Appendices

Appendix 1:

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Appendix 1A: Borehole logging, sample selection and petrographic analysis

The M4 core was geologically logged and sampled for the following reasons: (a) To identify rock types and the contact relationships; (b) To record the macro and micro scale characteristics of the target rocks and the impactites; (c) To characterize the pre- and post-impact deformations (veins and fractures) cross-cutting relationships. (d) To select samples for petrographical and geochemical analysis; e). Lastly to determine the stratigraphical sequence in the M4 borehole and correlate it to those of other boreholes within the Morokweng impact structure. Sample selection was done concurrently with the core logging. The lithostratigraphy of the M4 borehole was constructed using both the information obtained from core logging and petrographic studies (see Figure 2.1). For every lithology type, representative samples were selected at varying depths. The sample depths were recorded, the core was cut into half, photographed, described and placed back in the core tray. The other half of that sample was submitted for petrographic and geochemical examination. The rock type names were assigned following Stöffler and Grieve (2007) for the impactites and for the target rocks using the International Union of Geological Sciences (IUGS) system. The microscopic characterization of the M4 core lithologies was done to identify the mineral assemblages in target rocks; asses the clast population, grain size and matrix type in suevites, and as well as post-impact hydrothermal effects. Petrographic study of both the target rocks and impactites was done using the standard polarizing petrographic microscope to study polished thin sections from selected samples. In total 98 thin sections were obtained from 70 selected samples (37 target rocks, 33 impactites). The 268 m of the M4 core is shown photographically in Appendix 2A. The Sample list and macroscopic descriptions are presented in Appendix 2B.and the petrographic descriptions are presented in Appendix 2D.

Appendix 1B: Whole Rock X-Ray Fluorescence (XRF) analysis and Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Whole-rock X-Ray Fluorescence (XRF) analysis for major and trace elements and Inductively Coupled Plasma Mass Spectrometer (ICP-MS) for trace element and rare earth element (REE) contents of M4 lithologies was done at the University of the Witwatersrand using the APW 1400 XRF machine. In total 53 (35 target rocks and 18 impactite) samples were selected for geochemical analysis. The samples were crushed and milled, the powder was mixed with glue (Mowiol 40-80TM) and the pressed powder pellets were used in the trace element analysis and the fusion discs used for major element analysis. The main objective of using these techniques was to investigate the chemical relationship between target lithologies and impact-derived rocks. Standards used for XRF are: NIM-P, NIM-D, W2, NIM-S, GSP2, BCR2, NIM-N, NIM-G, PCC1, BHVO2, AGV2, G2, DTS1; and for the ICP-MS: BCR1, BHVO1 and BIR1 (Mr. Marlin Patchappa and Prof. A. Wilson, pers. comm, 2017.). Data obtained is presented in Appendix 3A and B (XRF data) and Appendix 3B and C (ICP-MS data). Results obtained from the

examination of the whole-rock geochemistry for target rocks served to classify target rocks and allowed comparison with Morokweng regional datasets. The geochemical signatures obtained for the impactites, allowed investigation of the impactite source rocks.

Appendix 1C: X-ray diffraction (XRD)

Powder X-ray Diffraction (XRD) was performed on 20 samples (19 impactite samples and 1 dolerite sample for comparison). Of interest was to characterise the alteration assemblages noted in melt fragments and MMBr matrices and of secondary minerals filling voids and fractures. The samples were analysed at the School of Chemistry at the University of the Witwatersrand, Johannesburg, using a Bruker D2 PHASER powder diffractometer. Sample preparation for the X-ray analysis involved separating mineral clast and matrix section using a drilling tool to crush selected sections into a fine powder and packing of 10-30 mg of the sample. The powder then was placed on a zero-background sample holder, levelled out and inserted into a diffractometer. The Bruker D2 PHASER diffractometer is fitted with a Bruker LYNXEYE PSD detector and equipped with Nickel Filter Co K-α radiation source (1.78897 Å). The X-ray source was operated at 10 mA and 30 kV. All samples were scanned through from 10° to 90°, 2θ, with a step size of 0.026°/s and a total run time of 10 minutes. The X-ray diffraction patterns of the sample were then recorded then indexed using Bruker DIFFRAC Plus EVA version 3. When interpreting the XRD patterns, the intensity of the diffraction peak was an important component quantitatively. The minerals identified/matched were quartz, albite and haematite, zeolites and smectites. The X-ray diffraction (XRD) patterns are presented in Appendix 4C.

Appendix 1D: Scanning Electron Microscopy (SEM)

Scanning Electron Microscopy (SEM) was done on several impactite samples with the aim of examining the features (abundance, shape, texture and alteration features) of both the matrix, mineral and lithic fragments and melt particles. SEM analyses was done at the University of the Witwatersrand, University of Johannesburg and Rhodes University (see Table 4.5). Thin sections used in this analyses were carbon coated before being placed in the vacuum chamber of scanning microscope and then analyzed. The imaging of the microscopic features by backscattered electron (BSE) images, was done with a JEOL JXA-8230 electron microprobe fitted with a wavelength dispersive X-ray (WDS) spectrometer using beam operating conditions of 15 kV and 20 nA at the Department of Geology at Rhodes University. Additional backscatter electron images were taken with a Tescan Vega 3 LM SEM operating at 20 kEV at the Spectrum Analytical Facility (SPECTRAU), at the University of Johannesburg. In this facility, the SEM equipped with an energy dispersive spectrometer with Oxford Aztec software was used. At the University of the Witwatersrand SEM studies were performed using JEOL Jon a FEI Quanta 400 SEM scanning electron microscope (SEM) equipped with an Oxford ISIS

energy dispersive spectrometer. The BSE images allowed clear documentation of micro-scale features and textures associated with the M4 borehole impactites. The BSE images are shown in Chapter 2.

Appendix 1E: Electron microprobe analyses (EMPA)

Electron microprobe analysis (EMPA) of target rock minerals and matrices, mineral and lithic clasts of impactites were done at the University of Pretoria and Rhodes University (see Table 4.1 and 4.5 for the list of samples analysed). The aim of utilizing this technique was to determine the composition of mineral phases in order assist with classification of the rocks and to better constraints on the source rocks for the impactites. Major element compositions of minerals were obtained using the CAMECA SX 100 electron microprobe at the University of Pretoria. The analyses were made using a 15 kV accelerating voltage, a 10 nA beam current, and and a defocused 1 μm beam. Counting times were 20 s on peak position and 10 s on each background position. Elements were calibrated using the following mineral standards: x-ray lines, spectrometer crystals and standards (in brackets) were used: SiKα, TAP (KP Garnet); AlKα, TAP (KP Garnet); MgKα, TAP (JChromite); NaKα, LTAP (KP Hornblende); FeKα, LLIF (KP Garnet); MnKα, LLIF (Rhodonite); ZnKα, LLIF (Gahnite); BaLα, LLIF (Barite); NiKα, LLIF (Ni metal); TiKα, PET (Rutile); CaKα, PET (KP Garnet); KKα, PET (KP Hornblende); CrKα, PET (Chromite); PKα, PET (Apatite). Additional electron-microprobe (EMP) analyses of minerals were done using the JEOL JXA-8230 at the Department of Geology at Rhodes University. The probe was fitted with a wavelength dispersive X-ray (WDS) spectrometer was used to obtain quantitative chemical analyses using beam operating conditions of 15 kV and 20 nA. Electron microprobe analyses (EMPA) of mineral and lithic fragments enclosed in impactites was conducted using a 10 μm defocused electron beam. Raw data were corrected using the ZAF correction program provided by JEOL. The defocused beam was used in the EMPA analysis of melt particles and of the fine-grained breccias matrix. The precision of this method complements the whole-rock analysis in the highly heterogeneous breccias. EMPA data for mi target rock mineral constituents are presented in Appendix 4A, those of lithic and mineral clasts in impactites is presented in Appendix 4B. The EMPA data for melt clasts/particles and breccia matrices is presented in Appendix 4D.

Appendix 1F: Universal stage data

Thin section petrography provided a detailed description of the mineral assemblages in the target rocks and the clast population of impactites and aided in identifying the microscopic shock-related features of importance, the planar deformation features (PDF) in quartz. Microphotographs were taken to record the evidence of shock features and these are presented throughout Chapter 5. To estimate the shock pressures that the M4 core lithologies were subjected to, crystallographic orientations of PDF were measured using the Universal Stage (U-stage). In this procedure, the 4-axis Leitz U-stage was mounted

on a petrographic microscope to measure (in one quartz grain) the angles between the quartz c-axis and the poles to the PDF planes (i.e. the orientation of the pole to each set of PDF is measured relative to the optic axis orientation (c-axis) of a quartz grain). The pole to each PDF set are averaged and then plotted on a histogram (data reported in absolute frequency after Engelhardt and Bertsch, 1969). The shock pressure for each sample is estimated by averaging the pole angles and comparing those results to relative shock pressure estimates (see Table 5.2). Langenhorst (2002) and Stöffler and Langenhorst (1994) provides a detail account of the use of Universal stage method in measuring crystallographic PDF orientations in quartz. In total 357 PDF sets were measured in 199 quartz grains from 14 samples (8 target rocks and 6 impactites). For each quartz grain displaying PDF, the c-axis azimuth (0^0 - 360^0) and is measured around the vertical axis of the U-stage. Then the c-axis inclination (0^0 - 90^0) is measured around the horizontal axis (E-W). The plane of orientation for each PDF set was then measured (azimuth and inclination angles are recorded). Data was then indexed using the ANIE v1.1 program by Huber et al. (2011) available online:

http://onlinelibrary.wiley.com/doi/10.1111/j.1945-5100.2011.01234.x/suppinfo.

Results using ANIE with average values from U-stage data with both 5° and 6° error. The PDF crystallographic measurements from each sample are presented in Appendix 5A (target rock samples) and 5B (impactite samples).

Appendix 2:

2A: M4 borehole log

2B: Sample list for this study

APPENDIX - 2A: Core box photographs of the M4 drillcore.

Photographs of the 32 core boxes of the M4 drillcore. Box 18 numbering was not omitted during the initial logging, but the core is continuous. Each core box is 1.5 m and the 3 photographs stitched together represents 1 box. Box 1-33contain 103.00 m to 368.58 m of the M4 core. For scale, the core is 5 cm wide, a tape measure is placed along the top. For orientation purposes, the photos of the core are positioned so as to constantly indicate increasing depth from left to right, with the top left marking the top of the core. The intervals where samples were selected for analysis are marked in yellow and those of noteworthy features are marked with clear boxes. Core depths for each box are provided in each caption. The displaced rock units in tray 33, were left in their original position in order to preserve the state of the core. (Note: areas of core loss are marked and yellow arrows mark continuous core).

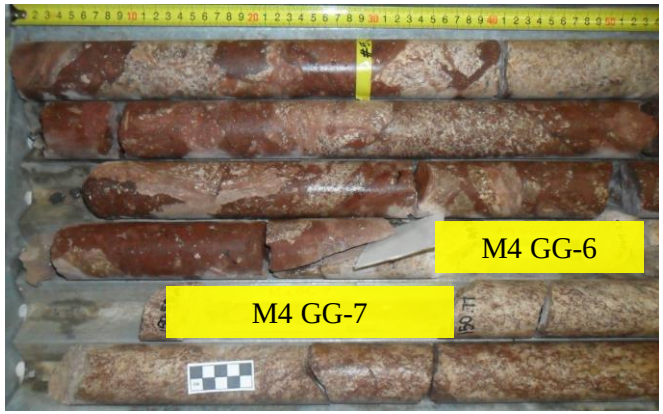
Box 1, Box depth = 103.00-110.80 m.

Box 2, Box depth = 110.80 -119.25 m.

Box 3, Box depth = 119.25 -127.75 m.

Box 4, Box depth = 127.75 -136.25 m.

Box 5, Box depth = 136.25 -144.55 m.



Box 6, Box depth = 144.55 -153.20 m.

Box 7, Box depth = 153.20-161.50 m.

Box 8, Box depth = 161.50 -169.80 m.

Box 9, Box depth = 169.80 -177.90 m.

Box 10, Box depth = 177.90 - 186.33 m.

Box 11, Box depth = 186.33 -195.13 m.

Box 12, Box depth = 195.13 -203.00 m.

Box 13, Box depth = 202.58 -211.30 m.

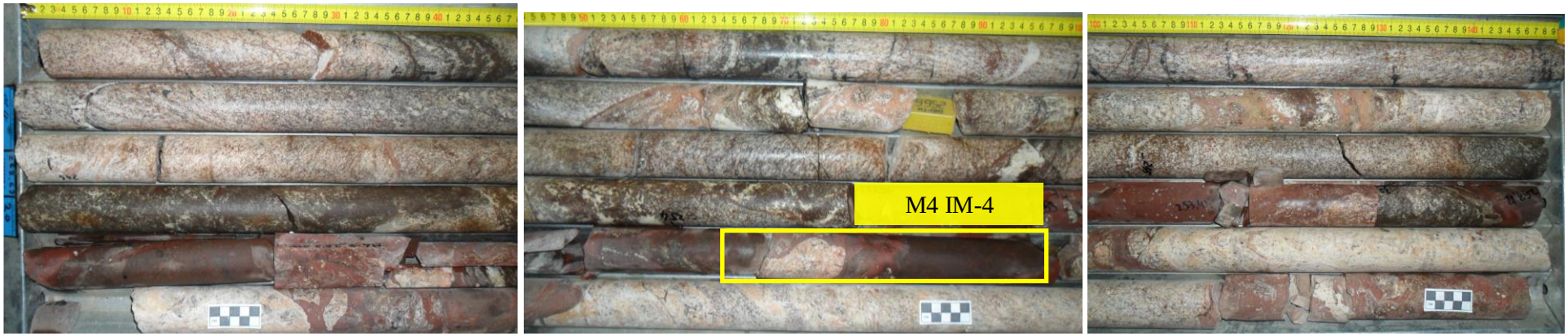
Box 14, Box depth = 211.30-219.80 m.

Box 15, Box depth = 219.80 -228.20 m.

Box 16, Box depth = 228.20 -236.50 m.

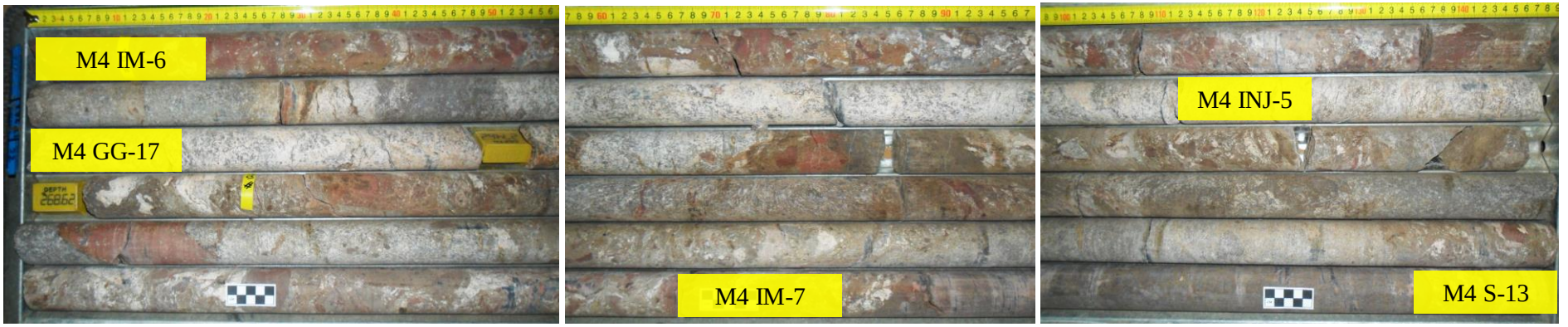
Box 17, Box depth = 236.50 -245.20 m.

Box 19, Box depth = 245.20-254.15- m.

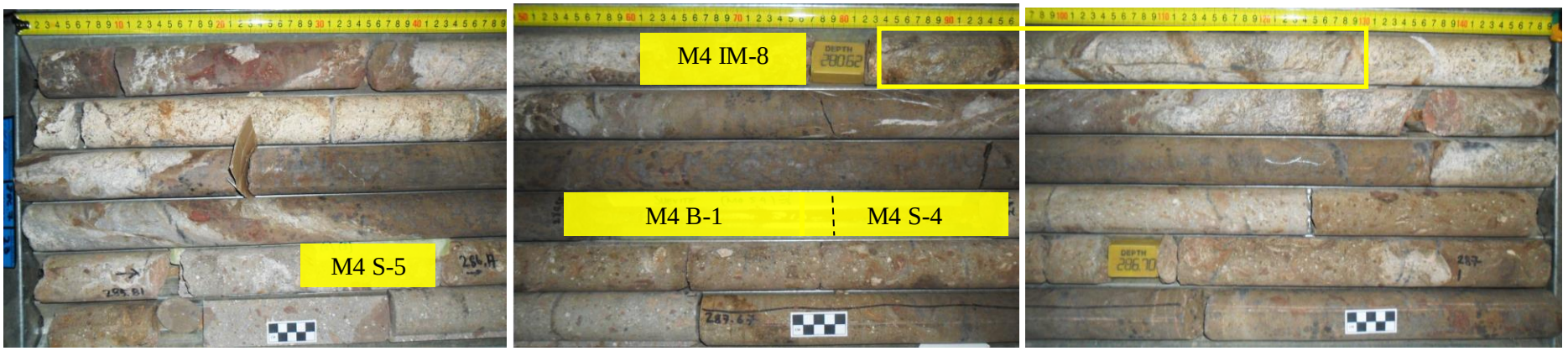


Box 20, Box depth = 254.15 -262.60 m.

Box 21, Box depth = 262.60 -271.17 m.



Box 22, Box depth = 271.17 -279.88 m.



Box 23, Box depth = 279.88 -288.53 m.

Box 24, Box depth = 288.53 -297.08 m.

Box 25, Box depth = 297.08 -305.40 m.

Box 26, Box depth = 305.40 -314.00 m.

Box 27, Box depth = 314.00 -322.60 m.

Box 28, Box depth = 322.60 -331.20 m.

Box 29, Box depth = 331.20 -338.38 m.

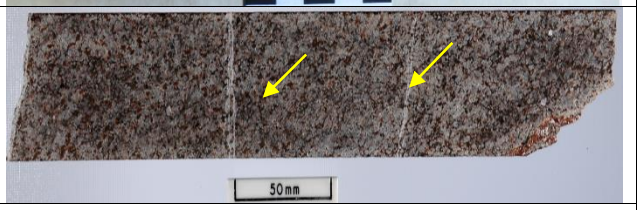
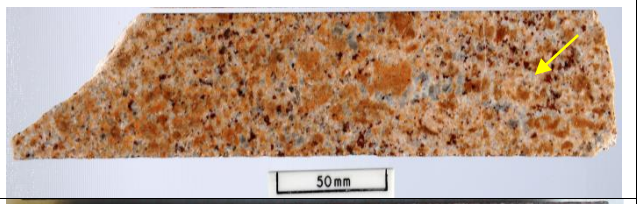
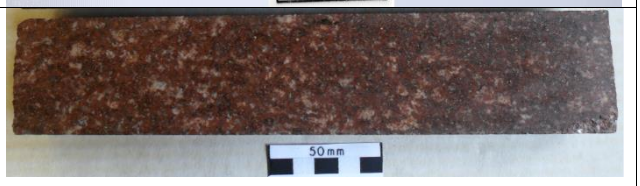
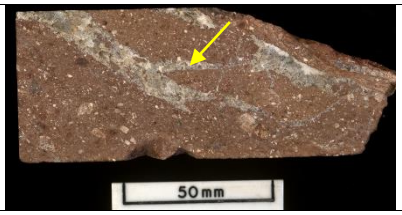
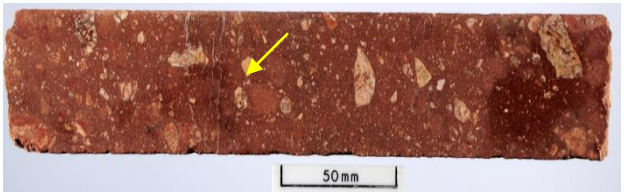
Box 30, Box depth = 338.38 -347.36 m.

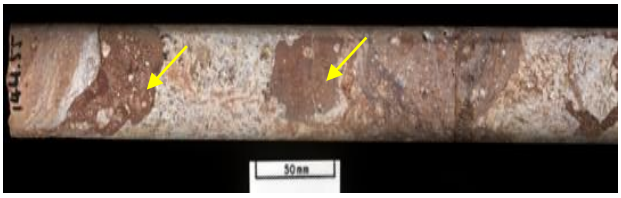
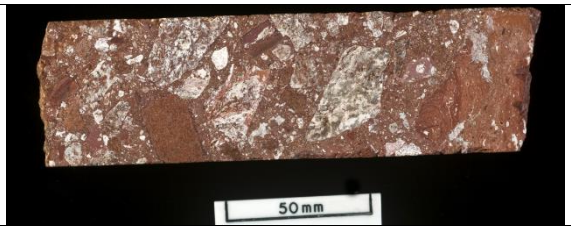
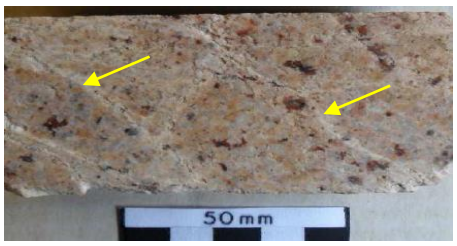
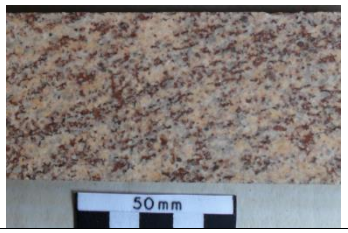
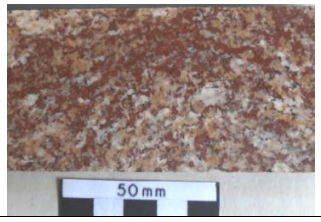
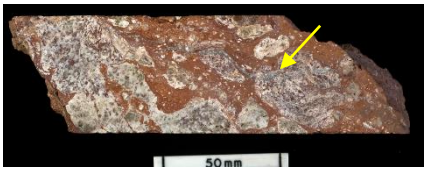
Box 31, Box depth = 347.36 -355.11 m.

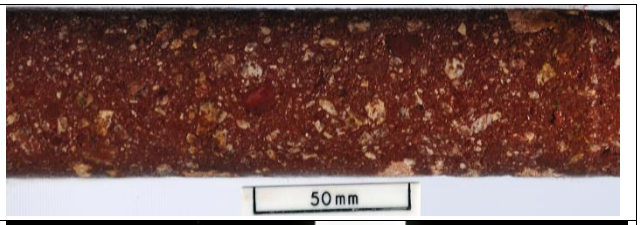
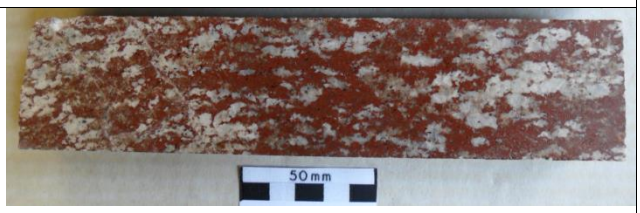
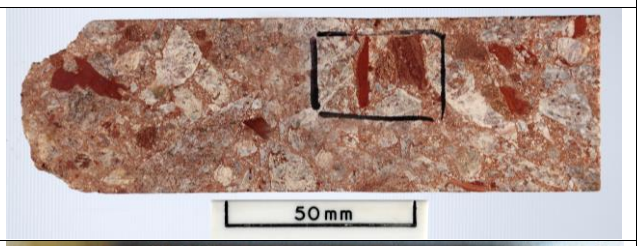
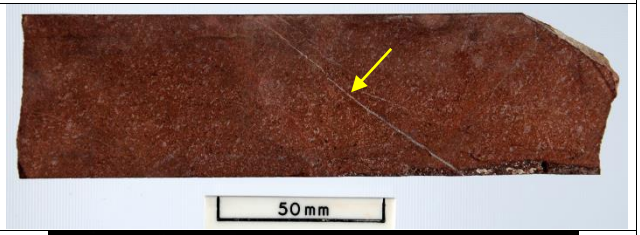
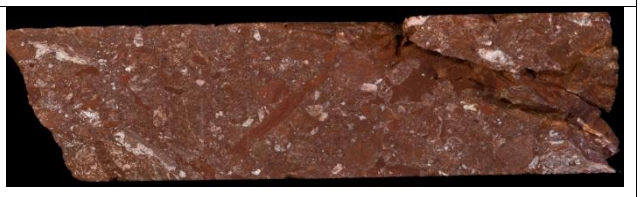
Box 32, Box depth = 355.11-363.48 m.

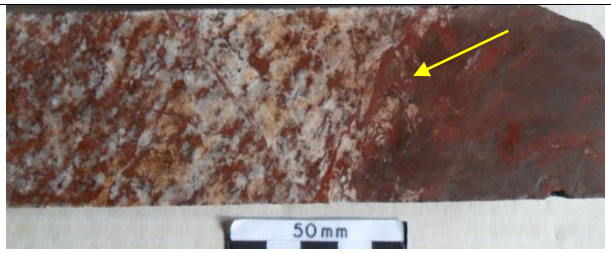
Box 33, Box depth = 363.48 -368.58 m (End of the M4 drillcore)

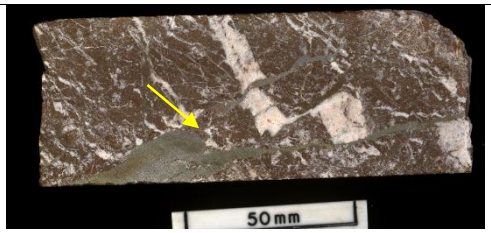
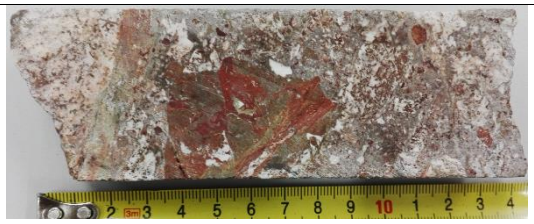
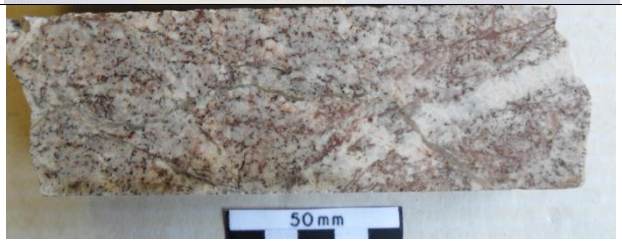
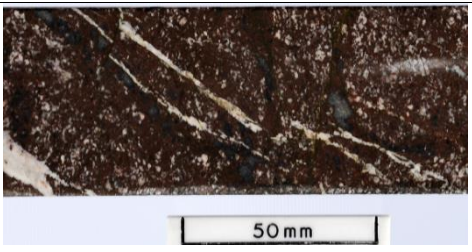
APPENDIX 2B: Detail of drillcore intersections sampled for petrographic and/or geochemical analysis, or with noteworthy features. Note that the samples selected for showing special features were not used in any analysis.

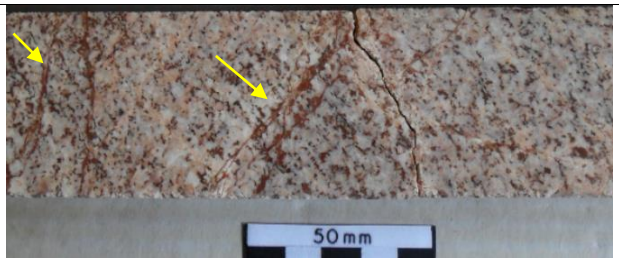
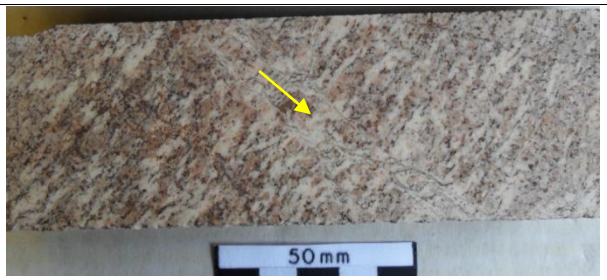
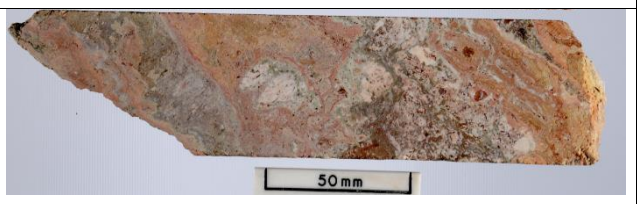
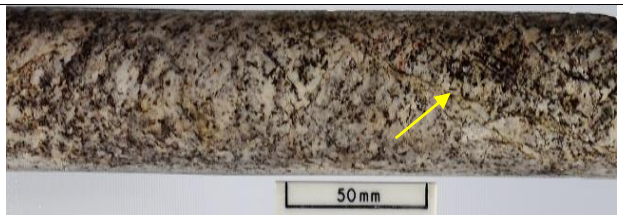
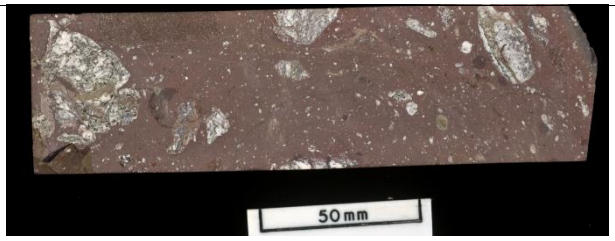
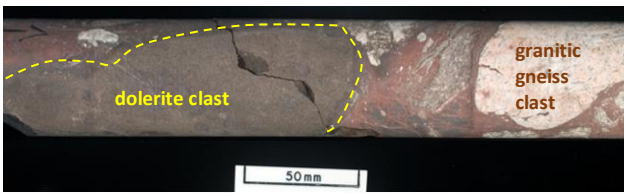
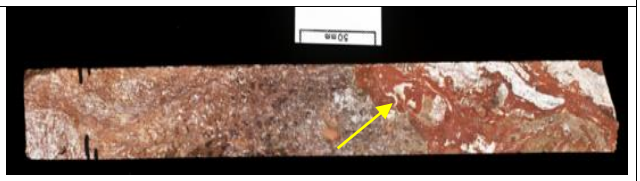
Depth (m) (From -To)	Sample Number	Description	Sample Photograph
109.20 - 109.40	**M4 GG -4**	**Granodioritic Gneiss**	
126.60 - 126.75	**M4 GG -1**	**Dioritic Gneiss** -Note the cross-cutting calcite veins	
131.90 - 132.13	**M4 GG -2**	**Granitic Gneiss** -Note the hairline cross-cutting calcite veins	
136.90 - 137.15	**M4 GG -5**	**Dioritic Gneiss**	
140.30 - 140.73	**M4 INJ-1**	**Melt matrix breccia (MMBr) injection vein** (reddish brown) in dioritic gneiss	
143.00 - 143.12	**(Note-worthy features)**	-A cm thick calcite vein in reddish brown suevite	
144.09 - 144.35	**M4 S-1**	**Suevite** (reddish brown) -Note the hairline cross-cutting calcite veins	

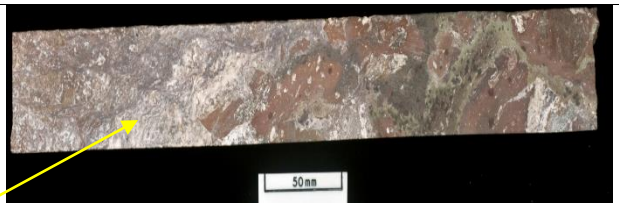
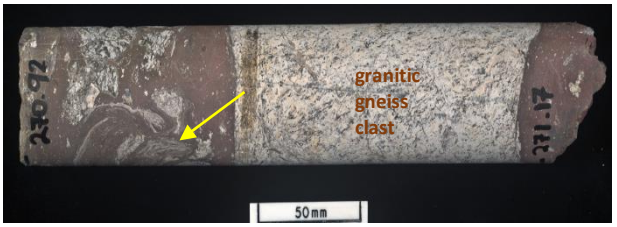
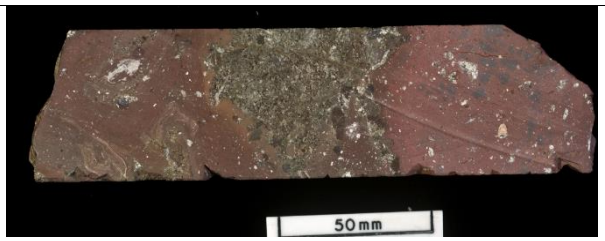
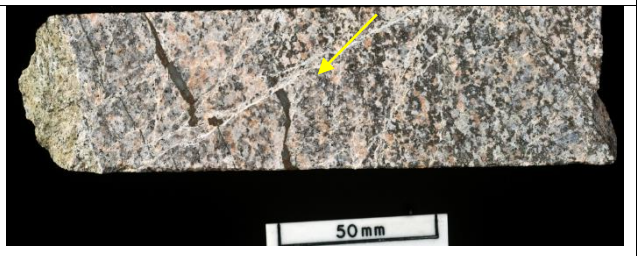
144.35 - 144.55	**M4 S -14**	**Suevite** (reddish brown)	
144.55 - 144.95	**(Note-worthy features)**	Clast-rich suevite zone (reddish brown), giving an appearance of lensoid suevite masses	
146.68 - 146.83	**M4 S -7**	**Suevite** (reddish brown)	
148.15 - 148.33	**M4 S -12**	**Suevite** (reddish brown) With irregular, coarse, fluidal melt clasts	
149.24 - 149.33	**M4 GG -6**	**Granitic Gneiss** -Note the cross-cutting calcite veins	
150.58 - 150.77	**M4 GG -7**	**Granodioritic Gneiss**	
152.65 - 152.80	**M4 GG -8**	**Granodioritic Gneiss**	
153.95 - 154.10	**(Note-worthy features)**	-A mm thick calcite vein in reddish brown suevite	

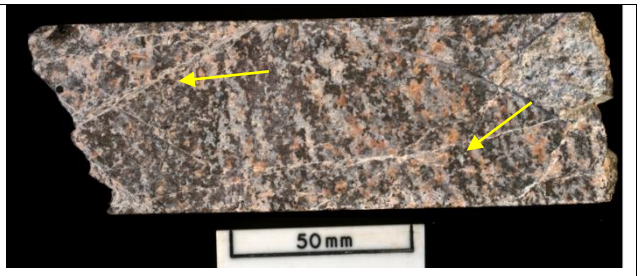
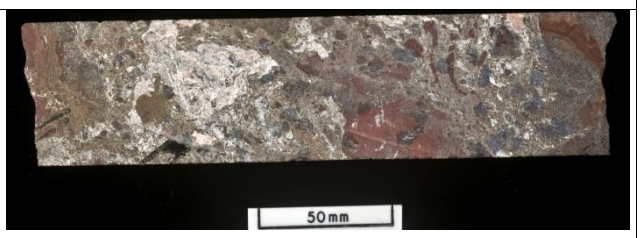
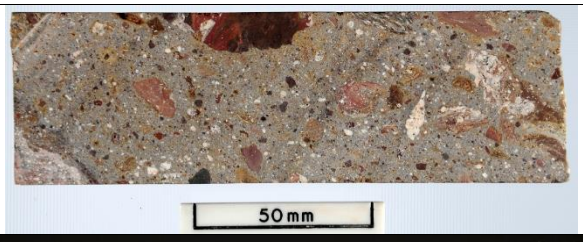
156.35 - 156.62	**M4 S-2**	**Suevite** (reddish brown) -Note the homogeneous lithic clast size range	
158.06 - 158.45	**M4 INJ-2**	**MMBr injection vein** (reddish brown) in granitic gneiss	
159.36 - 159.57	**M4 GG -9**	**Granodioritic Gneiss** (Coarse grained)	
59.98 - 160.13	**M4 S-3**	**Suevite** (reddish brown)	
165.98 - 166.10	**M4 GG -10**	**Dioritic Gneiss**	
166.33 - 166.50	**M4 A-1**	**Meta-dolerite** -Note the thin cross-cutting quartz veins	
167.50 - 167.60	**M4 S-11**	**Suevite** (reddish brown) -Note the angular lasts (left) and the fluidal deformed melt fragments.	
170.07 - 170.21	**M4 S-8**	**Suevite** (reddish brown) - Note the flow banding in matrix (core sample -5 cm wide)	

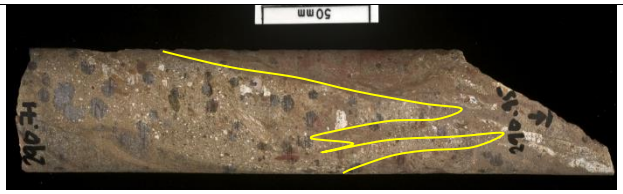
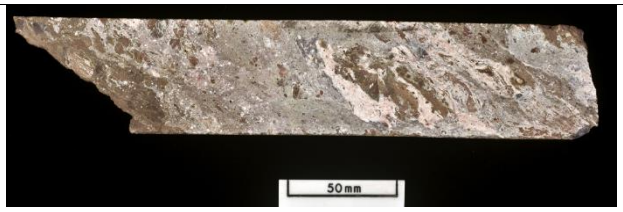
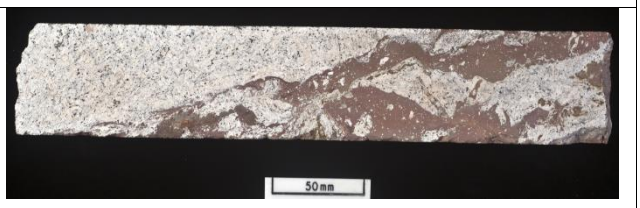
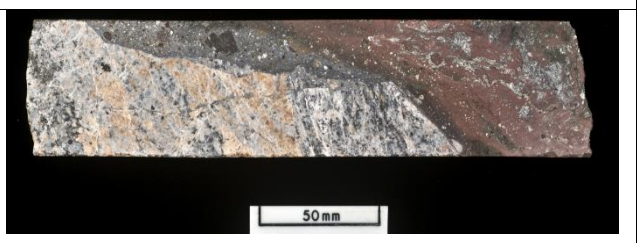
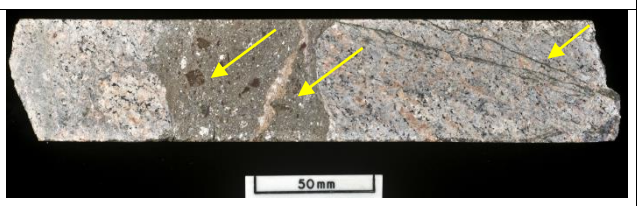
176.60 - 176.79	**M4 IM-1**	**Melt matrix breccia**	
178.05 - 178.35	**M4 GG -11**	**Granodioritic Gneiss**	
179.18 - 179.35	**M4 GG -12**	**Granodioritic Gneiss** -Note the original intrusive contact with meta-dolerite	
182.62 - 182.91	**M4 A-2**	**Meta-dolerite**	
189.00 - 189.19	**M4 A-INJ**	**Melt matrix breccia (MMBr)-injection vein** (reddish brown) into meta-dolerite	
198.03 - 198.18	**M4 S-9**	**Suevite** (reddish brown) -Dominated by white quartz vein clasts	

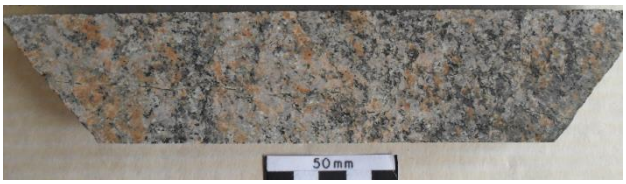
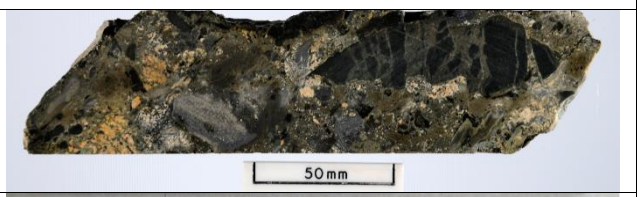
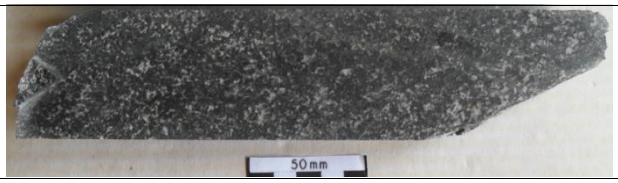
204.62 - 204.72	**M4 A-3**	**Meta-dolerite** -Note quartz vein	
206.28 - 206.40	**M4 INJ-3**	**Melt matrix breccia - injection vein** (grey) in altered silicified meta-dolerite. -Note quartz vein offset and cut by suevitic vein	
208.34 - 208.49	**M4 S-10**	**Suevite** (grey)	
208.49 - 208.63	**M4 S-15**	**Suevite** (grey)	
211.41 - 211.88	**M4 IS-2**	Silicified, quartz veined and iron impregnated **Silicified meta-dolerite**	
219.30-219.45	**M4 FZ-2**	**Trondhjemitic Gneiss**	
221.20 – 221.43	**M4 IS-1**	Silicified, quartz veined and iron impregnated **Silicified meta-dolerite**	

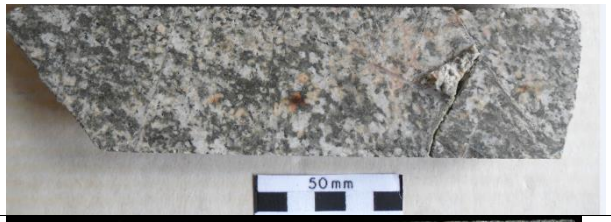
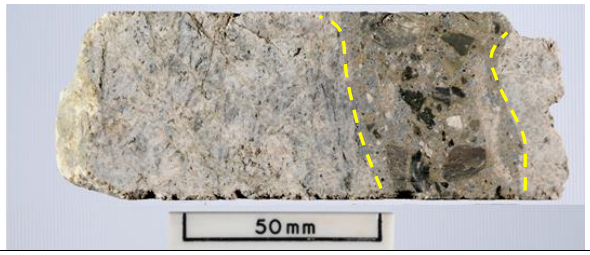
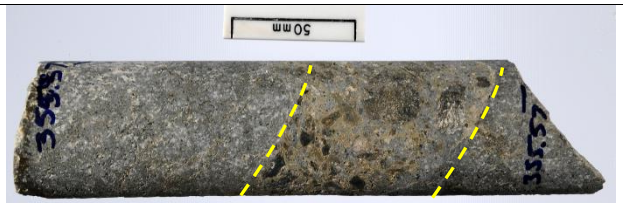
226.80 - 227.05	**M4 FZ-3**	**Trondhjemitic Gneiss** -Note iron stained fractures	
233.48 - 233.63	**M4 FZ -4**	**Trondhjemitic Gneiss** -Note the strong foliation and cross-cutting fractures	
234.33 - 234.53	**M4 IM-2**	Variegated **Melt matrix breccia**	
249.62 - 250.03	**M4 FZ -1**	**Trondhjemitic Gneiss** -Note cross-cutting fractures	
259.11 - 259.30	**M4 IM -4**	**Melt matrix breccia** -Note the undigested rounded granitoid clasts	
260.39 - 260.70	**(Note-worthy features)**	Rounded lithic clasts of granitic gneiss and dolerite enclosed in melt matrix breccia	
262.60 - 262.98	**M4 IM-5**	Melt matrix breccia with elongated melted clasts (arrow) next to a melted lithic clast.	

