0.478	0.481	0.482	0.482	0.500	0.480	0.501	0.501	0.500	RO
TiO2	0.492	0.496	0.496	0.495	0.004	0.498	0.000	0.000	0.000	TiO2
Fe2O3	0.043	0.036	0.035	0.034	0.302	0.031	0.497	0.495	0.496	Fe2O3
FeO	0.466	0.468	0.469	0.471	0.693	0.471	0.503	0.505	0.504	FeO

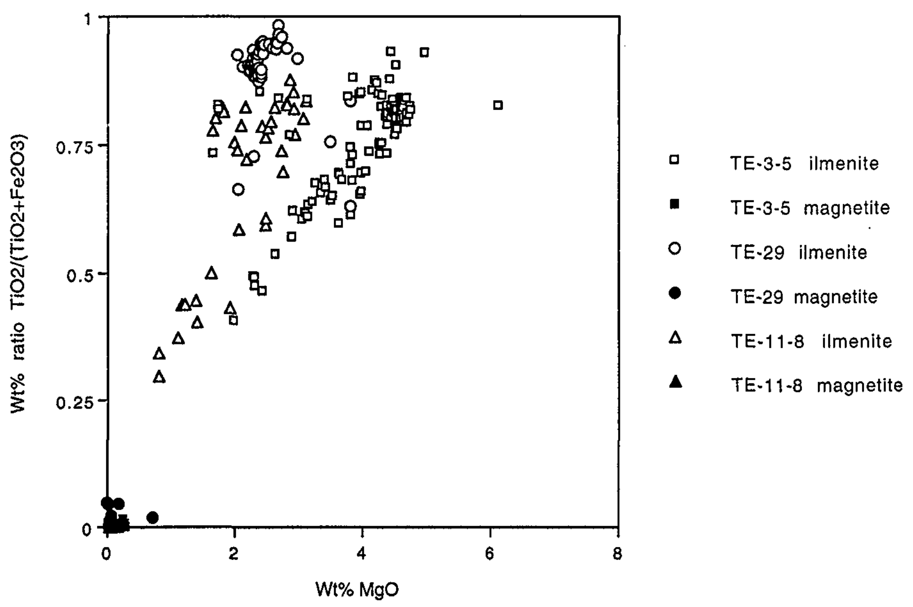
TE-41-1a ilmenite with hematite exsolution									
Corrected probe data									
Point #	1	2	3	4	5	6	7	8	Point #
Comment	ilm	ilm	ilm	ilm	hem exsol	hem exsol	ilm	ilm	Comment
Corrected oxide wt %									Cor wt% oxide
SiO2	0.028	0.036	0.029	0.025	0.054	0.027	0.032	0.031	SiO2
TiO2	46.215	46.940	47.189	46.812	13.138	13.229	46.987	45.856	TiO2
Al2O3	0.000	0.000	0.000	0.000	0.071	0.047	0.000	0.000	Al2O3
Cr2O3	0.000	0.036	0.005	0.033	0.045	0.100	0.000	0.000	Cr2O3
V2O3	0.337	0.547	0.481	0.439	1.081	0.978	0.467	0.396	V2O3
Fe2O3	12.245	11.082	10.572	10.961	75.659	75.737	11.268	13.156	Fe2O3
FeO	39.826	40.547	40.610	40.276	11.692	11.701	40.551	39.495	FeO
MgO	0.821	0.825	0.829	0.827	0.099	0.116	0.840	0.771	MgO
CaO	0.008	0.000	0.007	0.003	0.004	0.009	0.000	0.008	CaO
MnO	0.289	0.234	0.368	0.354	0.005	0.009	0.240	0.344	MnO
ZnO	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.052	ZnO
total	99.769	100.247	100.090	99.745	101.848	101.954	100.386	100.108	total
Corrected cations/3"O"									Cor. cat/3"O"
Si	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	Si
Ti	0.879	0.888	0.894	0.890	0.254	0.256	0.888	0.870	Ti
Al	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000	Al
Cr	0.000	0.001	0.000	0.001	0.001	0.002	0.000	0.000	Cr
V3+	0.007	0.011	0.010	0.009	0.022	0.020	0.009	0.008	V3+
Fe3+	0.233	0.210	0.200	0.209	1.464	1.464	0.213	0.250	Fe3+
Fe2+	0.843	0.853	0.856	0.852	0.251	0.251	0.852	0.834	Fe2+
Mg	0.031	0.031	0.031	0.031	0.004	0.004	0.031	0.029	Mg
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Ca
Mn	0.006	0.005	0.008	0.008	0.000	0.000	0.005	0.007	Mn
Zn	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	total
RO2	0.468	0.471	0.472	0.471	0.203	0.204	0.471	0.466	RO2
R2O3	0.064	0.059	0.055	0.058	0.593	0.592	0.059	0.069	R2O3
RO	0.468	0.471	0.472	0.471	0.203	0.204	0.471	0.466	RO
TiO2	0.478	0.481	0.483	0.482	0.205	0.206	0.481	0.476	TiO2
Fe2O3	0.063	0.057	0.054	0.056	0.592	0.591	0.058	0.068	Fe2O3
FeO	0.458	0.462	0.463	0.461	0.203	0.203	0.461	0.456	FeO

