



HIGH GRADE METAMORPHIC AND STRUCTURAL RELATIONSHIPS  
NEAR AMATA, MUSGRAVE RANGES, CENTRAL AUSTRALIA

Volume 2

by

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TABLE 4.2

ANALYSES OF QUARTZO-FELDSPATHIC GRANULITES, WITH SELECTED TRACE ELEMENTS,  
CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A325/-	205	199	1121	1165a	77	138
SiO <sub>2</sub>	67.56	67.43	69.10	70.02	71.78	71.82
Al <sub>2</sub> O <sub>3</sub>	16.33	16.78	15.25	16.37	14.72	13.51
Fe <sub>2</sub> O <sub>3</sub>	1.03	0.66	1.53	0.64	0.99	1.28
FeO	2.50	2.41	2.68	0.92	2.75	1.95
MgO	1.48	1.29	1.19	0.57	0.90	0.71
CaO	4.46	4.16	2.65	3.30	1.37	1.98
Na <sub>2</sub> O	4.74	4.74	2.93	4.90	3.03	3.58
K <sub>2</sub> O	0.92	1.15	3.33	1.94	3.90	3.92
TiO <sub>2</sub>	0.39	0.36	0.54	0.21	0.50	0.48
MnO	0.10	0.09	0.15	0.06	0.14	0.11
P <sub>2</sub> O <sub>5</sub>	0.06	0.08	0.07	0.04	0.04	0.02
L.O. Ignit.	0.20	0.41	0.28	0.55	0.10	0.30
Total	99.77	99.56	99.70	99.52	100.31	99.66
%K	0.76	0.96	2.76	1.61	3.31	3.25
%Ca	3.19	2.98	1.89	2.36	0.98	1.42
%Ti	0.23	0.22	0.32	0.13	0.30	0.29
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	3.81	3.34	4.51	1.66	4.05	3.45
Oxidation Ratio	27.1	19.8	34.0	38.5	24.5	37.2
Molecular (MgO x 100)/(MgO + FeO)	51.4	48.9	44.2	52.5	36.9	39.4
TRACE ELEMENTS IN (P.P.M.)						
Sr	263.5	340.7	327.3	615.3	215.6	196.0
Rb	7.3	15.3	76.2	24.3	83.6	84.9
Th	1.0	-	9.0	-	0.8	-
Zr	97.6	111.6	265.0	56.0	227.3	189.2
Ce	6.8	33.8	107.9	13.3	81.3	101.2
La	-	8.2	49.8	17.3	33.6	40.6
U	-	0.3	0.6	0.3	-	-
Rb/Sr	0.028	0.045	0.233	0.039	0.388	0.433
La/Ce	-	0.243	0.462	1.301	0.413	0.401
(Th/K) x 10 <sup>4</sup>	1.30	-	3.25	-	0.24	-
K/Rb	1046.2	624.0	362.8	662.8	396.2	383.3
(U/K) x 10 <sup>4</sup>	-	0.31	0.21	0.18	-	-
Ti/Zr	25.96	19.34	12.22	22.48	13.19	15.21
NIGGLI NUMBERS						
si	273.2	278.9	313.0	328.5	356.7	362.9
al	38.9	40.9	40.7	45.3	43.1	40.2
fm	20.8	18.7	24.0	10.1	22.4	18.9
c	19.3	18.4	12.9	16.6	7.3	10.7
alk	20.9	22.0	22.5	28.1	27.2	30.2
p	0.10	0.14	0.13	0.08	0.08	0.04
ti	1.19	1.12	1.84	0.74	1.87	1.82
mg	0.43	0.43	0.34	0.39	0.30	0.28
k	0.11	0.14	0.43	0.21	0.46	0.42

TABLE 4.2

ANALYSES OF CALC SILICATE MANGANIFEROUS AND  
ULTRAMAFIC GRANULITES, WITH SELECTED TRACE ELEMENTS,  
CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A325/-	2040	2048	2050c
SiO <sub>2</sub>	40.24	67.57	48.65
Al <sub>2</sub> O <sub>3</sub>	27.70	2.16	8.90
Fe <sub>2</sub> O <sub>3</sub>	4.50	9.43	1.71
FeO	3.16	0.43	7.81
MgO	0.10	0.49	21.30
CaO	22.74	5.17	7.13
Na <sub>2</sub> O	0.35	0.15	1.11
K <sub>2</sub> O	0.04	0.05	0.83
TiO <sub>2</sub>	1.06	0.08	0.78
MnO	0.21	12.99	0.20
P <sub>2</sub> O <sub>5</sub>	0.22	0.10	0.05
L.O. Ignit.	0.60	0.72	0.89
<b>Total</b>	<b>100.92</b>	<b>99.34</b>	<b>99.36</b>
%K	0.03	0.04	0.69
%Ca	16.25	3.69	5.10
%Ti	0.64	-	0.47
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	8.01	9.91	10.39
Oxidation Ratio	56.2	95.2	16.5
Molecular (MgO x 100)/(MgO + FeO)	5.3	67.0	83.0
TRACE ELEMENTS IN (P.P.M.)			
Sr	1123.3	62.1	30.2
Rb	-	-	30.1
Th	42.0	3.0	-
Zr	1481.0	-	53.7
Ce	229.9	31.4	21.2
La	83.0	3.4	-
U	-	-	-
Rb/Sr	-	-	0.997
La/Ce	0.365	0.108	-
(Th/K) x 10 <sup>4</sup>	1264.8	72.5	-
K/Rb	-	-	228.9
(U/K) x 10 <sup>4</sup>	-	-	-
Ti/Zr	4.29	-	87.08
NIGGLI NUMBERS			
si	84.9	255.6	89.8
al	34.4	4.4	9.7
fm	13.4	75.8	73.3
c	51.4	19.1	14.1
alk	0.77	0.61	3.00
p	0.20	0.15	0.04
ti	1.68	0.21	1.08
mg	0.23	0.03	0.80
k	0.07	0.18	0.33