263.08 - 263.45	**(Note-worthy features)**	Note the turbulent and laminar flow of clasts in melt matrix breccia and crenulations on the cataclased section.	
265.55 - 265.75	**M4 IM -3**	Melt matrix breccia with large, un-melted, granitic gneiss clast entrained.	
266.85 - 267.15	**M4 INJ -4**	Suevitic injection vein (green) in granitic gneiss	
268.30 - 268.45	**M4 SILL-1**	**Dolerite** -Note the fractures	
270.92 - 271.17	**(Note-worthy features)**	Melt matrix breccia with granitic gneiss clasts. Note the contrast between small fluidal clasts (arrow) versus the large, un-melted granitic clast.	
271.17 - 271.34	**M4 IM-6**	**Melt matrix breccia** with green fluidal clast	
273.73 - 273.90	**M4 INJ-5**	**Suevitic injection vein** in granitic gneiss displaced by later calcite in filled fractures	

274.15 - 274.30	**M4 GG -17**	**Granitic Gneiss** cut by later calcite in filled fractures	
279.06 - 279.27	**M4 IM-7**	**Melt matrix breccia**	
279.67 - 279.88	**M4 S-13**	**Suevite** contact with blotchy altered dolerite. Note the displaced contact.	
280.48 - 280.62	**M4 IM-8**	Variegated **melt matrix breccia**	
280.62 - 281.00	**(Note-worthy features)**	Vertical fracture in granitic gneiss.	
284.85 - 285.03 **285.03 - 285.17**	**M4 B-1** **and** **M4 S-4**	**Suevite** (grey, sample M4 S-4) contact with blotchy, altered dolerite (M4 B-1sample)	
285.97 - 286.10	**M4 S -5**	**Suevite** (grey)	
289.97 - 290.27	**M4 B-2**	**Dolerite** (altered) - Note blotchy appearance	

290.71 - 290.95	**(Note-worthy features)**	Inter-mingled contact between altered dolerite and melt matrix breccia	
290.95 - 291.18	**M4 IM-10**	**Melt matrix breccia**	
291.63 - 291.88	**(Note-worthy features)**	Variegated melt matrix breccia (red-green and white)	
295.88 - 296.19	**(Note-worthy features)**	Suevite injection vein into granitic gneiss	
299.76 - 299.98	**M4 IM-9**	**Mixed cataclasite, suevite and melt matrix breccia**	
301.15 - 301.44	**(Note-worthy features)**	Banded/variegated grey suevite in granodioritic gneiss	
302.74 - 302.99	**(Note-worthy features)**	Granitic Gneiss with grey suevite. Note the angular clasts, stringed out granitic clast and cross-cutting factures.	
305.82 - 306.21	**M4 GG -3**	**Granitic Gneiss** cut by grey suevite and thinner suevitic injection veins. Note the strong clast alignment caused by flow.	

306.97 - 306.81	**M4 GG -13**	**Granodioritic Gneiss**	
316.38 - 316.52	**M4 GG -14**	**Granitic Gneiss**	
316.52 - 316.70	**M4 S-6**	**Suevite** (dark green)	
324.87 - 325.10	**M4 GG -15**	**Granitic Gneiss**	
331.50 – 331.65	**M4 MG -1**	**Granodioritic Gneiss** (magnetic)	
334.52 - 334.70	**M4 MG -2**	**Granodiorite Gneiss** (magnetic and coarse grained)	
338.15 - 338.38	**M4 AM -2**	**Dioritic Gneiss**	
340.70 - 341.06	**M4 AM-1**	**Dioritic Gneiss**	

346.70 - 346.86	**M4 MG -3**	**Granodioritic Gneiss**	
349.65 - 349.81	**M4 AM -3**	**Dioritic Gneiss**	
354.84 - 354.96	**M4 SB-2**	**Suevite** (green) in granitic gneiss	
355.15 - 355.22	**M4 SB-4**	**Suevite** (grey) along contact of granitic gneiss and dioritic gneiss	(**Quarter core – no photo available**)
355.37 - 355.57	**M4 SB -3**	**Suevite** (green) in dioritic gneiss	
359.60 - 359.88	**M4 AM -4**	**Dioritic Gneiss** -Note the foliation	
360.18 - 360.42	**M4 GG -16**	**Granodioritic Gneiss**	
362.63 - 362.90	**M4 AM -5**	**Dioritic Gneiss**	

Appendix 3:

3A: Whole Rock X-Ray Fluorescence (XRF) data for target rocks

3B: Whole Rock X-Ray Fluorescence (XRF) data for impactites

3C: Inductively Coupled Plasma Mass Spectrometry (ICP-MS) data for target rocks

3D: Inductively Coupled Plasma Mass Spectrometry (ICP-MS) data for impactites

Appendix 3A: Major (wt.%) and trace (ppm) element concentrations for M4 core target rocks

Sample:	**M4 GG -2**	**M4 GG -6**	**M4 GG-17**	**M4 GG -3**	**M4 GG -14**	**M4 GG -15**	**M4 GG -4**	**M4 GG -7**	**M4 GG -8**	**M4 GG -9**	**M4 GG -11**	**M4 MG -2**	**M4 MG-3**	**M4 GG -16**
Depth (m):	131.90	149.24	274.62	305.82	316.38	324.87	109.20	150.58	152.65	159.36	178.05	334.52	346.70	360.18
Rock Type:	Granitic Gneiss						Granodioritic Gneiss							
wt% (by XRF)														
SiO2	75.30	74.27	73.85	72.83	74.05	74.84	72.11	73.25	71.51	75.30	74.60	74.39	73.31	73.20
TiO2	0.04	0.05	0.15	0.16	0.18	0.12	0.31	0.18	0.24	0.15	0.19	0.20	0.19	0.16
Al2O3	14.12	14.59	14.70	14.52	14.11	14.09	15.05	14.60	15.38	14.16	14.55	14.52	14.62	14.85
Fe2O3	0.08	0.11	0.15	0.18	0.16	0.13	0.25	0.16	0.20	0.18	0.14	0.20	0.14	0.17
FeO	0.63	0.87	1.20	1.47	1.26	1.05	2.04	1.33	1.62	1.45	1.16	1.62	1.13	1.38
MnO	0.01	0.01	0.02	0.03	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02
MgO	0.11	0.07	0.42	0.44	0.41	0.33	0.65	0.39	0.72	0.49	0.77	0.54	0.33	0.43
CaO	1.14	1.32	1.31	1.47	1.14	1.35	1.93	1.48	1.48	1.46	1.55	1.20	2.13	1.63
Na2O	3.70	4.91	4.87	4.52	4.95	4.52	5.06	4.93	4.63	5.22	5.70	5.67	6.49	5.27
K2O	5.34	3.76	3.29	4.53	3.68	3.73	2.31	3.57	4.11	1.69	1.33	1.96	1.48	2.82
P2O5	0.01	0.01	0.05	0.06	0.05	0.04	0.11	0.05	0.08	0.06	0.07	0.07	0.05	0.06
Cr2O3	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	100.48	99.98	100.04	100.21	99.99	100.21	99.82	99.96	99.99	100.18	100.08	100.39	99.89	99.99
LOI	0.52	n.d.	1.18	1.79	n.d.	n.d.	n.d.	n.d.	n.d.	1.83	n.d.	n.d.	n.d.	n.d.
(ppm)														
Sc	0.36	0.26	1.00	1.47	1.50	0.91	0.09	1.22	1.91	0.01	0.82	0.83	0.50	0.96
V	4.43	15.17	16.30	15.26	13.79	8.23	34.43	30.49	30.47	32.61	21.55	18.23	13.41	20.39
Cr	8.92	0.24	-3.90	12.31	6.51	1.10	2.89	5.74	10.60	19.78	3.48	4.05	0.68	2.65
Co	0.18	2.66	6.00	4.96	0.69	5.14	3.94	2.01	4.31	1.08	5.75	4.19	5.84	2.23
Ni	-1.73	6.94	2.90	-1.49	4.18	1.62	5.79	3.07	3.83	2.36	6.59	3.89	4.95	3.09
Cu	5.48	5.22	1.90	2.32	6.46	6.05	6.78	14.21	32.01	8.48	6.31	4.16	4.58	5.47
Zn	10.09	3.55	21.90	34.11	22.92	7.02	19.26	13.41	13.14	10.33	19.28	11.38	44.27	23.82
Ga	13.86	15.13	14.20	14.77	14.34	12.63	17.02	15.54	17.17	16.19	16.84	13.94	14.46	17.20
Rb	156.82	111.10	105.00	158.18	126.92	112.17	86.67	121.95	127.88	66.43	48.22	94.46	59.54	105.29
Sr	540.13	259.93	537.80	367.82	351.64	356.52	379.20	266.60	376.48	528.08	285.53	461.55	448.73	675.51
Y	-0.19	0.32	1.80	3.22	2.72	4.28	4.75	2.81	3.24	2.43	5.19	5.75	5.76	3.63
Zr	3.05	19.11	93.70	91.05	93.36	71.29	148.03	101.12	116.50	89.97	99.81	140.88	97.35	106.56
Nb	-0.68	0.57	1.10	2.01	4.42	2.66	4.74	2.25	4.71	0.11	4.76	6.15	8.71	3.72
Mo	0.66	0.56	-0.50	3.50	0.20	0.04	0.06	0.82	1.27	-0.47	0.01	0.36	0.82	1.45
Ba	1650.45	719.72	858.20	840.27	737.40	996.75	535.38	652.47	913.78	864.26	468.32	524.24	573.94	971.82
Pb	4.18	5.18	33.10	10.86	11.47	14.49	9.10	10.58	10.56	5.06	4.63	6.39	7.38	13.32
Th	-2.36	1.12	2.70	3.15	2.02	0.98	2.07	4.18	3.52	0.24	3.73	1.47	6.50	1.77
U	3.08	2.21	1.20	4.50	4.48	4.03	2.46	1.40	3.09	3.61	0.87	4.99	9.47	5.03

** n.d. = not detected. LOI = loss on ignition. All major element concentrations in wt%., all trace element concentrations in ppm (unless stated otherwise).*

Appendix 3A Continued....

Sample:	**M4 FZ-2**	**M4 FZ-3**	**M4 FZ-4**	**M4 FZ-1**	**M4 GG -1**	**M4 GG -5**	**M4 GG -10**	**M4 AM-2**	**M4 AM-1**	**M4 AM-3**	**M4 AM-4**	**M4 AM-5**
Depth (m):	219.30	226.80	233.48	249.62	126.60	136.90	165.98	338.15	340.70	354.23	359.60	362.63
Rock Type:	Trondhjemitic Gneiss				Dioritic Gneiss							
wt%												
(by XRF)												
SiO2	80.47	75.94	75.79	76.30	59.63	58.21	63.03	63.24	59.27	59.62	63.53	61.53
TiO2	0.20	0.20	0.19	0.21	0.97	0.99	0.70	0.74	0.87	0.90	0.73	0.81
Al2O3	10.82	13.56	13.87	13.50	18.29	18.43	17.77	17.43	18.14	18.88	17.32	18.31
Fe2O3	0.12	0.13	0.11	0.12	0.71	0.72	0.55	0.55	0.70	0.66	0.58	0.62
FeO	0.95	1.07	0.92	0.98	5.71	5.82	4.49	4.46	5.64	5.34	4.69	4.99
MnO	0.01	0.01	0.01	0.01	0.10	0.08	0.04	0.05	0.08	0.10	0.08	0.09
MgO	0.68	0.94	0.66	0.68	2.00	2.45	2.04	1.69	1.91	2.02	1.69	1.82
CaO	1.73	2.13	1.77	1.91	4.31	3.67	2.89	3.23	4.33	3.31	3.14	3.48
Na2O	4.79	5.80	6.48	5.86	6.00	6.64	6.78	6.27	6.50	5.36	6.25	6.92
K2O	0.19	0.19	0.35	0.34	2.02	2.25	1.61	2.20	2.09	3.48	1.70	1.47
P2O5	0.08	0.06	0.07	0.08	0.55	0.57	0.40	0.41	0.50	0.51	0.40	0.45
Cr2O3	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.01	0.00	0.00
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	100.03	100.03	100.22	99.98	100.30	99.83	100.32	100.28	100.04	100.19	100.10	100.49
LOI	n.d.	n.d.	n.d.	n.d.	2.36	1.78	n.d.	n.d.	1.79	2.80	n.d.	n.d.
ppm												
(by XRF)												
Sc	0.35	0.63	3.01	1.17	23.15	7.82	11.16	7.56	6.04	8.80	5.55	5.04
V	9.14	7.67	9.81	11.89	95.87	96.47	82.17	72.49	93.73	75.90	78.39	73.67
Cr	4.30	3.22	0.57	0.36	14.85	47.60	1.55	5.32	116.43	3.80	5.89	8.49
Co	0.85	6.33	6.73	5.56	18.31	14.25	24.44	4.68	12.43	9.60	13.42	11.91
Ni	18.45	19.12	12.89	9.79	15.07	7.45	11.10	8.94	4.65	9.20	10.28	10.51
Cu	1.24	0.45	5.83	2.30	11.55	22.80	24.70	7.35	57.16	29.00	23.32	7.00
Zn	14.01	11.63	15.04	4.91	100.07	81.93	16.15	29.89	48.23	104.30	52.99	63.06
Ga	9.77	15.30	13.52	13.03	24.32	21.08	17.82	24.16	23.12	27.00	24.76	28.98
Rb	6.02	4.67	11.93	9.54	140.84	124.11	74.02	119.04	115.20	214.70	128.07	112.05
Sr	463.19	316.07	471.73	360.09	682.30	1049.13	719.31	828.06	973.52	1054.20	1140.30	984.57
Y	3.46	2.82	3.48	3.37	36.96	17.38	18.63	24.13	21.57	49.90	13.16	35.66
Zr	102.85	89.41	104.57	116.99	329.10	334.76	252.10	269.90	297.99	306.20	256.68	293.19
Nb	3.71	4.34	4.09	4.32	20.22	6.38	10.01	19.31	14.09	27.50	10.80	22.30
Mo	0.74	0.39	0.19	0.42	2.03	0.39	1.49	1.14	0.66	1.60	2.37	0.99
Ba	35.35	37.03	54.15	101.81	377.52	947.03	460.82	526.86	578.45	877.20	400.30	313.76
Pb	2.70	3.37	5.07	8.82	9.65	6.82	3.74	8.25	5.95	18.20	7.77	7.92
Th	2.91	2.21	2.43	1.51	7.25	7.21	4.88	11.75	9.59	16.50	6.59	9.52
U	2.50	1.86	1.83	1.69	7.26	7.03	4.41	13.76	12.00	4.00	5.13	6.52

** n.d. = not detected. LOI = loss on ignition. All major element concentrations in wt%. all trace element concentrations in ppm (unless stated otherwise)*

Appendix 3A Continued....

Sample:	M4 A-1	M4 A-2	M4 A-3	M4 IS-2	M4 IS-1	M4 SILL-1	M4 B-1	M4 B-2
Depth (m):	166.33	182.62	204.62	211.41	221.20	268.30	284.85	290.00
Rock Type:	Metadolerite			Silicified metadolerite		Dolerite		
wt% (by XRF)								
SiO2	55.99	55.43	55.59	70.37	56.87	53.17	53.96	54.04
TiO2	0.95	0.87	0.93	0.51	0.92	1.36	1.32	1.32
Al2O3	11.54	12.83	12.65	12.39	17.53	14.13	13.53	13.74
Fe2O3	1.11	1.14	1.08	0.53	0.80	1.48	1.43	1.37
FeO	9.01	9.26	8.76	4.31	6.45	11.98	11.61	11.09
MnO	0.18	0.14	0.11	0.03	0.08	0.19	0.19	0.18
MgO	8.70	8.26	8.08	1.36	0.44	5.68	5.58	5.53
CaO	9.96	9.80	12.23	9.26	14.47	8.68	7.10	7.78
Na2O	2.12	1.87	0.69	1.10	1.50	2.92	3.94	3.39
K2O	0.29	0.21	0.09	0.10	0.06	0.94	1.16	1.12
P2O5	0.14	0.13	0.14	0.13	0.52	0.14	0.13	0.14
Cr2O3	0.09	0.07	0.07	0.02	0.01	0.02	0.02	0.02
NiO	0.04	0.03	0.03	0.00	0.00	0.01	0.01	0.01
TOTAL	100.14	100.06	100.47	100.12	99.65	100.71	99.98	99.74
LOI	2.46	n.d.	n.d.	n.d.	2.33	2.21	3.47	4.32
ppm (by XRF)								
Sc	36.28	28.62	36.30	16.25	20.48	34.22	31.61	29.20
V	253.73	223.60	216.69	94.87	125.54	315.37	299.40	289.00
Cr	567.10	435.62	468.83	167.92	36.84	52.90	60.88	46.80
Co	44.69	58.25	44.70	0.89	2.20	53.28	62.25	50.80
Ni	262.55	239.58	246.18	28.16	8.23	76.07	74.69	81.50
Cu	61.46	42.08	47.88	8.14	4.72	158.29	162.21	134.90
Zn	68.46	64.91	37.17	22.97	10.11	173.19	303.23	113.20
Ga	15.91	14.48	18.21	19.04	35.29	20.55	21.01	20.60
Rb	10.31	11.67	6.43	9.34	7.37	47.91	73.81	77.20
Sr	466.33	455.22	672.07	967.07	1745.03	293.56	358.73	482.40
Y	16.87	14.02	16.48	9.50	23.35	21.91	20.46	19.20
Zr	99.04	88.86	94.39	104.12	305.17	119.92	114.23	112.30
Nb	2.28	5.11	4.49	6.54	6.48	5.25	3.85	5.50
Mo	-0.16	1.63	0.51	0.89	0.69	1.69	1.70	1.10
Ba	98.72	54.14	4.11	28.03	13.44	222.84	242.88	280.10
Pb	2.67	0.21	0.91	1.24	1.89	10.20	8.87	10.30
Th	-0.01	4.71	3.64	3.81	10.34	4.00	2.90	0.00
U	6.80	2.02	0.24	6.70	17.27	5.89	6.60	0.00

** n.d. = not detected. LOI = loss on ignition. All major element concentrations in wt%. all trace element concentrations in ppm (unless stated otherwise)*

Appendix 3B: Major (wt.%) and trace (ppm) element concentrations for M4 core impactites.

Sample:	M4 S -1	M4 S-7	M4 S -2	M4 S -3	M4 S-8	M4 S-9	M4 S-10	M4 S -5	M4 S -6	M4 SB-4
Depth (m):	144.09	146.00	156.35	159.98	170.07	198.03	208.34	285.97	316.52	355.15
Rock Type:	Suevite									
SiO2	59.62	62.00	68.21	69.12	65.21	68.26	73.32	66.07	48.73	62.45
TiO2	0.97	0.75	0.51	0.48	0.72	0.52	0.33	0.62	0.63	0.88
Al2O3	13.93	13.92	14.61	14.79	11.31	11.90	11.21	15.39	15.00	14.93
Fe2O3	0.77	0.81	0.47	0.40	0.86	0.61	0.50	0.55	0.98	0.78
FeO	6.27	6.54	3.78	3.22	7.00	4.91	4.01	4.45	7.93	6.35
MnO	0.12	0.11	0.05	0.05	0.09	0.05	0.04	0.07	0.16	0.08
MgO	2.04	5.06	2.91	2.56	8.09	5.62	1.87	1.97	15.60	3.04
CaO	10.31	5.74	2.87	2.40	4.89	5.99	5.35	4.05	4.39	5.74
Na2O	4.48	3.49	5.54	5.96	1.83	1.77	2.88	4.59	1.95	3.77
K2O	1.34	1.29	1.08	1.27	0.53	0.36	0.33	2.34	4.34	2.14
P2O5	0.27	0.22	0.17	0.19	0.12	0.13	0.12	0.19	0.53	0.26
Cr2O3	0.02	0.03	0.02	0.01	0.06	0.04	0.01	0.01	0.02	0.02
NiO	0.01	0.01	0.01	0.01	0.03	0.01	0.00	0.01	0.04	0.01
TOTAL	100.18	99.98	100.23	100.44	100.74	100.16	99.97	100.31	100.30	100.45
LOI	11.62	11.07	6.19	4.63	8.72	6.78	6.18	5.00	6.77	7.17
ppm (by XRF)										
Sc	25.50	19.70	12.20	7.40	24.90	17.60	8.50	12.50	24.20	16.90
V	233.50	152.40	64.80	50.90	172.00	114.60	69.50	86.30	164.80	141.60
Cr	115.00	167.60	99.00	68.60	344.60	209.00	23.90	39.10	125.30	64.20
Co	20.90	22.60	17.90	16.90	31.00	21.50	8.30	16.60	45.90	21.60
Ni	80.20	84.90	58.20	41.50	170.50	105.50	17.50	41.00	291.90	64.50
Cu	215.10	96.60	8.30	8.60	15.20	5.40	0.90	35.50	51.10	32.50
Zn	56.80	71.40	30.90	27.10	38.40	15.10	43.40	38.20	48.10	26.80
Ga	25.10	24.80	19.50	16.90	13.20	15.00	15.60	19.30	80.10	19.70
Rb	40.00	44.10	34.90	51.50	25.50	19.30	20.20	98.40	294.60	77.00
Sr	243.40	346.70	216.30	700.00	343.40	485.50	1391.60	316.50	390.30	223.00
Y	19.70	14.90	10.10	11.00	12.20	10.20	8.10	13.50	14.10	17.20
Zr	142.00	124.20	136.90	158.20	81.50	77.60	111.20	151.80	187.40	148.40
Nb	8.80	7.80	6.60	5.80	3.80	3.50	2.40	8.70	76.30	9.90
Mo	1.50	1.70	2.00	1.00	0.40	0.60	0.00	1.10	2.50	1.70
Ba	276.30	297.70	147.40	254.60	69.80	50.30	90.30	575.80	1115.80	507.30
Pb	5.60	5.70	4.30	0.60	0.30	2.60	0.40	8.10	4.90	1.20
Th	0.00	5.60	2.10	2.60	3.70	0.00	2.20	7.80	18.50	2.90
U	2.30	8.80	2.80	5.00	0.70	1.00	7.80	0.50	6.10	0.00

** n.d. = not detected. LOI = loss on ignition. All major element concentrations in wt%. all trace element concentrations in ppm (unless stated otherwise)*

Appendix 3B Continued....

Sample:	M4 IM-1	M4 IM-2	M4 IM-4	M4 IM-5	M4 IM-3	M4 IM-6	M4 IM-7	M4 IM 8
Depth (m):	176.60	234.33	259.11	262.60	265.55	271.17	279.06	280.48
Rock Type:	Impact melt breccia (MMBr)							
SiO2	61.04	71.80	58.87	64.13	62.53	63.27	59.44	61.51
TiO2	14.06	14.87	15.71	15.51	14.75	15.05	14.98	14.64
Al2O3	1.02	0.22	0.86	0.58	0.80	0.72	0.96	0.86
Fe2O3	8.24	1.82	6.96	4.68	6.49	5.79	7.76	7.00
FeO	0.10	0.02	0.10	0.07	0.10	0.09	0.13	0.10
MnO	8.46	1.01	4.57	2.58	4.59	3.74	3.67	3.32
MgO	4.95	4.37	6.28	4.29	5.26	4.68	5.20	4.33
CaO	1.01	5.40	4.18	4.73	3.89	3.84	4.64	5.39
Na2O	0.23	0.25	1.55	3.09	1.80	2.35	1.98	1.83
K2O	0.96	0.25	0.89	0.65	0.77	0.78	0.99	0.95
P2O5	0.11	0.14	0.24	0.28	0.21	0.26	0.24	0.25
Cr2O3	0.07	0.01	0.02	0.01	0.03	0.02	0.01	0.01
NiO	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01
TOTAL	100.26	100.15	100.24	100.60	101.24	100.59	100.01	100.21
LOI	n.d	4.89	3.78	3.27	4.60	4.29	4.57	4.70
ppm (by XRF)								
Sc	27.93	4.00	18.90	13.50	17.30	21.70	20.40	17.70
V	168.87	36.50	148.00	86.10	126.90	123.30	179.00	161.90
Cr	408.99	8.70	106.50	48.00	166.60	137.20	41.30	43.80
Co	25.89	3.50	27.50	17.00	28.00	23.00	34.80	23.90
Ni	174.17	15.10	77.40	46.00	95.00	76.40	49.50	48.20
Cu	7.19	0.30	42.70	22.00	36.80	38.00	75.50	42.10
Zn	63.20	25.60	47.70	55.30	59.10	125.50	79.70	66.90
Ga	21.73	13.30	21.90	17.90	20.80	21.10	20.40	24.90
Rb	11.61	9.50	66.50	131.90	69.50	96.60	105.90	70.80
Sr	468.32	652.20	534.20	892.90	516.10	605.00	628.40	307.70
Y	17.31	7.40	19.30	13.90	17.20	17.90	23.80	21.70
Zr	122.15	110.60	151.50	154.20	142.70	155.20	150.40	166.30
Nb	7.84	4.60	8.60	11.80	9.20	9.40	11.50	12.90
Mo	0.37	1.10	0.00	1.00	1.60	1.80	2.00	2.20
Ba	23.48	93.90	461.50	956.90	459.30	601.70	568.30	559.90
Pb	2.29	1.10	9.10	12.10	12.80	9.10	9.00	10.10
Th	4.09	7.00	2.60	6.20	5.70	3.60	4.70	5.00
U	4.96	3.00	4.50	6.50	2.70	4.70	3.20	2.60

** n.d. = not detected. LOI = loss on ignition. All major element concentrations in wt%. all trace element concentrations in ppm (unless stated otherwise)*

Appendix 3C: ICP-MS data for trace (ppm) and rare earth element contents (ppm) of target rocks from the M4 borehole core. All data in ppm.

Sample:	M4 GG -2	M4 GG -6	M4 GG-17	M4 GG -3	M4 GG -14	M4 GG -15	M4 GG -4	M4 GG -7	M4 GG -8	M4 GG -9	M4 GG -11	M4 MG -2	M4 MG-3	M4 GG -16
Depth (m):	131.9	149.24	274.62	305.82	316.38	324.87	109.2	150.58	152.65	159.36	178.05	334.52	346.7	360.18
Rock Type:	Granitic Gneiss						Granodioritic Gneiss							
Li	n.d.	7.35	19.739	n.d.	18.721	12.241	6.333	9.249	14.268	n.d.	26.676	29.839	14.469	18.662
P	10.099	34.603	224.698	216.306	198.178	163.069	421.646	228.95	353.485	220.187	300.042	339.826	225.243	259.18
Sc	0.196	0.321	1.551	0.815	1.852	0.911	1.614	1.561	1.475	0.572	1.27	2.29	0.963	1.544
Ti	214.493	265.708	878.312	864.935	1062.901	656.319	1920.035	1057.193	1585.188	805.508	1171.291	1153.899	1092.428	972.317
V	3.323	13.498	13.543	12.713	10.389	10.099	26.497	30.124	26.369	26.746	18.504	14.088	14.619	16.707
Cr	6.984	2.544	21.351	12.529	4.289	3.549	4.686	5.722	5.248	22.748	6.422	6.772	4.102	5.17
Co	1.853	1.919	2.679	2.903	2.723	2.225	5.474	3.246	3.334	2.449	4.336	3.455	2.794	3.386
Ni	4.936	7.609	42.609	6.719	6.92	5.199	7.482	5.837	8.766	6.762	7.391	6.854	5.748	5.875
Cu	5.467	4.959	179.295	4.903	7.024	4.49	8.592	14.826	27.872	8.303	8.185	3.927	4.874	6.173
Zn	10.704	7.055	99.093	28.975	26.229	11.432	15.483	16.159	17.62	12.166	21.095	14.403	41.375	26.111
Ga	12.990	15.105	13.508	14.078	14.447	13.007	11.327	15.643	10.256	14.994	16.154	15.063	15.488	17.946
As	0.053	0.035	0.212	0.171	0.046	0.048	0.147	0.07	0.067	0.136	0.056	0.065	0.054	0.072
Rb	135.134	104.222	65.687	101.309	95.48	84.97	29.517	87.099	37.043	41.276	13.604	62.709	37.373	79.821
Sr	382.285	113.226	231.475	214.058	283.461	251.62	237.91	214.69	193.39	361.319	174.868	426.564	368.076	707.731
Y	0.139	0.386	1.562	2.414	2.013	3.643	5.166	2.668	3.965	1.843	3.545	6.003	3.008	3.786
Zr	5.256	15.734	94.061	81.789	73.619	67.152	139.375	91.16	119.917	58.458	88.996	127.207	98.865	89.466
Nb	0.743	0.424	2.029	3.741	4.738	2.774	5.434	3.749	5.533	2.008	6.632	5.782	9.471	3.729
Ba	913.642	456.287	1047.472	544.699	719.51	1016.396	406.577	624.522	493.754	573.259	245.844	516.36	467.29	1130.801
Sn	n.d.	0.315	1.095	n.d.	0.844	0.74	0.99	0.65	0.924	n.d.	0.924	1.288	1.426	0.777
Cs	1.348	1.267	2.664	3.403	2.952	2.24	2.008	1.788	1.621	4.138	0.97	2.727	4.151	2.267
La	1.006	1.399	5.981	14.373	11.214	5.819	21.215	12.916	14.154	9.951	12.712	11.05	9.161	15.976
Ce	1.127	1.34	9.846	29.095	17.576	8.796	25.275	26.357	18.05	21.026	27.593	20.504	24.006	26.047
Pr	0.102	0.164	1.32	2.936	2.31	1.283	4.543	3.157	3.242	1.827	2.697	2.533	1.776	2.897
Nd	0.316	0.561	4.479	10.099	7.675	4.668	15.231	10.92	10.99	5.936	9.18	9.136	6.062	9.252
Sm	0.695	0.348	1.152	1.818	1.502	1.474	2.513	1.926	1.947	1.211	1.448	2.015	1.107	1.85
Eu	0.598	0.564	0.564	0.638	0.694	0.83	0.719	0.889	0.75	0.506	0.429	0.648	0.493	0.871
Gd	0.043	0.078	0.638	1.355	0.905	0.728	1.816	1.339	1.361	0.811	1.264	1.542	0.878	1.13
Tb	0.002	0	0.067	0.127	0.085	0.093	0.213	0.126	0.151	0.074	0.129	0.192	0.074	0.114
Dy	0.017	0.056	0.292	0.504	0.405	0.572	1.006	0.551	0.734	0.315	0.655	1.087	0.434	0.6
Ho	0.001	0.004	0.047	0.074	0.06	0.098	0.163	0.076	0.117	0.050	0.11	0.185	0.064	0.101
Er	0.004	0.029	0.155	0.193	0.185	0.293	0.467	0.224	0.323	0.120	0.314	0.499	0.245	0.314
Tm	0.000	-0.003	0.02	0.024	0.017	0.04	0.056	0.017	0.035	0.019	0.033	0.066	0.026	0.041
Yb	0.011	0.04	0.171	0.176	0.168	0.304	0.414	0.163	0.254	0.150	0.248	0.465	0.267	0.318
Lu	0.000	0.001	0.028	0.026	0.02	0.04	0.056	0.019	0.034	0.024	0.027	0.061	0.035	0.039
Hf	0.210	0.469	2.759	2.550	2.145	2.276	3.749	2.604	3.416	1.676	2.54	3.627	2.789	2.452
Ta	0.040	0.03	0.113	0.087	0.18	0.257	0.531	0.146	0.251	0.097	0.477	0.452	0.988	0.328
W	0.014	0.079	0.105	0.169	0.104	0.071	0.166	0.085	0.129	0.118	0.211	0.193	0.141	0.04
Pb	7.078	5.755	40.065	10.147	12.084	15.5	5.712	9.816	5.199	6.085	5.484	7.622	8.427	15.51
Th	0.075	0.153	1.47	3.414	2.718	0.813	2.82	2.356	2.925	1.603	1.96	2.425	3.654	2.9
U	0.194	0.765	0.52	0.785	0.494	0.709	5.132	1.126	4.781	0.658	0.97	1.302	4.119	1.871

** n.d. = not detected. All trace and rare earth element concentrations in ppm (unless stated otherwise).*

Appendix 3C Continued....

Sample:	M4 FZ-2	M4 FZ-3	M4 FZ-4	M4 FZ-1	M4 GG -1	M4 GG -5	M4 GG -10	M4 AM-2	M4 AM-1	M4 AM-3	M4 AM-4	M4 AM-5
Depth (m):	219.30	226.8	233.48	249.62	126.6	136.9	165.98	338.15	340.7	354.23	359.6	362.63
Rock Type:	Trondhjemitic Gneiss				Dioritic Gneiss							
Li	22.726	42.677	27.311	22.764	n.d.	n.d.	43.929	30.319	n.d.	73.414	41.983	53.738
P	316.321	244.98	293.695	308.84	1899.705	2120.486	1678.051	1817.417	1726.603	2585.916	1942.731	2154.752
Sc	1.966	1.584	2.555	2.089	12.853	6.222	10.635	6.378	4.997	4.829	3.261	6.273
Ti	1198.707	1118.202	1089.646	1040.894	3595.64	5203.588	4086.95	3746.744	4383.725	5351.847	4372.752	4715.748
V	10.053	12.147	9.174	11.419	82.873	80.79	73.353	68.344	79.168	78.524	68.831	68.214
Cr	5.676	5.323	5.681	4.905	22.754	55.339	13.561	7.769	126.798	23.309	10.735	11.092
Co	3.247	4.144	3.546	3.246	8.848	13.797	19.694	7.682	10.968	14.675	11.418	11.352
Ni	18.332	16.168	11.608	10.004	17.852	15.468	13.977	13.1	14.624	42.604	11.774	11.255
Cu	5.62	3.518	4.024	3.464	8.771	21.004	26.448	10.244	49.207	136.825	22.591	9.783
Zn	16.458	15.359	17.331	8.593	49.834	65.903	23.212	26.33	42.268	129.823	51.56	62.368
Ga	11.347	15.351	13.857	8.861	14.039	20.827	18.403	14.758	20.89	26.358	24.95	29.503
As	0.056	0.057	0.062	0.056	0.851	0.734	0.252	0.272	0.681	0.573	0.215	0.258
Rb	5.762	4.342	5.332	7.118	72.59	65.398	20.539	34.366	20.439	69.981	14.44	39.418
Sr	543.858	329.077	494.351	286.846	451.875	800.676	588.358	576.705	629.202	538.868	727.924	906.3
Y	3.483	1.559	3.608	4.369	29.662	13.986	21.687	26.876	15.368	43.472	13.05	38.984
Zr	79.016	85.175	81.014	102.954	154.142	86.618	134.931	221.239	181.364	297.048	147.353	139.783
Nb	4.542	4.689	4.789	3.902	12.927	8.068	12.723	23.147	15.326	28.781	13.213	26.222
Ba	32.16	32.676	59.394	85.898	247.077	660.561	325.011	369.695	279.869	744.216	241.046	256.193
Sn	0.774	0.752	0.843	0.694	n.d.	n.d.	2.226	3.106	n.d.	4.661	2.893	4.096
Cs	1.68	0.676	1.449	0.782	3.705	22.929	2.373	3.731	4.387	5.797	3.722	4.202
La	13.622	10.641	14.195	17.223	59.003	70.766	62.49	67.798	65.236	54.39	55.236	79.361
Ce	28.564	26.42	27.362	20.657	98.002	156.662	116.26	76.31	130.611	107.549	99.941	150.775
Pr	2.894	2.007	2.97	3.599	14.098	14.704	13.475	14.025	11.612	15.067	10.724	17.58
Nd	9.655	6.616	10.178	11.912	48.987	49.14	47.372	47.523	39.002	55.033	36.786	59.967
Sm	1.472	0.92	1.577	1.908	8.258	7.544	7.554	7.488	5.864	11.364	5.054	10.448
Eu	0.332	0.308	0.395	0.522	1.592	2	1.556	1.566	1.481	1.895	1.199	1.752
Gd	1.356	0.906	1.41	1.553	7.712	7.192	7.079	6.369	5.781	10.556	4.77	9.676
Tb	0.144	0.066	0.145	0.182	1.033	0.708	0.884	0.826	0.593	1.56	0.505	1.306
Dy	0.688	0.317	0.722	0.846	5.43	3.042	4.4	4.392	2.763	8.701	2.423	7.131
Ho	0.111	0.034	0.102	0.133	0.968	0.479	0.751	0.786	0.478	1.582	0.409	1.269
Er	0.299	0.136	0.29	0.369	2.507	1.305	1.942	2.165	1.381	4.293	1.184	3.239
Tm	0.031	0.005	0.026	0.041	0.369	0.158	0.257	0.306	0.207	0.639	0.157	0.459
Yb	0.227	0.107	0.234	0.31	2.272	0.969	1.582	1.896	1.366	3.65	1.097	2.55
Lu	0.03	0.008	0.027	0.041	0.32	0.143	0.211	0.273	0.214	0.461	0.161	0.328
Hf	2.117	2.369	2.265	2.903	3.34	1.979	2.969	4.992	3.981	7.015	3.417	3.222
Ta	0.144	0.17	0.12	0.2	1.391	0.967	1.809	2.207	1.957	3.856	1.311	2.926
W	0.128	0.209	0.158	0.11	0.108	0.118	0.293	0.48	0.208	0.182	0.126	0.169
Pb	4.259	4.493	6.584	5.579	5.13	7.415	4.989	4.26	6.052	22.574	10.723	11.402
Th	2.892	1.861	2.464	3.428	6.395	4.017	6.887	10.122	5.766	6.982	5.641	12.718
U	0.531	1.144	0.577	2.299	1.943	1.763	2.682	6.02	3.491	1.916	2.067	2.171

** n.d. = not detected. All trace and rare earth element concentrations in ppm (unless stated otherwise).*

Appendix 3C Continued....