TE-41-2b pyroxene								
Probe data (page 2)								
Point #	12	13	14	15			5	Point #
Comment	cpx	cpx	cpx	cpx			**opx**	Comment
Wt% oxide								Wt% oxide
SiO2	51.648	51.86	51.722	51.361			51.448	SiO2
TiO2	0.249	0.251	0.2	0.141			0.09	TiO2
Al2O3	1.796	1.794	1.722	1.333			1.133	Al2O3
Cr2O3	0	0	0.041	0			0	Cr2O3
Fe2O3	2.964	2.509	2.919	2.941			1.317	Fe2O3
FeO	6.477	7.558	6.407	13.184			23.029	FeO
MgO	13.509	13.716	13.568	16.135			20.938	MgO
MnO	0.174	0.141	0.164	0.254			0.475	MnO
CaO	22.676	21.728	22.715	13.996			0.587	CaO
Na2O	0.475	0.475	0.468	0.293			0	Na2O
K2O	0	0.017	0	0.017			0.007	K2O
total	99.968	100.049	99.926	99.655			99.024	total
Cations/6"O"								Cations/6"O"
Si	1.929	1.936	1.932	1.936	Si		1.953	Si
Al	0.071	0.064	0.068	0.059	Al		0.047	Al
Fe3+				0.005	Fe3+			Fe3+
total	2.000	2.000	2.000	2.000	total		2.000	total
Al	0.008	0.015	0.008		Al		0.004	Al
Fe3+	0.083	0.07	0.082	0.078	Fe3+		0.038	Fe3+
Ti	0.007	0.007	0.006	0.004	Ti		0.003	Ti
Cr			0.001		Cr			Cr
Mg	0.752	0.763	0.755	0.906	Mg		1.185	Mg
Fe2+	0.15	0.145	0.148	0.012	Fe2+		0.731	Fe2+
Mn					Mn		0.015	Mn
total	1.000	1.000	1.000	1.000	total		0.024	Ca
								Na
Fe2+	0.052	0.091	0.052	0.404	Fe2+			K
Mn	0.006	0.004	0.005	0.008	Mn		2.000	total
Ca	0.907	0.869	0.909	0.565	Ca			
Na	0.034	0.034	0.034	0.021	Na			
K		0.001		0.001	K			
total	0.999	0.999	1.000	0.999	total			

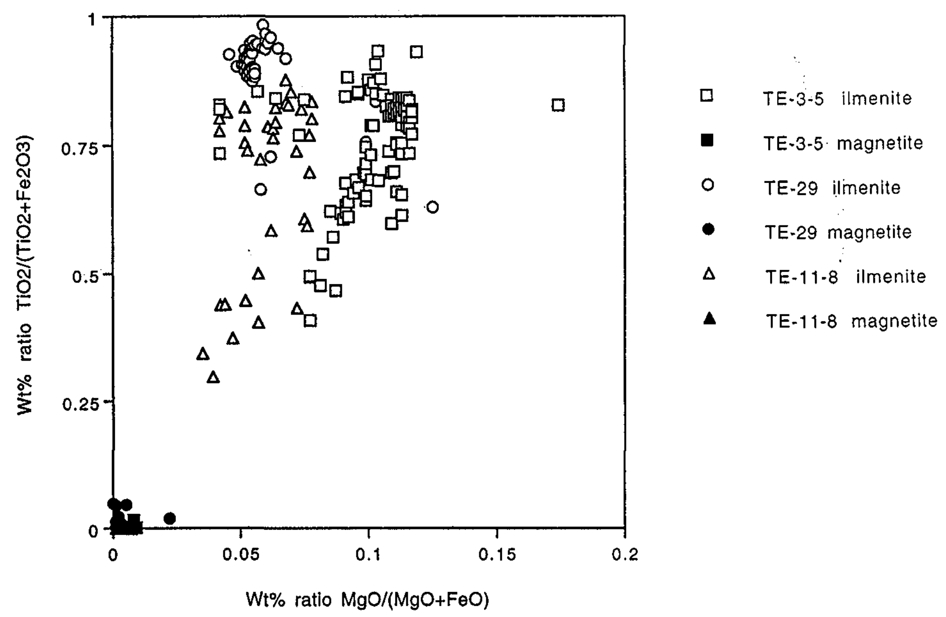
TE-41-2b traverse 1: across ilm and into mt													
Corrected probe data													
Point #	1	2	3	4	5	6	7	9	11	12	14	16	Point #
Comment	ilm by sil	ilm	ilm	ilm	ilm core	ilm core	ilm	ilm	mt by ilm	mt	mt	mt	Comment
Cor. ox. wt%	trav starts->												Oxide wt%
SiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.032	0.011	0.000	0.000	SiO2
TiO2	36.970	46.729	46.042	46.737	43.735	40.243	44.909	46.529	0.089	0.010	0.000	5.788	TiO2
Al2O3	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.548	0.238	0.223	6.613	Al2O3
Cr2O3	0.026	0.000	0.000	0.017	0.000	0.042	0.000	0.000	0.036	0.044	0.048	0.008	Cr2O3
V2O3	0.682	0.420	0.485	0.544	0.544	0.759	0.513	0.558	0.810	0.770	0.839	0.843	V2O3
Fe2O3	29.155	10.840	11.788	10.788	16.483	22.911	14.033	10.938	66.765	67.223	67.314	49.821	Fe2O3
FeO	31.636	39.915	39.564	40.085	37.501	34.542	38.487	39.920	30.797	30.655	30.646	34.437	FeO
MgO	0.736	0.930	0.854	0.861	0.853	0.773	0.851	0.844	0.099	0.043	0.002	1.024	MgO
CaO	0.043	0.012	0.009	0.018	0.000	0.004	0.009	0.004	0.020	0.018	0.043	0.007	CaO
MnO	0.170	0.403	0.302	0.319	0.304	0.255	0.353	0.345	0.035	0.063	0.032	0.099	MnO
ZnO	0.080	0.029	0.000	0.071	0.000	0.006	0.015	0.071	0.046	0.042	0.158	1.734	ZnO
total	99.499	99.277	99.044	99.440	99.420	99.535	99.170	99.208	99.277	99.117	99.304	100.374	total
Corrected cations/3"O"(ilm); 4"O"(mt)													Cor. cations
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	Si
Ti	0.712	0.892	0.882	0.891	0.837	0.772	0.860	0.890	0.003	0.000	0.000	0.159	Ti
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.011	0.010	0.285	Al
Cr	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	Cr
V3+	0.014	0.009	0.010	0.011	0.011	0.016	0.010	0.011	0.025	0.024	0.026	0.025	V3+
Fe3+	0.562	0.207	0.226	0.206	0.316	0.440	0.269	0.209	1.941	1.962	1.962	1.371	Fe3+
Fe2+	0.677	0.847	0.843	0.850	0.798	0.737	0.820	0.849	0.995	0.994	0.993	1.053	Fe2+
Mg	0.028	0.035	0.032	0.033	0.032	0.029	0.032	0.032	0.006	0.002	0.000	0.056	Mg
Ca	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.000	Ca
Mn	0.004	0.009	0.007	0.007	0.007	0.006	0.008	0.007	0.001	0.002	0.001	0.003	Mn
Zn	0.002	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.047	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	3.000	3.000	3.000	3.000	total
RO2	0.416	0.472	0.469	0.471	0.456	0.436	0.462	0.471	0.002	0.000	0.000	0.074	RO2
R2O3	0.168	0.057	0.063	0.057	0.089	0.129	0.075	0.058	0.497	0.499	0.500	0.389	R2O3
RO	0.416	0.472	0.469	0.471	0.456	0.436	0.462	0.471	0.501	0.500	0.500	0.537	RO
TiO2	0.426	0.484	0.480	0.483	0.467	0.447	0.474	0.483	0.001	0.000	0.000	0.084	TiO2
Fe2O3	0.168	0.056	0.061	0.056	0.088	0.127	0.074	0.057	0.493	0.497	0.497	0.361	Fe2O3
FeO	0.406	0.460	0.459	0.461	0.445	0.426	0.452	0.461	0.506	0.503	0.503	0.555	FeO