TABLE 4.2

ANALYSES OF MAFIC AND ULTRAMAFIC ROCKS FROM THE TRANSITIONAL TERRAIN,  
WITH SELECTED TRACE ELEMENTS, CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A525/-	517	544	339	523	295	497
SiO <sub>2</sub>	48.03	46.84	47.05	47.28	50.52	51.76
Al <sub>2</sub> O <sub>3</sub>	16.68	21.01	16.83	17.99	7.75	16.16
Fe <sub>2</sub> O <sub>3</sub>	2.30	1.24	2.97	3.40	2.58	1.56
FeO	8.47	5.67	6.99	6.91	9.71	6.44
MgO	10.97	10.12	9.33	8.86	18.17	7.68
CaO	10.74	11.02	11.81	11.53	8.76	10.55
Na <sub>2</sub> O	1.17	2.10	2.19	2.42	0.35	3.17
K <sub>2</sub> O	0.40	0.34	0.77	0.47	0.07	0.56
TiO <sub>2</sub>	0.36	0.35	0.87	0.41	0.63	0.42
MnO	0.21	0.17	0.22	0.21	0.30	0.24
P <sub>2</sub> O <sub>5</sub>	0.04	0.05	0.07	0.03	0.10	0.05
L.O. Ignit.	0.74	1.22	1.14	1.01	0.89	1.00
<b>Total</b>	<b>100.11</b>	<b>100.13</b>	<b>100.24</b>	<b>100.52</b>	<b>99.83</b>	<b>99.59</b>
%K	0.33	0.28	0.64	0.39	0.06	0.47
%Ca	7.68	7.88	8.44	8.24	6.26	7.54
%Ti	0.22	0.21	0.52	0.25	0.38	0.25
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	11.71	7.54	10.74	11.08	13.37	8.72
Oxidation Ratio	19.7	16.5	27.7	30.7	19.3	17.9
Molecular (MgO x 100)/(MgO + FeO)	69.8	76.1	70.4	69.6	77.0	68.0
TRACE ELEMENTS IN (P.P.M.)						
Sr	54.3	210.4	162.0	65.9	32.0	110.9
Rb	8.4	8.9	14.3	8.5	4.7	8.1
Th	0.8	2.0	3.3	4.5	5	1.5
Zr	0.7	20.5	30.3	6.1	40.4	66.1
Ce	11.3	23.8	28.7	28.6	35.8	38.0
La	-	9.2	-	-	7.2	9.7
U	-	-	-	-	-	-
Rb/Sr	0.155	0.042	0.088	0.129	0.147	0.073
La/Ce	-	0.387	-	-	0.201	0.255
(Th/K) x 10 <sup>4</sup>	2.40	7.08	5.16	11.53	86.04	3.22
K/Rb	395.5	317.1	447.0	459.0	123.6	573.9
(U/K) x 10 <sup>4</sup>	-	-	-	-	-	-
Ti/Zr	3083.10	102.40	172.10	402.90	93.50	38.09
NIGGLI NUMBERS						
si	100.0	99.0	99.4	100.0	97.7	121.9
al	20.5	26.2	20.9	22.4	8.8	22.4
fm	52.7	44.2	46.8	45.9	72.3	42.9
c	23.9	24.9	26.7	26.1	18.1	26.6
alk	2.9	4.8	5.5	5.6	0.7	8.1
p	0.04	0.05	0.06	0.03	0.10	0.05
ti	0.56	0.56	1.38	0.65	0.90	0.70
mg	0.65	0.72	0.63	0.61	0.72	0.62
k	0.18	0.10	0.19	0.11	0.10	0.10

TABLE 4.2

ANALYSES OF AMPHIBOLITE FACIES LITHOLOGIES WITH SELECTED TRACE ELEMENTS,  
CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A325/-	1659	1744 <sup>+</sup>	1636a <sup>+</sup>	1684	1748 <sup>+</sup>	1687
SiO <sub>2</sub>	71.81	67.40	68.70	44.92	47.50	45.50
Al <sub>2</sub> O <sub>3</sub>	14.22	15.80	14.80	14.18	15.50	23.00
Fe <sub>2</sub> O <sub>3</sub>	1.07	1.00	1.04	10.14	2.24	3.27
FeO	1.38	1.93	2.21	7.86	7.88	8.02
MgO	0.51	1.00	0.95	4.66	9.50	4.23
CaO	2.54	2.00	2.10	9.31	10.60	2.19
Na <sub>2</sub> O	3.14	2.60	2.20	3.07	2.20	3.95
K <sub>2</sub> O	4.45	6.80	6.30	0.97	1.80	5.52
TiO <sub>2</sub>	0.50	0.70	0.65	2.97	1.05	1.43
MnO	0.09	0.10	0.08	0.45	0.20	0.56
P <sub>2</sub> O <sub>5</sub>	0.09	0.20	0.20	0.40	0.10	0.09
L.O. Ignit.	0.38	0.49	0.89	1.16	1.50	1.70
Total	100.18	100.08	100.12	100.09	100.07	99.46
%K	3.69	5.65	5.23	0.81	1.49	4.58
%Ca	1.82	1.43	1.50	6.65	7.58	1.57
%Ti	0.30	-	-	1.78	-	0.86
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	2.60	3.21	3.50	18.88	11.00	12.18
Oxidation Ratio	41.10	33.09	29.76	53.70	20.38	26.90
Molecular (MgO x 100)/(MgO + FeO)	39.70	48.04	43.41	51.40	68.26	48.50
TRACE ELEMENTS IN (P.P.M.)						
Sr	189.8	250.7	199.4	132.4	130.3	220.0
Rb	159.0	298.2	294.3	18.7	24.76	217.1
Th	9.0	57.3	249.3	6.9	1.1	50.0
Zr	321.8	-	-	137.8	-	444.7
Ce	99.8	-	-	76.61	-	291.4
La	46.5	-	-	-	-	180.3
U	2.0	-	-	-	-	-
Rb/Sr	0.838	1.190	1.480	0.141	0.190	0.987
La/Ce	0.466	-	-	-	-	0.619
(Th/K) x 10 <sup>4</sup>	2.43	10.14	47.66	8.51	0.73	10.91
K/Rb	232.3	189.3	177.7	430.6	603.5	211.1
(U/K) x 10 <sup>4</sup>	0.54	-	-	-	-	-
Ti/Zr	12.93	-	-	216.40	-	19.28
NIGGLI NUMBERS						
si	363.2	302.4	323.6	103.4	102.5	116.1
al	42.40	41.76	41.07	19.23	19.70	34.60
fm	14.10	17.88	19.37	49.50	48.74	40.70
c	13.80	9.61	10.59	22.95	24.49	6.00
alk	29.70	30.75	28.96	8.27	7.07	18.80
p	0.19	0.38	0.40	0.39	0.09	0.10
ti	1.90	2.36	2.30	5.14	1.70	2.74
mg	0.27	0.37	0.34	0.32	0.63	0.40
k	0.48	0.63	0.65	0.17	0.35	0.48

<sup>+</sup> Major elements analysed by A.M.D.E.L.