Sample:	M4 A-1	M4 A-2	M4 A-3	M4 IS-2	M4 IS-1	M4 SILL-1	M4 B-1	M4 B-2
Depth (m):	166.33	182.62	204.62	211.41	221.20	268.30	284.85	290.00
Rock Type:	Metadolerite			Silicified metadolerite		Dolerite		
Li	n.d.	46.925	55.122	11.324	n.d.	n.d.	n.d.	67.644
P	483.728	534.404	591.358	551.564	1994.960	592.907	490.848	777.63
Sc	29.651	40.353	43.06	17.905	5.329	24.586	26.516	20.674
Ti	2788.393	4956.961	5366.987	2870.232	5282.737	3979.53	7580.914	8480.988
V	221.278	216.392	212.533	95.191	117.631	269.222	264.816	314.897
Cr	419.654	494.421	509.928	203.814	35.432	44.438	71.352	64.243
Co	23.427	57.216	44.524	7.404	8.477	28.571	54.957	55.15
Ni	115.409	193.328	196.964	27.624	16.320	44.659	71.774	106.943
Cu	29.834	46.402	44.303	3.826	5.911	63.328	134.17	143.178
Zn	36.463	63.321	41.392	27.915	20.523	69.512	214.217	101.008
Ga	8.753	16.134	16.995	20.028	32.888	11.227	18.571	18.696
As	0.784	0.548	0.523	0.424	1.567	1.035	0.962	0.351
Rb	6.072	9.072	4.274	7.47	4.517	30.955	68.246	70.007
Sr	358.434	594.124	880.335	1232.734	1602.110	227.356	338.497	464.568
Y	15.966	21.938	22.712	13.168	19.061	20.295	20.203	20.694
Zr	56.659	80.408	77.537	72.051	101.009	55.024	102.289	107.717
Nb	2.397	4.25	4.45	5.283	9.194	3.755	5.581	5.86
Ba	43.568	61.917	14.199	33.417	9.191	116.33	203.865	360.582
Sn	n.d.	1.011	1.013	1.31	n.d.	n.d.	n.d.	1.633
Cs	0.833	0.915	0.553	19.978	12.503	3.095	4.882	7.062
La	11.713	18.618	19.83	23.914	88.525	13.44	13.617	12.252
Ce	20.935	29.021	30.771	35.867	171.564	20.589	29.465	25.394
Pr	3.288	4.632	4.993	4.998	17.590	3.817	3.822	3.486
Nd	13.477	18.449	19.829	17.442	57.519	15.781	15.857	14.593
Sm	2.768	3.808	4.026	3.081	8.216	3.456	3.561	3.737
Eu	0.805	1.072	1.1	1.041	2.130	0.99	1.022	1.196
Gd	2.811	3.75	4.055	2.999	8.445	3.457	3.67	4.054
Tb	0.457	0.598	0.644	0.406	0.911	0.584	0.6	0.647
Dy	2.800	3.716	3.973	2.239	3.972	3.601	3.721	3.912
Ho	0.566	0.731	0.795	0.42	0.633	0.727	0.747	0.779
Er	1.450	1.955	2.054	1.113	1.544	1.832	1.882	2.094
Tm	0.215	0.286	0.3	0.152	0.196	0.28	0.273	0.316
Yb	1.337	1.726	1.826	0.962	1.175	1.648	1.732	1.97
Lu	0.200	0.254	0.264	0.137	0.167	0.25	0.263	0.299
Hf	1.424	1.965	1.919	1.867	2.156	1.408	2.675	2.967
Ta	0.134	0.231	0.25	0.326	0.453	0.22	0.353	0.373
W	0.606	0.299	0.586	0.306	0.360	0.276	0.351	0.482
Pb	1.036	1.933	2.032	1.73	3.503	3.802	8.449	10.537
Th	0.922	1.316	1.413	2.971	4.360	2.079	2.184	1.937
U	0.237	0.257	0.261	1.773	5.271	0.302	0.558	0.598

** n.d. = not detected. All trace and rare earth element concentrations in ppm (unless stated otherwise).*

Appendix 3D: ICP-MS data for trace (ppm) and rare earth element contents (ppm) of impactites from the M4 borehole core.

Sample:	**M4 S -1**	**M4 S-7**	**M4 S -2**	**M4 S -3**	**M4 S-8**	**M4 S-9**	**M4 S-10**	**M4 S -5**	**M4 S -6**	**M4 SB-4**
Depth (m):	**144.09**	**146.00**	**156.35**	**159.98**	**170.07**	**198.03**	**208.34**	**285.97**	**316.52**	**355.15**
Rock Type:	**Suevite**									
Li	36.73	127.16	58.89	62.01	105.29	65.94	33.85	20.72	168.69	37.07
P	1007.09	1002.13	699.99	811.94	510.13	530.59	555.56	736.28	2636.64	1313.65
Sc	3.60	10.61	3.85	3.62	24.05	8.55	2.92	4.84	10.73	5.70
Ti	4611.05	3817.24	2509.77	2443.37	3684.97	2631.66	1666.04	3318.41	3407.87	4971.52
V	196.06	130.05	58.98	47.44	152.37	102.11	65.86	84.74	158.08	159.03
Cr	128.99	177.24	102.85	66.86	383.32	232.03	43.68	51.76	150.43	79.70
Co	25.75	22.83	14.63	14.36	28.30	17.69	6.29	14.35	45.22	24.11
Ni	127.61	91.20	101.66	44.32	240.29	149.01	87.36	52.76	312.90	113.76
Cu	207.60	111.40	153.63	16.37	55.58	53.85	44.30	46.22	87.50	136.61
Zn	60.55	76.02	75.59	30.26	57.02	44.27	58.23	41.87	55.66	81.36
Ga	23.19	21.41	17.38	14.87	13.23	14.05	13.85	17.28	69.57	18.81
As	0.50	0.59	0.26	0.34	0.42	0.49	0.39	0.25	0.46	0.40
Rb	37.77	32.16	25.87	24.96	25.43	18.33	18.47	46.48	285.40	69.05
Sr	261.70	322.38	209.02	624.91	360.94	518.11	1397.25	259.37	384.91	212.45
Y	18.31	14.98	9.94	9.63	13.07	11.50	7.62	12.45	15.89	17.96
Zr	133.52	116.77	133.85	161.09	74.00	75.61	93.15	146.03	160.09	136.41
Nb	9.86	7.27	6.24	7.00	4.37	4.29	4.67	9.38	85.60	8.68
Ba	332.79	353.08	158.79	222.86	91.68	52.73	100.53	504.34	1443.55	623.80
Sn	0.86	1.00	0.94	1.09	0.93	0.87	1.18	0.99	4.76	1.30
Cs	0.91	1.23	0.98	3.17	1.81	1.05	6.61	1.62	32.23	8.83
La	32.09	28.59	26.68	26.00	15.59	15.79	26.11	29.01	218.79	26.38
Ce	58.95	54.67	49.41	48.74	29.09	29.81	45.69	57.38	341.23	52.55
Pr	7.61	6.58	5.92	5.88	3.70	3.81	5.38	6.99	34.72	6.48
Nd	28.50	23.82	21.26	21.43	14.19	15.10	19.43	25.86	108.92	24.48
Sm	5.30	4.34	3.57	3.66	2.81	2.82	3.05	4.51	11.76	5.01
Eu	1.56	1.24	1.06	1.06	0.89	0.87	0.98	1.25	2.63	1.41
Gd	5.09	4.29	3.38	3.34	2.87	2.81	2.79	4.11	11.48	4.85
Tb	0.69	0.57	0.42	0.41	0.42	0.40	0.32	0.53	1.01	0.65
Dy	3.59	2.95	2.05	1.99	2.40	2.17	1.50	2.66	3.79	3.53
Ho	0.68	0.56	0.37	0.36	0.48	0.41	0.26	0.49	0.58	0.65
Er	1.86	1.52	1.01	0.97	1.30	1.11	0.73	1.36	1.86	1.78
Tm	0.27	0.22	0.14	0.14	0.20	0.16	0.10	0.19	0.21	0.26
Yb	1.68	1.38	0.93	0.88	1.23	1.01	0.62	1.23	1.31	1.63
Lu	0.25	0.20	0.13	0.13	0.18	0.15	0.09	0.19	0.19	0.25
Hf	3.28	3.01	3.32	3.98	1.94	1.98	2.32	3.80	3.79	3.61
Ta	0.69	0.62	0.59	0.53	0.24	0.29	0.38	0.74	1.82	0.64
W	0.60	0.56	0.66	0.49	0.80	0.58	0.36	0.48	0.54	0.55
Pb	6.87	6.90	8.26	3.96	6.05	4.84	5.34	10.51	6.95	6.81
Th	2.71	3.16	2.91	2.57	1.32	1.41	2.55	3.37	13.36	3.90
U	4.04	9.36	3.69	2.92	0.70	1.34	2.26	1.77	3.56	1.85

** n.d. = not detected. All trace and rare earth element concentrations in ppm (unless stated otherwise).*

Appendix 3D Continued....

Sample:	M4 IM-1	M4 IM-2	M4 IM-4	M4 IM-5	M4 IM-3	M4 IM-6	M4 IM-7	M4 IM 8
Depth (m):	176.60	234.33	259.11	262.60	265.55	271.17	279.06	280.48
Rock Type:	Melt matrix breccia							
Li	105.91	28.74	38.69	38.69	80.90	67.87	40.50	26.90
P	422.61	571.99	1088.06	1088.06	881.58	1361.30	1265.27	1129.53
Sc	40.07	1.13	6.62	6.62	7.99	7.15	6.64	4.88
Ti	3893.21	1306.25	4860.60	4860.60	4116.68	4637.54	6275.84	4871.18
V	162.23	32.43	150.39	150.39	119.79	130.16	194.49	142.46
Cr	312.33	15.88	118.71	118.71	166.00	150.22	55.30	50.49
Co	16.06	4.14	28.26	28.26	25.50	22.50	36.07	22.07
Ni	90.62	30.47	101.87	101.87	100.55	90.73	84.60	62.62
Cu	7.58	16.15	74.13	74.13	36.04	69.46	90.85	65.44
Zn	40.81	30.68	57.54	57.54	57.93	115.64	75.01	63.39
Ga	15.34	12.92	19.38	19.38	19.30	19.90	17.23	18.36
As	0.49	0.43	0.74	0.74	0.37	0.29	0.32	0.34
Rb	8.85	8.17	58.32	58.32	64.67	81.48	98.06	50.70
Sr	525.43	628.82	515.69	515.69	507.42	586.67	598.70	235.90
Y	21.53	6.86	17.94	17.94	16.32	16.74	22.22	15.99
Zr	91.46	110.75	142.30	142.30	130.37	143.95	137.69	126.93
Nb	4.92	5.33	9.78	9.78	9.32	9.74	11.65	10.95
Ba	25.51	100.37	478.06	478.06	475.44	670.51	721.81	581.48
Sn	0.82	0.98	0.84	0.84	1.25	1.19	1.66	1.33
Cs	2.91	3.07	1.85	1.85	2.57	2.19	3.08	1.31
La	21.15	18.91	27.44	27.44	27.07	27.66	29.22	27.24
Ce	23.82	37.42	58.27	58.27	58.17	55.95	57.35	51.68
Pr	4.93	4.11	6.99	6.99	6.86	6.97	6.96	6.11
Nd	18.02	14.58	26.31	26.31	26.29	26.12	25.92	22.90
Sm	3.58	2.48	5.20	5.20	4.89	5.13	5.48	4.45
Eu	1.13	0.63	1.46	1.46	1.44	1.47	1.49	1.21
Gd	3.60	2.44	4.97	4.97	4.58	4.78	5.49	4.37
Tb	0.59	0.30	0.67	0.67	0.60	0.63	0.78	0.58
Dy	3.72	1.41	3.58	3.58	3.12	3.24	4.31	3.11
Ho	0.76	0.24	0.67	0.67	0.58	0.60	0.82	0.59
Er	1.98	0.65	1.82	1.82	1.56	1.62	2.17	1.60
Tm	0.29	0.09	0.26	0.26	0.23	0.24	0.33	0.24
Yb	1.82	0.56	1.62	1.62	1.40	1.46	1.99	1.44
Lu	0.27	0.08	0.24	0.24	0.21	0.22	0.29	0.22
Hf	2.31	2.90	3.67	3.67	3.33	3.62	3.59	3.28
Ta	0.26	0.33	0.68	0.68	0.64	0.85	1.18	0.91
W	0.92	0.27	0.42	0.42	0.55	0.48	0.53	0.39
Pb	2.41	2.93	10.89	10.89	15.06	11.56	10.30	9.06
Th	2.66	2.93	3.74	3.74	3.52	3.78	4.16	3.58
U	1.86	2.00	1.79	1.79	1.80	1.89	1.50	1.58

** n.d. = not detected. All trace and rare earth element concentrations in ppm (unless stated otherwise).*

Appendix 4:

Appendix 4: Mineral Chemistry

4A: Electron microprobe analyses (EMPA) data for mineral constituents of target rocks

4B: EMPA data for lithic and mineral fragments enclosed in impactites

4C: X-ray diffraction (XRD) profiles

4D: Melt particle traverses

Appendix 4A: Electron microprobe analyses of albite in sample M4 GG-1.

M4 -GG1 (126.5 m)														
(wt.%)	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C4_P1	62.15	0.02	21.72	0.08	0	0	3.85	8.72	0.76	0	0	0.01	0	**97.33**
C4_P2	62.34	0	22.26	0.13	0.01	0	4.29	8.74	0.65	0	0	0	0	**98.43**
C4_P3	62.81	0	22.09	0.08	0	0.01	4.16	8.8	0.73	0	0.01	0.07	0	**98.77**
C4_P4	62.37	0.03	22.4	0.07	0	0.01	4.33	8.58	0.72	0.03	0	0.04	0	**98.56**
C4_P6	62.31	0	22	0.08	0	0	4.14	8.73	0.61	0	0	0.06	0.03	**97.95**
C4_P7	62.84	0.05	22.37	0.06	0	0.05	3.98	8.78	0.83	0	0.01	0	0	**98.97**
C4_P8	62.23	0	22.25	0.03	0.02	0	4.18	8.63	0.62	0.03	0	0.02	0.01	**98.01**
C2_P1	62.97	0.03	22.22	0.12	0	0.01	4.27	8.56	0.81	0.02	0.02	0	0.03	**99.06**
C2_P2	62.69	0.01	22.31	0.11	0	0	4.18	8.74	0.72	0	0.01	0	0.01	**98.77**
C2_P3	62.97	0.01	22.33	0.11	0.01	0.01	4.1	8.73	0.67	0.01	0	0.13	0	**99.08**
C2_P4	63.21	0.04	22.44	0.15	0	0	4.1	8.88	0.63	0	0	0	0	**99.46**
C2_P5	63.16	0	22.22	0.1	0	0.01	4.08	8.73	0.77	0	0.05	0	0	**99.11**
C3_P1	62.25	0	22.24	0.13	0.01	0.01	4.37	8.59	0.71	0	0	0.04	0	**98.35**
C3_P2	62.43	0.03	22.7	0.16	0.01	0.01	4.37	8.72	0.6	0.01	0	0.02	0	**99.06**
C3_P3	61.95	0.01	22.3	0.15	0	0.03	4.42	8.54	0.82	0	0	0	0	**98.22**
C3_P4	62.36	0	22.6	0.16	0	0.01	4.56	8.39	0.94	0.05	0.02	0.01	0	**99.09**
C3_P5	62.16	0.05	22.24	0.16	0.01	0.01	4.46	8.51	0.78	0.05	0.01	0	0	**98.43**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 GG-2.

M4 GG-2	**(131.90 m)**													
(wt.%)	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C4_P_1	65.41	0.00	21.26	0.06	0.00	0.01	2.57	9.38	0.81	0.02	0.01	0.00	0.00	**99.53**
C4_P_2	69.23	0.01	19.24	0.06	0.00	0.02	0.33	10.92	0.25	0.00	0.00	0.00	0.05	**100.11**
C4_P_3	68.09	0.00	19.57	0.01	0.00	0.02	0.57	10.99	0.31	0.03	0.04	0.04	0.01	**99.69**
C4_P_4	64.31	0.01	21.68	0.05	0.00	0.00	3.66	9.12	0.68	0.01	0.00	0.00	0.03	**99.54**
C4_P_5	63.77	0.02	22.03	0.02	0.00	0.00	3.65	8.87	0.85	0.00	0.00	0.00	0.00	**99.20**
C4 P_1	69.44	0.00	19.49	0.02	0.00	0.00	0.64	10.91	0.31	0.00	0.01	0.03	0.00	**100.86**
C4_ P_2	64.66	0.00	21.55	0.04	0.01	0.01	2.97	9.88	0.24	0.02	0.00	0.05	0.00	**99.42**
C4_P_3	66.75	0.00	21.76	0.02	0.04	0.01	3.27	8.53	0.30	0.00	0.01	0.00	0.03	**100.72**
C4 P_4	67.14	0.00	20.16	0.07	0.00	0.03	1.35	10.49	0.55	0.02	0.00	0.01	0.00	**99.83**
C3_F_1	66.15	0.00	20.35	0.04	0.03	0.01	1.61	10.12	0.62	0.00	0.00	0.00	0.00	**98.93**
C3_F_2	68.12	0.02	19.23	0.03	0.01	0.03	0.52	11.29	0.63	0.03	0.04	0.03	0.03	**100.02**
C1_1	68.01	0.00	18.72	0.05	0.00	0.01	0.30	10.24	1.46	0.06	0.00	0.03	0.00	**98.87**
C1_2	67.71	0.01	19.49	0.05	0.00	0.02	0.47	11.00	0.40	0.01	0.00	0.01	0.00	**99.17**
C1_3	67.85	0.02	19.09	0.00	0.00	0.01	0.57	10.95	0.42	0.04	0.00	0.02	0.00	**98.98**
C1_4	63.51	0.01	22.37	0.03	0.01	0.00	4.06	8.83	0.44	0.00	0.00	0.00	0.00	**99.26**
C1_5	63.68	0.00	22.15	0.02	0.00	0.00	3.91	8.87	0.52	0.00	0.01	0.00	0.02	**99.18**
C1_C _6	63.52	0.00	21.63	0.03	0.00	0.02	3.41	8.25	1.77	0.00	0.00	0.07	0.03	**98.72**
C1_F_1	68.10	0.01	19.12	0.01	0.00	0.01	0.44	10.96	0.34	0.00	0.01	0.03	0.02	**99.05**
C1_F _2	68.35	0.01	19.36	0.02	0.01	0.03	0.36	11.02	0.39	0.03	0.00	0.06	0.00	**99.65**
C1_F_3	66.16	0.02	20.24	0.04	0.00	0.00	2.02	9.67	0.93	0.01	0.00	0.06	0.00	**99.15**
C1_F_4	64.57	0.03	21.26	0.04	0.01	0.01	2.87	9.48	0.60	0.01	0.00	0.00	0.00	**98.90**
C1_ F_5	64.99	0.02	20.39	0.00	0.00	0.00	2.20	9.58	0.71	0.00	0.00	0.00	0.00	**97.90**
C1_F_6	63.23	0.01	21.92	0.02	0.00	0.01	3.74	8.94	0.68	0.03	0.02	0.00	0.02	**98.60**
C1_1	63.50	0.00	21.94	0.05	0.01	0.02	3.87	8.70	0.96	0.05	0.00	0.05	0.00	**99.14**
C1_2	63.46	0.03	21.92	0.05	0.00	0.01	3.92	8.50	0.93	0.01	0.00	0.04	0.00	**98.88**
C1_Micr_1	64.75	0.01	22.19	0.01	0.00	0.01	3.70	9.13	0.45	0.00	0.00	0.00	0.03	**100.29**

C1_Micr_2	64.36	0.02	21.61	0.01	0.00	0.00	3.50	8.78	0.93	0.04	0.00	0.02	0.04	**99.32**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 GG-6.

M4 GG-6	**(depth: 149.24 m)**													
(wt.%)	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C2_Core to Rim_1	67.42	0.01	19.47	0.02	0.00	0.00	0.74	10.82	0.37	0.03	0.01	0.00	0.00	**98.88**
C2_Core to Rim_2	68.19	0.01	19.46	0.04	0.00	0.01	0.71	10.80	0.32	0.00	0.01	0.00	0.00	**99.55**
C2_Core to Rim_4	62.39	0.05	17.52	1.64	0.01	0.00	0.46	8.66	1.57	0.00	0.00	0.00	0.02	**92.34**
C2_Core to Rim_5	66.94	0.02	19.03	0.03	0.00	0.10	0.45	11.03	0.20	0.01	0.00	0.02	0.00	**97.82**
C2_Core to Rim_6	66.17	0.00	20.91	0.01	0.01	0.01	2.41	9.92	0.30	0.05	0.03	0.00	0.00	**99.83**
C2_Core to Rim_7	65.46	0.00	21.15	0.01	0.02	0.01	2.61	9.76	0.25	0.00	0.00	0.00	0.00	**99.27**
C2_Core to Rim_8	64.15	0.02	21.72	0.04	0.01	0.00	3.98	9.39	0.51	0.03	0.00	0.00	0.00	**99.85**
C2_Core to Rim_9	66.24	0.03	20.46	0.05	0.00	0.00	1.90	10.12	0.14	0.02	0.00	0.00	0.00	**98.97**
C2_Core to Rim_10	69.17	0.00	19.06	0.03	0.00	0.02	0.24	11.23	0.13	0.00	0.02	0.00	0.00	**99.90**
C2_P1	68.69	0.02	19.20	0.04	0.02	0.00	0.24	11.05	0.14	0.02	0.03	0.03	0.00	**99.47**
C4_P1	69.78	0.00	18.99	0.02	0.00	0.00	0.24	10.93	0.10	0.00	0.03	0.00	0.00	**100.10**
C4_P2	68.06	0.00	18.92	0.02	0.00	0.03	0.23	11.05	0.16	0.04	0.01	0.00	0.00	**98.52**
C4_P3	69.04	0.01	18.89	0.05	0.00	0.00	0.22	11.14	0.16	0.00	0.00	0.00	0.03	**99.52**
C4_P4	67.26	0.00	18.89	0.01	0.00	0.01	0.20	11.16	0.19	0.00	0.02	0.03	0.00	**97.76**
C5_Per_1	65.44	0.00	20.99	0.02	0.02	0.00	2.57	9.94	0.13	0.00	0.00	0.00	0.00	**99.11**
C5_Per_2	65.88	0.03	21.10	0.00	0.00	0.01	2.82	10.04	0.27	0.00	0.04	0.04	0.00	**100.24**
C5_Per_3	65.03	0.02	19.80	0.05	0.00	0.01	1.72	10.67	0.23	0.01	0.00	0.06	0.01	**97.60**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 GG-7.

M4 GG-7	**(depth: 150.58 m)**													
(wt.%)	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C4_P_1	64.01	0.03	21.84	0.09	0.00	0.01	3.87	9.07	0.59	0.03	0.00	0.00	0.01	**99.56**
C4_P_2	67.58	0.02	19.88	0.05	0.01	0.00	1.46	10.50	0.61	0.00	0.01	0.00	0.03	**100.16**
C4_P_3	64.12	0.00	21.81	0.06	0.01	0.02	3.75	9.10	0.44	0.02	0.00	0.09	0.00	**99.42**
C4_P_4	65.78	0.03	20.85	0.03	0.00	0.00	2.66	9.99	0.28	0.00	0.00	0.00	0.03	**99.66**
C4_P_5	64.05	0.02	21.94	0.03	0.01	0.01	3.90	8.91	0.69	0.00	0.04	0.00	0.02	**99.62**
C4_P_ 1	68.56	0.00	19.64	0.02	0.00	0.01	0.62	10.95	0.48	0.03	0.00	0.00	0.02	**100.33**
C4_P_ 2	67.83	0.03	19.09	0.04	0.00	0.00	0.36	11.01	0.52	0.02	0.01	0.01	0.03	**98.94**
C4_P_3	68.66	0.01	19.17	0.04	0.00	0.00	0.57	10.88	0.60	0.02	0.02	0.01	0.02	**100.00**
C4_P_6	68.03	0.00	20.16	0.03	0.00	0.00	1.17	10.57	0.27	0.02	0.00	0.03	0.01	**100.30**
C4_P_7	68.62	0.00	19.06	0.02	0.00	0.01	0.52	10.94	0.27	0.06	0.00	0.01	0.01	**99.51**
C4_P_8	68.88	0.01	19.16	0.05	0.03	0.01	0.34	11.05	0.41	0.01	0.03	0.00	0.02	**100.00**
C4_P_4	69.06	0.01	19.21	0.04	0.00	0.00	0.31	11.16	0.48	0.03	0.00	0.01	0.00	**100.31**
C4_P_5	67.63	0.04	18.91	0.00	0.00	0.00	0.20	11.02	0.48	0.00	0.00	0.00	0.00	**98.28**
P_ 6	68.14	0.02	18.95	0.06	0.01	0.00	0.32	11.14	0.34	0.03	0.00	0.00	0.00	**99.03**
C4_P_9	63.86	0.00	22.25	0.04	0.00	0.00	3.97	9.00	0.55	0.03	0.01	0.00	0.00	**99.70**
C4_P_10	68.37	0.01	19.26	0.00	0.00	0.00	0.62	11.02	0.20	0.00	0.00	0.03	0.02	**99.53**
C4_P_11	65.55	0.00	22.03	0.05	0.00	0.01	3.43	9.31	0.47	0.01	0.00	0.00	0.03	**100.90**
C4_F_1	67.51	0.00	19.94	0.01	0.02	0.00	1.64	10.37	0.33	0.00	0.00	0.00	0.03	**99.84**
C4_F_2	63.79	0.00	22.34	0.00	0.00	0.00	4.06	9.00	0.41	0.00	0.03	0.00	0.00	**99.64**
C4_F_3	64.44	0.04	21.71	0.00	0.02	0.01	3.53	9.10	0.39	0.02	0.00	0.00	0.00	**99.26**
C4_F_5	66.76	0.00	20.02	0.01	0.01	0.00	1.38	10.48	0.16	0.02	0.01	0.00	0.00	**98.84**
C4_F_4	66.82	0.01	18.77	0.02	0.03	0.00	0.49	10.87	0.43	0.02	0.00	0.01	0.02	**97.48**
C2_M_4	69.14	0.00	19.07	0.03	0.00	0.01	0.18	11.27	0.14	0.00	0.00	0.00	0.00	**99.84**
C3_F_2	69.86	0.00	18.95	0.05	0.02	0.01	0.18	11.38	0.15	0.00	0.02	0.01	0.00	**100.65**
C3_F_3	68.89	0.00	19.34	0.06	0.02	0.00	0.16	11.24	0.12	0.00	0.02	0.00	0.02	**99.87**
C3_F_6	63.23	0.00	22.15	0.02	0.00	0.14	3.72	9.18	0.29	0.00	0.02	0.04	0.05	**98.84**
C4_Per_10	68.52	0.03	19.26	0.05	0.01	0.01	0.46	11.12	0.61	0.00	0.01	0.01	0.01	**100.11**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 GG-10.

M4 GG-10	(depth: 165.98 m)													
(wt.%)	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
C6_F_ _1	67.07	0.03	18.63	0.10	0.02	0.01	0.53	10.96	0.42	0.02	0.05	0.05	0.00	**97.88**
C6_F_CR2	66.40	0.03	18.30	0.16	0.02	0.42	0.35	10.93	0.45	0.00	0.00	0.00	0.00	**97.06**
C6_F_ _3	66.85	0.00	20.04	0.14	0.00	0.03	1.13	10.30	0.56	0.00	0.00	0.00	0.00	**99.05**
C6_F_ _4	68.00	0.00	18.89	0.08	0.00	0.06	0.43	10.98	0.31	0.00	0.00	0.02	0.00	**98.78**
C6_F_ _5	67.98	0.00	19.11	0.03	0.00	0.00	0.51	10.70	0.69	0.03	0.00	0.01	0.00	**99.07**
C6_F_8	68.80	0.00	19.30	0.00	0.00	0.00	0.42	10.65	0.79	0.00	0.00	0.00	0.02	**99.99**
C5_P_1	67.32	0.01	19.29	0.07	0.00	0.02	0.67	10.62	0.40	0.03	0.00	0.03	0.01	**98.46**
C5_P_2	67.39	0.01	19.26	0.08	0.00	0.02	0.86	10.48	0.35	0.03	0.00	0.02	0.03	**98.52**
C5_P_3	67.27	0.03	19.17	0.05	0.00	0.00	0.69	10.58	0.37	0.00	0.01	0.02	0.00	**98.19**
C3_F_P_4	65.59	0.04	18.59	0.06	0.00	0.00	0.80	10.72	0.32	0.03	0.00	0.00	0.00	**96.16**
C3_F_P_5	67.50	0.02	19.53	0.10	0.00	0.00	0.92	10.60	0.36	0.00	0.01	0.01	0.00	**99.04**
C3_F_P_1	66.75	0.00	19.71	0.05	0.00	0.02	1.21	10.39	0.57	0.04	0.00	0.00	0.00	**98.73**
C3_F_P_2	64.77	0.03	20.09	0.45	0.02	0.05	2.47	9.52	0.76	0.00	0.00	0.04	0.00	**98.21**
C3_F_P_3	65.59	0.01	19.60	0.14	0.00	0.06	1.50	9.84	0.71	0.02	0.00	0.03	0.00	**97.51**
C4_P_1	64.66	0.01	18.94	0.11	0.00	0.00	1.31	10.26	0.80	0.00	0.00	0.03	0.00	**96.13**
C4_P_2	67.03	0.00	19.45	0.03	0.00	0.00	0.88	9.13	2.27	0.03	0.03	0.22	0.00	**99.07**
C4_P_3	67.24	0.00	20.43	0.06	0.00	0.01	1.57	10.18	0.56	0.00	0.00	0.00	0.00	**100.06**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 IS-1.

M4 IS-1	(depth: 221.2 m													
(wt.%)	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
C3_P_4	68.37	0.00	19.62	0.06	0.00	0.00	1.68	9.96	0.24	0.00	0.01	0.00	0.01	**99.96**
C3_P_6	66.54	0.04	19.13	0.05	0.03	0.00	1.44	10.29	0.06	0.06	0.00	0.01	0.00	**97.65**
C3_P_7	68.57	0.00	19.93	0.04	0.01	0.00	0.93	10.68	0.16	0.02	0.03	0.00	0.02	**100.39**
C1_P_1	68.02	0.00	19.49	0.17	0.01	0.00	1.20	10.59	0.19	0.00	0.00	0.00	0.00	**99.67**
C1_P_2	67.78	0.00	19.40	0.13	0.01	0.02	0.99	10.53	0.19	0.00	0.00	0.02	0.00	**99.08**
C2_P_1	67.23	0.00	19.16	0.14	0.02	0.00	0.97	10.75	0.21	0.00	0.01	0.00	0.00	**98.48**
C2_P_2	66.94	0.00	19.19	0.22	0.00	0.01	0.91	10.48	0.14	0.00	0.00	0.09	0.00	**97.98**
C1_P_3	63.90	0.01	22.15	0.23	0.00	0.01	3.10	9.43	0.09	0.00	0.00	0.00	0.00	**98.91**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 FZ-1.

M4 FZ-1	(depth: 249.62 m)													
(wt.%)	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
C1_P1	67.09	0.07	20.26	0.03	0.00	0.01	1.03	10.98	0.28	0.00	0.00	0.01	0.01	**99.75**
C1_P3	67.44	0.02	20.65	0.05	0.01	0.02	1.34	11.02	0.34	0.00	0.00	0.00	0.00	**100.89**
C1_P4	66.71	0.00	20.87	0.05	0.01	0.01	1.96	10.21	0.30	0.03	0.03	0.14	0.00	**100.31**
C1_P5	67.58	0.00	20.03	0.06	0.00	0.02	0.97	11.21	0.28	0.00	0.00	0.00	0.00	**100.15**
C1_P6	68.69	0.00	20.07	0.07	0.03	0.00	0.89	11.16	0.25	0.00	0.00	0.01	0.00	**101.16**
C2_P2	64.68	0.03	19.90	0.06	0.00	0.03	1.85	10.43	0.24	0.00	0.01	0.00	0.00	**97.22**
C2_P3	66.27	0.04	20.47	0.09	0.00	0.02	1.79	10.38	0.28	0.00	0.02	0.00	0.00	**99.37**
C3_P1	63.87	0.00	21.76	0.04	0.00	0.01	3.61	9.43	0.33	0.02	0.01	0.00	0.00	**99.09**
C3_P2	63.52	0.00	22.40	0.02	0.01	0.00	3.75	9.37	0.28	0.00	0.00	0.03	0.00	**99.39**
C3_P3	64.85	0.00	18.91	0.03	0.01	0.03	0.73	12.65	0.28	0.03	0.00	0.02	0.00	**97.55**
C4_P1	65.74	0.00	20.45	0.07	0.00	0.00	1.89	10.29	0.29	0.00	0.00	0.04	0.00	**98.77**
C4_P2	64.30	0.00	22.29	0.06	0.00	0.00	3.82	9.14	0.29	0.03	0.01	0.01	0.02	**99.97**
C4_P3	66.42	0.01	20.47	0.03	0.01	0.01	1.48	10.80	0.24	0.00	0.00	0.01	0.01	**99.50**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 SILL-1.

M4 SILL-1	(depth: 268.3)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
53.61	0.21	23.87	7.16	0.01	0.51	8.26	5.58	0.46	0.07	0.00	0.05	0.00	**99.78**
52.28	0.07	28.99	0.71	0.02	0.07	13.28	4.02	0.16	0.00	0.00	0.03	0.00	**99.63**
53.68	0.05	28.19	0.76	0.00	0.06	12.26	4.47	0.24	0.02	0.00	0.00	0.02	**99.75**
53.34	0.09	26.51	3.16	0.04	0.17	10.78	4.72	0.21	0.00	0.01	0.00	0.00	**99.02**
53.36	0.05	27.96	0.74	0.00	0.09	12.45	4.43	0.25	0.02	0.00	0.00	0.00	**99.34**
52.38	0.05	28.07	0.71	0.03	0.11	12.79	4.21	0.19	0.01	0.00	0.00	0.00	**98.56**
53.15	0.05	28.16	0.79	0.00	0.08	12.56	4.38	0.26	0.00	0.01	0.06	0.00	**99.48**
53.89	0.06	26.58	0.80	0.01	0.28	11.10	4.91	0.30	0.02	0.01	0.03	0.02	**98.02**
52.92	0.05	28.32	0.78	0.02	0.07	12.57	4.21	0.26	0.03	0.03	0.00	0.00	**99.27**
52.77	0.05	28.02	0.76	0.00	0.11	12.79	4.16	0.23	0.05	0.00	0.00	0.04	**98.98**
52.97	0.05	28.49	0.78	0.00	0.08	12.64	4.16	0.17	0.00	0.03	0.06	0.04	**99.45**
52.96	0.06	28.02	0.79	0.01	0.07	12.53	4.16	0.28	0.03	0.00	0.00	0.00	**98.91**
54.00	0.05	26.76	0.74	0.01	0.09	11.41	4.92	0.32	0.01	0.00	0.00	0.05	**98.37**
54.12	0.07	26.98	0.73	0.00	0.10	11.44	4.80	0.30	0.00	0.00	0.04	0.00	**98.59**
54.01	0.05	27.30	0.79	0.01	0.29	11.71	4.50	0.24	0.02	0.01	0.04	0.02	**98.99**
54.53	0.02	27.22	0.73	0.00	0.08	11.75	4.77	0.20	0.04	0.00	0.04	0.00	**99.37**
54.41	0.04	27.43	0.66	0.03	0.06	11.34	4.74	0.21	0.00	0.01	0.02	0.00	**98.95**
53.98	0.03	27.64	0.66	0.02	0.08	11.98	4.62	0.26	0.00	0.00	0.00	0.00	**99.27**
52.63	0.01	27.79	0.72	0.00	0.11	12.24	4.28	0.22	0.05	0.02	0.03	0.00	**98.10**
51.15	0.05	22.43	4.31	0.04	0.68	8.11	5.25	1.09	0.31	0.03	0.06	0.00	**93.51**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of albite in sample M4 AM-1.