TE-41-2b ilm-hem: short traverses across hematite exsolution in ilmenite; plus one hematite exsolution in pyroxene											
Corrected probe data											Cor. data
Point #	3(23)	4(24)	5(25)	8(28)	9(29)	10(30)	12(32)	13(33)	14(34)	51	Point #
Cor. oxide wt %										hem ex in px	
SiO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.017	SiO2
TiO2	47.068	24.412	18.470	46.722	46.844	46.055	46.901	24.199	14.635	0.000	TiO2
Al2O3	0.000	0.082	0.060	0.000	0.000	0.000	0.000	0.100	0.078	0.092	Al2O3
Cr2O3	0.000	0.023	0.052	0.000	0.037	0.000	0.005	0.002	0.031	0.067	Cr2O3
V2O3	0.426	0.794	1.096	0.470	0.398	0.427	0.367	0.903	1.117	1.010	V2O3
Fe2O3	9.695	52.559	64.585	9.985	10.058	11.637	10.195	53.192	70.735	99.528	Fe2O3
FeO	41.011	21.405	16.343	40.652	40.668	40.176	41.039	21.382	12.954	0.000	FeO
MgO	0.518	0.182	0.056	0.531	0.518	0.501	0.476	0.096	0.039	0.000	MgO
CaO	0.022	0.033	0.021	0.018	0.000	0.007	0.000	0.027	0.018	0.147	CaO
MnO	0.266	0.124	0.090	0.361	0.379	0.291	0.263	0.147	0.056	0.016	MnO
ZnO	0.107	0.063	0.055	0.031	0.169	0.048	0.025	0.040	0.065	0.061	ZnO
total	99.113	99.676	100.828	98.770	99.071	99.142	99.271	100.096	99.728	100.938	total
Corrected cations/3"O"											Cor. cat/3"O"
Si	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Si
Ti	0.903	0.477	0.359	0.899	0.899	0.884	0.898	0.471	0.289	0.000	Ti
Al	0.000	0.003	0.002	0.000	0.000	0.000	0.000	0.003	0.002	0.003	Al
Cr	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.001	Cr
V3+	0.009	0.017	0.023	0.010	0.008	0.009	0.007	0.019	0.023	0.021	V3+
Fe3+	0.186	1.027	1.256	0.192	0.193	0.223	0.195	1.036	1.396	1.974	Fe3+
Fe2+	0.875	0.465	0.353	0.870	0.868	0.857	0.874	0.463	0.284	0.000	Fe2+
Mg	0.020	0.007	0.002	0.020	0.020	0.019	0.018	0.004	0.002	0.000	Mg
Ca	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.004	Ca
Mn	0.006	0.003	0.002	0.008	0.008	0.006	0.006	0.003	0.001	0.000	Mn
Zn	0.002	0.001	0.001	0.001	0.003	0.001	0.000	0.001	0.001	0.001	Zn
total	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.005	total
RO2	0.474	0.323	0.264	0.473	0.473	0.469	0.473	0.320	0.224	0.000	RO2
R2O3	0.051	0.354	0.472	0.053	0.053	0.062	0.053	0.359	0.552	0.994	R2O3
RO	0.474	0.323	0.264	0.473	0.473	0.469	0.473	0.320	0.224	0.006	RO
TiO2	0.483	0.328	0.268	0.482	0.482	0.477	0.480	0.324	0.227	0.000	TiO2
Fe2O3	0.050	0.353	0.469	0.052	0.052	0.060	0.052	0.357	0.549	1.000	Fe2O3
FeO	0.468	0.319	0.264	0.466	0.466	0.463	0.467	0.319	0.224	0.000	FeO