TABLE 4.2

## ANALYSES OF MAFIC GRANULITES WITH SELECTED TRACE ELEMENTS, CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A325/-	83	119	105b	81	138b	60	148	121	949	1105	78	158
SiO <sub>2</sub>	53.00	53.17	53.17	54.11	50.24	54.29	52.66	52.71	44.53	48.37	46.02	48.87
Al <sub>2</sub> O <sub>3</sub>	22.00	20.49	18.76	21.65	14.39	20.15	18.34	19.05	18.64	17.06	14.73	14.90
Fe <sub>2</sub> O <sub>3</sub>	1.49	1.86	0.88	0.89	3.04	0.99	1.16	1.83	2.59	2.41	4.21	2.11
FeO	4.35	5.44	6.41	4.87	7.80	5.22	7.50	7.03	8.42	8.37	9.52	8.10
MgO	4.21	4.55	6.88	4.78	6.90	6.41	7.03	6.38	10.92	9.48	8.77	12.03
CaO	8.26	8.08	8.27	7.98	11.21	7.24	7.50	7.71	12.03	11.27	12.56	9.62
Na <sub>2</sub> O	4.33	3.80	3.37	4.61	3.05	4.18	2.95	3.80	1.74	1.88	1.44	1.91
K <sub>2</sub> O	0.69	0.66	0.60	0.69	0.42	0.58	0.70	0.55	0.10	0.29	0.19	0.35
TiO <sub>2</sub>	0.64	0.75	0.37	0.36	1.05	0.20	0.78	0.77	0.77	0.92	1.49	1.14
MnO	0.12	0.15	0.18	0.13	0.24	0.16	0.19	0.18	0.21	0.25	0.29	0.20
P <sub>2</sub> O <sub>5</sub>	0.02	0.05	0.04	0.02	0.11	-	0.11	0.03	0.02	0.15	0.17	0.13
L.O. Ignit.	0.56	0.70	0.80	0.59	0.78	0.78	0.92	0.80	0.93	0.67	0.78	0.84
Total	99.67	99.70	99.73	100.68	99.23	100.20	99.84	100.84	100.99	101.12	100.17	100.20
%K	0.57	0.55	0.50	0.57	0.35	0.48	0.58	0.46	0.08	0.24	0.16	0.29
%Ca	5.90	5.78	5.91	5.70	8.01	5.17	5.39	5.51	8.60	8.06	8.98	6.88
%Ti	0.38	0.45	0.22	0.22	0.63	0.12	0.47	0.46	0.46	0.55	0.89	0.63
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	6.32	7.91	8.00	6.30	11.71	6.79	9.49	9.64	11.95	11.71	14.79	11.11
Oxidation Ratio	23.6	23.5	11.0	14.1	26.0	14.6	12.2	19.0	21.7	20.6	28.5	19.0
Molecular (MgO x 100)/(MgO + FeO)	63.3	59.9	65.7	63.7	61.2	68.7	62.6	61.8	69.8	66.9	62.2	72.6
TRACE ELEMENTS IN (P.P.M.)												
Sr	521.7	591.0	375.2	516.8	242.5	589.7	498.0	577.8	123.3	286.9	210.6	214.9
Rb	4.6	5.4	4.7	3.3	2.3	2.1	4.6	15.1	3.4	5.7	1.3	11.3
Th	-	-	4.0	1.0	0.4	0.5	-	0.7	-	3.6	0.1	3.8
Zr	16.7	14.6	23.2	13.4	63.0	10.1	42.0	33.8	18.4	48.9	38.5	65.8
Ce	32.0	24.3	16.3	3.8	75.9	-	32.2	33.0	23.3	-	19.2	8.4
La	-	-	-	-	-	-	-	1.8	-	-	-	-
U	-	-	-	-	-	-	-	-	-	-	-	-
Rb/Sr	0.009	0.009	0.013	0.006	0.009	0.004	0.009	0.026	0.028	0.020	0.006	0.053
La/Ce	-	-	-	-	-	-	-	0.055	-	-	-	-
(Th/K) x 10 <sup>4</sup>	-	-	8.03	1.74	1.14	1.03	-	1.55	-	14.95	0.66	13.07
K/Rb	1245.3	1014.6	1059.8	1735.3	1515.9	2293.0	1263.3	302.4	244.2	668.7	1213.0	257.1
(U/K) x 10 <sup>4</sup>	-	-	-	-	-	-	-	-	-	-	-	-
Ti/Zr	230.0	308.0	95.6	161.1	99.92	118.7	111.3	136.6	251.0	112.8	232.0	103.9
NIGGLI NUMBERS												
si	141.1	141.1	133.0	141.7	116.9	139.8	131.9	130.4	87.2	102.3	95.7	102.6
al	34.5	32.0	27.7	33.4	19.7	30.6	27.1	27.8	21.5	21.3	18.1	18.4
fm	29.6	34.1	41.1	31.4	44.9	38.1	44.5	41.8	49.8	49.0	50.8	55.6
c	23.5	23.0	22.2	22.4	27.9	20.0	20.1	20.4	25.2	25.5	28.0	21.6
alk	12.3	10.9	9.1	12.9	7.5	11.4	8.3	10.0	3.4	4.2	3.2	4.4
p	0.02	0.06	0.04	0.02	0.10	0.00	0.10	0.03	0.02	0.10	0.20	0.10
ti	1.30	1.50	0.70	0.70	1.80	0.40	1.50	1.43	1.10	1.50	2.30	1.80
mg	0.56	0.52	0.62	0.59	0.53	0.65	0.59	0.56	0.64	0.61	0.53	0.68
k	0.10	0.10	0.10	0.09	0.08	0.10	0.10	0.09	0.04	0.10	0.08	0.10