M4 AM-1	(depth: 340.7 m)													
(wt.%)	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C1_P1	65.78	0.04	20.43	0.12	0.01	0.03	1.92	10.18	0.39	0.04	0.00	0.00	0.00	**98.94**
C1_P2	67.38	0.00	19.55	0.06	0.02	0.00	0.46	11.05	0.36	0.01	0.00	0.00	0.00	**98.88**
C1_P3	66.99	0.00	19.32	0.10	0.00	0.00	0.46	11.01	0.44	0.00	0.02	0.00	0.00	**98.35**
C1_P4	65.31	0.00	20.45	0.07	0.00	0.00	1.74	10.16	0.26	0.00	0.00	0.01	0.04	**98.04**
C1_P5	65.37	0.01	19.57	0.05	0.00	0.00	1.01	10.68	0.47	0.00	0.00	0.03	0.00	**97.19**
C2_F_1	68.04	0.00	19.32	0.08	0.00	0.01	0.72	9.93	1.90	0.06	0.02	0.00	0.00	**100.10**
C2_F_2	67.03	0.01	20.06	0.07	0.04	0.00	0.99	10.40	0.60	0.00	0.02	0.00	0.00	**99.23**
C2_F_3	67.11	0.00	19.63	0.03	0.02	0.00	0.89	10.75	0.56	0.00	0.00	0.00	0.00	**99.00**
C2_P_1	67.53	0.00	19.73	0.05	0.00	0.02	0.54	11.09	0.35	0.03	0.00	0.00	0.00	**99.35**
C2_P_3	64.94	0.01	21.01	0.13	0.00	0.00	2.23	9.94	0.58	0.00	0.01	0.00	0.01	**98.85**
C5_F_1	67.61	0.02	19.64	0.14	0.01	0.00	0.37	11.13	0.29	0.03	0.00	0.00	0.00	**99.23**
C5_F_2	68.28	0.03	19.36	0.22	0.00	0.08	0.46	11.04	0.43	0.00	0.00	0.00	0.00	**99.90**
C5_F_3	67.24	0.00	19.88	0.16	0.01	0.05	0.81	10.67	0.58	0.00	0.00	0.00	0.00	**99.39**
C5_P_1	68.46	0.00	19.12	0.12	0.00	0.00	0.15	11.13	0.59	0.04	0.00	0.00	0.03	**99.64**
C5_P_2	67.93	0.01	19.18	0.05	0.00	0.00	0.11	11.25	0.29	0.00	0.02	0.00	0.00	**98.85**
C5_P_3	67.89	0.02	19.07	0.07	0.00	0.00	0.32	11.10	0.31	0.01	0.02	0.00	0.00	**98.83**
C4_F_C3	66.61	0.00	19.96	0.13	0.00	0.01	1.46	10.25	0.46	0.00	0.00	0.00	0.00	**98.88**
C4_F_C4	65.97	0.01	20.54	0.11	0.00	0.01	1.56	10.37	0.38	0.01	0.00	0.02	0.02	**99.01**
C4_F_C5	63.85	0.00	18.63	2.79	0.00	0.97	1.27	9.46	1.76	0.05	0.01	0.04	0.00	**98.84**
C3_P_1	63.12	0.01	22.36	0.11	0.02	0.01	4.13	8.97	0.27	0.04	0.01	0.04	0.01	**99.08**
C3_P_2	63.56	0.01	22.29	0.06	0.01	0.00	4.13	8.93	0.36	0.04	0.01	0.12	0.04	**99.56**
C3_P_3	62.68	0.00	22.44	0.13	0.03	0.01	4.31	8.90	0.43	0.00	0.00	0.00	0.00	**98.93**
C6_P_1	63.19	0.01	22.59	0.07	0.00	0.00	4.26	9.00	0.45	0.00	0.01	0.01	0.00	**99.61**
C6_P_2	63.02	0.00	22.60	0.11	0.00	0.00	4.17	8.93	0.41	0.00	0.00	0.00	0.00	**99.23**
C6_P_3	62.83	0.00	22.50	0.07	0.00	0.00	4.24	8.88	0.40	0.00	0.00	0.04	0.00	**98.95**
C6_F_1	66.81	0.01	19.90	0.07	0.03	0.00	0.83	10.53	0.42	0.05	0.03	0.00	0.00	**98.69**
C6_F_3	67.20	0.00	19.74	0.01	0.03	0.01	0.59	10.88	0.38	0.02	0.01	0.03	0.04	**98.94**
C6_F_4	66.94	0.02	19.81	0.06	0.00	0.00	1.08	10.52	0.38	0.00	0.00	0.04	0.00	**98.86**
C4_F1_R3	69.38	0.04	20.02	0.24	0.00	0.11	0.60	10.46	0.63	0.00	0.00	0.02	0.02	**101.51**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of alkali feldspar in sample M4 GG-2.

M4 GG-2	(depth: 131.90 m)													
Albite	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C1_Per_1	64.06	0.00	17.69	0.05	0.08	0.01	0.01	1.14	14.75	0.00	0.00	0.38	0.00	**98.18**
C1_Per_2	64.00	0.00	17.97	0.04	0.05	0.02	0.00	1.05	14.80	0.04	0.00	0.46	0.00	**98.44**
C1_Per_3	64.82	0.02	17.92	0.17	0.00	0.01	0.00	1.14	14.28	0.00	0.00	0.33	0.01	**98.70**
C1_Per_4	64.55	0.03	18.29	0.05	0.00	0.01	0.02	1.09	14.90	0.00	0.00	0.42	0.00	**99.36**
C1_Per_5	64.90	0.01	17.79	0.00	0.00	0.01	0.00	1.62	14.22	0.04	0.00	0.21	0.00	**98.80**
C1_Per_6	63.06	0.00	17.61	0.10	0.00	0.01	0.06	1.08	14.49	0.02	0.00	0.51	0.03	**96.97**
C2_Per_1	64.18	0.03	17.86	0.02	0.00	0.00	0.00	1.23	14.50	0.05	0.00	0.46	0.00	**98.32**
C2_Per_2	64.10	0.02	18.13	0.03	0.01	0.01	0.00	1.09	14.78	0.00	0.01	0.60	0.00	**98.79**
C1_P_1	65.01	0.01	18.02	0.07	0.00	0.00	0.03	1.01	14.77	0.05	0.00	0.38	0.00	**99.35**
C1_P_2	65.04	0.03	18.15	0.05	0.01	0.00	0.00	1.05	14.96	0.00	0.00	0.33	0.00	**99.62**
C1_P_3	65.10	0.01	18.09	0.01	0.02	0.01	0.00	1.09	14.82	0.00	0.00	0.40	0.00	**99.56**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of alkali feldspar in sample M4 GG-6.

M4 GG-6	(depth: 149.24 m)													
	SiO_2	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
C2_3	63.79	0.00	18.07	0.04	0.00	0.02	0.09	1.23	14.70	0.05	0.00	0.27	0.00	**98.27**
C3_P1	64.58	0.02	18.22	0.03	0.00	0.01	0.07	1.13	14.59	0.02	0.01	0.47	0.01	**99.17**
C3_P2	63.80	0.00	17.53	0.05	0.00	0.00	0.02	1.00	14.47	0.00	0.00	0.32	0.00	**97.20**
C3_P3	63.05	0.00	17.59	0.02	0.00	0.00	0.05	1.01	14.53	0.00	0.01	0.25	0.00	**96.52**
C3_P4	64.81	0.00	17.97	0.05	0.00	0.02	0.15	4.47	9.85	0.00	0.00	0.25	0.00	**97.58**
C3_F1	64.37	0.01	18.14	0.04	0.00	0.01	0.23	3.76	10.42	0.00	0.02	0.22	0.03	**97.25**
C3_F2	63.99	0.00	17.98	0.02	0.00	0.02	0.27	1.92	13.30	0.00	0.00	0.56	0.00	**98.06**
C3_F3	63.79	0.03	18.03	0.02	0.03	0.00	0.16	1.66	13.94	0.00	0.00	0.44	0.00	**98.09**
C4_P4	63.50	0.03	17.36	0.04	0.00	0.00	0.01	1.03	14.90	0.00	0.00	0.28	0.03	**97.17**
C4_P5	63.62	0.00	17.74	0.04	0.00	0.00	0.00	1.00	14.69	0.00	0.00	0.35	0.01	**97.46**
C5_P1	61.13	0.03	16.87	0.03	0.00	0.01	0.09	0.83	14.86	0.00	0.00	0.40	0.00	**94.24**
C5_P2	64.53	0.01	18.09	0.05	0.00	0.01	0.06	1.20	14.65	0.02	0.00	0.48	0.00	**99.10**
C5_P3	59.91	0.04	16.32	0.02	0.00	0.01	0.08	1.49	12.92	0.00	0.02	0.31	0.02	**91.14**
C5_4	62.57	0.00	17.27	0.04	0.02	0.00	0.07	1.01	14.13	0.00	0.00	0.34	0.03	**95.49**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of alkali feldspar in sample M4 GG-7.

M4 GG-7	(depth: 150.58 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
64.42	0.00	17.96	0.06	0.03	0.00	0.01	1.09	15.12	0.01	0.00	0.25	0.00	**98.95**
64.91	0.04	18.05	0.05	0.01	0.01	0.00	1.13	14.72	0.03	0.00	0.33	0.02	**99.31**
64.13	0.00	17.92	0.03	0.02	0.00	0.03	0.92	14.91	0.02	0.00	0.31	0.00	**98.28**
64.48	0.00	17.67	0.04	0.01	0.00	0.01	1.05	15.05	0.02	0.00	0.27	0.03	**98.63**
64.33	0.00	17.86	0.05	0.00	0.00	0.05	0.92	15.01	0.02	0.00	0.26	0.00	**98.50**
64.92	0.00	18.06	0.06	0.01	0.00	0.01	0.87	15.16	0.00	0.00	0.39	0.00	**99.47**
64.13	0.00	17.64	0.10	0.02	0.01	0.04	0.89	14.88	0.00	0.03	0.42	0.02	**98.18**
63.47	0.03	17.60	0.02	0.00	0.01	0.01	0.91	14.95	0.00	0.00	0.43	0.00	**97.45**
64.66	0.05	17.74	0.02	0.01	0.01	0.07	0.92	15.01	0.01	0.02	0.33	0.00	**98.86**
64.44	0.03	17.85	0.00	0.00	0.00	0.00	0.87	15.20	0.04	0.00	0.38	0.00	**98.81**
68.07	0.00	18.62	0.04	0.00	0.02	0.11	7.14	5.98	0.04	0.02	0.13	0.00	**100.17**
64.99	0.00	17.90	0.06	0.00	0.03	0.00	1.23	14.81	0.00	0.00	0.31	0.00	**99.32**
65.42	0.00	18.07	0.01	0.00	0.00	0.00	1.15	14.74	0.02	0.00	0.35	0.00	**99.76**
64.45	0.00	18.13	0.01	0.00	0.02	0.03	1.75	13.94	0.04	0.00	0.28	0.00	**98.65**
65.05	0.00	18.00	0.06	0.00	0.00	0.01	1.10	14.61	0.02	0.04	0.40	0.00	**99.28**
65.20	0.00	18.02	0.02	0.00	0.01	0.00	0.96	14.85	0.01	0.00	0.29	0.00	**99.35**
63.6	0.02	17.66	0.01	0	0.01	0.11	0.92	14.52	0	0	0.26	0	**97.11**
62.99	0.03	17.53	0.05	0.01	0	0.04	0.97	15.02	0.04	0	0.28	0.01	**96.97**
64.2	0	18.02	0.04	0.02	0.01	0.05	0.99	14.89	0.02	0	0.23	0	**98.47**
65.44	0.02	18.31	0.05	0	0	0.05	0.97	15.08	0	0	0.23	0	**100.15**
65.21	0.04	18.56	0.06	0.03	0.01	0.08	1.28	14.78	0	0.03	0.31	0	**100.39**
64.39	0.02	17.76	0.05	0.01	0	0.01	1.04	15.01	0	0	0.34	0.05	**98.68**
64.85	0	18	0.06	0.02	0	0.03	1.03	15.06	0.04	0	0.3	0	**99.38**
63.42	0.00	17.18	0.33	0.02	0.00	0.04	1.03	14.59	0.01	0.00	0.43	0.03	**97.09**
65.52	0.03	18.30	0.00	0.00	0.00	0.05	1.21	14.66	0.00	0.00	0.33	0.02	**100.13**
65.31	0.01	18.07	0.19	0.02	0.01	0.09	2.16	12.85	0.00	0.00	0.42	0.01	**99.13**
65.22	0.02	18.30	0.00	0.00	0.01	0.00	0.93	15.22	0.00	0.00	0.31	0.02	**100.02**
64.98	0.00	17.84	0.02	0.00	0.00	0.01	0.99	15.01	0.00	0.02	0.34	0.03	**99.26**
65.51	0.00	18.41	0.04	0.02	0.00	0.04	2.28	13.41	0.02	0.00	0.41	0.01	**100.15**
64.30	0.03	17.87	0.02	0.00	0.00	0.02	0.87	15.28	0.03	0.01	0.42	0.00	**98.86**
61.69	0.00	16.96	0.00	0.00	0.01	0.08	0.81	15.24	0.00	0.00	0.33	0.03	**95.15**
62.94	0.03	17.23	0.07	0.00	0.00	0.04	0.77	14.66	0.00	0.00	0.34	0.00	**96.06**
64.11	0.01	17.62	0.03	0.00	0.01	0.02	1.01	14.94	0.00	0.00	0.31	0.00	**98.07**
64.52	0.04	17.61	0.01	0.00	0.01	0.04	0.93	15.30	0.00	0.00	0.25	0.00	**98.70**
63.56	0.01	17.46	0.05	0.01	0.00	0.02	0.76	15.02	0.06	0.00	0.27	0.00	**97.21**
64.06	0.02	17.55	0.03	0.00	0.00	0.03	0.87	15.09	0.00	0.03	0.27	0.00	**97.96**
58.17	0.38	16.56	5.9	0.04	0.34	0.25	0.79	13.2	0	0	0.27	0	**95.9**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of biotite in sample M4 GG-1.

M4 GG-1	(126.5 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
36.07	1.96	15.39	15.32	0.47	15.80	0.12	0.21	7.63	0.01	0.00	0.14	0.04	**93.16**
36.06	2.04	15.53	13.93	0.53	16.63	0.18	0.20	7.49	0.03	0.00	0.13	0.04	**92.79**
37.17	1.94	15.29	16.92	0.32	13.76	0.10	0.30	8.98	0.01	0.02	0.15	0.06	**95.02**
36.97	1.94	15.64	15.79	0.40	14.94	0.16	0.25	8.72	0.00	0.03	0.15	0.04	**95.02**
35.90	2.03	15.80	12.91	0.49	18.01	0.18	0.20	7.14	0.05	0.00	0.05	0.01	**92.77**
36.69	1.93	16.11	12.48	0.53	17.43	0.30	0.23	7.20	0.00	0.00	0.05	0.04	**92.99**
37.42	1.89	15.51	13.28	0.33	17.02	0.14	0.22	8.68	0.00	0.01	0.20	0.03	**94.73**
37.30	1.94	15.03	13.54	0.27	16.47	0.08	0.31	9.39	0.07	0.03	0.24	0.08	**94.73**
35.46	1.93	14.66	14.74	0.32	14.62	0.11	0.29	8.95	0.06	0.00	0.12	0.07	**91.33**
37.66	2.02	15.06	13.49	0.24	16.58	0.07	0.31	9.58	0.01	0.02	0.16	0.06	**95.25**
37.39	2.00	15.59	13.03	0.35	17.24	0.09	0.25	8.76	0.03	0.00	0.15	0.01	**94.89**
36.20	2.10	15.64	13.69	0.52	16.32	0.24	0.27	7.92	0.00	0.00	0.00	0.06	**92.96**
37.43	1.89	15.39	14.32	0.18	15.73	0.07	0.24	9.14	0.00	0.00	0.15	0.04	**94.58**
36.99	1.93	15.35	13.30	0.21	17.21	0.07	0.23	8.56	0.01	0.03	0.12	0.04	**94.06**
41.18	1.62	15.75	11.27	0.19	15.58	0.69	0.21	7.91	0.05	0.00	0.13	0.03	**94.63**
36.92	1.94	15.50	16.87	0.51	14.17	0.08	0.29	8.49	0.00	0.00	0.17	0.02	**94.95**
36.50	1.98	16.03	15.91	0.60	15.01	0.15	0.22	7.18	0.00	0.00	0.13	0.07	**93.79**
32.28	1.43	15.52	26.56	0.87	14.15	0.37	0.24	3.76	0.03	0.03	0.03	0.18	**95.46**
39.15	1.67	16.62	14.81	0.51	14.83	0.44	0.26	6.49	0.00	0.00	0.17	0.10	**95.02**
36.31	2.07	15.21	15.93	0.51	14.64	0.30	0.28	6.90	0.01	0.00	0.07	0.05	**92.28**
36.54	1.94	14.96	16.05	0.48	15.18	0.09	0.22	8.23	0.02	0.01	0.13	0.00	**93.85**
35.04	1.88	16.30	15.49	0.55	16.43	0.17	0.21	6.26	0.02	0.00	0.08	0.06	**92.48**
35.69	1.91	15.41	15.43	0.50	15.71	0.17	0.20	7.12	0.02	0.00	0.07	0.03	**92.25**
36.82	2.03	15.20	15.97	0.34	14.98	0.08	0.26	8.72	0.01	0.00	0.07	0.01	**94.48**
37.79	1.97	15.12	14.36	0.23	15.00	0.09	0.26	8.84	0.02	0.01	0.18	0.04	**93.91**
36.81	1.96	15.69	15.23	0.23	15.60	0.05	0.25	8.88	0.03	0.01	0.11	0.03	**94.88**
37.40	1.90	14.98	13.96	0.18	16.54	0.04	0.30	9.41	0.02	0.00	0.10	0.04	**94.87**
36.39	1.95	15.33	12.71	0.37	17.60	0.08	0.23	8.61	0.00	0.04	0.10	0.01	**93.42**
36.91	2.06	15.61	14.02	0.33	16.61	0.06	0.24	8.77	0.00	0.00	0.21	0.07	**94.89**
37.73	2.02	15.89	12.78	0.38	16.52	0.22	0.24	7.75	0.02	0.00	0.12	0.02	**93.67**
36.95	1.97	15.13	13.68	0.29	16.66	0.09	0.24	9.16	0.01	0.00	0.09	0.00	**94.26**
35.16	4.69	12.18	31.39	0.22	4.99	0.67	1.85	4.98	0.07	0.00	0.15	0.00	**96.34**
37.32	1.83	15.50	13.67	0.27	16.84	0.05	0.21	9.32	0.01	0.01	0.13	0.00	**95.17**
39.33	1.73	15.54	11.62	0.25	17.10	0.24	0.25	9.10	0.00	0.00	0.10	0.03	**95.27**
35.53	1.75	11.53	17.55	0.21	3.61	1.36	2.31	5.59	0.22	0.06	0.11	0.19	**80.02**
36.83	1.98	15.10	14.20	0.34	16.19	0.07	0.20	8.60	0.00	0.00	0.12	0.01	**93.65**
36.78	1.97	15.51	13.43	0.36	16.05	0.15	0.26	8.63	0.00	0.00	0.09	0.03	**93.26**
35.74	1.91	15.63	13.27	0.52	16.69	0.20	0.19	7.16	0.00	0.00	0.14	0.04	**91.47**
36.85	1.85	15.39	14.94	0.28	15.03	0.08	0.27	9.29	0.05	0.00	0.13	0.03	**94.19**
36.80	1.89	15.27	13.94	0.33	16.29	0.06	0.25	8.88	0.00	0.00	0.12	0.01	**93.84**
37.86	1.68	15.16	11.78	0.23	18.55	0.05	0.24	9.24	0.00	0.03	0.11	0.00	**94.92**
37.20	1.93	15.55	14.07	0.31	16.16	0.08	0.22	9.21	0.01	0.01	0.06	0.02	**94.81**
37.38	1.93	15.33	12.91	0.26	16.99	0.07	0.22	9.22	0.00	0.05	0.10	0.04	**94.49**
38.07	2.04	15.27	12.45	0.21	17.83	0.09	0.20	9.32	0.01	0.01	0.15	0.02	**95.67**

37.50	2.21	15.40	12.05	0.39	17.27	0.16	0.14	7.70	0.02	0.01	0.12	0.05	**93.02**
37.78	1.76	15.57	11.92	0.43	16.55	0.26	0.20	6.59	0.00	0.03	0.03	0.04	**91.15**
38.92	2.76	15.74	14.25	0.52	15.93	0.20	0.21	7.64	0.00	0.00	0.08	0.07	**96.30**
37.85	2.49	15.16	18.42	0.40	12.74	0.42	0.50	6.05	0.01	0.01	0.10	0.00	**94.12**
36.77	1.96	15.78	15.52	0.39	15.36	0.15	0.18	8.47	0.02	0.01	0.06	0.03	**94.70**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of biotite in sample M4 GG-2.

M4 GG-2	**(131.90 m)**												
SiO_2	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
37.12	1.22	15.50	14.58	0.17	16.64	0.12	0.08	8.35	0.14	0.00	0.05	0.16	**94.11**
37.45	1.11	15.26	12.29	0.22	18.11	0.06	0.07	8.29	0.00	0.00	0.03	0.02	**92.91**
38.34	1.03	15.49	11.22	0.15	18.81	0.10	0.07	8.47	0.02	0.00	0.08	0.08	**93.85**
38.77	1.93	15.44	10.61	0.06	19.42	0.00	0.10	9.71	0.04	0.00	0.12	0.01	**96.22**
37.97	1.99	15.49	13.14	0.14	17.00	0.00	0.10	9.48	0.02	0.03	0.16	0.05	**95.59**
38.88	1.02	14.47	9.51	0.05	20.44	0.00	0.07	10.15	0.02	0.00	0.08	0.00	**94.70**
38.91	0.97	14.44	9.45	0.05	20.36	0.00	0.06	9.98	0.04	0.00	0.01	0.00	**94.28**
39.63	1.06	15.18	8.94	0.08	20.78	0.01	0.08	10.01	0.02	0.02	0.13	0.07	**96.02**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of biotite in sample M4 GG-7.

M4 GG-7	(150.58 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
38.95	1.83	14.86	9.33	0.07	19.37	0.11	0.17	9.36	0.00	0.01	0.14	0.02	**94.23**
37.86	1.95	14.72	12.67	0.08	19.18	0.16	0.15	8.89	0.00	0.00	0.03	0.00	**95.70**
39.00	1.94	15.30	8.91	0.05	20.18	0.02	0.14	9.89	0.00	0.00	0.03	0.00	**95.45**
38.88	1.91	15.09	8.97	0.05	19.61	0.05	0.14	9.74	0.00	0.02	0.05	0.00	**94.51**
39.16	1.70	15.08	8.52	0.04	20.64	0.00	0.15	10.08	0.00	0.00	0.10	0.00	**95.48**
38.55	1.52	15.02	9.55	0.08	19.85	0.07	0.15	9.62	0.01	0.01	0.00	0.05	**94.47**
38.20	1.45	15.49	9.95	0.07	19.69	0.05	0.12	9.96	0.01	0.02	0.03	0.00	**95.02**
39.38	1.62	15.58	10.16	0.06	18.65	0.08	0.26	9.15	0.03	0.00	0.03	0.02	**95.01**
37.41	1.69	15.36	16.42	0.12	14.35	0.05	0.17	9.28	0.00	0.02	0.16	0.02	**95.06**
39.77	1.61	16.69	16.37	0.19	14.97	0.25	0.22	8.48	0.01	0.00	0.11	0.03	**98.70**
37.58	1.78	15.39	18.10	0.14	13.05	0.05	0.19	9.32	0.00	0.02	0.12	0.02	**95.76**
39.56	2.08	14.28	10.00	0.10	16.84	0.06	0.99	8.62	0.01	0.00	0.03	0.00	**92.58**
39.70	1.47	14.67	9.03	0.05	20.04	0.27	0.17	9.07	0.03	0.00	0.12	0.01	**94.61**
39.34	1.44	14.64	8.33	0.05	20.40	0.05	0.15	9.89	0.00	0.01	0.05	0.00	**94.38**
39.05	1.67	14.18	8.60	0.06	18.87	0.12	0.37	9.09	0.00	0.01	0.03	0.01	**92.05**
38.78	0.99	14.61	8.01	0.05	20.98	0.08	0.17	9.35	0.02	0.00	0.05	0.00	**93.08**
38.27	1.50	15.63	13.23	0.08	16.56	0.07	0.19	9.49	0.00	0.01	0.10	0.00	**95.14**
39.88	1.51	15.14	10.29	0.06	19.11	0.05	0.29	9.41	0.00	0.00	0.09	0.00	**95.83**
39.16	1.46	14.87	9.54	0.10	19.99	0.10	0.15	9.55	0.02	0.00	0.04	0.00	**94.97**
37.03	1.27	15.47	10.68	0.35	18.20	0.27	0.43	8.07	0.02	0.02	0.11	0.02	**91.95**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of biotite in sample M4 GG-10.

M4 GG-10	(165.98 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
38.32	1.67	15.23	14.57	0.05	15.41	0.05	0.20	9.45	0.00	0.00	0.11	0.00	**95.07**
37.64	1.64	15.30	16.44	0.04	14.09	0.00	0.20	9.49	0.00	0.00	0.19	0.01	**95.05**
38.31	1.75	15.17	15.67	0.03	14.77	0.03	0.23	9.41	0.00	0.01	0.16	0.00	**95.54**
38.52	1.41	15.46	14.87	0.06	15.37	0.10	0.18	9.42	0.01	0.00	0.30	0.00	**95.70**
39.91	1.20	14.13	6.81	0.02	22.45	0.00	0.05	9.91	0.00	0.01	0.03	0.00	**94.51**
39.48	0.96	14.24	7.04	0.08	22.40	0.12	0.04	9.75	0.01	0.01	0.03	0.04	**94.20**
39.50	1.12	14.20	7.58	0.05	22.07	0.09	0.07	9.95	0.05	0.00	0.00	0.00	**94.67**
38.38	2.17	15.21	12.51	0.04	16.81	0.10	0.12	9.24	0.03	0.00	0.17	0.03	**94.79**
38.91	1.31	15.34	11.00	0.03	18.33	0.00	0.13	9.88	0.01	0.00	0.25	0.01	**95.20**
38.57	1.26	15.27	11.65	0.04	18.38	0.01	0.12	10.11	0.00	0.00	0.18	0.00	**95.60**
41.79	0.97	18.44	6.49	0.01	15.31	1.14	1.76	7.29	0.00	0.05	0.04	0.02	**93.31**
38.99	1.52	15.53	9.97	0.01	19.04	0.04	0.18	9.87	0.00	0.00	0.16	0.00	**95.30**
38.92	1.37	15.58	8.69	0.03	19.95	0.12	0.13	9.72	0.00	0.00	0.08	0.02	**94.62**
38.52	1.37	15.61	9.02	0.09	19.99	0.13	0.10	9.46	0.00	0.03	0.16	0.04	**94.53**
38.33	1.54	14.89	9.00	0.04	19.76	0.00	0.12	9.94	0.02	0.03	0.18	0.00	**93.85**
38.44	1.77	15.03	9.61	0.05	19.25	0.05	0.07	9.99	0.00	0.00	0.18	0.00	**94.45**
39.17	1.78	15.31	7.59	0.02	20.51	0.07	0.13	10.13	0.02	0.01	0.17	0.02	**94.91**
37.98	1.53	15.17	11.65	0.02	17.33	0.25	0.14	9.31	0.00	0.00	0.28	0.00	**93.66**
37.25	1.58	15.30	12.14	0.04	16.86	0.04	0.13	9.73	0.03	0.00	0.26	0.00	**93.37**
38.30	1.55	15.33	11.82	0.05	17.08	0.15	0.11	9.49	0.04	0.00	0.30	0.01	**94.23**
38.15	1.77	14.56	10.41	0.03	19.00	0.05	0.17	9.93	0.00	0.00	0.28	0.03	**94.39**
38.74	1.63	15.10	9.10	0.02	19.88	0.04	0.14	9.79	0.00	0.00	0.17	0.03	**94.63**
46.09	2.14	16.27	7.66	0.04	14.96	0.84	1.15	8.63	0.01	0.00	0.49	0.00	**98.29**
38.46	1.41	14.99	9.69	0.06	19.94	0.09	0.14	9.67	0.02	0.00	0.33	0.01	**94.80**
38.39	1.54	15.24	12.33	0.03	17.27	0.05	0.14	9.66	0.00	0.00	0.36	0.00	**95.00**
39.11	1.52	15.47	10.09	0.04	18.68	0.07	0.15	9.74	0.00	0.01	0.37	0.04	**95.29**
39.13	1.53	15.18	9.49	0.01	19.56	0.03	0.08	9.97	0.05	0.00	0.36	0.00	**95.39**
38.69	1.37	15.28	8.98	0.03	20.20	0.04	0.11	9.92	0.00	0.01	0.29	0.03	**94.96**
39.12	1.12	15.63	9.15	0.01	20.16	0.04	0.11	9.96	0.01	0.02	0.31	0.02	**95.65**
38.84	1.69	15.48	10.37	0.03	18.90	0.00	0.11	9.73	0.00	0.00	0.35	0.00	**95.51**
38.80	1.74	15.58	10.64	0.06	18.51	0.03	0.12	10.02	0.00	0.00	0.35	0.02	**95.86**
38.92	1.04	14.07	10.83	0.02	18.88	0.06	0.09	10.08	0.02	0.02	0.05	0.00	**94.09**
43.00	3.82	15.66	10.83	0.02	14.77	0.10	0.24	10.15	0.00	0.02	0.12	0.00	**98.73**
39.54	1.57	15.99	9.74	0.03	18.98	0.11	0.19	9.63	0.01	0.00	0.23	0.00	**96.02**
38.51	1.54	15.61	11.91	0.07	18.28	0.16	0.13	9.27	0.00	0.00	0.30	0.00	**95.79**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of clinopyroxene in sample M4 SILL-1.

M4 SILL-1	(268.3 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
50.95	0.50	2.64	13.64	0.33	15.16	16.88	0.33	0.02	0.00	0.00	0.00	0.03	**100.49**
50.99	0.46	2.40	12.01	0.26	13.44	19.44	0.30	0.06	0.02	0.03	0.00	0.05	**99.45**
51.42	0.45	2.62	11.57	0.29	14.76	18.99	0.29	0.03	0.01	0.03	0.04	0.00	**100.51**
49.38	0.70	2.77	14.93	0.39	12.64	17.08	0.29	0.03	0.06	0.02	0.00	0.00	**98.29**
50.70	0.41	2.80	13.06	0.40	12.89	19.03	0.34	0.12	0.03	0.01	0.05	0.00	**99.82**
51.70	0.37	2.41	10.64	0.32	15.16	18.97	0.32	0.06	0.02	0.06	0.00	0.04	**100.06**
49.57	0.30	2.78	10.85	0.21	13.88	20.87	0.38	0.03	0.00	0.11	0.00	0.03	**99.00**
50.81	0.51	2.72	13.10	0.27	15.44	16.67	0.25	0.00	0.03	0.06	0.00	0.02	**99.89**
51.83	0.39	2.59	10.58	0.25	17.55	16.48	0.24	0.01	0.09	0.08	0.00	0.01	**100.09**
51.37	0.47	3.17	10.50	0.22	17.19	16.89	0.29	0.00	0.00	0.08	0.00	0.00	**100.16**
51.42	0.41	3.34	9.97	0.25	16.60	17.57	0.33	0.00	0.00	0.06	0.00	0.02	**99.97**
49.46	0.37	1.29	17.36	0.49	9.29	20.55	0.26	0.07	0.10	0.02	0.02	0.00	**99.28**
50.51	0.27	2.31	11.30	0.24	13.89	20.54	0.32	0.05	0.00	0.00	0.00	0.00	**99.43**
48.66	0.61	3.01	15.46	0.40	11.27	17.03	0.51	0.28	0.22	0.00	0.00	0.06	**97.51**
50.52	0.53	2.65	14.06	0.30	14.27	17.02	0.34	0.03	0.12	0.00	0.00	0.02	**99.86**
48.49	0.59	1.70	19.99	0.50	8.89	17.92	0.37	0.04	0.02	0.03	0.02	0.01	**98.57**
51.48	0.46	2.28	13.01	0.30	15.20	16.87	0.31	0.01	0.00	0.00	0.01	0.05	**99.98**
52.57	0.12	1.01	11.28	0.30	14.08	21.21	0.08	0.05	0.00	0.01	0.08	0.00	**100.79**
51.40	0.53	3.39	9.70	0.27	14.62	20.67	0.43	0.08	0.13	0.03	0.00	0.01	**101.25**
51.77	0.37	1.77	10.56	0.28	13.62	21.66	0.26	0.01	0.01	0.09	0.00	0.01	**100.42**
48.77	0.34	3.39	14.45	0.34	11.91	17.90	0.43	0.40	0.02	0.03	0.00	0.05	**98.03**
50.99	0.35	2.37	10.43	0.27	14.16	20.71	0.33	0.03	0.00	0.06	0.03	0.03	**99.75**
50.36	0.40	2.88	12.44	0.27	13.59	18.29	0.39	0.14	0.00	0.07	0.00	0.02	**98.86**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of amphibole in sample M4 A-1.

M4 A-1	(166.33 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
51.51	0.09	3.71	12.50	0.26	16.11	12.90	0.56	0.22	0.00	0.31	0.00	0.01	**98.18**
50.28	0.12	4.33	12.60	0.28	15.52	13.52	0.66	0.24	0.02	0.44	0.00	0.03	**98.05**
48.67	0.13	4.48	12.82	0.27	15.57	12.35	0.55	0.25	0.00	0.85	0.00	0.00	**95.93**
48.74	0.16	5.82	12.22	0.23	15.65	12.51	0.77	0.26	0.00	0.51	0.02	0.00	**96.88**
51.38	0.08	4.06	11.09	0.24	16.65	12.83	0.63	0.20	0.00	0.33	0.00	0.04	**97.53**
55.49	0.07	2.94	11.04	0.21	14.67	12.11	0.49	0.15	0.01	0.11	0.00	0.00	**97.29**
50.45	0.12	3.12	13.51	0.27	16.57	13.51	0.61	0.12	0.03	0.15	0.00	0.04	**98.51**
50.56	0.05	3.55	13.30	0.31	15.79	13.13	0.63	0.15	0.00	0.28	0.00	0.00	**97.75**
51.53	0.14	4.08	12.79	0.30	15.23	12.62	0.68	0.27	0.00	0.49	0.06	0.00	**98.18**
50.56	0.11	4.84	13.77	0.25	14.49	12.73	0.83	0.31	0.04	0.64	0.09	0.00	**98.66**
50.66	0.10	5.32	13.66	0.28	14.26	12.60	0.85	0.34	0.00	0.59	0.00	0.00	**98.66**
52.41	0.14	2.77	12.31	0.29	17.14	12.52	0.46	0.10	0.01	0.22	0.00	0.02	**98.40**
51.46	0.07	2.43	12.48	0.22	16.96	13.75	0.46	0.09	0.00	0.12	0.04	0.00	**98.08**
51.51	0.10	3.33	10.13	0.23	17.24	13.59	0.59	0.22	0.02	0.10	0.00	0.00	**97.06**
49.77	0.47	4.54	12.88	0.22	15.13	13.51	0.69	0.19	0.12	0.22	0.01	0.06	**97.83**
50.90	0.17	3.67	12.60	0.25	16.34	13.42	0.62	0.14	0.00	0.44	0.03	0.02	**98.61**
51.55	0.07	3.78	11.80	0.25	15.90	13.29	0.64	0.22	0.05	0.38	0.02	0.00	**97.94**
51.94	0.08	3.42	12.49	0.26	16.16	13.02	0.66	0.14	0.03	0.54	0.00	0.00	**98.74**
56.18	0.07	2.44	11.62	0.29	16.23	12.21	0.35	0.06	0.04	0.12	0.00	0.02	**99.63**
52.70	0.07	3.20	12.28	0.29	16.79	12.79	0.43	0.15	0.02	0.30	0.02	0.02	**99.05**
50.74	0.10	3.77	11.61	0.28	16.73	13.47	0.56	0.19	0.06	0.04	0.00	0.00	**97.55**
52.25	0.07	2.76	12.54	0.31	17.46	12.55	0.46	0.13	0.00	0.09	0.03	0.02	**98.68**
51.08	0.04	2.13	12.39	0.30	17.12	14.00	0.45	0.14	0.00	0.05	0.05	0.00	**97.74**
52.69	0.07	3.27	11.69	0.23	17.05	13.29	0.59	0.16	0.00	0.21	0.04	0.00	**99.29**
49.29	0.09	2.72	11.01	0.25	16.59	12.01	0.56	0.17	0.06	0.19	0.04	0.02	**93.02**
55.15	0.16	3.22	11.53	0.25	17.07	12.42	0.46	0.17	0.02	0.68	0.03	0.03	**101.18**
52.57	0.03	2.57	11.29	0.27	17.15	13.33	0.50	0.12	0.00	0.77	0.02	0.05	**98.68**
57.05	0.08	2.20	10.25	0.28	15.46	11.74	0.46	0.09	0.06	0.89	0.06	0.00	**98.62**
50.99	0.09	4.05	11.69	0.29	16.27	13.28	0.68	0.26	0.00	0.29	0.02	0.03	**97.94**
51.72	0.09	4.21	12.05	0.28	15.80	12.67	0.70	0.25	0.00	0.56	0.02	0.00	**98.33**
54.51	0.10	2.61	11.12	0.25	17.45	12.72	0.51	0.09	0.02	0.06	0.00	0.01	**99.46**
54.16	0.11	3.93	12.36	0.26	15.95	12.20	0.79	0.15	0.02	0.37	0.00	0.05	**100.35**
54.99	0.22	2.72	12.68	0.29	16.78	12.41	0.35	0.10	0.02	0.04	0.00	0.00	**100.59**
55.54	0.23	3.00	11.89	0.30	18.01	12.80	0.52	0.11	0.08	0.04	0.00	0.00	**102.52**
49.60	5.20	2.56	11.35	0.25	16.23	11.95	0.59	0.11	0.00	0.23	0.03	0.00	**98.12**
52.96	0.08	2.70	12.19	0.31	17.07	12.44	0.53	0.07	0.04	0.33	0.01	0.00	**98.72**
52.84	0.05	2.46	12.60	0.32	17.42	12.91	0.46	0.07	0.00	0.31	0.00	0.00	**99.45**
54.75	0.13	4.42	8.39	0.20	17.78	12.85	0.92	0.09	0.00	0.34	0.00	0.00	**99.86**
52.76	0.10	2.96	11.96	0.26	17.04	12.61	0.63	0.10	0.05	0.43	0.00	0.02	**98.93**
52.50	0.28	2.92	12.22	0.32	16.42	13.03	0.45	0.15	0.06	0.48	0.00	0.00	**98.83**
53.19	0.10	4.19	11.28	0.33	16.72	13.01	0.93	0.05	0.00	0.21	0.01	0.03	**100.03**
52.25	0.08	3.00	11.61	0.23	16.85	14.09	0.50	0.14	0.06	0.16	0.00	0.00	**98.97**
52.81	0.13	2.43	10.00	0.24	17.34	12.01	0.47	0.12	0.06	0.24	0.00	0.02	**95.86**
55.33	0.17	2.27	11.47	0.30	16.24	12.42	0.44	0.10	0.03	0.28	0.00	0.00	**99.05**
53.53	0.13	1.82	11.82	0.28	18.41	12.28	0.31	0.03	0.02	0.31	0.00	0.00	**98.95**
51.32	0.08	3.68	12.01	0.27	16.45	13.19	0.48	0.22	0.00	0.15	0.06	0.00	**97.89**

55.79	0.06	2.70	10.88	0.25	16.01	13.81	0.41	0.11	0.00	0.11	0.06	0.03	**100.23**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of clinopyroxene in sample M4 SILL-1.