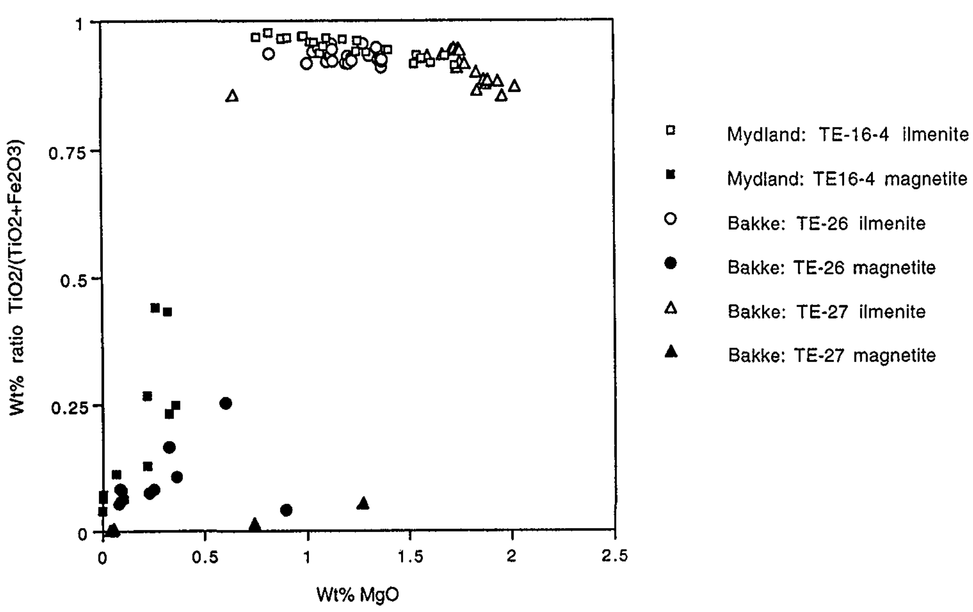
Mine Ilmenite & Magnetite
Wt% MgO vs Wt% ratio TiO2/(TiO2+Fe2O3)



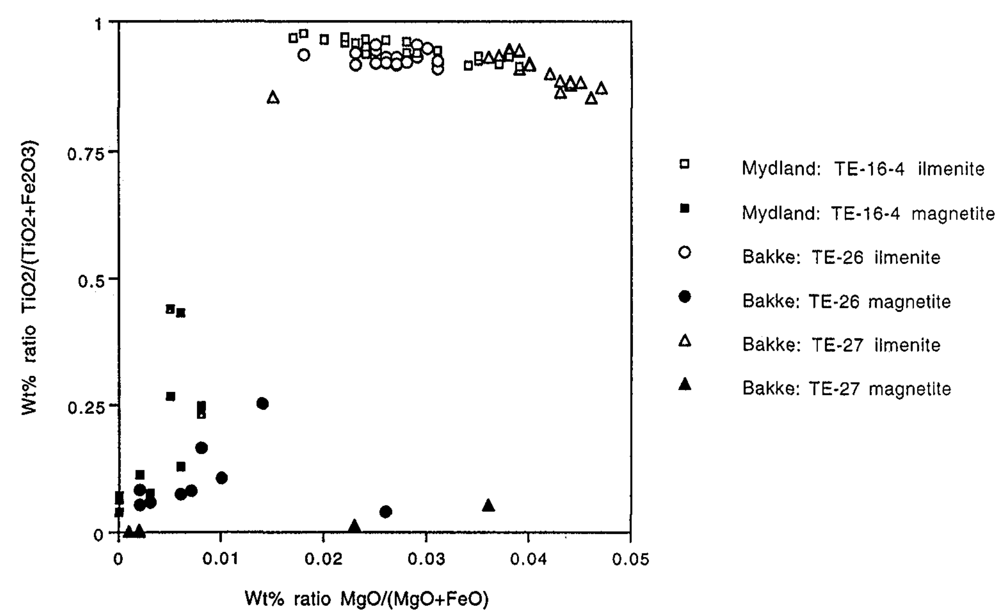
Mine Ilmenite & Magnetite
Wt% ratio TiO2/(TiO2+Fe2O3) vs Wt% ratio MgO/(MgO+FeO)