TABLE 4.2

ANALYSES OF MICACEOUS MAFIC ROCKS AND CALC SILICATE ROCK  
FROM THE TRANSITIONAL TERRAIN WITH SELECTED TRACE ELEMENTS,  
CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A325/-	14	6	990	1328	425
SiO <sub>2</sub>	49.91	46.33	50.82	48.31	45.00
Al <sub>2</sub> O <sub>3</sub>	14.80	17.03	12.11	9.00	21.47
Fe <sub>2</sub> O <sub>3</sub>	2.38	4.00	1.42	1.77	2.51
FeO	6.58	8.44	7.27	4.89	5.12
MgO	8.05	7.34	14.00	13.92	3.29
CaO	7.65	9.57	3.60	13.72	19.61
Na <sub>2</sub> O	3.40	3.22	0.98	0.88	0.80
K <sub>2</sub> O	3.08	1.45	4.43	4.13	0.17
TiO <sub>2</sub>	1.39	1.47	2.52	1.15	1.16
MnO	0.24	0.25	0.19	0.15	0.18
P <sub>2</sub> O <sub>5</sub>	0.79	0.17	1.23	1.02	0.25
L.O. Ignit.	1.10	1.07	0.85	0.69	0.62
Total	99.37	100.34	99.42	99.63	100.18
%K	2.56	1.20	3.68	3.43	0.14
%Ca	5.47	6.84	2.57	9.81	14.02
%Ti	0.83	0.88	1.51	0.69	0.695
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	9.69	13.38	9.50	7.20	8.20
Oxidation Ratio	24.6	29.9	15.0	24.6	30.6
Molecular (MgO x 100)/(MgO + FeO)	68.6	60.8	77.5	83.6	53.4
TRACE ELEMENTS IN (P.P.M.)					
Sr	975.0	210.0	320.0	1793.0	481.6
Rb	218.6	61.3	291.0	103.4	-
Th	16.7	0.4	6.4	7.0	6.9
Zr	434.2	66.0	408.9	246.8	139.4
Ce	265.4	30.3	114.1	308.0	85.6
La	89.1	-	4.0	95.8	10.6
U	-	-	-	-	-
Rb/Sr	0.224	0.292	0.909	0.058	-
La/Ce	0.336	-	0.035	0.311	0.124
(Th/K) x 10 <sup>4</sup>	6.53	0.33	1.74	2.04	48.90
K/Rb	120.0	196.4	126.4	331.6	-
(U/K) x 10 <sup>4</sup>	-	-	-	-	-
Ti/Zr	19.19	133.50	56.95	27.94	49.89
NIGGLI NUMBERS					
si	119.8	101.7	118.4	97.1	98.4
al	20.9	22.0	16.6	10.7	27.7
fm	46.8	46.6	65.6	52.8	24.5
c	19.7	22.5	9.0	29.5	45.9
alk	12.6	8.9	8.8	7.0	1.9
p	0.80	0.16	1.21	0.87	0.23
ti	2.51	2.43	4.40	1.74	1.91
mg	0.62	0.52	0.74	0.79	0.44
k	0.37	0.23	0.75	0.76	0.12

TABLE 4.2

ANALYSES OF QUARTZO-FELDSPATHIC ROCKS FROM THE TRANSITIONAL TERRAIN,  
WITH SELECTED TRACE ELEMENTS, CALCULATED RATIOS AND NIGGLI NUMBERS

SPECIMEN NUMBER A325/-	531	396	400	323	783	474	18	326	405
SiO <sub>2</sub>	63.50	68.75	69.73	62.68	74.44	71.44	71.85	64.37	65.02
Al <sub>2</sub> O <sub>3</sub>	17.57	14.46	13.70	14.68	12.90	14.74	14.75	16.70	18.54
Fe <sub>2</sub> O <sub>3</sub>	1.59	1.43	1.62	3.35	1.15	0.83	0.99	1.92	0.98
FeO	3.87	1.43	2.31	3.85	1.17	1.24	1.06	3.35	1.36
MgO	2.27	0.70	1.26	1.45	0.15	0.32	0.30	1.98	0.53
CaO	2.65	1.82	2.60	3.39	0.90	1.27	1.62	5.26	6.98
Na <sub>2</sub> O	3.16	4.21	3.42	3.20	3.02	2.93	3.83	4.04	4.55
K <sub>2</sub> O	3.59	5.57	4.58	4.63	5.74	6.78	5.01	0.82	0.82
TiO <sub>2</sub>	0.77	0.47	0.55	1.22	0.38	0.35	0.29	0.58	0.31
MnO	0.15	0.10	0.10	0.16	0.07	0.05	0.07	0.16	0.10
P <sub>2</sub> O <sub>5</sub>	0.04	0.16	0.11	0.55	0.04	0.10	0.09	0.13	0.07
L.O. Ignit.	0.40	0.64	0.47	0.54	0.09	0.27	-	0.52	0.48
Total	99.56	99.74	100.45	99.70	100.05	100.32	99.86	99.83	99.74
%K	2.98	4.62	3.80	3.84	4.77	5.63	4.16	0.68	0.68
%Ca	1.89	1.30	1.86	2.42	0.64	0.91	1.16	3.76	4.99
%Ti	0.46	0.28	0.33	0.73	0.23	0.21	0.17	0.35	0.19
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	5.89	3.02	4.19	7.63	2.45	2.21	2.17	5.64	2.49
Oxidation Ratio	27.0	47.4	38.7	43.9	47.0	37.6	45.7	34.0	39.4
Molecular (-MgO x 100)/(MgO + FeO)	51.1	46.6	49.3	40.2	18.6	31.5	33.6	51.3	41.0
TRACE ELEMENTS IN (P.P.M.)									
Sr	339.1	284.0	128.4	243.6	65.6	216.1	157.9	453.3	201.5
Rb	121.0	154.2	188.0	166.5	217.0	217.0	275.0	14.0	4.3
Th	5.0	50.0	14.0	2.0	-	26.0	29.0	-	23.0
Zr	219.0	229.0	307.0	894.0	389.5	215.0	218.5	113.3	134.8
Ce	161.2	274.8	189.4	329.8	66.9	174.0	103.9	66.7	65.7
La	55.7	171.8	79.4	112.8	45.6	66.5	47.2	11.6	41.6
U	-	-	1.0	-	0.7	0.6	-	-	-
Rb/Sr	0.357	0.543	1.464	0.683	3.310	1.004	1.742	0.031	0.021
La/Ce	0.346	0.625	0.419	0.342	0.682	0.382	0.454	0.174	0.633
(Th/K) x 10 <sup>4</sup>	1.67	10.81	3.68	0.52	-	4.61	6.97	-	33.78
K/Rb	246.3	299.9	202.2	230.8	219.6	259.4	151.2	486.2	1583.0
(U/K) x 10 <sup>4</sup>	-	-	0.26	-	0.14	0.10	-	-	-
Ti/Zr	21.08	12.30	10.74	8.18	5.85	9.76	7.96	30.69	13.79
NIGGLI NUMBERS									
si	239.8	319.8	314.1	237.7	436.5	368.5	369.1	236.3	249.3
al	39.1	39.6	36.4	32.8	44.6	44.8	44.6	36.1	41.9
fm	30.0	15.3	23.0	30.5	11.2	11.3	11.0	26.9	10.5
c	10.7	9.1	12.5	13.8	5.7	7.0	8.9	20.7	28.7
alk	20.2	35.5	28.1	23.0	38.6	36.9	35.5	16.3	18.9
p	0.06	0.32	0.21	0.88	0.10	0.22	0.20	0.20	0.11
ti	2.19	1.64	1.86	3.48	1.68	1.36	1.12	1.6	0.89
mg	0.43	0.31	0.37	0.27	0.00	0.22	0.26	0.40	0.29
k	0.43	0.47	0.47	0.49	0.56	0.60	0.21	0.10	0.11