M4 SILL-1	**(268.3 m)**												
SiO_2	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
51.30	0.41	2.74	18.25	0.33	12.25	12.36	0.32	0.44	0.02	0.02	0.00	0.00	**98.45**
50.12	0.40	2.48	21.60	0.40	10.39	12.06	0.39	0.36	0.03	0.00	0.00	0.04	**98.25**
50.04	0.72	3.34	18.15	0.55	11.99	13.17	0.47	0.55	0.02	0.00	0.04	0.00	**99.03**
50.24	0.67	2.28	17.97	0.47	11.48	15.74	0.28	0.28	0.01	0.00	0.06	0.00	**99.47**
49.12	0.63	2.55	19.20	0.34	11.89	13.90	0.38	0.16	0.09	0.00	0.00	0.00	**98.25**
50.50	1.82	3.31	15.24	0.22	12.69	14.69	0.46	0.25	0.05	0.00	0.02	0.00	**99.25**
54.19	0.42	1.68	18.59	0.42	11.18	12.03	0.28	0.22	0.00	0.02	0.03	0.02	**99.07**
49.46	0.49	1.58	21.66	0.54	9.99	15.06	0.22	0.07	0.05	0.00	0.00	0.03	**99.16**
49.00	0.63	2.78	17.18	0.34	12.88	15.67	0.33	0.04	0.07	0.02	0.07	0.02	**99.02**
50.95	0.50	2.64	13.64	0.33	15.16	16.88	0.33	0.02	0.00	0.00	0.00	0.03	**100.49**
49.70	0.55	3.44	17.08	0.28	13.61	11.87	0.36	0.51	0.00	0.00	0.05	0.00	**97.45**
50.11	0.33	2.40	15.69	0.39	12.53	15.67	0.38	0.34	0.04	0.01	0.00	0.00	**97.89**
50.14	0.46	3.18	15.13	0.33	16.90	11.76	0.26	0.13	0.01	0.04	0.00	0.01	**98.36**
50.74	0.15	2.54	18.61	0.19	13.40	12.25	0.30	0.22	0.03	0.05	0.00	0.01	**98.48**
51.02	0.25	3.55	17.63	0.20	13.08	11.85	0.42	0.27	0.02	0.01	0.00	0.02	**98.31**
48.91	0.50	3.18	16.21	0.29	13.25	14.72	0.47	0.21	0.11	0.00	0.04	0.02	**97.92**
47.40	0.43	3.17	17.45	0.43	12.81	12.13	0.58	0.61	0.07	0.00	0.03	0.00	**95.09**
49.90	0.89	2.62	16.92	0.40	14.27	12.43	0.35	0.30	0.04	0.04	0.03	0.03	**98.21**
52.29	0.57	2.11	15.43	0.20	14.85	12.23	0.33	0.15	0.02	0.00	0.00	0.01	**98.18**
49.81	0.30	2.73	15.60	0.28	14.00	15.05	0.31	0.36	0.00	0.06	0.00	0.00	**98.51**
50.79	0.45	3.86	19.32	0.35	12.93	10.30	0.56	0.45	0.03	0.00	0.04	0.00	**99.08**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of titanite in sample M4 GG-10.

M4 GG-10	**(165.98 m)**												
SiO_2	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**ZnO**	**Total**
30	35.81	1.51	1.43	0.15	0	27.53	0.01	0	0.06	0	0.04	0	**96.54**
29.54	35.49	1.5	1.39	0.09	0.02	27.37	0.02	0	0.1	0	0	0	**95.52**
29.47	35.76	1.43	1.36	0.16	0	27.46	0.02	0	0.08	0	0.1	0	**95.84**
29.63	36.09	1.44	1.08	0.04	0	27.91	0.02	0.02	0.08	0.03	0.01	0.02	**96.35**
29.66	35.86	1.24	1.28	0.11	0	27.47	0.02	0	0.07	0.02	0.08	0.01	**95.82**
29.6	35.76	1.22	1.35	0.15	0.01	27.66	0.01	0	0.12	0	0.14	0	**96.03**
30.12	35.71	1.7	1.19	0.1	0.04	27.73	0.01	0	0.09	0	0.09	0	**96.79**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of titanite in sample M4 IS-1.

M4 IS-1	(221.20 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
29.39	35.29	1.86	1.02	0.00	0.07	27.96	0.02	0.00	0.08	0.00	0.14	0.00	**95.83**
29.17	35.53	1.54	1.41	0.00	0.09	27.05	0.04	0.00	0.14	0.00	0.00	0.00	**94.97**
30.31	34.35	2.21	0.88	0.85	0.00	27.18	0.07	0.11	0.12	0.00	0.15	0.00	**96.23**
29.75	37.11	2.34	0.52	0.00	0.00	28.59	0.01	0.01	0.09	0.00	0.10	0.02	**98.55**
30.57	36.61	2.13	0.39	0.01	0.02	29.42	0.01	0.00	0.03	0.00	0.20	0.01	**99.40**
29.57	34.87	2.30	0.99	0.01	0.07	27.79	0.02	0.00	0.04	0.00	0.04	0.00	**95.69**
30.33	36.28	2.02	0.57	0.00	0.00	29.02	0.00	0.00	0.00	0.01	0.10	0.06	**98.40**
29.47	34.74	2.50	0.97	0.00	0.06	27.54	0.02	0.00	0.03	0.00	0.12	0.00	**95.47**
31.67	30.25	3.70	3.27	0.77	0.07	28.30	0.06	0.00	0.03	0.00	0.06	0.02	**98.19**
31.41	33.88	2.08	1.46	0.50	0.09	28.67	0.03	0.01	0.00	0.00	0.05	0.00	**98.19**
30.56	34.32	3.55	0.58	0.00	0.00	29.24	0.01	0.00	0.03	0.05	0.09	0.06	**98.48**
30.64	34.83	3.55	0.62	0.01	0.00	29.15	0.01	0.00	0.04	0.01	0.05	0.00	**98.91**
31.41	34.46	3.49	0.58	0.01	0.01	29.09	0.01	0.00	0.01	0.02	0.02	0.00	**99.11**
30.25	35.85	1.78	0.93	0.03	0.04	28.51	0.01	0.01	0.01	0.00	0.00	0.00	**97.42**
29.94	35.86	1.72	0.90	0.01	0.04	28.54	0.02	0.00	0.03	0.04	0.00	0.00	**97.12**
30.29	35.53	2.15	0.61	0.00	0.04	28.67	0.02	0.00	0.03	0.03	0.07	0.07	**97.49**
29.45	34.92	1.96	1.31	0.09	0.01	27.56	0.05	0.01	0.08	0.01	0.00	0.00	**95.43**
29.06	34.48	1.81	1.54	0.06	0.03	26.90	0.03	0.00	0.07	0.01	0.06	0.00	**94.06**
28.99	34.16	1.69	1.59	0.12	0.00	26.78	0.02	0.00	0.06	0.00	0.06	0.00	**93.48**
29.25	35.04	1.54	1.45	0.12	0.01	27.43	0.03	0.00	0.08	0.00	0.19	0.05	**95.19**
28.98	35.04	1.43	1.41	0.15	0.00	27.23	0.04	0.00	0.05	0.00	0.04	0.00	**94.36**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of titanite in sample M4 SILL-1.

M4 SILL-1	(268.3 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
29.23	20.40	3.49	20.89	0.85	6.31	16.21	0.17	0.17	0.06	0.02	0.00	0.02	**97.82**
25.32	23.19	4.38	27.67	0.67	4.66	11.74	0.45	0.52	0.00	0.00	0.07	0.03	**98.69**
24.56	20.16	3.90	29.59	0.30	6.06	7.55	0.24	1.09	0.00	0.00	0.03	0.04	**93.53**
21.98	26.84	1.96	28.54	0.29	6.26	9.54	0.11	0.25	0.02	0.00	0.07	0.00	**95.86**

** All Fe as FeO*

Appendix 4A Continued…: Electron microprobe analyses of titanite in sample M4 AM-1.

M4 AM-1	(340.70 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
30.54	31.95	3.57	1.84	0.02	0.05	28.71	0.01	0.02	0.01	0.04	0	0	**96.76**
35.74	25.81	2.48	6.37	0.37	1.24	26.67	0.19	0.03	0.02	0	0.03	0	**98.97**
31.56	28.99	4.22	2.71	0.08	0.6	27.55	0.06	0.03	0.06	0	0.07	0.04	**95.95**
29.85	36.12	1.29	1.23	0.14	0	28.36	0.02	0.02	0.1	0	0.04	0	**97.18**
29.66	35.88	1.2	1.26	0.13	0.01	27.92	0.03	0.01	0.08	0	0.06	0.01	**96.24**
30.23	36.24	1.41	0.97	0.04	0.1	28.27	0.03	0.02	0.07	0	0.07	0	**97.44**
29.33	35.56	1.28	1.31	0.13	0	27.5	0.02	0.01	0.09	0	0.04	0.02	**95.29**
29.62	36.56	1.24	1.17	0.1	0	27.89	0.03	0	0.16	0.02	0.03	0.01	**96.82**
29.56	35.16	1.54	1.3	0.08	0	27.32	0.04	0	0.17	0	0.13	0	**95.29**
29.32	35	1.48	1.42	0.12	0.01	28.04	0.03	0	0.06	0	0.02	0	**95.5**
29.41	35.46	1.4	1.39	0.13	0.02	27.79	0.03	0.02	0.07	0.03	0.07	0	**95.82**
29.08	35.64	1.28	1.38	0.17	0	27.44	0.02	0.01	0.12	0	0	0.03	**95.17**
29.32	35.66	1.61	1.4	0.16	0.02	27.3	0.03	0	0.03	0	0	0	**95.53**
29.35	35.63	1.63	1.46	0.14	0.01	27.69	0.02	0	0.08	0.03	0	0	**96.04**

** All Fe as FeO. all data is in wt. %*

Appendix 4A: Electron microprobe analyses of epidote in sample M4 A-1.

M4 A-1	(166.33 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
43.12	0.33	**19.13**	**11.90**	0.10	3.16	**19.98**	0.58	0.02	0.07	0.04	0.03	0.01	**98.45**
48.63	0.06	**21.85**	6.73	0.15	2.52	16.11	1.65	0.12	0.06	0.04	0.03	0.00	**97.94**
42.81	5.91	**23.70**	**7.76**	0.19	1.70	**15.26**	1.36	0.11	0.00	0.09	0.07	0.00	**98.95**
42.65	0.06	**26.93**	**6.64**	0.13	0.20	**18.64**	0.72	0.04	0.03	0.00	0.10	0.06	**96.21**
42.65	0.06	26.93	6.64	0.13	0.20	18.64	0.72	0.04	0.03	0.00	0.10	0.06	**96.21**
42.81	5.91	23.70	7.76	0.19	1.70	15.26	1.36	0.11	0.00	0.09	0.07	0.00	**98.95**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of epidote in sample M4 IS-1.

M4 IS-1	(221.20 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
39.59	0.07	27.46	6.93	0.01	0.02	23.81	0.03	0.00	0.00	0.01	0.01	0.01	**97.95**
37.78	0.12	25.41	9.49	0.07	0.04	24.66	0.01	0.00	0.02	0.00	0.00	0.00	**97.59**
38.23	0.03	23.71	11.59	0.07	0.00	23.80	0.01	0.00	0.03	0.00	0.03	0.01	**97.51**
38.13	0.08	23.88	11.62	0.10	0.00	23.76	0.07	0.00	0.06	0.03	0.00	0.00	**97.72**
38.01	0.14	25.65	11.29	0.14	0.02	23.09	0.12	0.01	0.03	0.00	0.00	0.01	**98.50**
38.62	0.02	24.32	10.53	0.02	0.01	23.92	0.05	0.00	0.01	0.00	0.00	0.01	**97.51**
35.39	0.05	21.54	12.50	0.06	0.01	23.46	0.07	0.00	0.00	0.00	0.00	0.00	**93.07**
38.25	0.07	22.14	11.75	0.11	0.98	23.42	0.11	0.00	0.00	0.01	0.01	0.00	**96.86**
37.89	0.14	25.31	9.90	0.16	0.04	23.61	0.01	0.00	0.06	0.00	0.03	0.03	**97.19**
38.63	0.23	26.77	7.93	0.07	0.01	23.45	0.03	0.02	0.02	0.00	0.00	0.00	**97.17**
37.91	0.09	24.89	10.42	0.05	0.02	23.20	0.02	0.00	0.00	0.00	0.04	0.00	**96.63**
38.74	0.08	23.00	12.96	0.14	0.01	21.17	0.73	0.03	0.06	0.02	0.01	0.00	**96.93**
42.81	0.07	25.84	10.70	0.11	0.01	19.24	0.99	0.00	0.01	0.00	0.05	0.01	**99.83**
37.79	0.10	22.59	12.27	0.05	0.01	23.65	0.05	0.00	0.00	0.02	0.06	0.00	**96.61**
37.95	0.04	23.54	12.30	0.03	0.00	23.58	0.05	0.00	0.00	0.00	0.00	0.01	**97.50**
37.75	0.11	25.30	9.14	0.07	0.00	23.62	0.01	0.00	0.05	0.01	0.05	0.03	**96.13**
40.36	0.04	25.16	9.66	0.02	0.00	22.22	0.53	0.00	0.03	0.00	0.00	0.00	**98.02**
39.30	0.04	23.59	10.96	0.03	0.01	23.45	0.17	0.00	0.01	0.00	0.02	0.01	**97.58**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of epidote in sample M4 FZ-1.

M4 FZ-1	(249.62 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
38.06	0.12	25.46	8.92	0.17	0.03	22.68	0.45	0.01	0.05	0.00	0.00	0.01	**95.96**
37.63	0.06	24.97	9.94	0.03	0.02	23.47	0.00	0.01	0.06	0.03	0.00	0.00	**96.23**
38.94	0.08	23.67	12.51	0.04	0.08	21.65	0.64	0.00	0.06	0.02	0.03	0.01	**97.71**
37.09	0.10	24.49	10.68	0.12	0.06	23.10	0.01	0.01	0.04	0.00	0.01	0.00	**95.71**
37.45	0.20	25.00	10.42	0.41	0.10	22.81	0.00	0.00	0.32	0.02	0.00	0.04	**96.77**
37.18	0.27	23.11	13.19	0.24	0.53	21.16	0.20	0.03	0.31	0.02	0.00	0.00	**96.24**
37.13	0.11	23.91	11.68	0.22	0.04	22.78	0.01	0.03	0.21	0.00	0.01	0.00	**96.12**

** All Fe as FeO. all data is in wt. %*

Appendix 4A Continued…: Electron microprobe analyses of epidote in sample M4 AM-1.

M4 AM-1	(340.7 m)												
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	Total
36.97	0.04	22.36	13.27	0.23	0.01	22.28	0.00	0.00	0.02	0.02	0.00	0.02	**95.22**
36.48	0.02	19.34	13.94	0.18	0.02	19.31	0.81	0.04	0.00	0.02	0.00	0.00	**90.16**
37.54	0.02	21.47	14.20	0.10	0.01	23.18	0.01	0.00	0.00	0.01	0.00	0.03	**96.56**
37.28	0.04	21.01	14.37	0.14	0.01	23.28	0.04	0.01	0.03	0.01	0.00	0.00	**96.22**
37.30	0.09	21.35	14.52	0.01	0.02	23.28	0.02	0.01	0.04	0.01	0.03	0.00	**96.66**
41.87	0.06	19.60	12.86	0.09	0.02	19.00	1.12	0.12	0.05	0.04	0.08	0.00	**94.92**
38.22	0.11	20.58	15.18	0.25	0.03	19.57	1.58	0.04	0.02	0.05	0.06	0.00	**95.70**
36.90	0.05	22.16	13.90	0.17	0.00	22.32	0.06	0.02	0.06	0.00	0.02	0.02	**95.68**
37.55	0.06	22.40	13.56	0.16	0.01	22.40	0.13	0.00	0.00	0.02	0.00	0.00	**96.30**

** All Fe as FeO. all data is in wt. %*

Appendix 4B: Feldspar mineral clasts in suevite sample M4 S-3.

M4 S-3	(depth: 159.98)													
SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	NiO	Total
67.98	0.02	19.15	0.00	0.03	0.00	0.30	11.10	0.91	0.01	0.01	0.03	0.00	0.00	**99.54**
67.53	0.00	19.41	0.05	0.00	0.00	0.62	11.30	0.35	0.03	0.01	0.00	0.01	0.00	**99.31**
70.46	0.00	20.56	0.08	0.02	0.00	0.70	5.34	0.36	0.00	0.00	0.04	0.00	0.00	**97.55**
66.98	0.00	19.25	0.10	0.03	0.02	0.53	11.27	0.38	0.06	0.00	0.04	0.01	0.00	**98.67**
68.27	0.00	19.18	0.01	0.03	0.01	0.22	11.55	0.32	0.00	0.01	0.01	0.03	0.03	**99.67**
67.40	0.00	19.56	0.06	0.02	0.01	0.58	11.44	0.32	0.00	0.02	0.00	0.04	0.01	**99.48**
68.09	0.00	19.39	0.03	0.00	0.01	0.68	11.14	0.38	0.02	0.00	0.04	0.00	0.01	**99.80**
64.33	0.00	18.05	0.00	0.00	0.00	0.28	0.91	15.16	0.00	0.00	0.00	0.01	0.03	**98.78**
62.54	0.00	17.48	0.00	0.04	0.00	0.14	0.63	15.10	0.01	0.00	0.16	0.00	0.01	**96.11**
64.15	0.03	17.94	0.01	0.01	0.00	0.13	0.69	15.49	0.01	0.00	0.11	0.08	0.00	**98.64**
64.15	0.03	17.94	0.01	0.01	0.00	0.13	0.69	15.49	0.01	0.00	0.11	0.08	0.00	**98.64**
67.98	0.02	19.15	0.00	0.03	0.00	0.30	11.10	0.91	0.01	0.01	0.03	0.00	0.00	**99.54**
67.53	0.00	19.41	0.05	0.00	0.00	0.62	11.30	0.35	0.03	0.01	0.00	0.01	0.00	**99.31**
70.46	0.00	20.56	0.08	0.02	0.00	0.70	5.34	0.36	0.00	0.00	0.04	0.00	0.00	**97.55**
66.98	0.00	19.25	0.10	0.03	0.02	0.53	11.27	0.38	0.06	0.00	0.04	0.01	0.00	**98.67**
68.27	0.00	19.18	0.01	0.03	0.01	0.22	11.55	0.32	0.00	0.01	0.01	0.03	0.03	**99.67**
67.40	0.00	19.56	0.06	0.02	0.01	0.58	11.44	0.32	0.00	0.02	0.00	0.04	0.01	**99.48**
68.09	0.00	19.39	0.03	0.00	0.01	0.68	11.14	0.38	0.02	0.00	0.04	0.00	0.01	**99.80**

** All Fe as FeO*

Appendix 4B Continued…: Feldsparthic components of lithic clasts in MMBr sample M4 IM-3.

M4 IM-3	(depth: 265.55 m)												
SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Cr_2O_3	BaO	ZnO	NiO
61.82	0.00	21.14	0.20	0.01	0.00	3.94	7.77	2.25	0.01	0.00	0.04	0.03	0.02
60.38	0.01	20.68	0.15	0.01	0.00	3.74	7.80	2.25	0.00	0.00	0.04	0.00	0.01
62.81	0.00	21.03	0.16	0.00	0.02	3.67	6.77	3.56	0.00	0.00	0.00	0.00	0.00
62.49	0.00	21.02	0.14	0.00	0.00	3.70	7.00	3.11	0.04	0.01	0.00	0.00	0.00
61.85	0.03	19.45	0.73	0.01	0.03	3.31	9.01	0.23	0.01	0.00	0.00	0.00	0.03
59.80	0.00	22.63	0.81	0.01	0.09	4.87	7.86	0.43	0.00	0.00	0.00	0.01	0.00
57.99	0.08	21.02	3.23	0.03	0.32	4.52	7.69	1.02	0.03	0.02	0.07	0.00	0.03
52.89	0.34	19.87	5.93	0.09	2.66	8.14	3.88	0.41	0.14	0.04	0.00	0.00	0.01
54.16	0.31	19.93	5.62	0.07	2.08	7.38	5.08	0.33	0.13	0.04	0.00	0.00	0.02
52.20	0.26	20.31	5.19	0.07	2.66	8.07	4.10	0.32	0.11	0.01	0.00	0.00	0.00
51.13	0.28	20.85	4.22	0.05	2.51	8.26	3.70	0.28	0.10	0.02	0.00	0.01	0.01
67.27	0.00	19.26	0.05	0.02	0.01	0.78	9.40	3.07	0.00	0.00	0.07	0.02	0.01
64.83	0.04	18.70	0.07	0.02	0.01	1.18	4.40	9.23	0.00	0.00	0.07	0.00	0.00
63.74	0.02	19.35	0.20	0.01	0.04	1.35	3.94	10.09	0.02	0.00	0.08	0.00	0.00
64.12	0.00	19.26	0.83	0.00	0.05	1.42	3.54	10.46	0.00	0.01	0.14	0.00	0.00
59.73	0.02	22.20	0.17	0.01	0.11	4.79	6.45	2.66	0.02	0.02	0.00	0.00	0.00
64.50	0.00	18.78	0.08	0.02	0.01	1.08	1.63	13.03	0.00	0.01	0.22	0.00	0.00
64.35	0.01	18.21	0.05	0.00	0.00	0.49	0.90	14.73	0.00	0.00	0.25	0.00	0.00

** All Fe as FeO*

Appendix 4B Continued…: Feldsparthic components of lithic clasts in suevite sample M4 S-4.

M4 S-4	**(depth: 285.03 m)**										
SiO_2	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**BaO**	SrO	
64.71	0.01	18.03	0.09	0.00	0.00	0.11	0.00	16.71	0.00	2.02	**101.68**
64.10	0.00	18.78	0.04	0.00	0.00	0.10	0.05	16.07	0.00	2.35	**101.50**
64.59	0.00	21.58	0.10	0.00	0.00	4.57	0.99	0.85	0.00	3.59	**96.27**
66.79	0.00	19.44	0.10	0.00	0.00	0.03	0.00	12.98	n.d.	n.d.	**99.35**
68.80	0.00	20.26	0.10	0.00	0.00	0.02	0.00	8.36	n.d.	n.d.	**97.55**
68.75	0.00	20.28	0.10	0.00	0.00	0.02	0.00	9.35	n.d.	n.d.	**98.50**
61.36	0.00	17.41	0.00	0.00	0.00	0.32	0.27	18.94	n.d.	n.d.	**98.30**
61.26	0.00	17.57	0.00	0.00	0.00	0.54	0.63	15.34	n.d.	n.d.	**95.34**
64.37	0.00	19.02	0.05	0.02	0.00	0.02	0.09	17.47	n.d.	n.d.	**101.04**
64.94	0.00	18.90	0.05	0.01	0.00	0.03	0.09	16.82	n.d.	n.d.	**100.83**
66.23	0.01	18.73	0.00	0.03	0.00	0.05	0.05	12.31	n.d.	n.d.	**97.41**
65.07	0.00	18.98	0.00	0.00	0.00	0.02	0.03	17.27	n.d.	n.d.	**101.37**
64.37	0.00	19.10	0.00	0.00	0.00	0.17	0.15	17.47	n.d.	n.d.	**101.26**
65.63	0.00	19.39	0.00	0.01	0.00	0.23	0.33	14.89	n.d.	n.d.	**100.48**
64.31	0.00	18.16	0.10	0.00	0.00	0.03	0.03	15.22	n.d.	n.d.	**97.85**
59.82	0.05	17.98	0.80	0.02	0.09	0.55	1.49	9.29	n.d.	n.d.	**90.10**
61.71	0.00	17.51	0.04	0.00	0.00	0.02	0.14	19.78	n.d.	n.d.	**99.19**
63.62	0.00	17.92	0.09	0.00	0.00	0.01	0.05	19.23	n.d.	n.d.	**100.93**

** All Fe as FeO. n.d.: not determined.*

Appendix 4B Continued…: Feldspar mineral clasts in composite dyke sample M4 IM-9.

M4 IM-9	**(depth: 299.76 m)**										
SiO_2	**TiO_2**	**Al_2O_3**	**FeO***	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**BaO**	SrO	
64.96	0.01	18.57	0.19	0.01	0.00	0.35	0.10	16.05	n.d.	n.d.	**100.24**
64.76	0.00	18.44	0.00	0.00	0.00	0.02	0.13	16.42	n.d.	n.d.	**99.76**
63.01	0.00	18.51	0.02	0.00	0.00	0.10	0.15	15.96	n.d.	n.d.	**97.76**
65.85	0.00	18.42	0.36	0.01	0.00	0.04	0.17	14.58	n.d.	n.d.	**99.42**
61.47	0.31	13.67	1.98	0.08	3.17	2.50	0.12	14.72	n.d.	n.d.	**98.02**
61.85	0.36	13.85	1.92	0.08	3.19	2.30	0.14	15.83	n.d.	n.d.	**99.51**
64.00	0.00	18.15	0.00	0.00	0.00	0.02	0.05	16.72	n.d.	n.d.	**98.94**
64.68	0.02	18.69	0.06	0.02	0.00	0.08	0.12	16.97	n.d.	n.d.	**100.64**
63.71	0.01	18.16	0.00	0.04	0.00	0.01	0.17	17.26	n.d.	n.d.	**99.35**
64.95	0.02	18.50	0.00	0.02	0.00	0.04	0.02	16.51	n.d.	n.d.	**100.05**
64.56	0.01	18.38	0.03	0.02	0.00	0.01	0.10	16.71	n.d.	n.d.	**99.82**
63.92	0.00	17.94	0.00	0.02	0.00	0.00	0.12	16.69	n.d.	n.d.	**98.70**
65.05	0.00	18.67	0.02	0.02	0.00	0.06	0.15	15.90	n.d.	n.d.	**99.87**
64.87	0.00	18.45	0.00	0.00	0.00	0.01	0.10	16.43	n.d.	n.d.	**99.86**
64.84	0.00	18.42	0.01	0.01	0.00	0.04	0.12	16.68	n.d.	n.d.	**100.12**
64.33	0.03	18.08	0.06	0.00	0.00	0.19	0.41	16.39	n.d.	n.d.	**99.48**
63.60	0.08	18.04	0.04	0.00	0.01	0.21	0.37	16.22	n.d.	n.d.	**98.55**

** All Fe as FeO. n.d.: not determined.*

Appendix 4B: Average EMPA data for pyroxene lithic and mineral clasts in impactites.

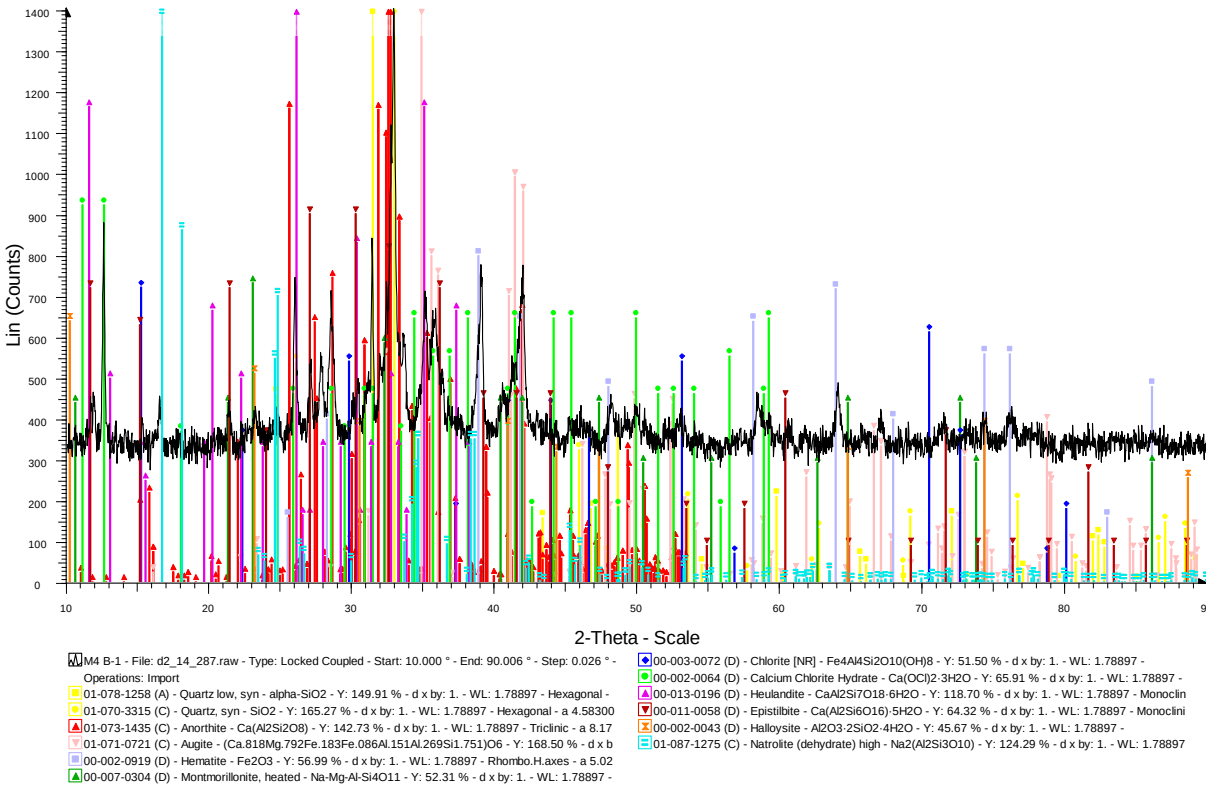
Sample: **Depth (m):** **Mineral:** **Rock Type:**	**M4 IM-6** **271.17 m** **Clinopyroxene(Augite)** **Melt matrix breccia**	**M4 IM-3** **259.65 m** **Clinopyroxene(Augite)** **Melt matrix breccia**		**M4 S 4(3)** **284.85 m** **Clinopyroxene(Augite)** **Suevite**		**M4 S6(3)** **316.52 m** **Clinopyroxene(Augite)** **Suevite**	
	n=1	n=3		n=4		**n=10**	
		Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
SiO_2	48.35	51.49	0.72	51.63	1.67	52.04	2.45
TiO_2	0.69	0.08	0.02	0.44	0.48	0.42	0.50
Al_2O_3	0.11	2.24	0.32	6.28	3.20	4.69	4.96
FeO*	18.9	16.59	0.05	11.05	1.21	6.09	2.95
MnO	0.5	0.25	0.02	0.24	0.04	0.19	0.09
MgO	9.59	13.48	0.17	14.02	3.45	11.31	4.79
CaO	19.61	12.74	0.05	11.51	1.89	18.30	6.06
Na_2O	0.26	0.28	0.03	1.52	1.95	0.74	0.50
K_2O	0.11	0.13	0.04	0.36	0.11	2.30	3.21
P_2O_5	0	0.00	0.00	0.06	0.04	0.39	0.40
Cr_2O_3	0	0.03	0.02	0.05	0.07	0.02	0.02
BaO	0.08	0.00	0.01	0.03	0.03	0.82	1.08
ZnO	0	0.01	0.01	0.04	0.03	0.01	0.01
NiO	0.02	0.03	0.03	0.04	0.01	0.03	0.01
Total	**98.23**	**97.36**	**0.57**	**97.25**	**0.23**	**97.35**	**1.34**
Oxygens (cations) *Cations per formular unit*	6	6.00		6		6	
Si	1.94	1.99	0.01	1.96	0.04	1.98	0.07
Ti	0.02	0.00	0.00	0.01	0.01	0.01	0.02
Al	0.01	0.10	0.02	0.28	0.14	0.21	0.22
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe(ii)	0.63	0.54	0.00	0.35	0.04	0.20	0.10
Mn	0.02	0.01	0.00	0.01	0.00	0.01	0.00
Mg	0.57	0.78	0.01	0.79	0.20	0.64	0.27
Ca	0.84	0.53	0.01	0.47	0.08	0.75	0.24
Na	0.02	0.02	0.00	0.11	0.14	0.05	0.04
K	0.01	0.01	0.00	0.02	0.01	0.11	0.15
TOTAL	4.05	3.97	0.01	4		4.01	
Wo	40.53	28.15	0.19	26.85	2.36	45.19	1.60
En	27.58	41.46	0.38	45.22	7.76	37.57	7.06
Fs	30.91	29.26	0.18	20.81	0.58	12.27	5.72
Ac	0.97	1.13	0.13	7.12	9.83	4.97	6.02
Mg#	0.47	0.59	0.00	0.69	0.04	0.76	0.11

** All Fe as FeO*

Appendix 4C: X-ray diffraction profiles of the M4 core impactite samples (melt particles and matrices)

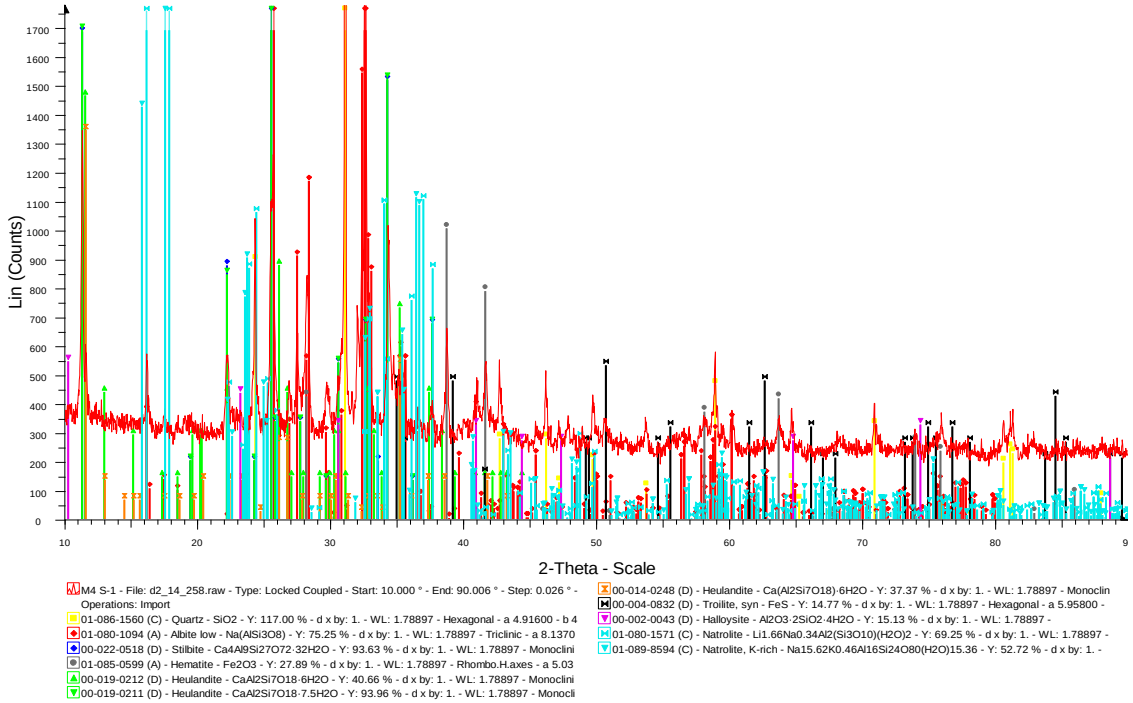
: X-ray diffraction profile- dolerite sample (inserted for comparison)

Sample: M4 B-1 from 284.85 m depth
Analysed: bulk rock

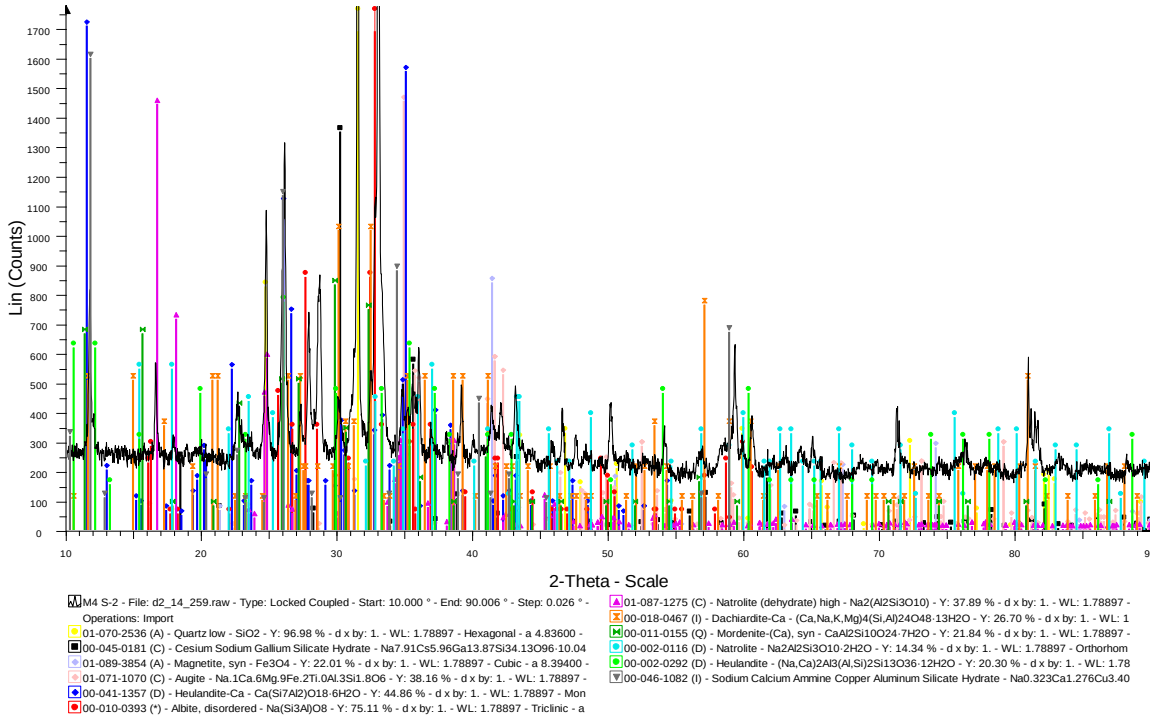


Appendix 4C: X-ray diffraction profiles - Suevite samples

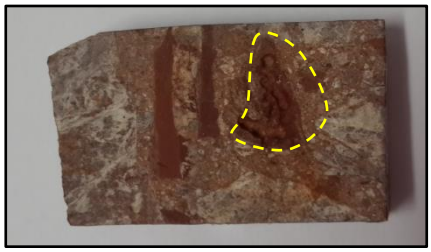
Sample: M4 S-1 from 144.09m depth
Analysed: matrix