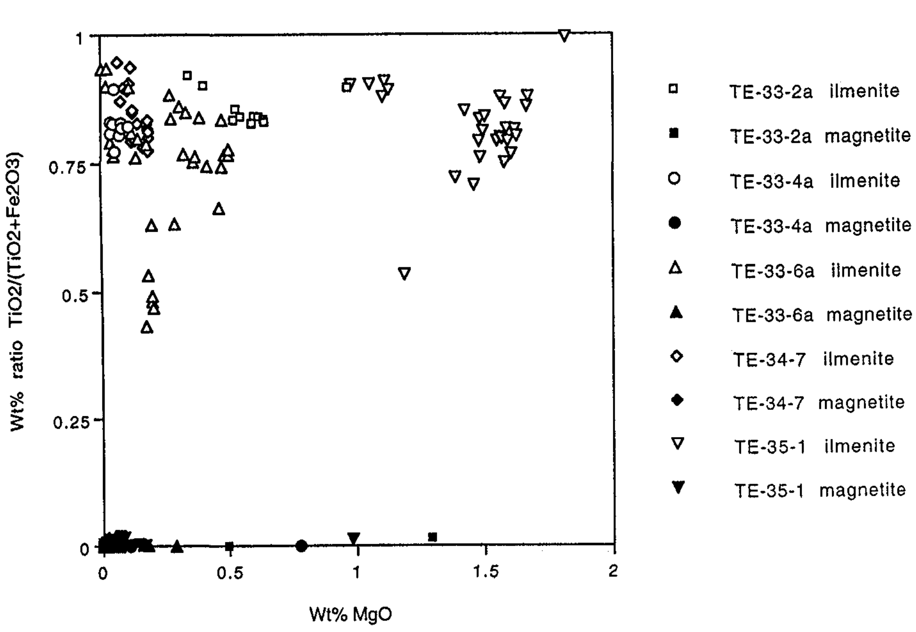
Mydland and Bakke Highs Ilmenite & Magnetite
Wt% MgO vs Wt% ratio TiO2/(TiO2+Fe2O3)



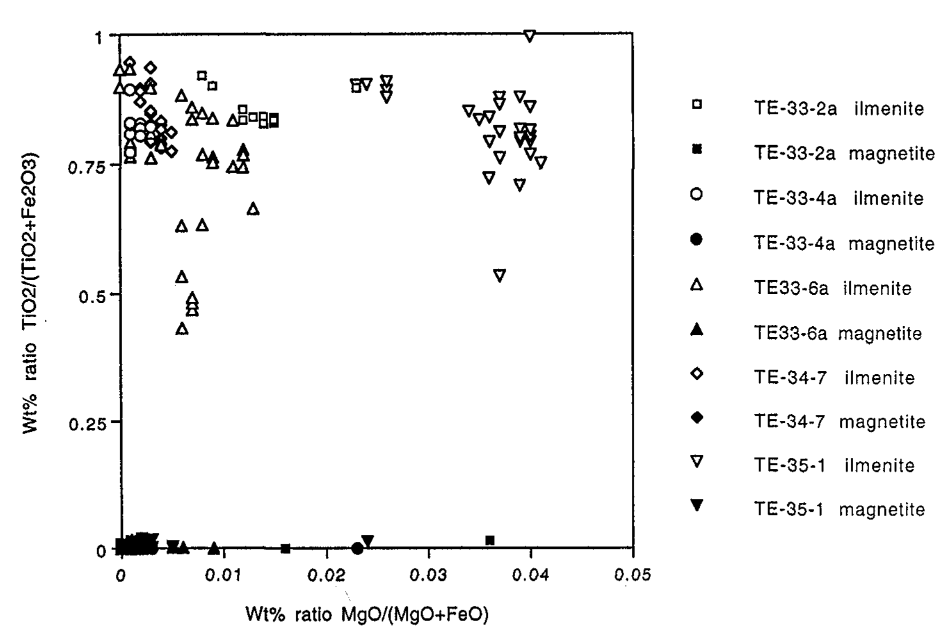
Mydland and Bakke Highs Ilmenite & Magnetite
Wt% ratio MgO/(MgO+FeO) vs Wt% ratio TiO2/(TiO2+Fe2O3)



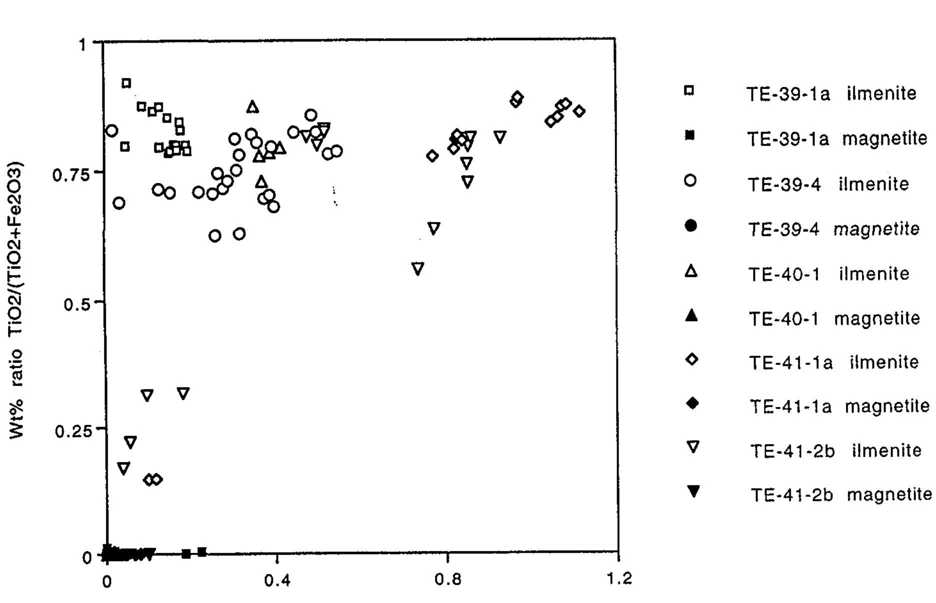
Mydland Low Ilmenite & Magnetite
Wt% MgO vs Wt% ratio TiO2/(TiO2+Fe2O3)