TABLE 4.10

AVERAGE COMPOSITION OF THE QUARTZO-FELDSPATHIC AND MAFIC ROCKS FROM THE THREE METAMORPHIC TERRAINS

	GRANULITE FACIES				TRANSITIONAL TERRAIN							AMPHIBOLITE FACIES			
	QUARTZO-FELDSPATHIC		MAFIC		QUARTZO-FELDSPATHIC					MAFIC		QUARTZO-FELDSPATHIC		MAFIC	
	$\bar{x}$	s	$\bar{x}$	s	$K_2O > Na_2O$		$Na_2O > K_2O$		WEIGHTED AVERAGE	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
					$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$						
SiO <sub>2</sub>	69.62	1.95	50.93	3.28	68.92	4.37	64.70	0.46	68.49	48.35	2.13	69.50	2.27	46.21	1.82
Al <sub>2</sub> O <sub>3</sub>	15.49	1.24	18.35	2.61	14.69	1.45	17.62	1.30	14.98	15.53	4.39	14.94	0.80	14.84	0.93
Fe <sub>2</sub> O <sub>3</sub>	1.02	0.35	1.96	1.00	1.57	0.84	1.45	0.66	1.55	2.38	0.86	1.04	0.04	6.19	5.59
FeO	2.20	0.69	6.92	1.65	2.13	1.25	2.36	1.41	2.16	6.95	1.48	1.84	0.42	7.87	0.01
MgO	1.02	0.35	7.36	2.48	0.92	0.78	1.26	1.05	0.96	10.16	4.02	0.82	0.27	7.08	3.42
CaO	2.99	1.22	9.31	1.93	2.04	0.88	6.12	1.22	2.44	10.78	3.94	2.21	0.29	9.96	0.91
Na <sub>2</sub> O	3.99	0.91	3.09	1.11	3.40	0.47	4.30	0.36	3.49	1.88	1.10	2.65	0.47	2.64	0.62
K <sub>2</sub> O	2.54	1.38	0.49	0.21	5.13	1.02	0.82	0.00	4.70	1.44	1.64	5.85	1.24	1.39	0.59
TiO <sub>2</sub>	0.41	0.12	0.77	0.30	0.58	0.33	0.45	0.19	0.56	0.98	0.66	0.62	0.10	2.01	1.36
MnO	0.11	0.03	0.19	0.04	0.10	0.04	0.13	0.04	0.10	0.21	0.04	0.09	0.01	0.33	0.18
P <sub>2</sub> O <sub>5</sub>	0.05	0.02	0.07	0.07	0.16	0.18	0.10	0.04	0.15	0.35	0.45	0.16	0.06	0.25	0.25
%K	2.11	1.15	0.40	0.17	4.26	0.85	0.68	0.00	3.90	1.20	1.36	4.86	1.05	1.15	0.48
Sr	326.0	153.0	397.0	197.0	205.0	94.3	327.4	178.1	217.2	401.3	535.1	213.3	32.7	131.4	1.5
Pb	48.6	36.6	5.3	4.0	191.2	50.5	9.2	6.9	173.0	72.7	102.5	231.9	157.9	21.7	4.3
Th	3.6	4.7	1.8	1.7	18.0	13.1	11.5	16.3	17.4	5.0	4.6	105.2	127.1	4.0	4.1
Zr	157.8	81.8	32.4	19.4	353.1	247.2	124.1	15.2	330.2	132.7	159.4	-	-	-	-
Ce	58.8	41.2	26.8	19.9	185.7	91.5	66.2	0.7	173.8	88.2	103.0	-	-	-	-
La	29.9	17.0	7.7	5.2	82.7	45.6	26.6	21.2	77.1	32.2	41.2	-	-	-	-
U	0.4	0.2	-	-	0.8	0.2	-	-	0.8	-	-	-	-	-	-
Rb/Sr	0.194	0.184	0.016	0.014	1.300	1.020	0.260	-	1.170	0.212	0.257	1.169	0.322	0.166	0.035
(Th/K) x 10 <sup>4</sup>	1.60	1.53	3.27	3.91	4.04	3.86	16.89	23.89	5.32	15.91	26.99	20.08	24.20	4.62	5.50
K/Rb	579.2	263.0	1067.8	629.9	229.9	46.7	1034.6	775.6	310.4	309.0	161.9	199.8	28.8	517.1	122.5
(U/K) x 10 <sup>4</sup>	0.233	0.069	-	-	0.167	0.084	-	-	0.167	-	-	-	-	-	-