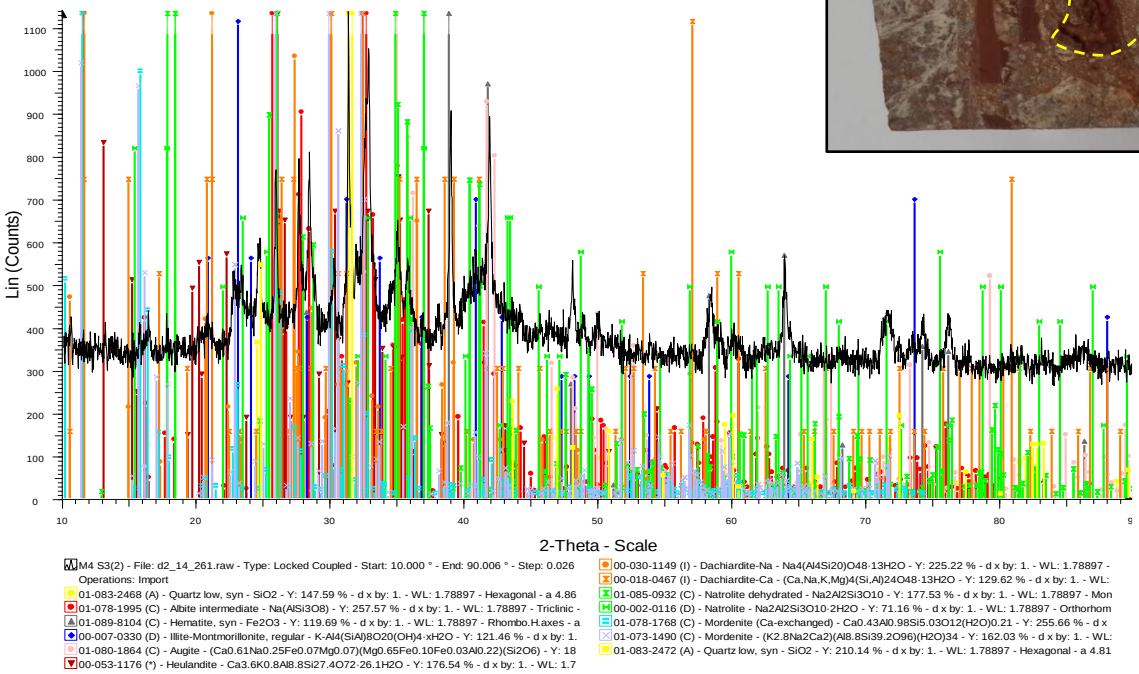


Sample: M4 S-2 from 156.35 m depth
Analysed: matrix

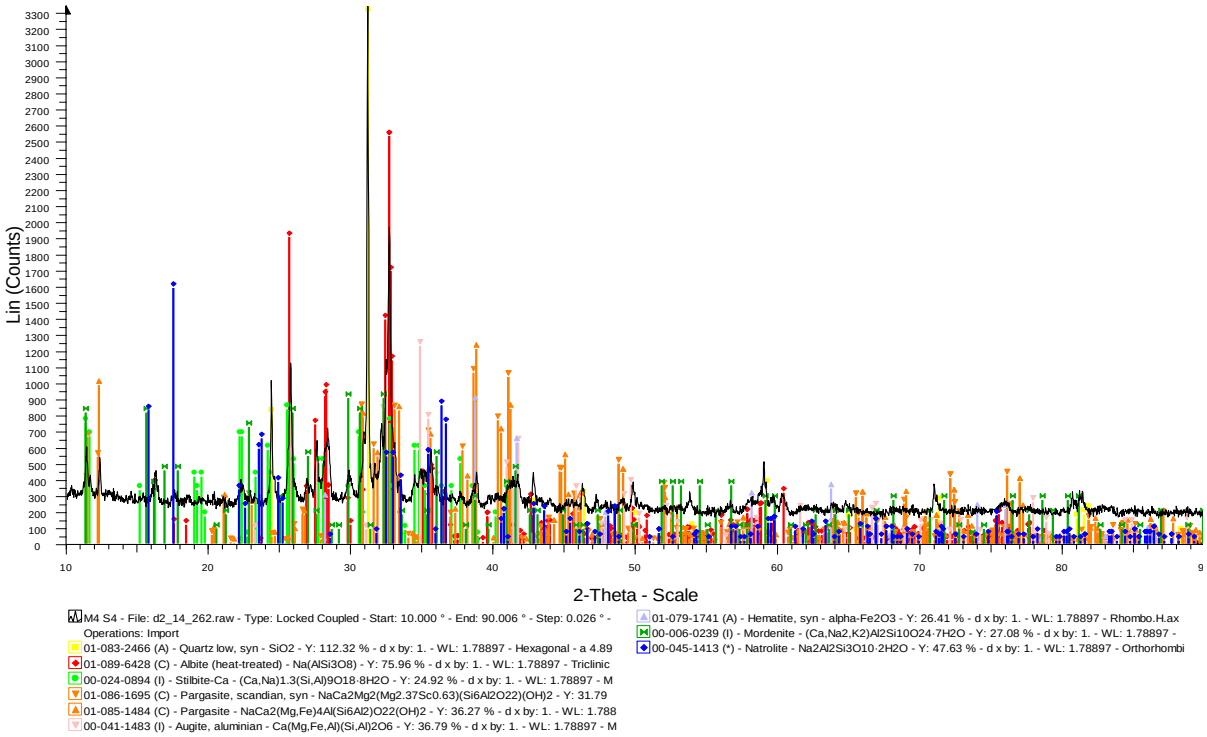


Sample: M4 S-3 from 159.98 m depth
Analysed: melt clast

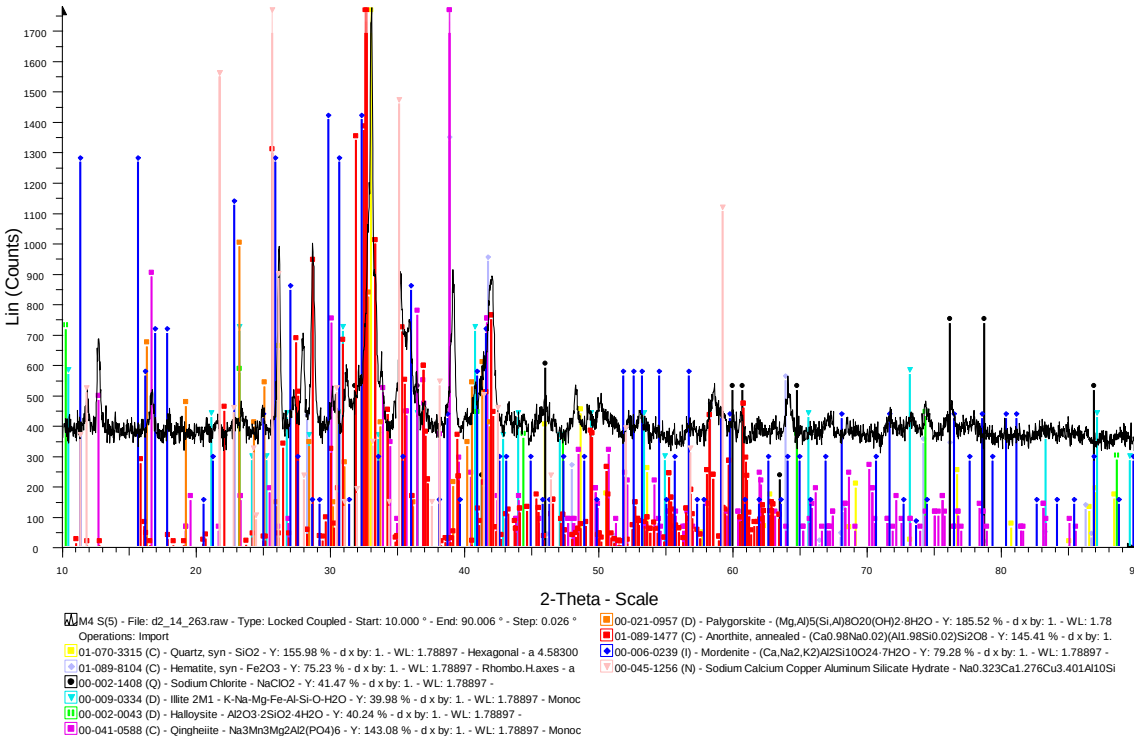




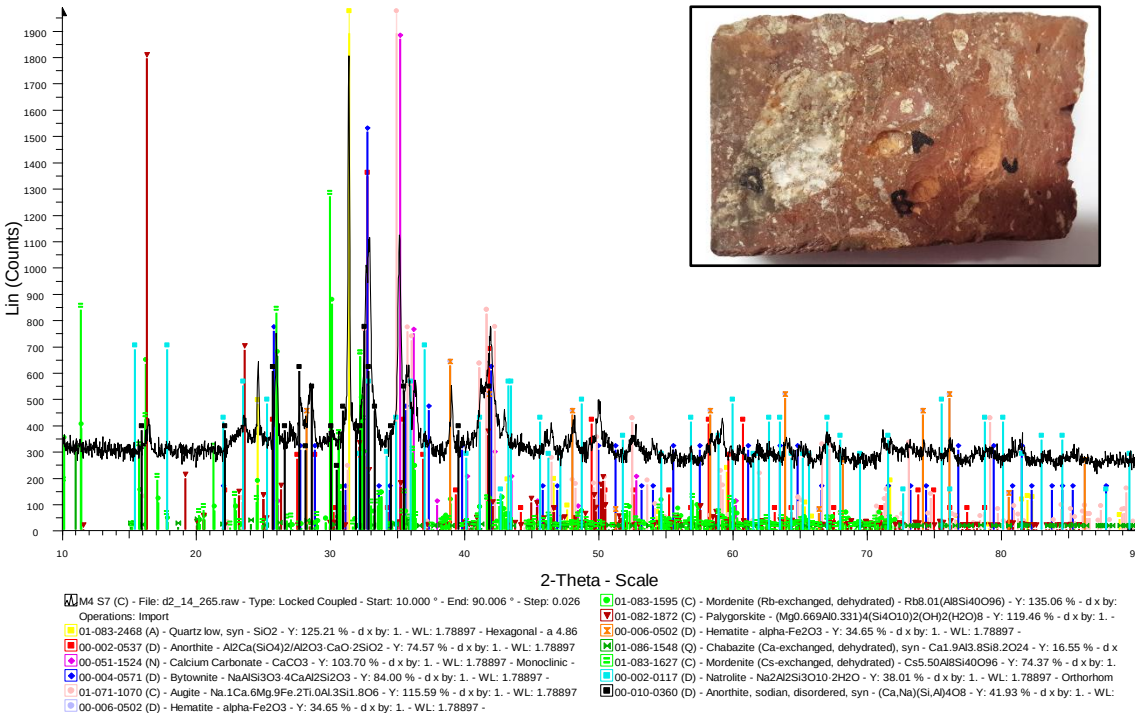
Sample: M4 S-4 from 285.03 m depth
Analysed: matrix



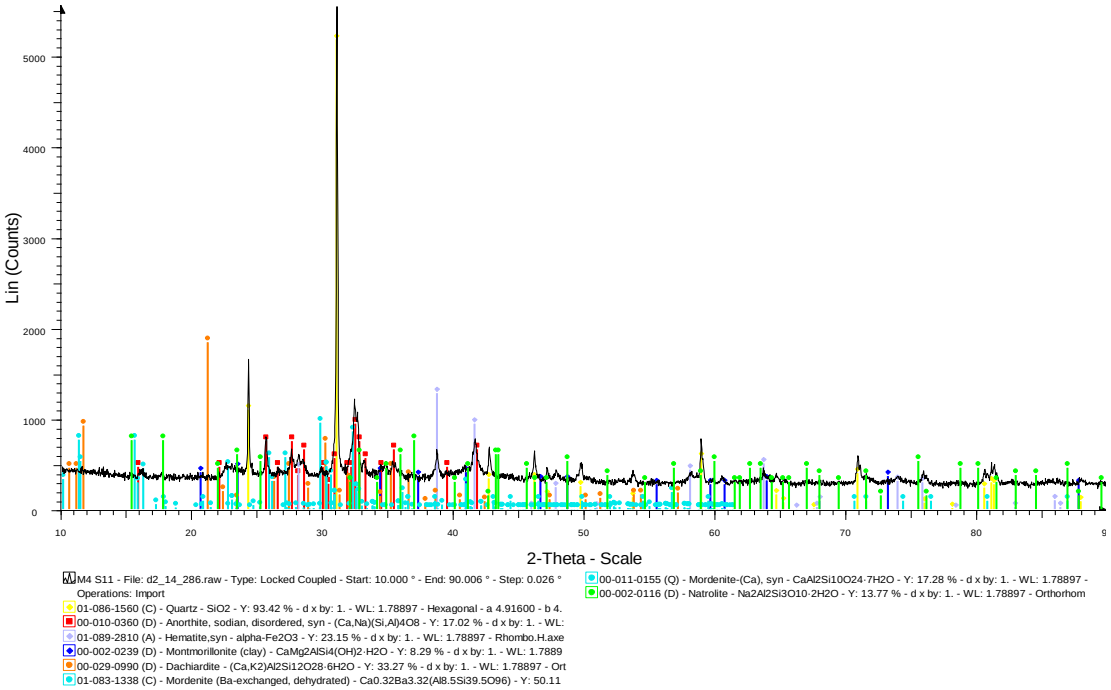
Sample: M4 S-5 from 285.97 m depth
Analysed: matrix



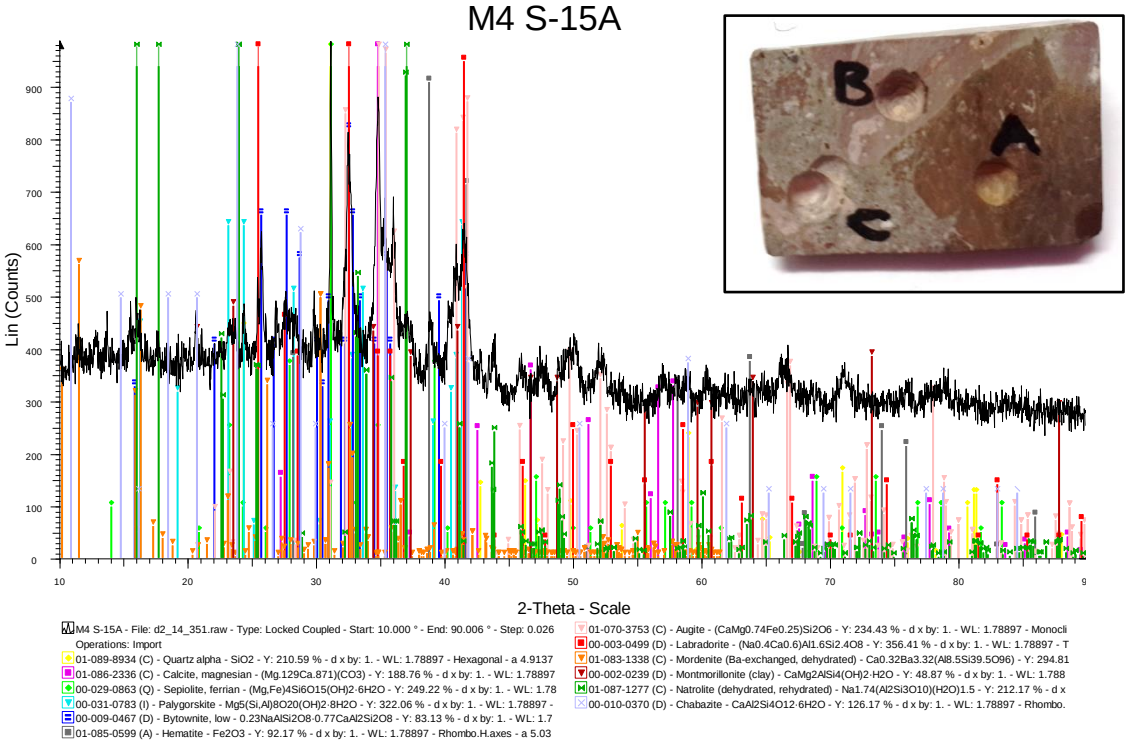
Sample: M4 S-7 from 146.68 m depth
Analysed: matrix (C)



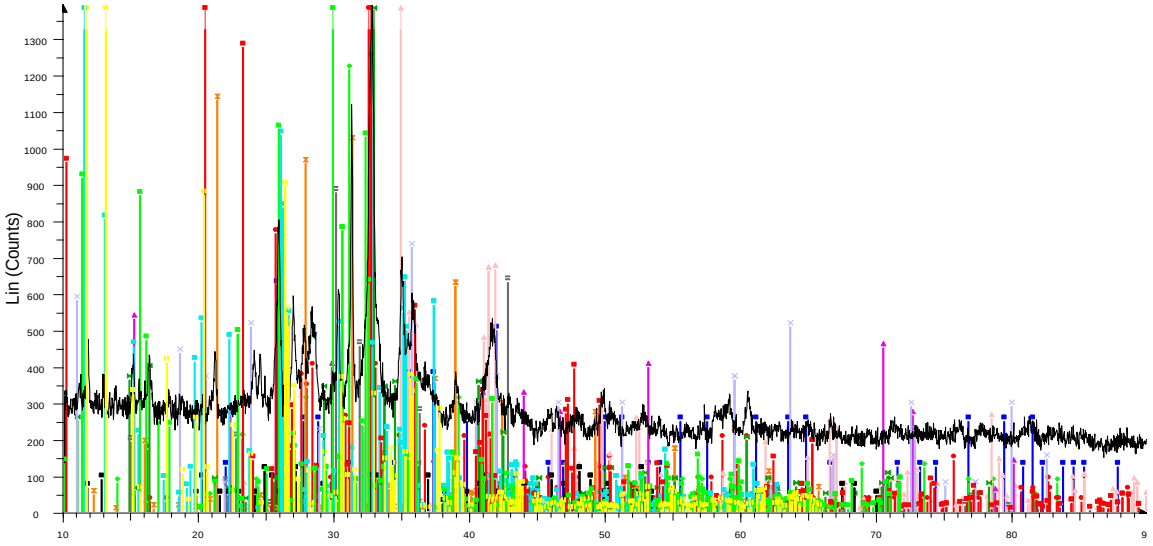
Sample: M4 S-11 from 167.50 m depth
Analysed: matrix



Sample: M4 S-15 from 208.49-208.63 m depth
Analysed: melt clasts (A and B), matrix (C)

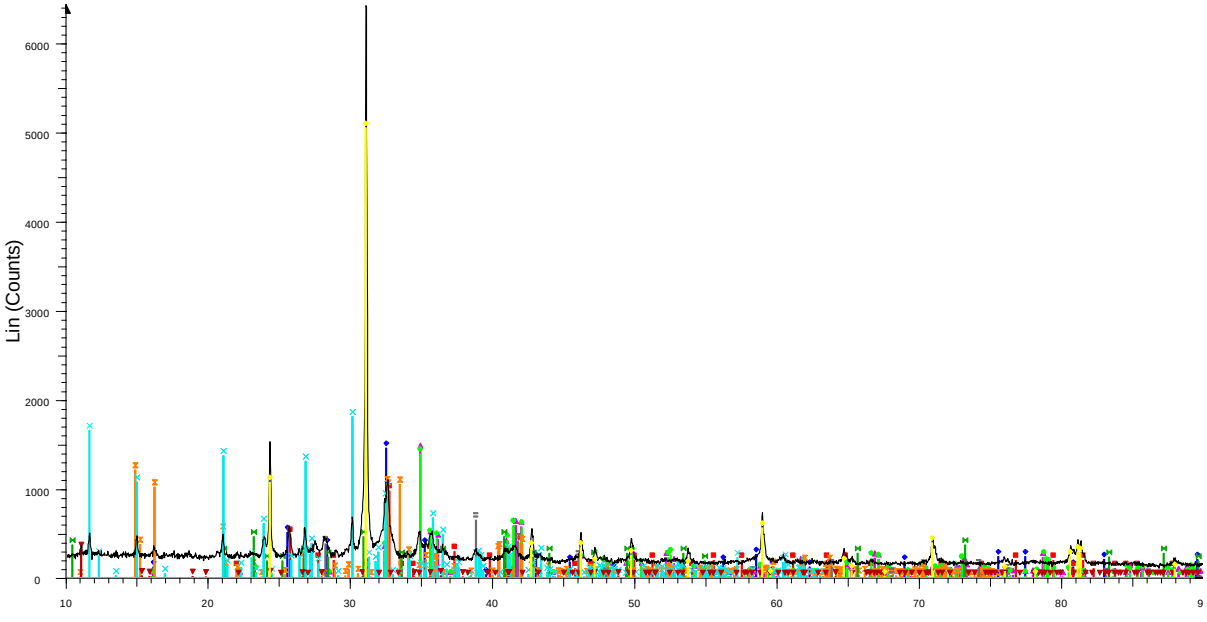


M4 S-15 B



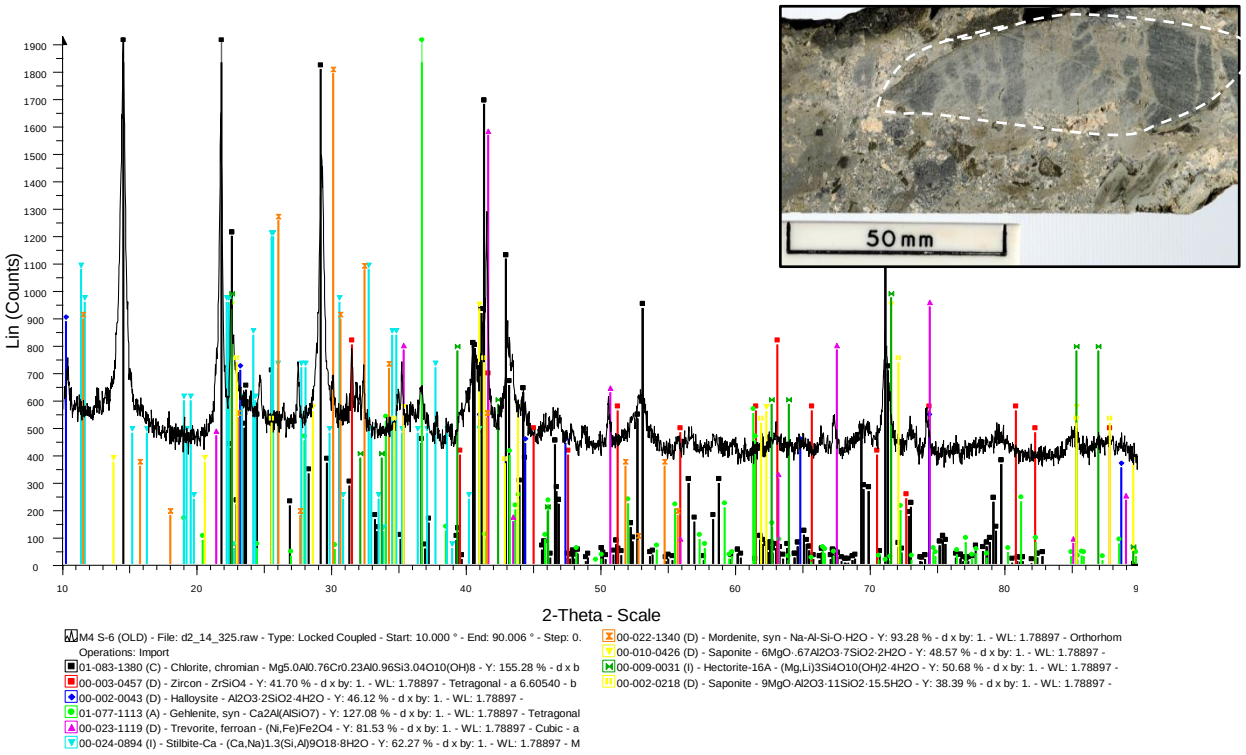
M4 S-15 B - File: d2_14_352.raw - Type: Locked Coupled - Start: 10.000 ° - End: 90.006 ° - Step: 0.02
Operations: Import
00-004-0571 (D) - Bytownite - NaAlSi3O3·4CaAl2Si2O3 - Y: 89.63 % - d x by: 1. - WL: 1.78897 -
00-029-0863 (Q) - Sepiolite, ferrian - (Mg,Fe)4Si6O15(OH)2·6H2O - Y: 145.69 % - d x by: 1. - WL: 1.78
00-041-1480 (I) - Albite, calcian, ordered - (Na,Ca)Al(Si,Al)3O8 - Y: 203.91 % - d x by: 1. - WL: 1.78897
01-088-0834 (A) - Augite - (Mg,Fe,Al,Ti)(Ca,Mg,Fe,Na)(Si,Al)2O6 - Y: 116.84 % - d x by: 1. - WL: 1.788
00-003-0072 (D) - Chlorite [NR] - Fe4Al4Si2O10(OH)8 - Y: 38.18 % - d x by: 1. - WL: 1.78897 -
01-087-0606 (C) - Quadridavyne - (Na5.03K.98Cl1.62)(Ca2Cl2)(Si6Al6O24) - Y: 81.42 % - d x by: 1. -
01-081-1995 (C) - Clinoptilolite-K - (Na0.28Ca0.222)4(Ba0.08K0.42)4(Al6.96Si29.04O72)(H2O)6.72 -
00-054-0662 (I) - Lemmleinite-Ba - Na2K2Ba1+xTi4[Si4O12]2(O,OH)4·5H2O - Y: 100.32 % - d x by: 1.
00-053-1041 (N) - Fenaksite - (K,Na)4Fe2Si8O20(OH,F) - Y: 63.08 % - d x by: 1. - WL: 1.78897 - Tricli
00-053-0912 (N) - Chabazite-Sr - (Sr,Ca,K,Na)(Al2Si4O12)·6H2O - Y: 52.29 % - d x by: 1. - WL: 1.7889
00-052-1646 (N) - Kalifersite - (K,Na)5Fe7(Si20O50)(OH)6·12H2O - Y: 161.93 % - d x by: 1. - WL: 1.7
01-085-1843 (C) - Heulandite - (Na,Ca)2.5Al3(Al,Si)2Si13O36·12H2O - Y: 138.71 % - d x by: 1. - WL: 1
01-074-1022 (D) - Halloysite - (OH)8Al2Si2O3 - Y: 142.20 % - d x by: 1. - WL: 1.78897 - Monoclinic - a
01-073-1490 (C) - Mordenite - (K2.8Na2Ca2)(Al8.8Si39.2O96)(H2O)34 - Y: 120.56 % - d x by: 1. - WL:

M4 S-15 C MATRIX

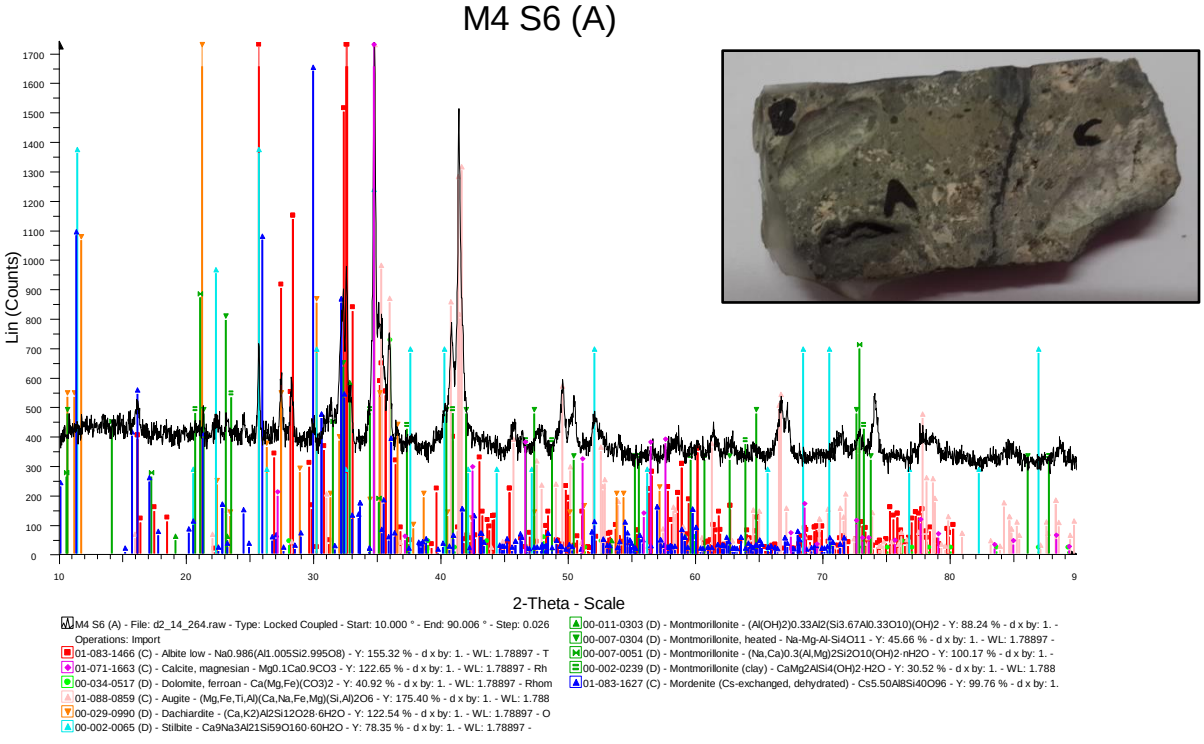


M4 S-15 C MATRIX - File: d2_14_353.raw - Type: Locked Coupled - Start: 10.000 ° - End: 90.006 ° - St
Operations: Import
01-086-1560 (C) - Quartz - SiO2 - Y: 78.77 % - d x by: 1. - WL: 1.78897 - Hexagonal - a 4.91600 - b 4.
00-001-0739 (D) - Albite - NaAlSi3O8 - Y: 22.62 % - d x by: 1. - WL: 1.78897 - Triclinic - a 8.10000 - b
00-004-0571 (D) - Bytownite - NaAlSi3O3·4CaAl2Si2O3 - Y: 15.09 % - d x by: 1. - WL: 1.78897 -
01-080-1862 (C) - Diopside sodian - (Ca0.78Na0.18Mg0.04)(Mg0.79Fe0.05Cr0.09Al0.07)(Si1.97Al0.03
01-071-0721 (C) - Augite - (Ca.818Mg.792Fe.183Fe.086Al.151Al.269Si1.751)O6 - Y: 21.59 % - d x by:
01-089-6219 (C) - Labuntsovite (Mn-exchanged) - (K2.9Na0.3)((H2O)3.3K0.7(Mn1.3Mg0.2Fe0.15))(Ti6.
00-009-0334 (D) - Illite 2M1 - K-Na-Mg-Fe-Al-Si-O-H2O - Y: 7.11 % - d x by: 1. - WL: 1.78897 - Monocli
01-085-0987 (A) - Hematite - Fe2O3 - Y: 10.03 % - d x by: 1. - WL: 1.78897 - Rhombo.R.axes - a 5.42
01-087-1034 (C) - Epistilbite - Ca3.06((Al6.18Si17.82)O48)(H2O)16 - Y: 28.11 % - d x by: 1. - WL: 1.78
01-085-0594 (C) - Chabazite (Ca-exchanged, dehydrated) - Ca1.95Al3.9Si8.1O24 - Y: 4.88 % - d x by:

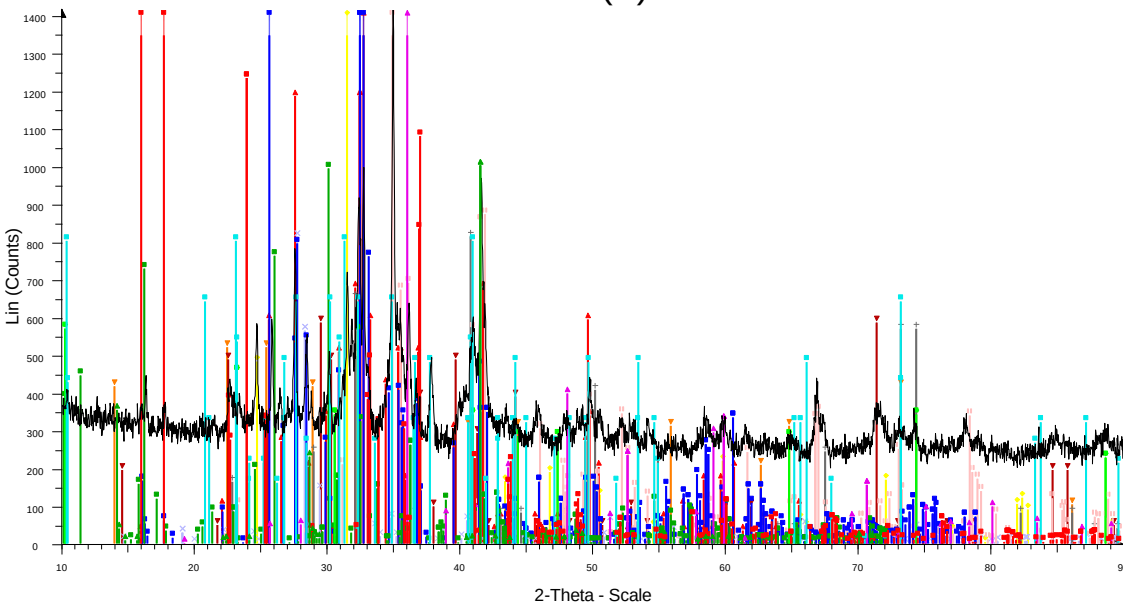
Sample: M4 S-6 from 316.52 m depth
Analysed: lithic clast



Sample: M4 S-15 from 208.49-208.63 m depth
Analysed: melt clasts (A and B), matrix (C)

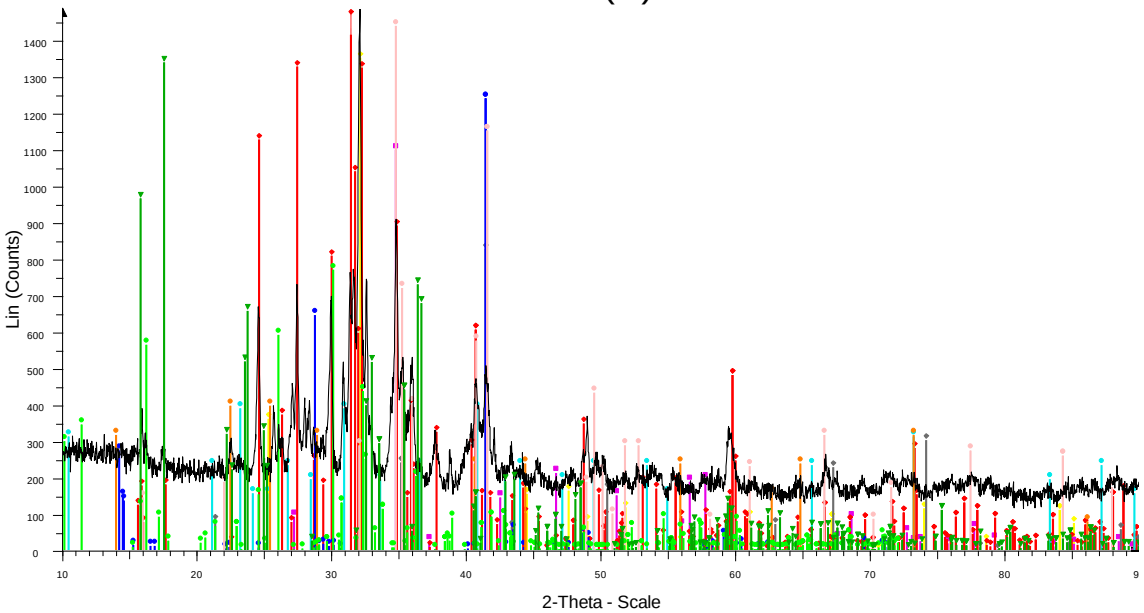


M4 S-6 (B)



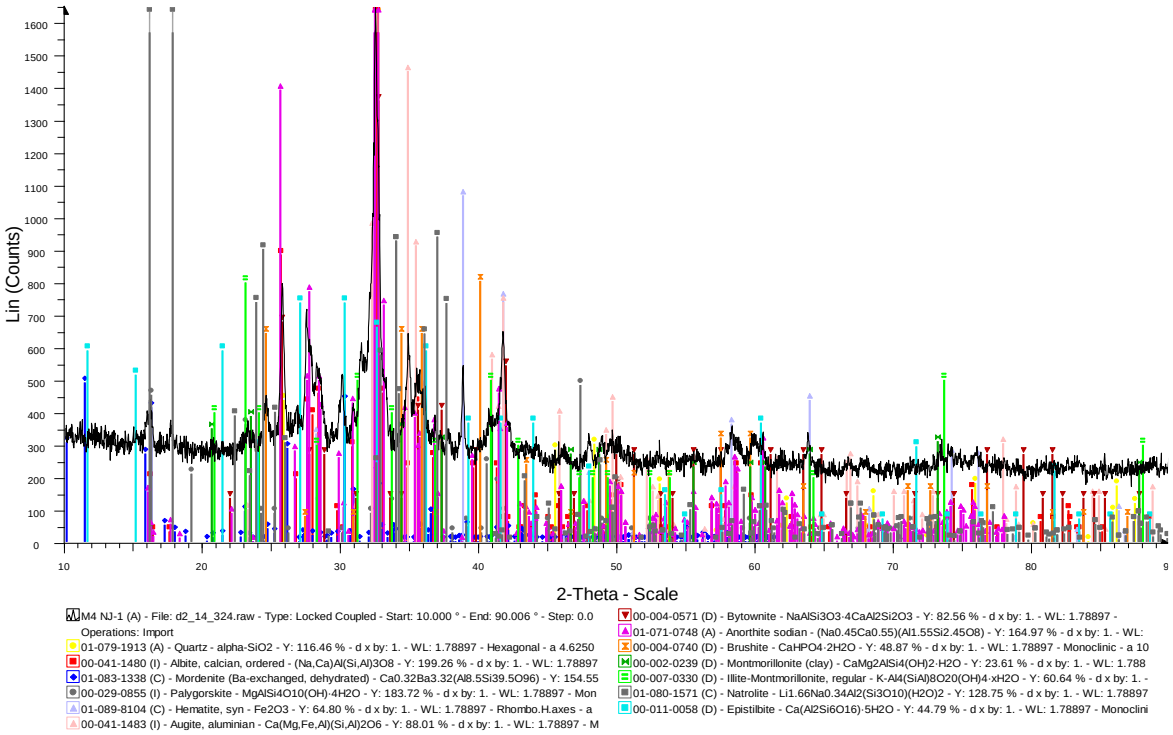
M4 S-6 (B) - File: d2_14_326.raw - Type: Locked Coupled - Start: Operations: Import
00-002-0043 (D) - Halloysite - Al2O3·2SiO2·4H2O - Y: 40.24 % - d
01-078-1258 (A) - Quartz low, syn - alpha-SiO2 - Y: 155.38 % - d x
00-018-1202 (I) - Anorthite, sodian, intermediate - (Ca,Na)(Si,Al)4
00-052-1572 (Q) - Antigorite - Mg3Si2O5(OH)4 - Y: 70.95 % - d x
00-002-0204 (D) - Kaolinite - (Al,Si)2Si2(O,OH)9 - Y: 36.81 % - d x
00-010-0418 (D) - Vermiculite - Mg11Al5FeSi11O42·40H2O - Y: 6
01-075-1716 (C) - Petalite - LiAlSi4O10 - Y: 57.51 % - d x by: 1. -
00-004-0742 (D) - Xanthophyllite (valuevite) - Ca(Mg2Al)(Al2.8Si1.
01-088-2376 (C) - Augite - Mg.927Ca.818Al.078Fe.069Na.06Cr.0
01-078-0433 (C) - Labradorite - Na0.45Ca0.55Al1.55Si2.45O8 - Y
01-083-1595 (C) - Mordenite (Rb-exchanged, dehydrated) - Rb8.0
00-002-0043 (D) - Halloysite - Al2O3·2SiO2·4H2O - Y: 40.24 % - d
00-009-0334 (D) - Illite 2M1 - K-Na-Mg-Fe-Al-Si-O-H2O - Y: 37.85
01-074-1687 (C) - Dolomite - CaMg(CO3)2 - Y: 126.22 % - d x by:
00-002-0056 (D) - Illite - KAl2Si3AlO10(OH)2 - Y: 56.72 % - d x by:
01-087-1277 (C) - Natrolite (dehydrated, rehydrated) - Na1.74(Al2