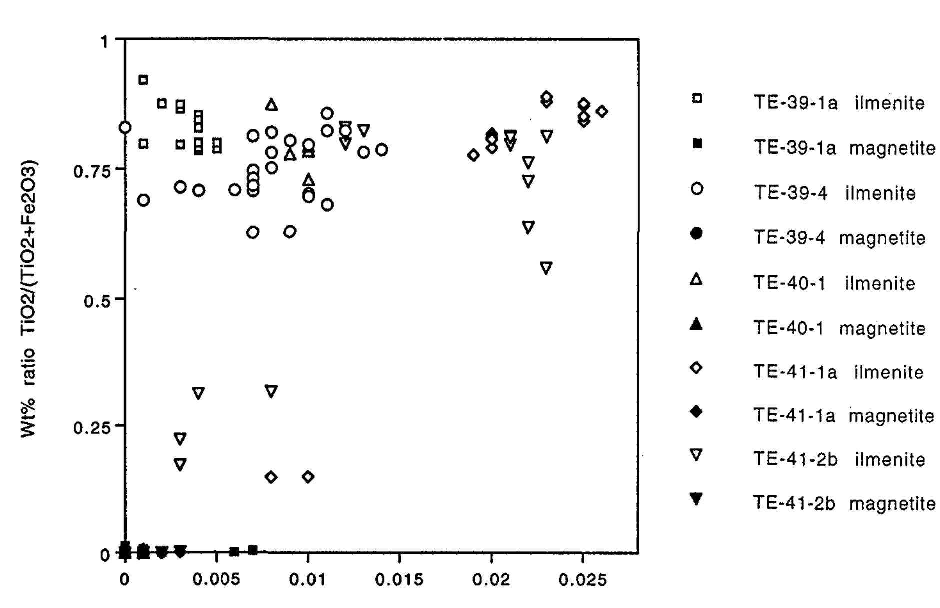
Mydland Low Ilmenite & Magnetite
Wt% ratio MgO/(MgO+FeO) vs Wt% ratio TiO2/(TiO2+Fe2O3)



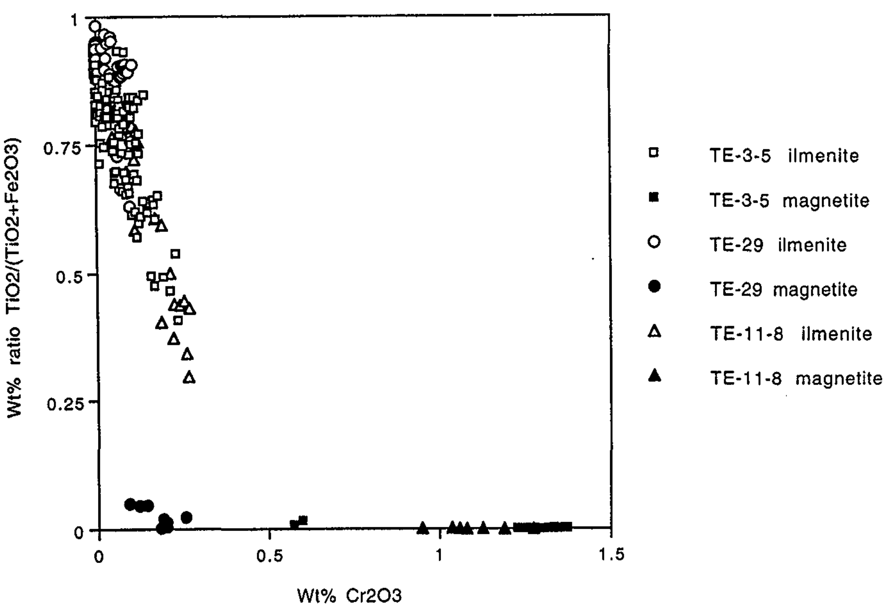
Heskestad Ilmenite & Magnetite
Wt% MgO vs Wt% ratio TiO2/(TiO2+Fe2O3)



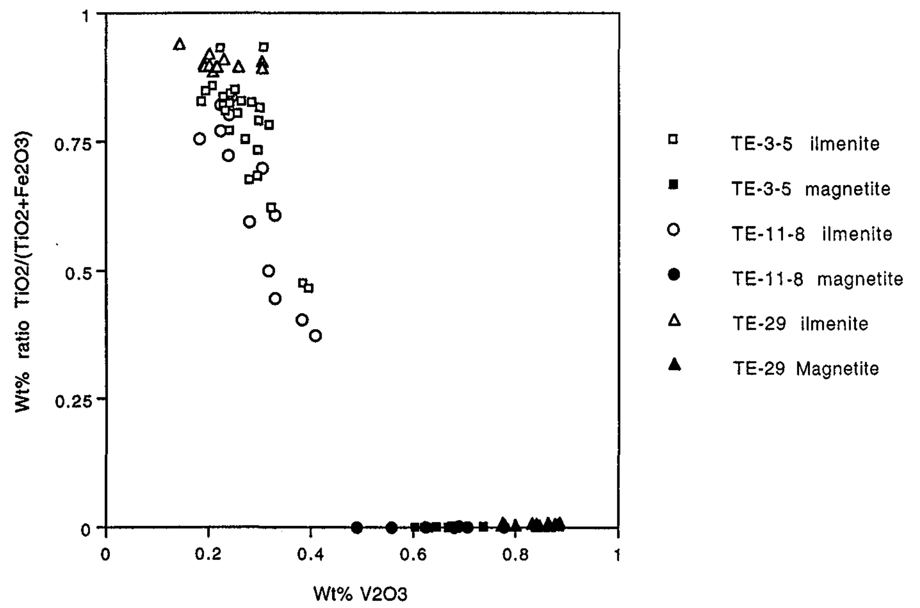
Heskestad Ilmenite & Magnetite
Wt% ratio MgO/(MgO+FeO) vs Wt% ratio TiO2/(TiO2+Fe2O3)