$\bar{x}$  = Arithmetic Mean

s = Standard Deviation



TABLE 4.20

## ORTHOPIYROXENE ANALYSES

SPECIMEN NO. A325/-	1105	949*	121	60	105b	138b	81	119	517	339	523	295	326	990
SiO <sub>2</sub>	50.21	49.25	49.20	52.68	51.84	49.23	50.69	48.95	50.39	50.47	50.84	50.75	51.19	50.98
Al <sub>2</sub> O <sub>3</sub>	3.02	6.56	2.30	2.40	2.33	2.78	2.36	2.35	2.57	2.61	2.75	2.34	2.37	3.17
Fe <sub>2</sub> O <sub>3</sub>	n.d.	n.d.	0.48	0.64	0.93	n.d.	0.42	0.46	0.84	0.25	2.33	1.25	n.d.	n.d.
FeO	24.20	15.51	25.51	21.28	21.95	27.72	24.17	26.69	22.15	24.40	20.27	18.83	23.44	19.56
MgO	21.91	25.20	21.16	23.46	21.73	19.03	21.62	19.49	22.03	20.42	22.88	25.41	20.63	24.02
CaO	0.53	0.60	0.49	0.46	0.56	0.60	0.48	0.51	0.74	0.89	0.69	0.71	1.01	0.29
Na <sub>2</sub> O	-	n.d.	0.06	0.05	0.05	0.08	0.04	0.06	0.06	0.08	0.07	0.06	0.12	0.07
K <sub>2</sub> O	-	n.d.	-	-	-	0.01	-	0.05	-	0.01	0.02	-	-	0.28
TiO <sub>2</sub>	0.21	0.19	0.19	0.20	0.16	0.18	0.14	0.17	0.11	0.16	0.09	0.18	0.28	0.33
MnO	0.40	0.14	0.51	0.46	0.48	0.66	0.45	0.55	0.48	0.66	0.57	0.39	0.95	0.54
P <sub>2</sub> O <sub>5</sub>	-	n.d.	-	-	-	-	0.01	-	-	-	-	-	-	-
L.O. Ignit.	-	n.d.	-	-	-	-	-	-	-	-	-	-	-	-
Total	100.48	97.44	99.90	100.91	100.03	100.29	100.38	99.28	99.37	99.95	100.51	99.92	99.99	99.24
STRUCTURAL FORMULAE (BASED ON 6 OXYGEN ATOMS)														
Si	1.884	1.828	1.878	1.923	1.933	1.888	1.905	1.891	1.901	1.910	1.887	1.879	1.927	1.897
Al <sup>IV</sup>	0.116	0.172	0.103	0.077	0.067	0.112	0.095	0.107	0.099	0.090	0.115	0.102	0.073	0.103
Al <sup>VI</sup>	0.018	0.115	-	0.027	0.036	0.013	0.010	-	0.015	0.027	0.007	-	0.053	0.036
Fe <sup>3+</sup>	-	-	0.014	0.018	0.026	-	0.012	0.013	0.024	0.007	0.065	0.035	-	-
Fe <sup>2+</sup>	0.760	0.481	0.814	0.650	0.685	0.889	0.760	0.862	0.699	0.772	0.629	0.583	0.738	0.609
Mn	0.013	0.004	0.016	0.014	0.015	0.021	0.014	0.018	0.015	0.021	0.018	0.012	0.030	0.017
Mg	1.226	1.394	1.204	1.277	1.208	1.088	1.212	1.122	1.239	1.152	1.266	1.402	1.158	1.332
Ca	0.021	0.024	0.020	0.018	0.022	0.025	0.019	0.021	0.030	0.036	0.027	0.028	0.041	0.012
Na	-	-	0.004	0.004	0.004	0.006	0.003	0.004	0.004	0.006	0.005	0.004	0.009	0.005
K	-	-	-	-	-	-	-	0.002	-	-	0.001	-	-	0.013
Ti	0.006	0.005	0.005	0.005	0.004	0.005	0.004	0.005	0.003	0.005	0.003	0.005	0.008	0.009
Z	2.000	2.000	1.981	2.000	2.000	1.998	2.000	2.000	2.000	2.000	2.000	1.981	2.000	2.000
X	0.021	0.024	0.024	0.022	0.026	0.031	0.022	0.028	0.034	0.042	0.033	0.032	0.050	0.050
Y	2.022	2.000	2.054	1.991	1.974	2.016	2.012	2.021	1.995	1.984	1.988	2.037	1.967	2.003
ΣXY	2.043	2.024	2.078	2.013	2.000	2.047	2.034	2.049	2.029	2.026	2.021	2.069	2.017	2.033
mg	61.3	74.2	58.8	65.2	62.5	54.4	60.6	55.7	62.7	59.0	64.0	69.0	60.1	68.0
%Ca	1.1	1.3	1.0	0.9	1.2	1.2	1.0	1.0	1.5	1.8	1.4	1.4	2.1	0.6
%Mg	61.1	73.4	58.7	65.1	62.2	54.4	60.5	55.6	62.2	58.6	63.7	68.5	59.8	68.2
%Fe	37.9	25.3	40.4	34.0	36.6	44.4	38.5	43.4	36.3	39.6	34.9	30.2	38.1	31.2
% End Member Molecules														
En	60.45	71.41	58.13	64.32	61.68	53.95	59.93	55.20	61.49	58.00	62.81	67.42	59.13	67.05
Fs	38.56	27.43	40.76	34.60	37.03	44.59	39.03	43.63	36.89	39.97	35.67	31.10	38.41	32.13
Wo	0.99	1.16	1.11	1.07	1.29	1.46	1.05	1.17	1.62	2.03	1.52	1.48	2.47	0.82

\* Micro-probe analyses by AMDEL

Mg = Molecular % Mg<sup>2+</sup>;Fe = Molecular % (Fe<sup>2+</sup> + Fe<sup>3+</sup>);Ca = Molecular % Ca<sup>2+</sup>En = Molecular % enstatite = Mg + ½Al<sup>IV</sup> + ½Ti;Fs = Molecular % ferrosilite = Fe<sup>2+</sup> + Fe<sup>3+</sup> + ½Al<sup>IV</sup> + ½Ti;