M4 S6 (C)

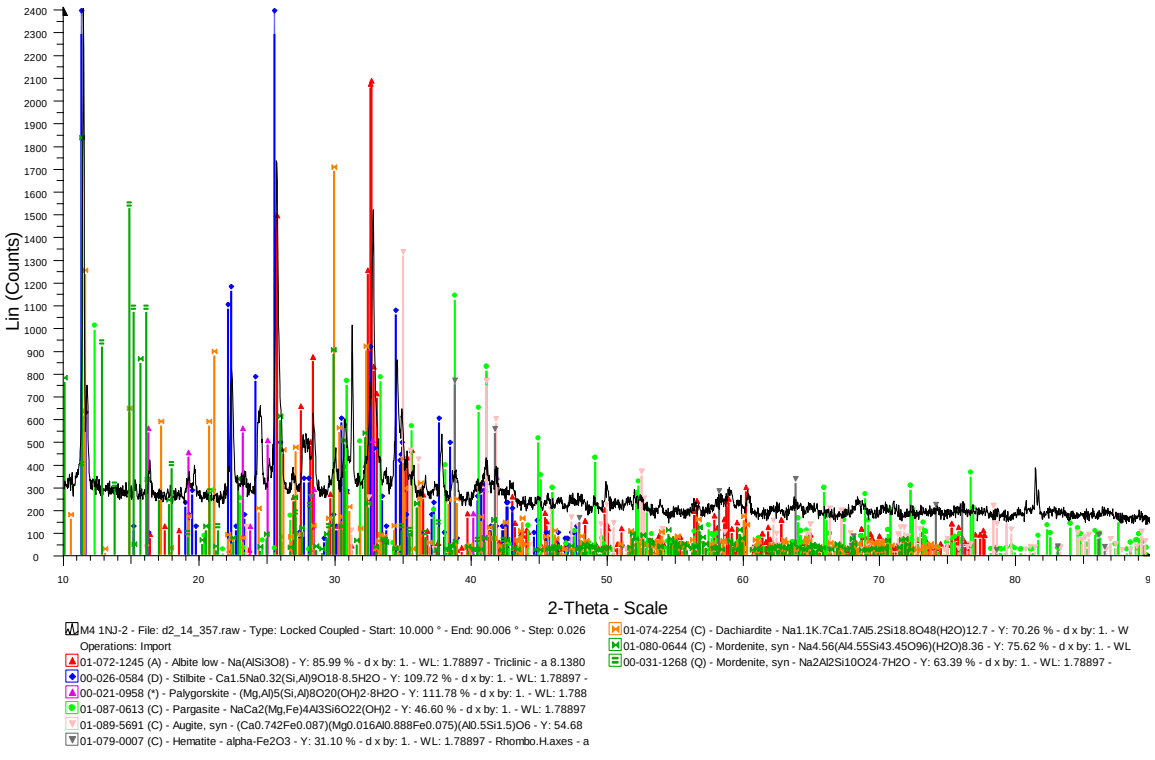


M4 S6 (C) - File: d2_14_327.raw - Type: Locked Coupled - Start: 10.000 ° - End: 90.006 ° - Step: 0.026
Operations: Import
01-085-0460 (A) - Quartz low - alpha-SiO2 - Y: 91.01 % - d x by: 1. - WL: 1.78897 - Hexagonal - a 4.73
01-086-2336 (C) - Calcite, magnesian - (Mg.129Ca.871)(CO3) - Y: 74.00 % - d x by: 1. - WL: 1.78897 -
01-071-0992 (C) - Sanidine - Na.56K3.44Al4Si12O32 - Y: 110.43 % - d x by: 1. - WL: 1.78897 - Monocl
01-075-1372 (A) - Magnetite - Fe3O4 - Y: 55.72 % - d x by: 1. - WL: 1.78897 - Cubic - a 8.39580 - b 8.
00-052-1573 (Q) - Antigorite - Mg3Si2O5(OH)4 - Y: 83.51 % - d x by: 1. - WL: 1.78897 - Monoclinic - a
00-009-0334 (D) - Illite 2M1 - K-Na-Mg-Fe-Al-Si-O-H2O - Y: 26.20 % - d x by: 1. - WL: 1.78897 - Monoc
00-002-0204 (D) - Kaolinite - (Al,Si)2Si2(O,OH)9 - Y: 26.64 % - d x by: 1. - WL: 1.78897 -
00-024-0201 (I) - Augite - Ca(Fe,Mg)Si2O6 - Y: 96.90 % - d x by: 1. - WL: 1.78897 - Monoclinic - a 9.7
01-083-1595 (C) - Mordenite (Rb-exchanged, dehydrated) - Rb8.01(Al8Si40O96) - Y: 146.58 % - d x by:
01-075-2271 (A) - Natrolite - Na2Al2Si3O10(H2O)2 - Y: 90.13 % - d x by: 1. - WL: 1.78897 - Orthorhom

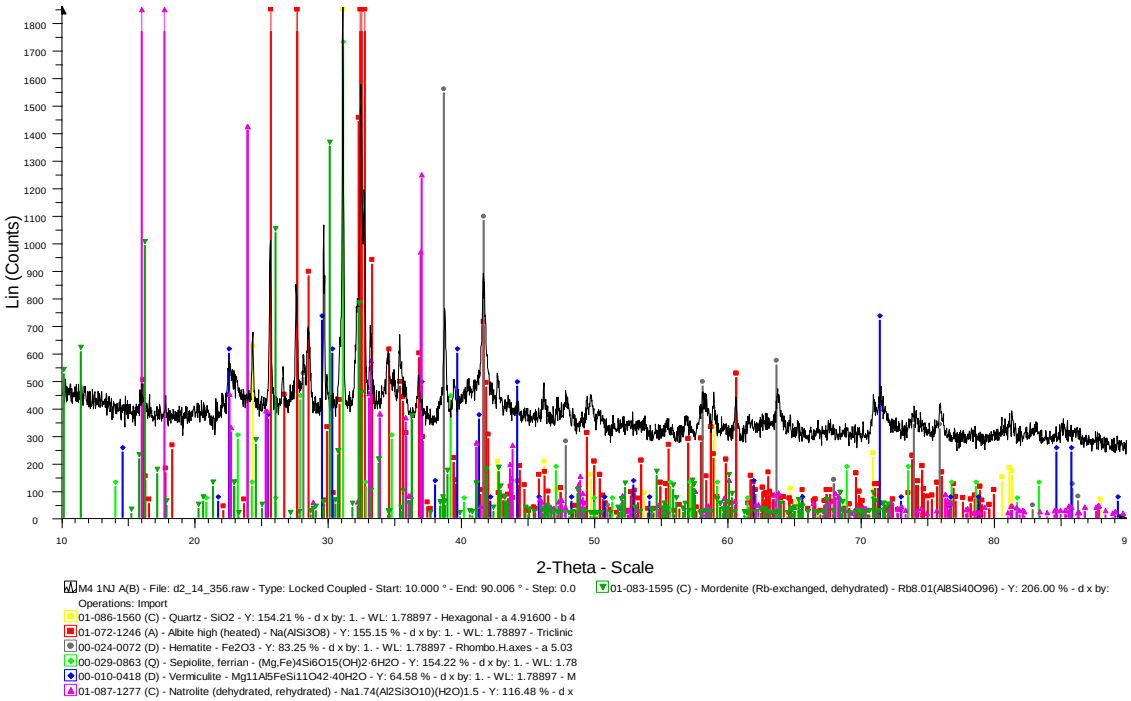
Sample: M4 INJ-1 from 140.30 m depth
Analysed: matrix



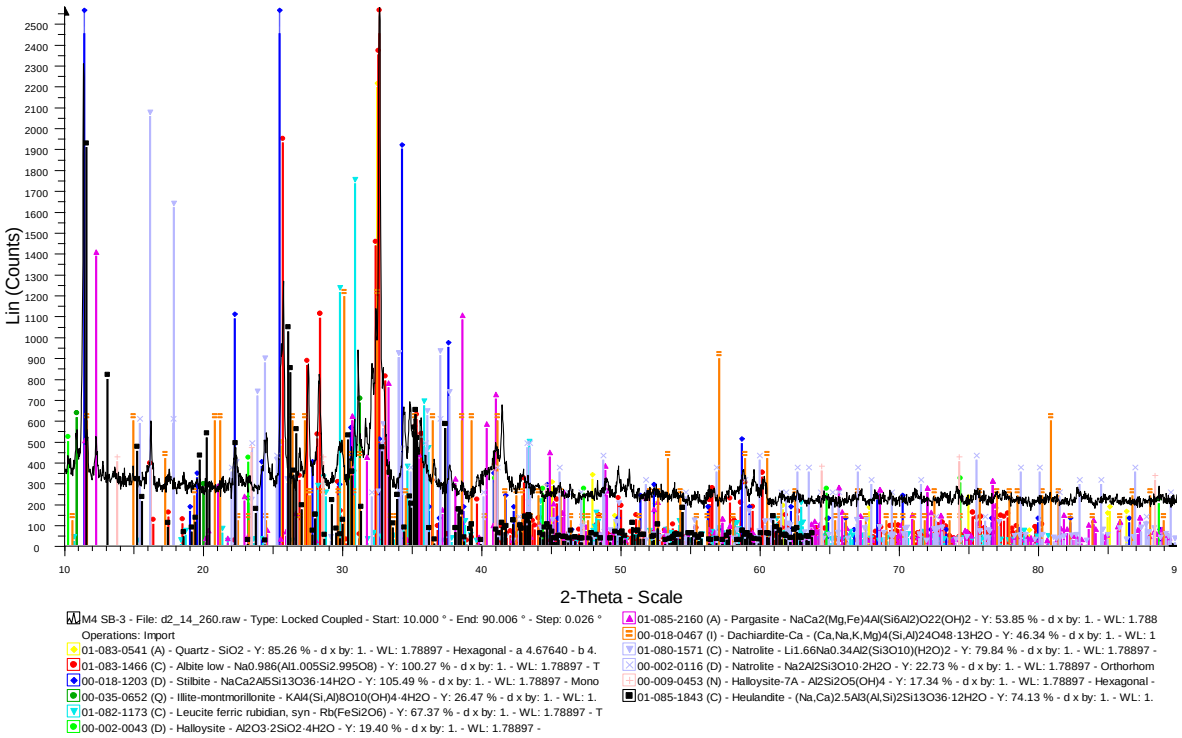
Sample: M4 INJ-2 from 158.06 m depth
Analysed: matrix



Sample: M4 A-INJ from 189.00 m depth
Analysed: matrix



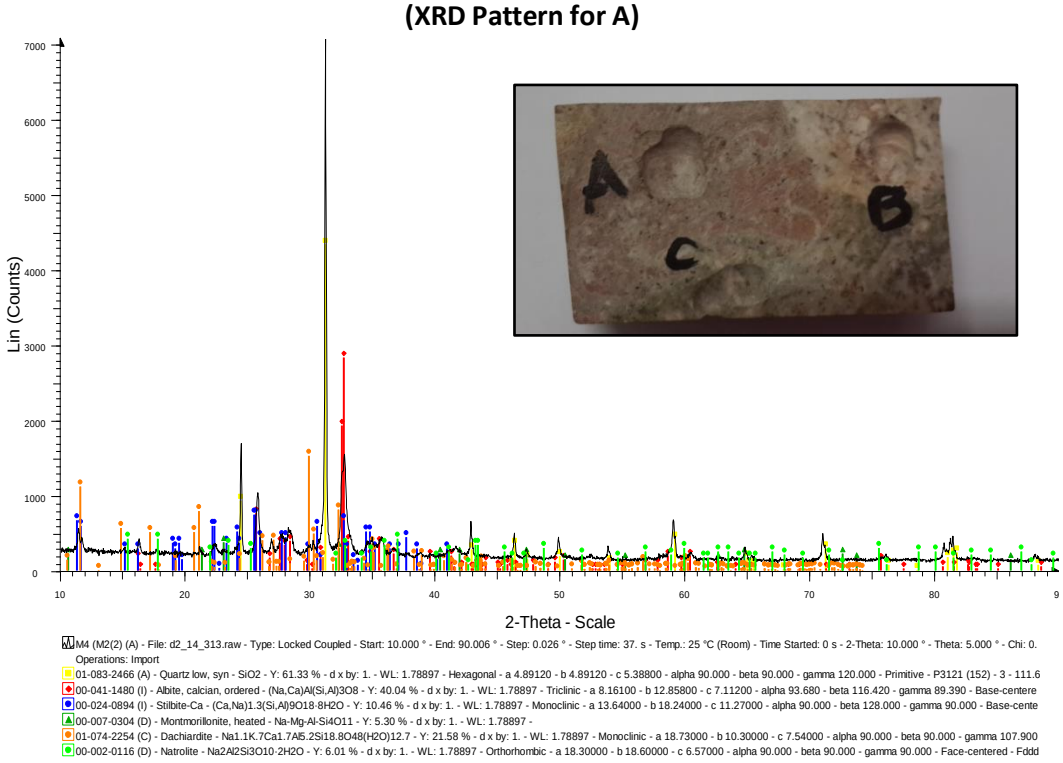
Sample: M4 SB-3 from 355.37 m depth
Analysed: matrix

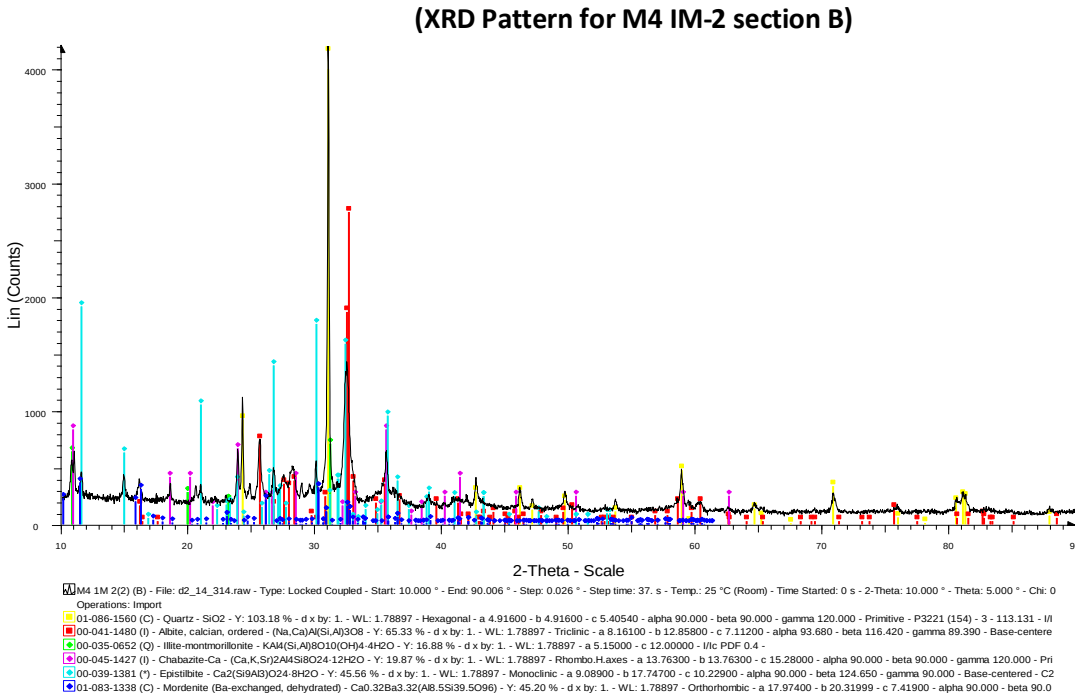


Appendix 4C Continued….: **X-ray diffraction profiles - Melt matrix breccia (MMBr) samples**

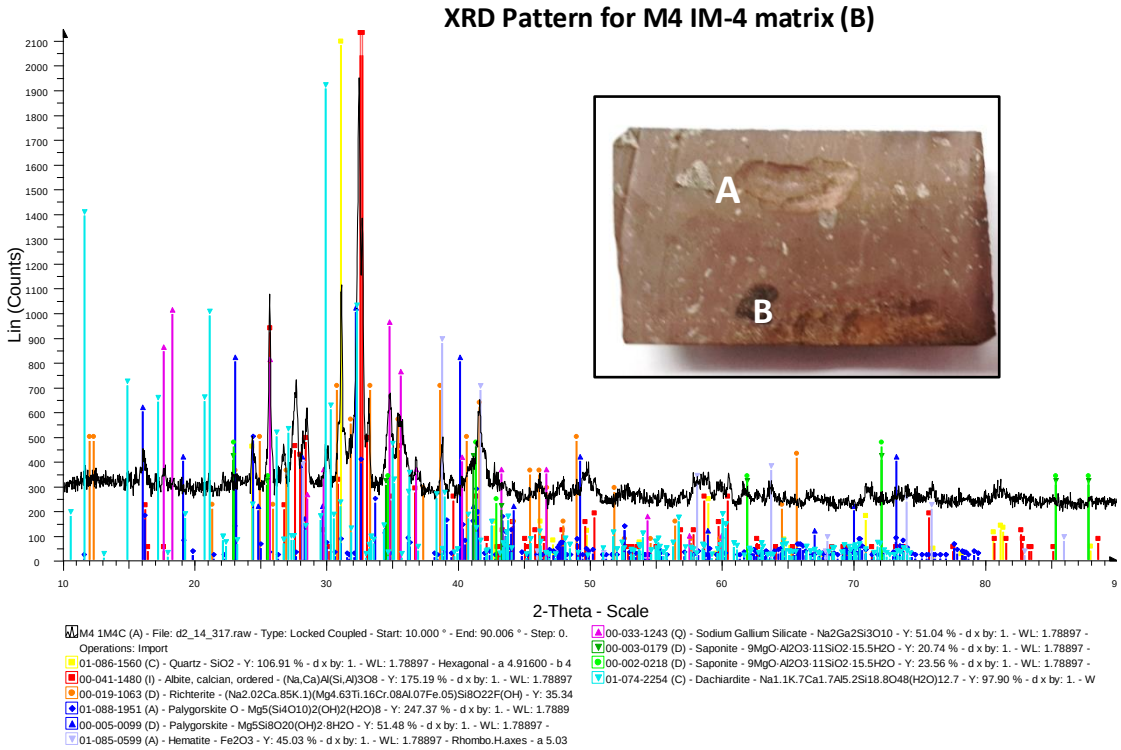
Sample: M4 IM-1 from 176.60 m depth
Analysed: matrix

Sample: M4 IM-2 from 234.33 m depth
Analysed: matrix and melt particle

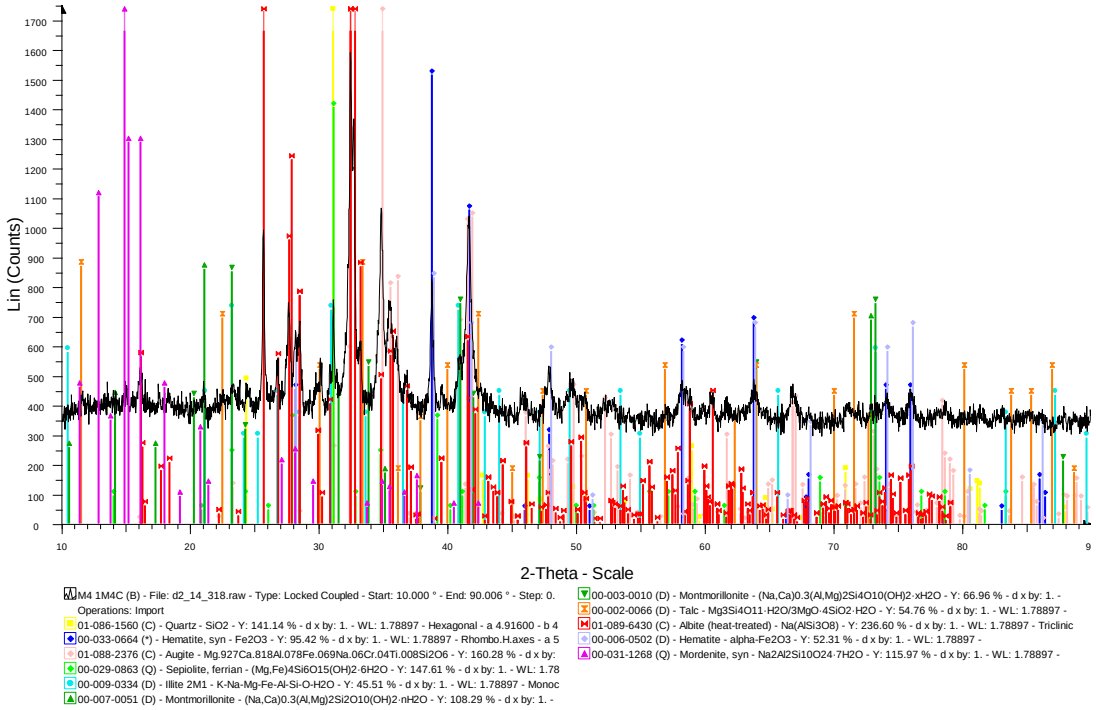




Sample: M4 IM-4 from 259.11 m depth
Analysed: matrix and lithic clast

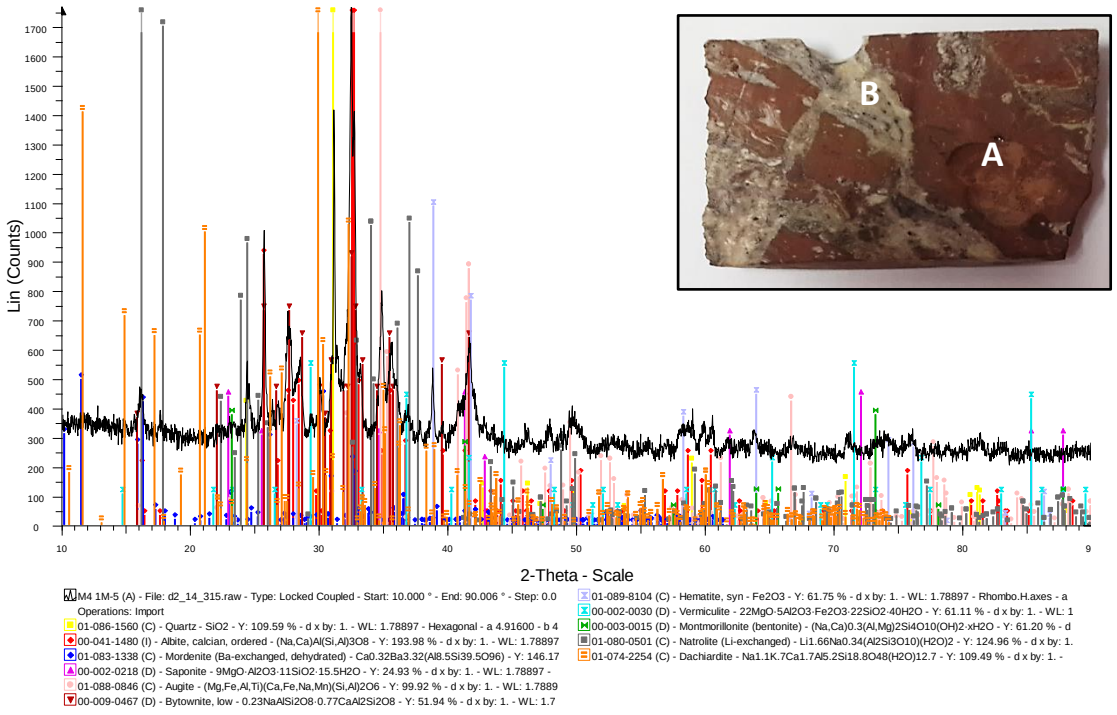


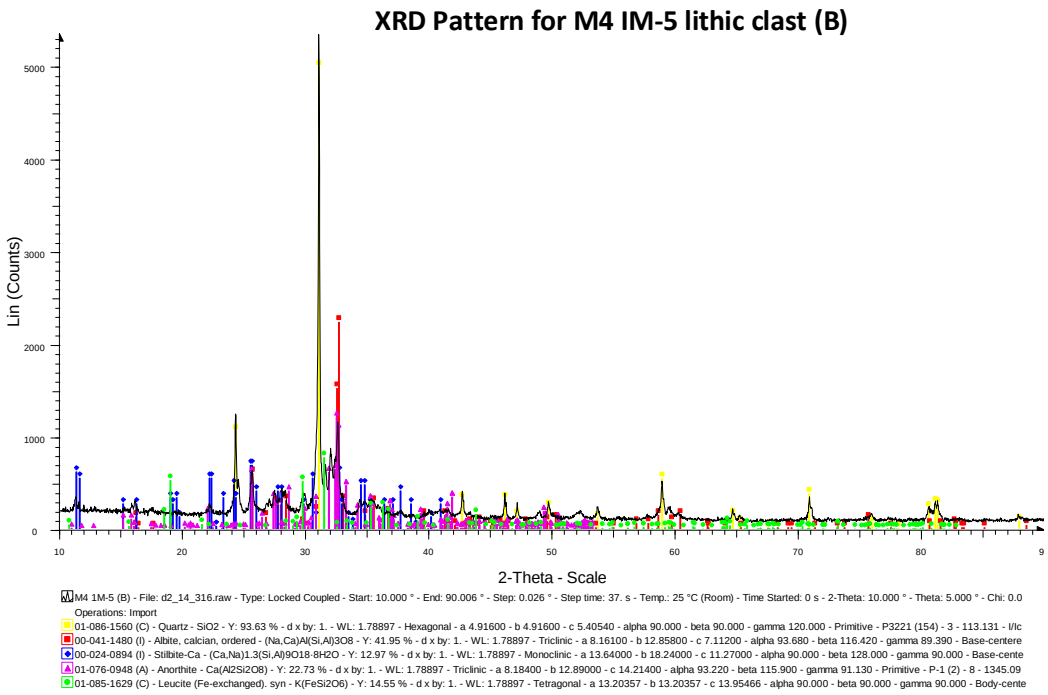
XRD Pattern for M4 IM-4 dolerite lithic clast (B)



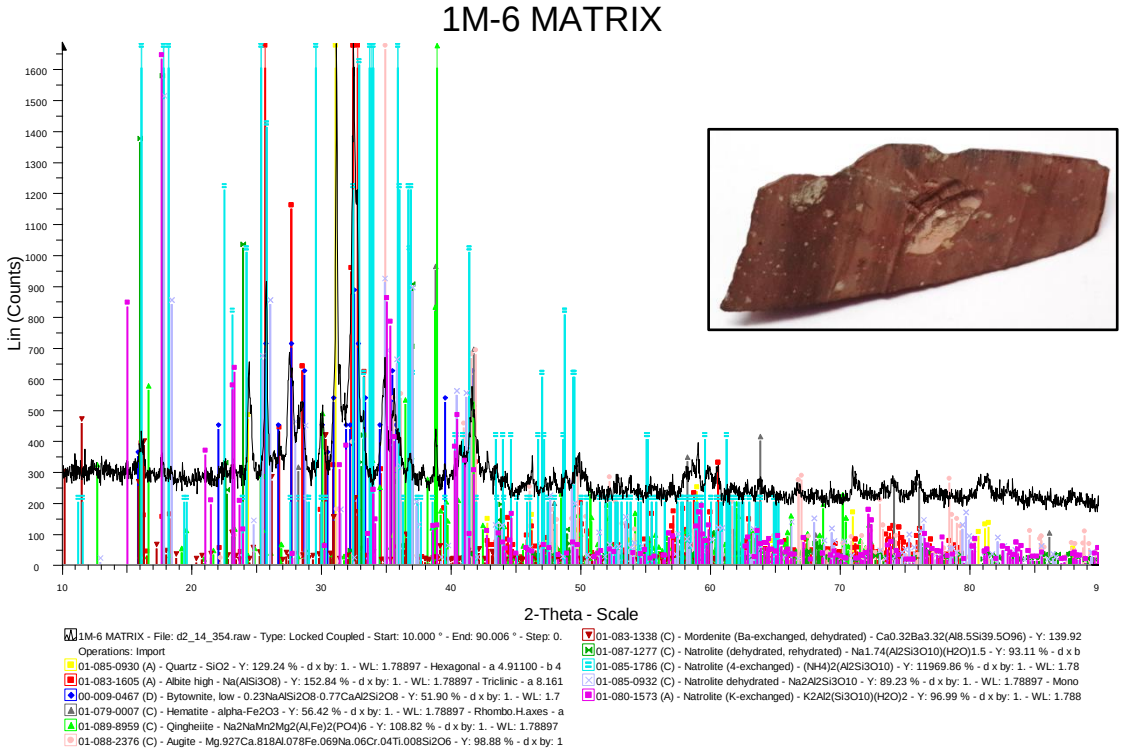
Sample: M4 IM-5 from 262.60 m depth
Analysed: matrix and lithic clast

XRD Pattern for M4 IM-5 matrix (A)





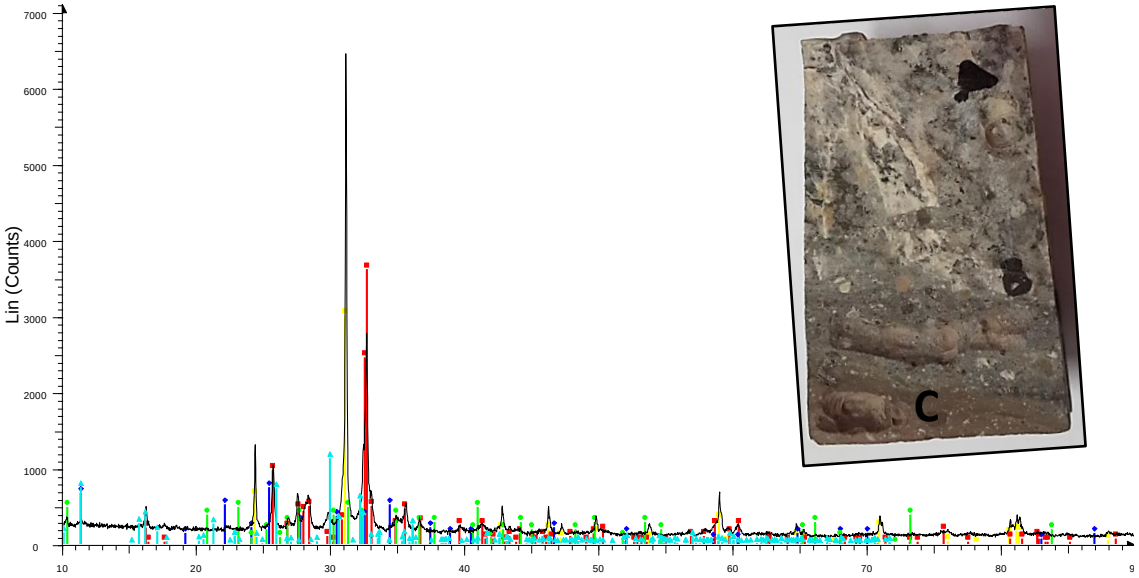
Sample: M4 IM-6 from 271.17 m depth
Analysed: matrix



Sample: M4 IM-9 from 299.76 m depth

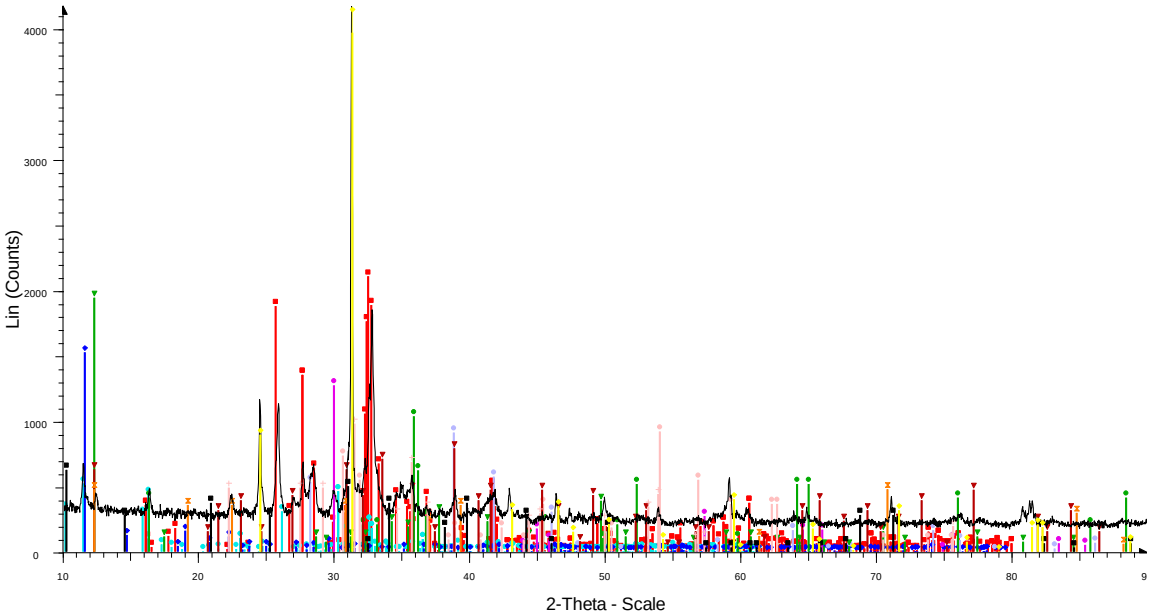
Analysed: Cataclased section (A), suevite matrix (B) and MMBr matrix (C)

1M 9 A



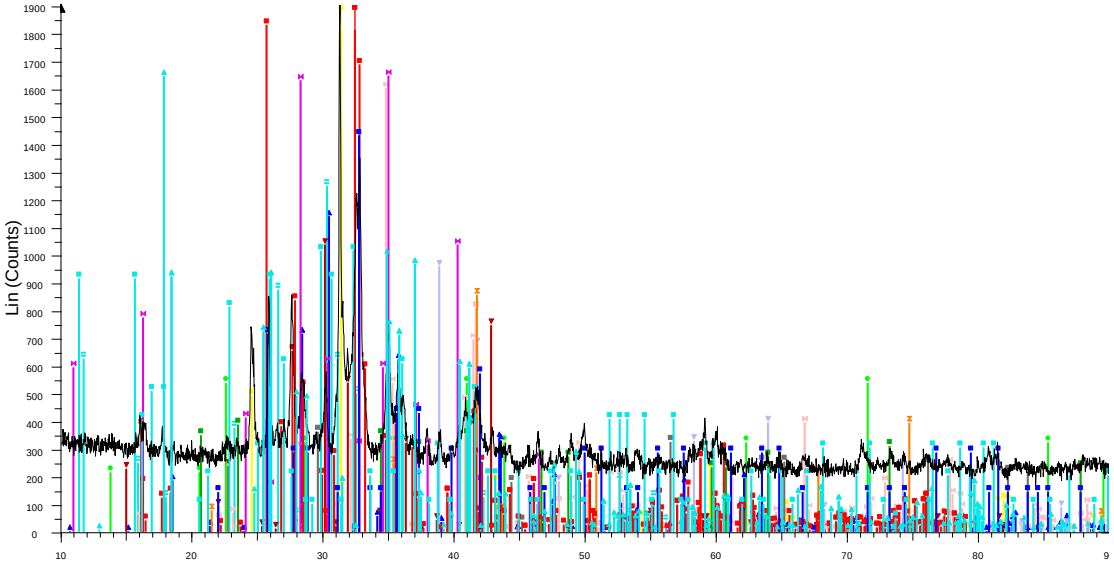
1M 9 A - File: d2_14_321.raw - Type: Locked Coupled - Start: 10.000 ° - End: 90.006 ° - Step: 0.026 ° - Step time: 37. s - Temp.: 25 °C (Room) - Time Started: 0 s - 2-Theta: 10.000 ° - Theta: 5.000 ° - Chi: 0.00 ° - P
Operations: Import
01-086-1560 (C) - Quartz - SiO2 - Y: 46.71 % - d x by: 1. - WL: 1.78897 - Hexagonal - a 4.91600 - b 4.91600 - c 5.40540 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P3221 (154) - 3 - 113.131 - I/Ic
00-041-1480 (I) - Albite, calcian, ordered - (Na,Ca)Al(Si,Al)3O8 - Y: 56.12 % - d x by: 1. - WL: 1.78897 - Triclinic - a 8.16100 - b 12.85800 - c 7.11200 - alpha 93.680 - beta 116.420 - gamma 89.390 - Base-centere
00-010-0433 (D) - Stilbite - NaCa2Al5Si13O36·14H2O - Y: 11.61 % - d x by: 1. - WL: 1.78897 - Monoclinic - a 13.63000 - b 18.16000 - c 11.31000 - alpha 90.000 - beta 128.000 - gamma 90.000 - Base-centered -
00-002-0056 (D) - Illite - KAl2Si3AlO10(OH)2 - Y: 7.61 % - d x by: 1. - WL: 1.78897 - Monoclinic - a 5.18000 - b 9.02000 - c 20.04000 - alpha 90.000 - beta 95.500 - gamma 90.000 - Base-centered - C2/c (15) - 4 -
01-083-1627 (C) - Mordenite (Cs-exchanged, dehydrated) - Cs5.50Al8Si40O96 - Y: 18.62 % - d x by: 1. - WL: 1.78897 - Orthorhombic - a 18.19400 - b 20.47000 - c 7.50600 - alpha 90.000 - beta 90.000 - gamma 9

1 M9 B



1 M9 B - File: d2_14_322.raw - Type: Locked Coupled - Start: 10.000 ° - End: 90.006 ° - Step: 0.026 ° -
Operations: Import
01-083-2467 (A) - Quartz low, syn - SiO2 - Y: 102.37 % - d x by: 1. - WL: 1.78897 - Hexagonal - a 4.86
01-072-1246 (A) - Albite high (heated) - Na(AlSi3O8) - Y: 50.60 % - d x by: 1. - WL: 1.78897 - Triclinic -
01-083-1338 (C) - Mordenite (Ba-exchanged, dehydrated) - Ca0.32Ba3.32(Al8.5Si39.5O96) - Y: 64.93
01-074-1786 (D) - Kaolinite 1A - Al2Si2O5(OH)4 - Y: 36.59 % - d x by: 1. - WL: 1.78897 - Triclinic - a 5.
01-075-1537 (A) - Anatase - TiO2 - Y: 30.50 % - d x by: 1. - WL: 1.78897 - Tetragonal - a 3.73000 - b 3
01-085-0987 (A) - Hematite - Fe2O3 - Y: 21.82 % - d x by: 1. - WL: 1.78897 - Rhombo.R.axes - a 5.42
00-023-0868 (D) - Calcium Chlorite Hydrate - Ca(ClO)2·3H2O - Y: 46.59 % - d x by: 1. - WL: 1.78897 -
00-016-0119 (Q) - Calcium Chlorite - Ca(ClO2)2 - Y: 24.85 % - d x by: 1. - WL: 1.78897 -
00-003-1067 (D) - Aragonite - gamma-CaCO3 - Y: 22.03 % - d x by: 1. - WL: 1.78897 - Orthorhombic -
00-009-0437 (D) - Tremolite - Ca2Mg5Si8O22(OH)2 - Y: 18.94 % - d x by: 1. - WL: 1.78897 - Monoclini
00-008-0250 (D) - Sauconite - Zn-Mg-Fe-Al-Si-Al-O-H2O - Y: 14.30 % - d x by: 1. - WL: 1.78897 -
00-008-0075 (D) - Carnallite - KCl·MgCl2·6H2O - Y: 23.54 % - d x by: 1. - WL: 1.78897 - Orthorhombic
00-011-0248 (D) - Plancheite - 3CuSiO3·H2O/3Cu·3SiO2·H2O - Y: 15.01 % - d x by: 1. - WL: 1.78897

M4 1M-9 C



M4 1M-9 C - File: d2_14_323.raw - Type: Locked Coupled - Start: Operations: Import

01-083-2468 (A) - Quartz low, syn - SiO2 - Y: 122.16 % - d x by: 1.