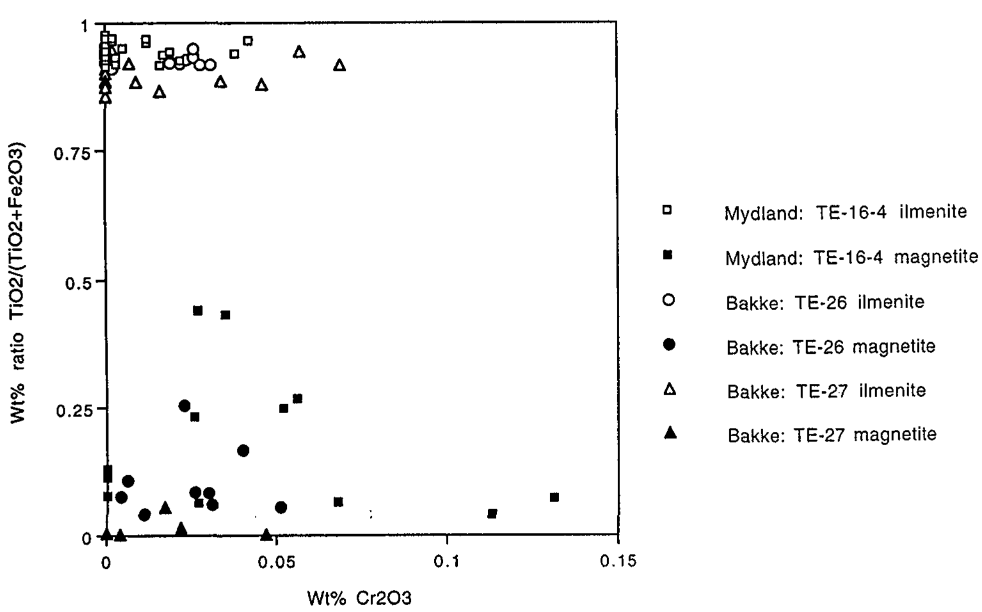
Mine Ilmenite & Magnetite
Wt% Cr2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



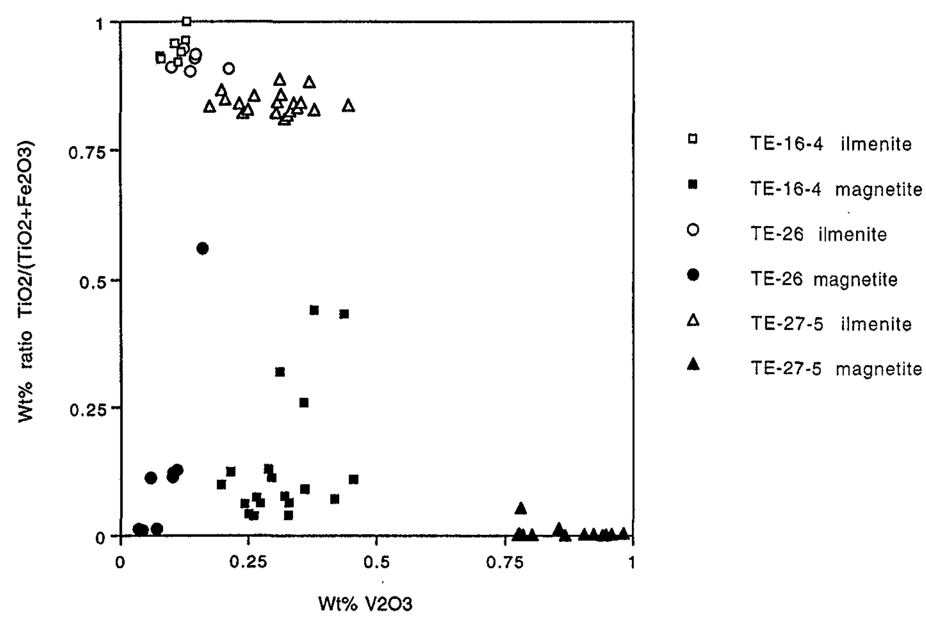
Mine Ilmenite & Magnetite
Wt% V2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