Wo = Molecular % wollastonite = Ca + Na

TABLE 4.21

## CLINOPYROXENE ANALYSES

SPECIMEN NO. A525/-	1105*	949	121*	60*	158b*	81*	119*	158*	517*	339*	523*	295*	14	425	1328	
SiO <sub>2</sub>	46.75	48.49	45.22	49.05	44.29	48.37	46.64	47.48	47.55	45.84	49.86	45.47	52.35	47.05	51.49	
Al <sub>2</sub> O <sub>3</sub>	7.04	8.12	4.56	4.85	5.17	4.05	4.93	8.35	4.62	4.73	5.47	3.78	3.26	5.33	2.63	
Fe <sub>2</sub> O <sub>3</sub>	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.77	
FeO	10.09	6.20	9.45	8.53	11.21	9.61	9.80	7.47	9.30	9.45	8.20	7.92	7.82	17.10	5.92	
MgO	10.82	13.07	12.08	12.57	9.94	10.61	12.02	10.90	12.58	12.62	12.58	14.46	13.58	7.21	14.18	
CaO	22.16	20.91	21.52	25.68	23.63	23.97	22.56	22.14	22.31	21.22	20.64	21.77	20.60	21.97	22.32	
Na <sub>2</sub> O	n.d.	1.17	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.86	0.55	0.66	
K <sub>2</sub> O	n.d.	0.01	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.06	-	0.05	
TiO <sub>2</sub>	1.05	1.06	0.36	0.17	0.64	0.51	0.46	1.21	0.36	0.53	0.26	0.66	0.23	0.71	0.26	
MnO	0.20	0.07	0.22	0.23	0.37	0.22	0.26	0.19	0.28	0.35	0.31	0.22	0.16	0.30	0.21	
P <sub>2</sub> O <sub>5</sub>	n.d.	-	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	0.05	-	
L.O. Ignit.	n.d.	-	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.36	-	-	
Total	98.11	99.10	95.40	101.07	95.25	97.52	96.67	97.73	97.00	94.73	97.32	94.28	100.33	100.27	99.49	
STRUCTURAL FORMULAE (BASED ON 6 OXYGEN ATOMS)																
Si	1.798	1.805	1.831	1.833	1.789	1.880	1.827	1.804	1.847	1.826	1.896	1.815	1.943	1.833	1.920	
Al <sup>IV</sup>	0.202	0.195	0.169	0.167	0.211	0.120	0.173	0.196	0.153	0.174	0.104	0.178	0.057	0.167	0.080	
Al <sup>VI</sup>	0.117	0.161	0.048	0.047	0.036	0.065	0.054	0.178	0.058	0.049	0.141	-	0.086	0.078	0.036	
Fe <sup>3+</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fe <sup>2+</sup>	0.325	0.193	0.320	0.267	0.379	0.312	0.321	0.237	0.302	0.315	0.261	0.264	0.243	0.557	0.185	
Mn	0.007	0.002	0.008	0.007	0.013	0.007	0.009	0.006	0.009	0.012	0.010	0.007	0.005	0.010	0.007	
Mg	0.620	0.725	0.729	0.700	0.599	0.615	0.702	0.617	0.729	0.750	0.713	0.860	0.751	0.419	0.788	
Ca	0.913	0.834	0.934	1.029	1.023	0.998	0.947	0.901	0.929	0.906	0.841	0.931	0.819	0.917	0.892	
Na	-	0.084	-	-	-	-	-	-	-	-	-	-	0.134	0.042	0.048	
K	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	0.002	
Ti	0.030	0.030	0.011	0.005	0.019	0.015	0.014	0.035	0.011	0.016	0.007	0.020	0.006	0.021	0.007	
Z	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	1.993	2.000	2.000	2.000	
X	0.913	0.919	0.934	1.029	1.023	0.998	0.947	0.901	0.929	0.906	0.841	0.931	0.956	0.959	0.942	
Y	1.099	1.111	1.116	1.026	1.045	1.014	1.099	1.073	1.108	1.141	1.133	1.152	1.091	1.085	1.073	
ΣXY	2.012	2.030	2.050	2.055	2.068	2.012	2.046	1.974	2.037	2.047	1.974	2.083	2.047	2.044	2.015	
mg	65.2	78.8	69.0	71.9	60.5	65.8	68.0	71.7	70.1	69.6	72.5	76.0	75.2	42.5	76.6	
%Ca	49.1	47.6	47.1	51.5	51.1	51.8	48.1	51.3	47.4	46.0	46.3	45.3	45.2	48.4	46.6	
%Mg	33.4	41.4	36.8	35.1	29.9	31.9	35.6	35.2	37.2	38.0	39.3	41.9	41.4	22.1	41.2	
%Fe	17.5	11.0	16.1	13.4	18.9	16.2	16.3	13.5	15.4	16.0	14.4	12.9	13.4	29.4	12.2	
% End Member Molecules																
En%	35.22	40.64	37.86	36.25	32.00	33.13	36.88	36.88	38.18	39.10	39.90	42.57	38.93	24.16	40.56	
Fs%	21.10	14.82	18.96	16.28	22.14	18.42	19.22	17.75	18.08	18.97	16.43	16.11	13.66	30.66	13.59	
Wo%	43.68	44.54	43.18	47.46	45.85	48.45	43.90	45.37	43.74	41.93	43.67	41.32	47.41	45.17	45.85	

\* Micro-probe Analyses by AMDEL

Mg = 100.Mg/(Mg + Fe<sup>3+</sup> + Fe<sup>2+</sup> + Mn)Ca = Molecular % Ca<sup>2+</sup>Mg = Molecular % Mg<sup>2+</sup>Fe = Molecular % (Fe<sup>2+</sup> + Fe<sup>3+</sup>)En = Molecular % enstatite = Mg + ½Al<sup>IV</sup> + ½Ti;Fs = Molecular % ferrosilite = Fe<sup>2+</sup> + Fe<sup>3+</sup> + ½Al<sup>IV</sup> + ½Ti

Wo = Molecular % wollastonite = Ca + Na

TABLE 4.23

## GARNET ANALYSES

SPECIMEN NO. A325/-	1105	77	531	1121	2048	2040
SiO <sub>2</sub>	38.39	37.04	38.10	37.16	36.28	34.21
Al <sub>2</sub> O <sub>3</sub>	22.24	23.76	21.95	22.72	15.11	13.44
Fe <sub>2</sub> O <sub>3</sub>	0.98	1.88	1.57	0.44	16.97	11.17
FeO	22.47	24.47	24.47	26.49	-	7.03
MgO	8.25	9.45	11.17	9.79	-	0.26
CaO	6.11	1.49	1.12	2.32	11.99	27.55
Na <sub>2</sub> O	0.03	0.04	0.03	0.03	-	0.04
K <sub>2</sub> O	0.03	0.02	-	-	-	-
TiO <sub>2</sub>	0.17	0.18	0.10	0.08	0.24	1.40
MnO	0.87	1.01	0.81	0.93	18.88	0.49
P <sub>2</sub> O <sub>5</sub>	-	0.02	-	0.01	-	-
L.O. Ignit.	-	-	-	-	-	-
Total	99.54	99.36	99.32	99.97	99.47	95.59

## STRUCTURAL FORMULAE (BASED ON 24 OXYGEN ATOMS)

Si	5.910	5.715	5.863	5.748	5.898	5.736
Al <sup>IV</sup>	0.090	0.285	0.137	0.252	0.102	0.264
Al <sup>VI</sup>	3.946	4.037	3.844	3.890	2.793	2.392
Fe <sup>3+</sup>	0.114	0.218	0.182	0.051	2.076	1.409
Fe <sup>2+</sup>	2.893	3.158	3.149	3.427	-	0.986
Mn	0.113	0.132	0.106	0.122	2.600	0.070
Mg	1.893	2.174	2.562	2.257	-	0.065
Ca	1.008	0.246	0.185	0.385	2.089	4.950
Na	0.009	0.012	0.009	0.009	-	0.013
K	0.006	0.004	-	-	-	-
Ti	0.020	0.021	0.012	0.009	0.029	0.177
Z	6.000	6.000	6.000	6.000	6.000	6.000
X	5.923	5.726	6.011	6.200	4.688	6.083
Y	4.080	4.276	4.038	3.951	4.899	3.978

## % End Member Molecules

Alm.	48.96	55.31	51.34	51.91	-	11.35
Sp.	1.93	2.30	1.80	2.12	-	1.21
Py.	32.05	38.06	43.71	39.28	-	1.14
Gross.	14.18	-	-	5.36	-	49.44
And.	2.89	4.32	3.16	1.33	-	36.86

## Measured Optical and Physical Properties

n(±.002)	*	*	1.770	*	1.799	1.775
aλ(±.002)	11.570	11.522	11.496	11.534	+	+
aλ(approx.)					11.879	11.961

\* High R.I. oils were not available to measure these specimens

+ Cell dimensions could not be accurately measured for these garnets because of the anomalous high angle lines in the powder photographs (see discussion, p.213). Cell dimensions of these are based on the (642) (640) and (444) reflections.

TABLE 4.27

## ALKALI FELDSPAR ANALYSES

SPECIMEN NO. A325/-	138*	1165a*	77	1121	783	323	396	400	531	474	18	1659
SiO <sub>2</sub>	65.87	65.05	65.78	64.24	64.04	64.32	64.20	64.72	63.76	63.79	66.76	64.65
Al <sub>2</sub> O <sub>3</sub>	19.15	19.00	19.33	18.50	19.12	18.69	19.41	19.03	19.13	18.87	18.71	18.59
Fe <sub>2</sub> O <sub>3</sub>	0.17	0.25	0.15	0.12	0.14	0.16	0.14	0.13	0.10	0.11	0.25	0.10
FeO	-	-	-	-	-	-	-	-	-	-	-	-
MgO	-	0.09	-	-	-	-	-	-	-	-	-	-
CaO	1.89	2.12	0.41	0.60	0.99	0.49	0.78	0.42	0.54	0.26	0.02	0.10
Na <sub>2</sub> O	3.94	3.71	2.07	1.44	3.70	2.73	4.71	3.85	2.17	2.23	1.10	0.48
K <sub>2</sub> O	8.11	7.94	12.44	12.57	9.70	11.30	9.48	11.66	12.66	12.72	4.61	2.23
TiO <sub>2</sub>	0.07	0.07	0.08	0.07	0.07	0.08	0.06	0.07	0.09	0.06	0.06	0.05
MnO	0.04	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.02	0.03	0.03	0.03
P <sub>2</sub> O <sub>5</sub>	-	0.05	0.01	0.08	0.03	0.02	0.01	-	0.10	-	-	0.05
Rb <sub>2</sub> O	0.02	-	-	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.03
SrO	0.04	-	-	0.07	0.01	0.05	0.05	0.02	0.06	0.04	0.02	0.02
BaO	0.45	-	-	0.52	0.23	0.59	0.30	0.17	0.64	0.38	0.22	0.45
L.O. Ignit.	0.57	0.29	0.05	0.82	0.61	0.79	-	-	-	0.64	0.1	0.57
Total	100.32	98.60	100.28	99.09	98.70	99.28	99.21	100.15	99.30	99.17	100.90	100.37
Rb p.p.m.	189	n.d.	n.d.	275	335	316	272	399	307	376	438	344
Sr p.p.m.	339	n.d.	n.d.	618	109	389	411	175	543	299	206	226
Ba p.p.m.	5991	n.d.	n.d.	4739	2078	5256	2670	1536	5729	3413	1995	4033
STRUCTURAL FORMULAE (BASED ON 32 OXYGEN ATOMS)												
Si	11.898	11.883	11.935	11.968	11.838	11.921	11.766	11.829	11.817	11.873	11.959	11.910
Al <sup>IV</sup>	4.077	4.091	4.132	4.062	4.166	4.083	4.193	4.100	4.179	4.140	3.956	4.037
Al <sup>VI</sup>	-	-	-	-	-	-	-	-	-	-	-	-
Fe <sup>3+</sup>	0.023	0.054	0.016	0.017	0.019	0.022	0.019	0.018	0.014	0.015	0.054	0.014
Fe <sup>2+</sup>	-	-	-	-	-	-	-	-	-	-	-	-
Mn	0.006	0.005	0.003	0.005	0.005	0.005	0.006	0.006	0.003	0.005	0.005	0.005
Mg	-	0.025	-	-	-	-	-	-	-	-	0.005	0.027
Ca	0.366	0.415	0.080	0.120	0.196	0.097	0.153	0.082	0.107	0.052	0.211	0.095
Na	1.380	1.314	0.728	0.520	1.326	0.981	1.674	1.364	0.780	0.805	1.603	0.797
K	1.869	1.850	2.879	2.983	2.288	2.672	2.217	2.719	2.993	3.021	2.076	3.060
Ti	0.010	0.010	0.011	0.010	0.010	0.011	0.008	0.010	0.013	0.008	0.008	0.007
Ba	0.032	-	-	0.038	0.017	0.043	0.022	0.012	0.046	0.028	0.015	0.032
Sr	0.004	-	-	0.008	0.001	0.005	0.005	0.002	0.006	0.004	0.002	0.002
Rb	0.002	-	-	0.004	0.004	0.004	0.004	0.005	0.004	0.005	0.005	0.004
Z	15.976	15.974	16.067	16.030	16.004	16.004	15.959	15.929	15.996*	16.013	15.915	15.946
X	3.692	3.653	3.717	3.708	3.865	3.840	4.108	4.218	3.967	3.943	3.964	4.042

\* Mesopertnite