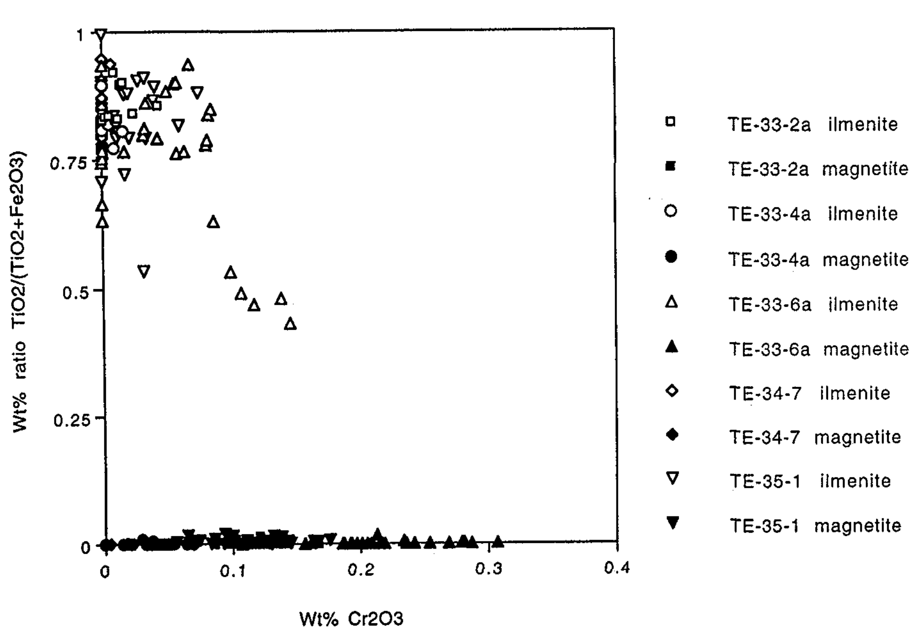
Mydland and Bakke Highs Ilmenite & Magnetite
Wt% Cr2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



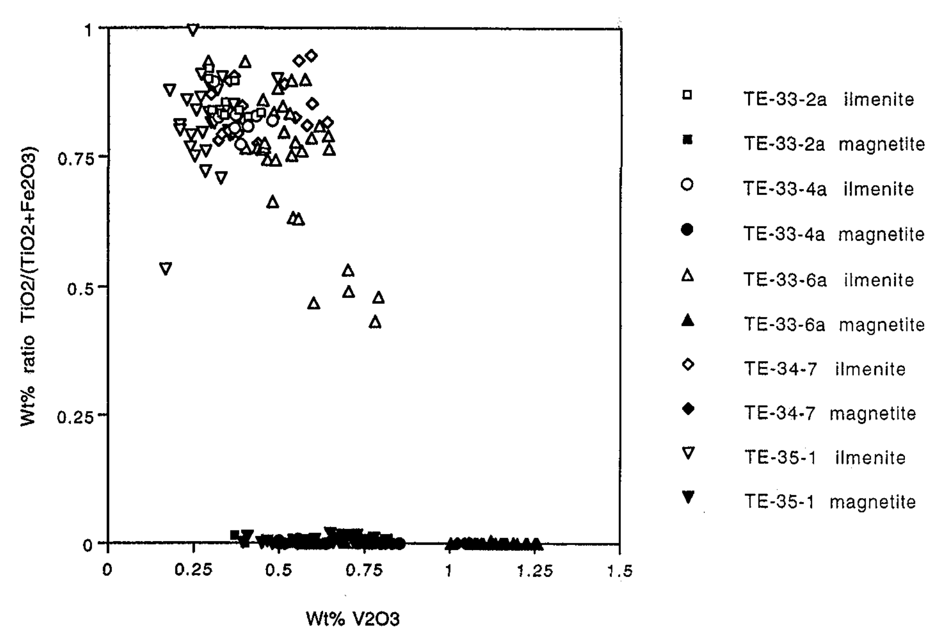
Mydland and Bakke Highs Ilmenite & Magnetite
Wt% V2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



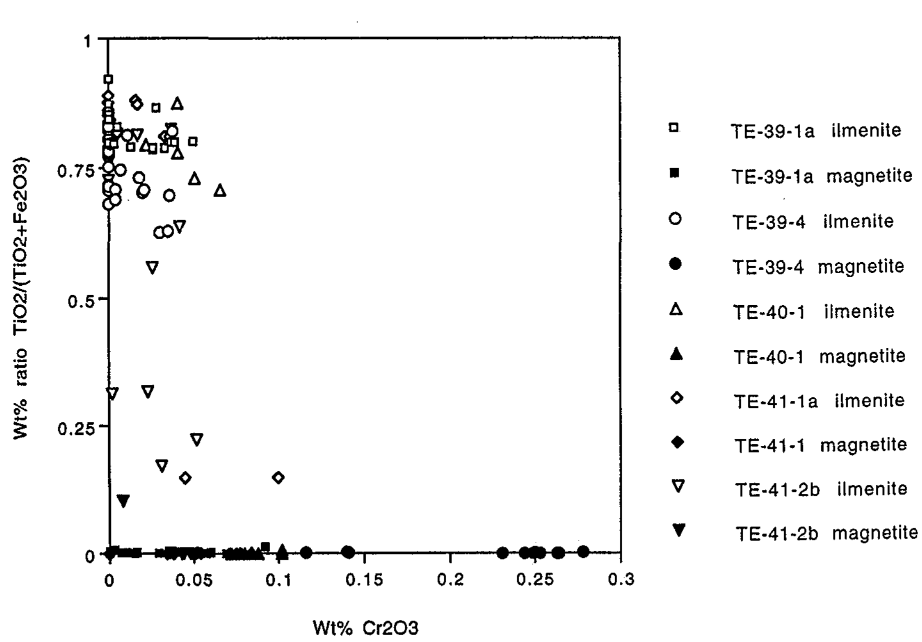
Mydland Low Ilmenite & Magnetite
Wt% Cr2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



Mydland Low Ilmenite & Magnetite
Wt% V2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



Heskestad Ilmenite & Magnetite
Wt% Cr2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)



Heskestad Ilmenite & Magnetite
Wt% V2O3 vs Wt% ratio TiO2/(TiO2+Fe2O3)