00-010-0426 (D) - Saponite - 6MgO·.67Al2O3·7SiO2·2H2O - Y: 28

01-085-1628 (C) - Leucite (Cs-exchanged) - Cs(AlSi2O6) - Y: 59.9

01-085-0932 (C) - Natrolite dehydrated - Na2Al2Si3O10 - Y: 86.64

00-022-1339 (D) - Mordenite - Na-Al-Si-O-H2O - Y: 65.71 % - d x b

01-089-8104 (C) - Hematite, syn - Fe2O3 - Y: 50.39 % - d x by: 1.

01-088-0845 (A) - Augite - (Mg,Fe,Ti,Al)(Ca,Fe,Na,Mn)(Si,Al)2O6 -

00-053-1041 (N) - Fenaksite - (K,Na)4Fe2Si8O20(OH,F) - Y: 54.5

00-044-0248 (Q) - Chabazite-Na, syn - NaAlSiO4·xH2O - Y: 86.59

00-002-0239 (D) - Montmorillonite (clay) - CaMg2AlSi4(OH)2·H2O

00-054-0964 (*) - Trevorite, syn - NiFe2O4 - Y: 45.00 % - d x by: 1

00-002-0387 (D) - Anatase - TiO2 - Y: 18.97 % - d x by: 1. - WL: 1

01-089-6430 (C) - Albite (heat-treated) - Na(AlSi3O8) - Y: 134.31

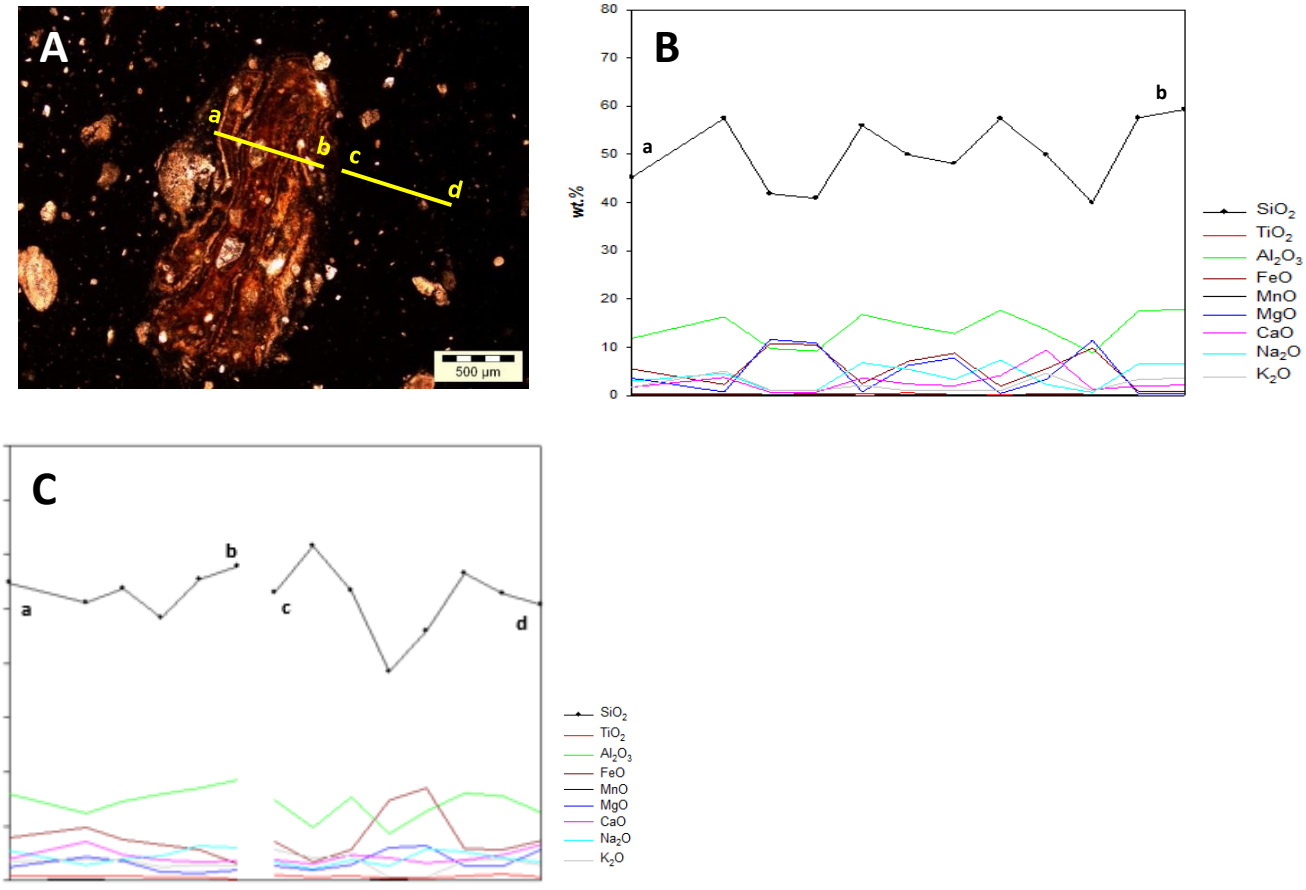
00-004-0571 (D) - Bytownite - NaAlSi3O3·4CaAl2Si2O3 - Y: 75.24

00-006-0239 (I) - Mordenite - (Ca,Na2,K2)Al2Si10O24·7H2O - Y:

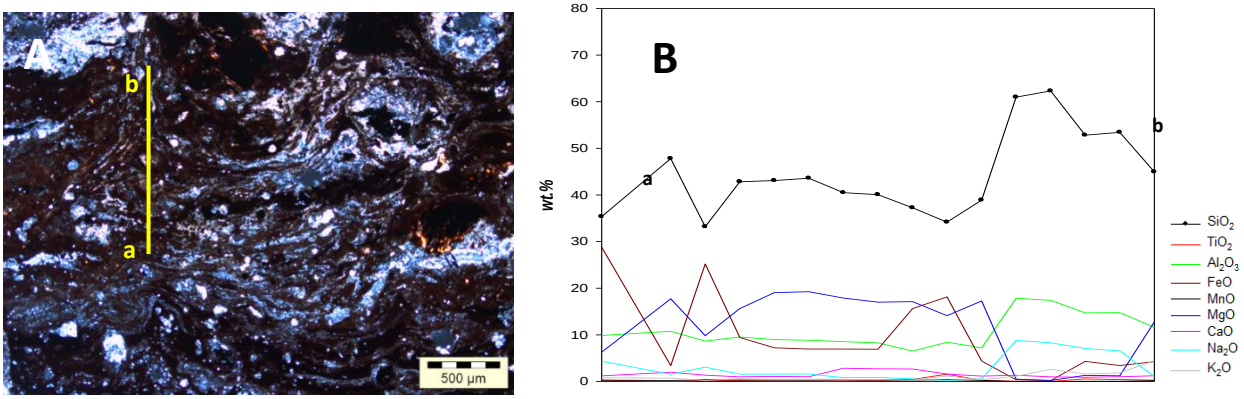
Appendix 4D: Melt fragments and matrix traverses

Geochemical characterisation of the melt particles

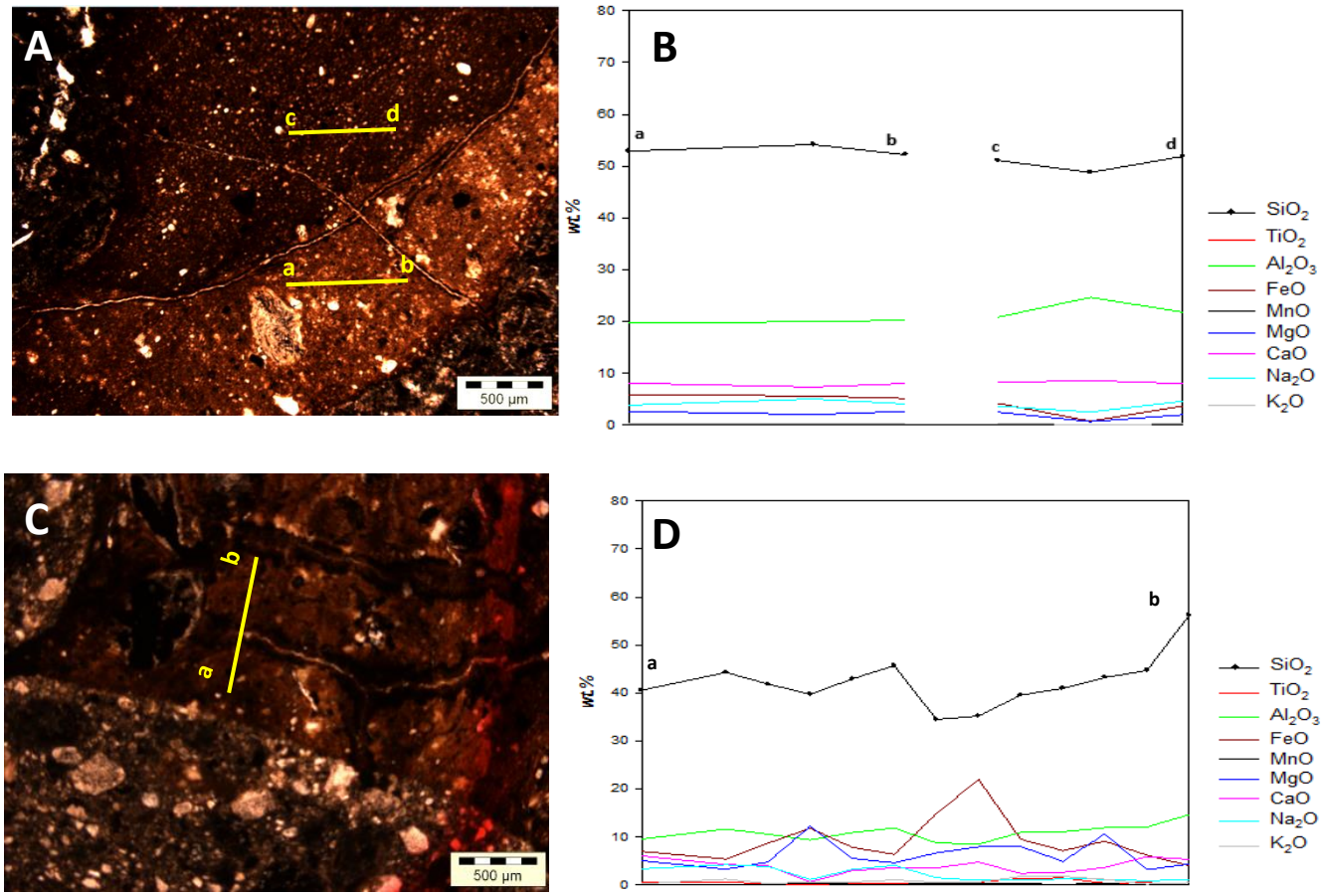
Despite many melt particles appearing isotropic in thin sections, XRD and BSEM have confirmed that no evidence of glass is preserved in these melt particles. The internal compositional heterogeneity of the melt clasts is assessed by plotting traverse profiles from data obtained by EMPA. The variegation of the melt clasts in the figures below is compositionally controlled. In all traverse profiles, there is a constant inverse relationship between the aluminium content with the iron content. Unfortunately, no compositions could be stoichimetrically matched to known zeolites/smectites despite low totals and textural features pointing to a hydrothermal overprint. Please note that the traverses are plotted along a "horizontal profile" just to display the compositional variations (though the actual analysis traverse path may have been skewed). The orange melt clasts relatively show homogeneous profiles compared to variegated melt clasts. The lighter portions generally correspond with higher SiO_2 levels and low MgO contents. The dark portion of the melt particles corresponds with SiO_2 contents of below 50 wt/% and higher CaO and MgO contents which probably represents the clinopyroxene/amphibole of the metadolerites. Most likely resembling the granitoid component to formed (or even entrained cataclased sections). The observed spikes in the FeO might be because of oxides encountered along the fractures. The black melt particles do show internal variegation.



Traverse profiles showing variation of major oxides abundances across variegated melt clasts **A)** Variegated melt clast enclosed in MMBr sample M4 IM-6 from 271.17 m depth. **B)** Traverse a - b of the melt particle in C. **C)** Traverse c - d, of the matrix of sample IM-6. All data in wt. %.



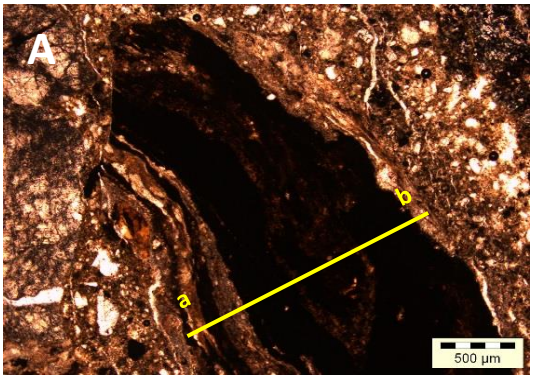
Traverse profiles showing variation of major oxides abundances across variegated melt clasts. **A)** Variegated melt clast from reddish brown suevite M4 S-3 from 159.98 m depth. **B)** The variation between the melt particles is clearly depicted in the traverse profile a to b.

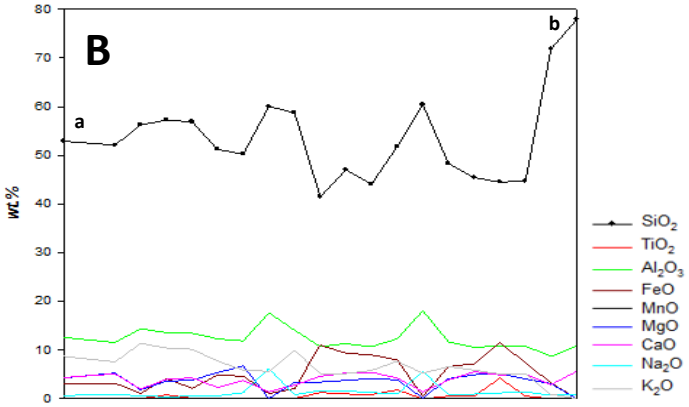


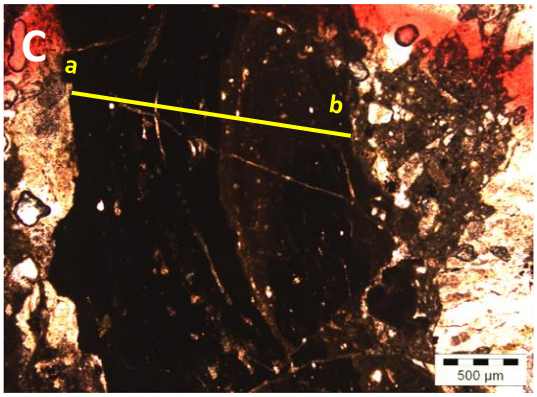
Traverse profile from A to B, showing variation of major oxides abundances across orange melt clasts. **A)** Variegated melt clast enclosed in MMBr sample M4 IM-3 from 265.55 m depth. **B)** The lack of variation between the melt particles is clearly depicted in the traverse profile a-b. **C)** Altered melt clast from green suevite M4 S-4 (from 285.03 m depth). Only data points with totals above 70 were used to plot the profiles. **D)** Traverse a - b of the melt particle in C. All data in wt. %.

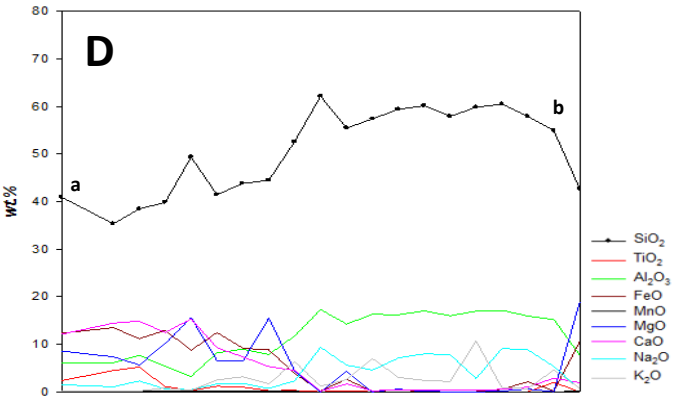
Geochemical characterisation of the impactite matrices

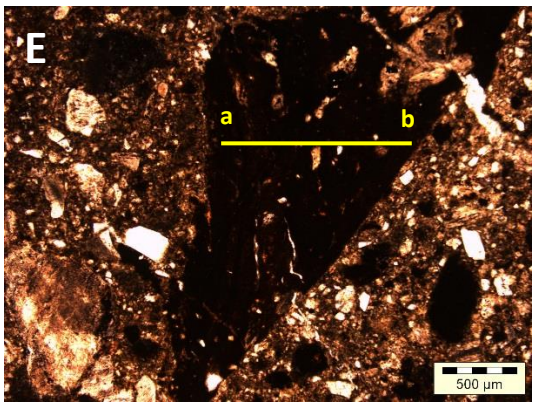
The matrices of suevites and that of MMBr are texturally different as those of suevites consist of a clastic matrix and that of MMBr are homogeneous and devitrified (see Chapter 2). To geochemically analyse these matrixes care had to be taken as the defocused beam diameter used during the EMPA is 10 µm. Traverses through suevite matrices were exceptionally difficult to examine owing to the enclosed mineral clasts which are at places < 10 µm. In the fine-grained sections of the matrix the analyses obtained are of 1 or 2 sections which represents mixed clasts compositions. Based on the observations, the matrix of suevite though heterogeneous texturally, chemically the bulk-compositional data obtained (Chapter 3) is of mixed clast populations and on average is similar to that of the homogenised MMBr. MMBr matrix entrains cataclased, infolded or sheared granitoid clasts (see Chapter 2, Figure 2.22B, 2.23C). The traverses show that the matrix of MMBr is relatively homogenised (compared to melt particles).

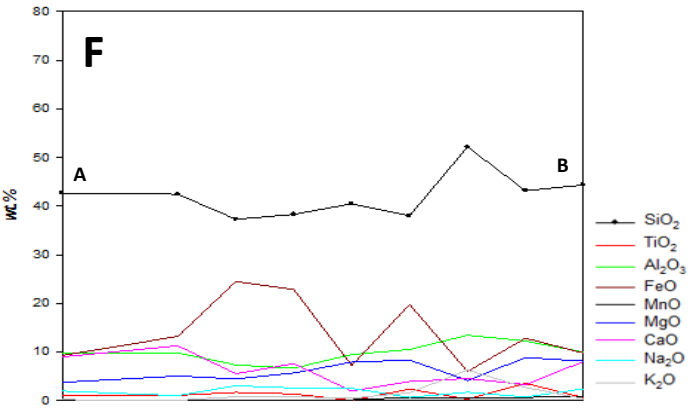




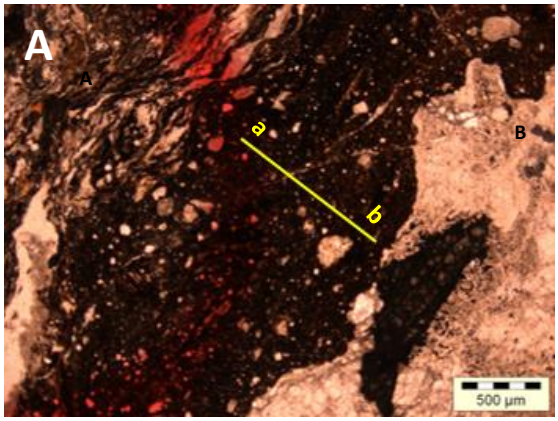


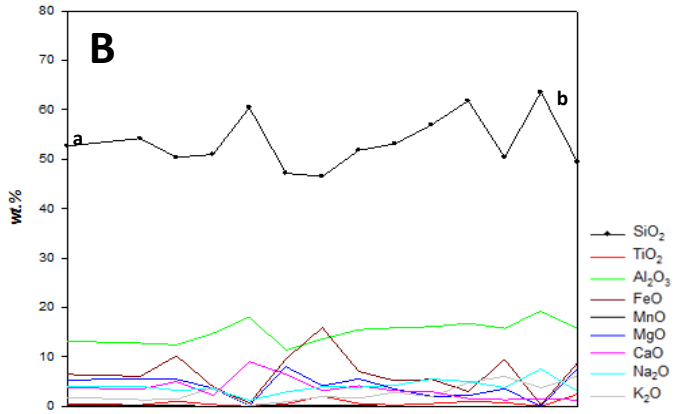


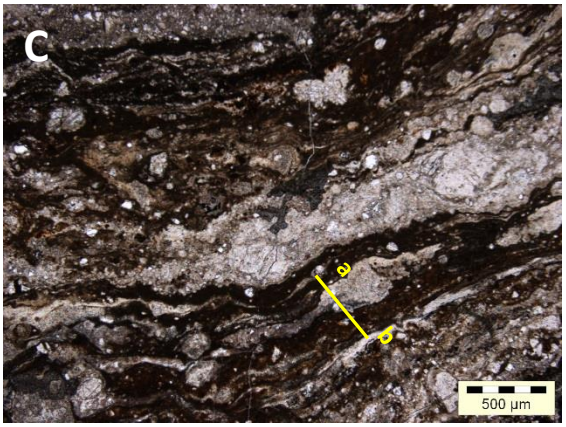


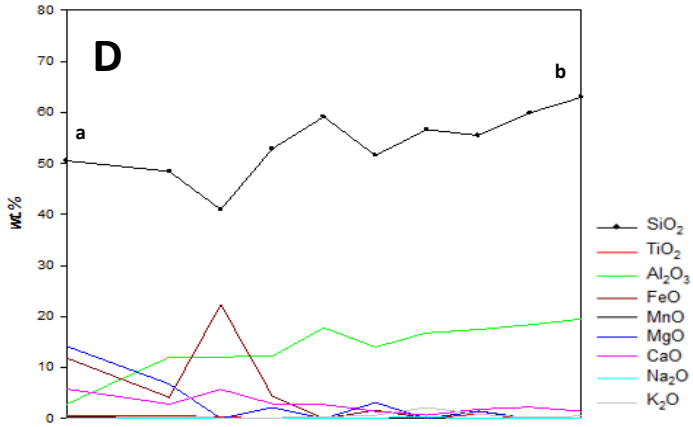


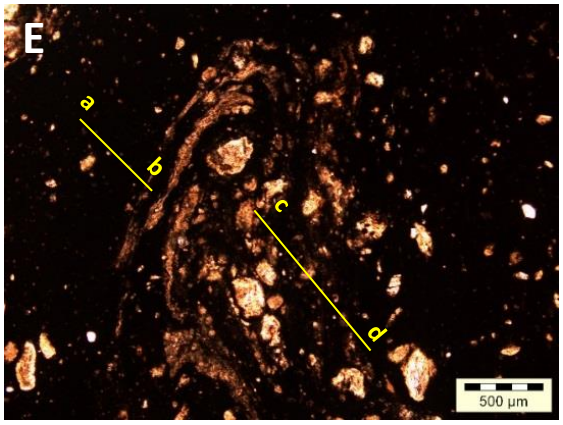
Traverse profiles showing variation of major oxide abundances across black melt clasts. **A)** Variegated melt clast enclosed in suevite sample M4 S-4 from 284.85 m depth. **B)** Traverse a - b of the melt particle in A. **C)** Variegated melt clast from green suevite M4 S-6 from 316.52 m depth and a corresponding melt traverse profile in **D**. **E)** Traverse from a - b through the angular brown melt particle from sample M4 S-4. **F)** Traverse a - b of the melt particle in E. All data in wt. %. Only data points with totals above 80 were used to plot the profiles.

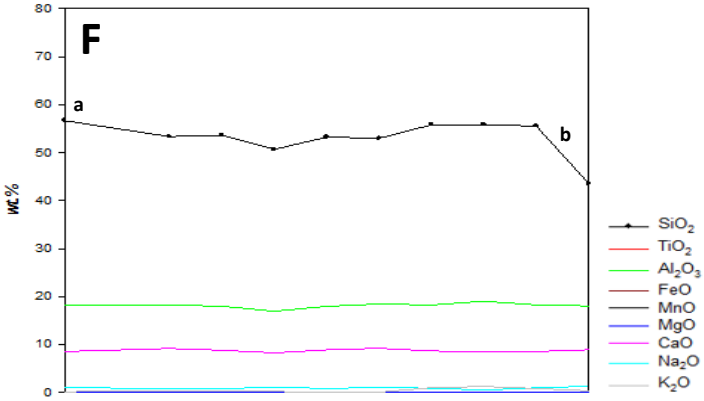




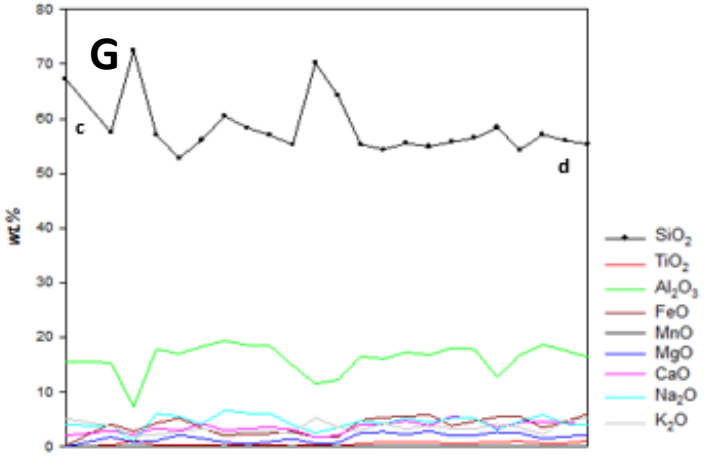








Traverse profiles showing variation of major oxides across impactite matrices. **A)** MMBr matrix traverse of sample M4 IM-3 from 265.55 m depth. **B)** Traverse a - b of the melt particle in A. **C)** Altered, variegated MMBr matrix enclosing sheared, boudinaged cataclastic clasts (sample M4 IM-2 from 234.33 m depth). **D)** Traverse a - b of the melt particle in C. **E)** Matrix traverse of sample IM-6 from 271.17 m depth. Note the infolded, fragmented clasts in aphanitic matrix. **F)** Traverse a - b of the melt particle in D. **G)** Continued profile of E showing the c-d traverse.



Appendix 5:

5A: Crystallographic measurements of PDF from selected quartz grain from representative M4 target rocks

5B: Crystallographic measurements of PDF from selected quartz grain from representative M4 impactites

5C: Histograms showing frequency distribution of angles between c-axis and poles to PDF in 5° intervals.

Appendix 5A: Crystallographic measurements of PDF from selected quartz grain from representative M4 target rocks

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-4 (From 109.20 m depth)	**Grain 1**	248°, H **67°, H	37^{o}E 36^{o}W	Set 1	251^{o} **71^{o}	At C-axis	2-3^{o}	c	(0001)
				Set 2	264^{o} **82^{o}	18^{o}E 16^{o}W	23^{o}	ω	$\{10\bar{1}3\}$
	Grain 2	302°, H **120°, H	21^{o}E 20^{o}W	Set 1	302^{o} **121^{o}	At C-axis	0-1^{o}	c	(0001)
	Grain 3	211°, H **34°, H	11^{o}E 8-9^{o}W	Set 1	11^{o} **190^{o}	5^{o}E 7^{o}W	25-27^{o}	ω	$\{10\bar{1}3\}$
				Set 2	213^{o} **32^{o}	At C-axis	1-4^{o}	c	(0001)
				Set 3	44^{o} **228^{o}	1°E 2°W	13--19^{o}	e	$\{10\bar{1}4\}$
	Grain 4	274°, H **92°, H	20°E 13°W	Set 1	272^{o} **93^{o}	At C-axis	0^{o}	c	(0001)
				Set 2	296^{o} **119^{o}	2°E 3°W	24-28^{o}	ω	$\{10\bar{1}3\}$
				Set 3	290^{o} **112^{o}	4^{o}E 4^{o}W	17--22^{o}	e	$\{10\bar{1}4\}$
	Grain 5	84°, H **263°, H	0° inclination	Set 1	271^{o} **92^{o}	9°E 8°W	10-12^{o}	Unindexed	
				Set 2	249^{o} **69^{o}	6^{o}E 4^{o}W	15^{o}	e	$\{10\bar{1}4\}$

Polar angle is defined as the angle between the pole to plane and quartz c-axis.
****Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-4 (***Continued…***)	**Grain 6**	83°, H **265°, H	16^{o}E 14^{o}W	Set 1	101^{o} **283^{o}	12^{o}E 11^{o}W	17--19^{o}	e	$\{10\ \bar{1}\ 4\}$
				Set 2	84^{o} **263^{o}	At C-axis	0-3^{o}	c	(0001)
				Set 3	89^{o} **272^{o}	2^{o}E 2^{o}W	13--16^{o}	e	$\{10\ \bar{1}\ 4\}$
	Grain 7	291°, H **114°, H	46^{o}E 46^{o}W	Set 1	310^{o} **128^{o}	15^{o}E 13^{o}W	34-35^{o}	π	$\{10\ \bar{1}\ 2\}$
				Set 2	314^{o} **136^{o}	25^{o}E 26^{o}W	27^{o}	Unindexed	
	Grain 8	90°, H **271°, H	0° inclination	Set 1	110^{o} **288^{o}	4^{o}E 2^{o}W	17--19^{o}	e	$\{10\ \bar{1}\ 4\}$
				Set 2	88^{o} **269^{o}	At C-axis	1-2^{o}	c	(0001)
				Set 3	78^{o} **255^{o}	5^{o}E 6^{o}W	13--16^{o}	Unindexed	
	Grain 9	2°, H **180°, H	16^{o}E 18^{o}W	Set 1	359^{o} **178^{o}	At C-axis	2-3^{o}	c	(0001)
				Set 2	162^{o} **342^{o}	9^{o}E 8^{o}W	29-32^{o}	π	$\{10\ \bar{1}\ 2\}$
	Grain 10	231°, H **52°, H	23^{o}E 20^{o}W	Set 1	234^{o} **54^{o}	At C-axis	2-3^{o}	c	(0001)
				Set 2	205^{o} **29^{o}	20^{o}E 18^{o}W	21-25^{o}	ω	$\{10\ \bar{1}\ 3\}$
	Grain 11	34°, H **212°, H	13^{o}E 12^{o}W	Set 1	50^{o} **229^{o}	15^{o}E 15^{o}W	15--16^{o}	e	$\{10\ \bar{1}\ 4\}$
				Set 2	35^{o} **212^{o}	At C-axis	1-2^{o}	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-4 (***Continued***…)	**Grain 12**	1°, H **183°, H	14°E 14°W	Set 1	2° **182°	At C-axis	0°	c	(0001)
	Grain 13	48°, H **229°, H	16°E 16°W	Set 1	206° **26°	3°E 4°W	29°	π	$\{10\bar{1}2\}$
				Set 2	69° **247°	12°E 9°W	19-20°	e	$\{10\bar{1}4\}$
	Grain 14	81°, H **265°, H	23°E 21°W	Set 1	68° **249°	14°E 14°W	15-17°	e	$\{10\bar{1}4\}$
	Grain 15	33°, H **213°, H	11°E 11°W	Set 1	250° **69°	3°E 3°W	38-39°	Unindexed	
	Grain 16	76°, H **258°, H	38°E 38-39°W	Set 1	78° **258°	At C-axis	0-1°	c	(0001)
				Set 2	269° **90°	19°E 19°W	58-59°	Unindexed	
	Grain 17	258°, H **79°, H	33°E 35°W	Set 1	262° **82°	At C-axis	3-4°	c	(0001)
				Set 2	284° **104°	28°E 28°W	22°	ω	$\{10\bar{1}3\}$
	Grain 18	329°, H **147°, H	15°E 20°W	Set 1	325° **144°	At C-axis	3-8°	c	(0001)
				Set 2	189° **8°	31°E 30°W	61-66°	s	$\{11\bar{2}1\}$
	Grain 19	19°, H **200°, H	30-31°E 29°W	Set 1	7° **189°	15°E 15-16°W	16--20°	e	$\{10\bar{1}4\}$
				Set 2	352° **171°	12°E 12°W	30-31°	π	$\{10\bar{1}2\}$
				Set 3	19° **201°	At C-axis	1-3°	c	(0001)
	Grain 20	306°, H **124°, H	32°E 35°W	Set 1	320° **139°	17-18°E 17°W	18--20°	e	$\{10\bar{1}4\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG -2 **(131.90 m depth)**	**Grain 1**	137°, H **320°, H	16^0E 11^0W	Set 1	295^0 **114^0	2-5°E 3-5°W	28--32^0	π	$\{10\ \bar{1}\ 2\}$
				Set 2	332^0 **151^0	10-12°E 12-14°W	26-35^0	Unindexed	
				Set 3	342^0 **161^0	1-2°E 0-1°W	26-30^0	π	$\{10\ \bar{1}\ 2\}$
	Grain 2	264°, H **85°, H	0° inclination	Set 1	245^0 **67^0	6-7^0E 5-8^0W	19-20^0	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
				Set 2	284^0 **103^0	10-12^0E 10^0W	20-22^0	ω	$\{10\ \bar{1}\ 3\}$
	Grain 3	125°, H **303°, H	11-15^0E 12^0W	Set 1	124^0 **302^0	At C-axis	1-6^0	c	(0001)
				Set 2	103^0 **284^0	5^0E 6^0W	20-23^0	ω	$\{10\ \bar{1}\ 3\}$
				Set 3	143^0 **321^0	9-10°E 9°W	17-19^0	Unindexed	
	Grain 4	110°, H **291°, H	0° inclination	Set 1	111^0 **290^0	At C-axis	0^0	c	(0001)
				Set 2	302^0 **121^0	15-16^0E 15-17^0W	19-21^0	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
				Set 3	281^0 **99^0	17-20°E 17-18°W	21-22^0	Unindexed	
	Grain 5	39°, H **221°, H	25^0E 17^0W	Set 1	42^0 **223^0	At C-axis	1-6^0	c	(0001)
				Set 2	22^0 **203^0	34-35°E 31-34^0W	15-20^0	e	$\{10\ \bar{1}\ 4\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-2 (***Continued…***)	**Grain 6**	81°, H **260°, H	30-33°E 25°W	Set 1	64^o **241^o	22-24°E 23-25°W	$15\text{-}22^o$	e	$\{10\ \bar{1}\ 4\}$
				Set 2	79^o **259^o	At C-axis	$4\text{-}12^o$	c	(0001)
				Set 3	51^o **234^o	17-20°E 18°W	$25\text{-}32^o$	π	$\{10\ \bar{1}\ 2\}$
	Grain 7	147°, H **328°, H	23°E 19°W	Set 1	310^o **130^o	4°E 2-3°W	$28\text{--}33^o$	π	$\{10\ \bar{1}\ 2\}$
				Set 2	122^o **305^o	25°E 23°W	$20\text{-}23^o$	ω	$\{10\ \bar{1}\ 3\}$
				Set 3	134^o **315^o	8°E 10°W	$16\text{-}21^o$	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
				Set 4	164^o **341^o	34^oE 30^oW	$12\text{-}19^o$	e	$\{10\ \bar{1}\ 4\}$
	Grain 8	242°, H **61°, H	14°E 16°W	Set 1	78^o **259^o	2^oE 2^oW	$22\text{-}24^o$	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	41^o **219^o	4^oE $3\text{-}4^o$W	$11\text{-}15^o$	Unindexed	
				Set 3	245^o **62^o	At C-axis	$1\text{-}4^o$	c	(0001)
	Grain 9	157°, H **335°, H	24°E 23°W	Set 1	169^o **348^o	12^oE 12^oW	$16\text{-}17^o$	e	$\{10\ \bar{1}\ 4\}$
	Grain 10	70°, H **249°, H	28°E 26°W	Set 1	70^o **248^o	At C-axis	$1\text{-}3^o$	c	(0001)
				Set 2	42^o **225^o	35^oE 35^oW	$21\text{-}24^o$	ω	$\{10\ \bar{1}\ 3\}$
				Set 3	85^o **265^o	7^oE 8^oW	$24\text{-}26^o$	ω	$\{10\ \bar{1}\ 3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-2 (***Continued…***)	**Grain 11**	93°, H **272°, H	0° inclination	Set 1	76^{o} **255^{o}	12°E 14°W	21^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	114^{o} **293^{o}	15°E 13°W	24-26^{o}	Unindexed	
	Grain 12	156°, H **340°, H	17^{o}E 17^{o}W	Set 1	157^{o} **337^{o}	At C-axis	1-3^{o}	c	(0001)
				Set 2	147^{o} **326^{o}	33^{o}E 30^{o}W	17-18^{o}	e	$\{10\ \bar{1}\ 4\}$
	Grain 13	232°, H **49°, H	25^{o}E 21^{o}W	Set 1	208^{o} **25^{o}	22°E 22°W	22-24^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	251^{o} **71^{o}	31^{o}E 28^{o}W	19-22^{o}	Unindexed	
	Grain 14	208°, H **30°, H	29^{o}E 28^{o}W	Set 1	218^{o} **38^{o}	17^{o}E 16^{o}W	28-30^{o}	π	$\{10\ \bar{1}\ 2\}$
				Set 2	182^{o} **359^{o}	23^{o}E 25^{o}W	2^{o}	c	(0001)
	Grain 15	132°, H **311°, H	5-8^{o}E 5-8^{o}W	Set 1	146^{o} **328^{o}	20^{o}E 18^{o}W	16-20^{o}	e	$\{10\ \bar{1}\ 4\}$
				Set 2	106^{o} **287^{o}	10°E 11°W	24-25^{o}	ω	$\{10\ \bar{1}\ 3\}$
	Grain 16	212°, H **34°, H	35^{o}E 35^{o}W	Set 1	226^{o} **44^{o}	42^{o}E 40^{o}W	10-12^{o}	Unindexed	

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-2 (***Continued…***)	**Grain 17**	194°, H **15°, H	9°E 10°W	Set 1	356^{o} **176^{o}	8°E 3-4°W	$22\text{-}26^{o}$	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	191^{o} **12^{o}	At C-axis	$2\text{-}3^{o}$	c	(0001)
	Grain 18	77°, H **255°, H	0° inclination	Set 1	58^{o} **239^{o}	18°E 21°W	$25\text{-}26^{o}$	ω	$\{10\ \bar{1}\ 3\}$
	Grain 19	232°, H **53°, H	10°E 8°W	Set 1	75^{o} **256^{o}	7^{o}E 6^{o}W	$25\text{-}28^{o}$	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	234^{o} **54^{o}	At C-axis	$1\text{-}3^{o}$	c	(0001)
	Grain 20	120°, H **300°, H	0° inclination	Set 1	95^{o} **274^{o}	$6\text{-}8^{o}$E $6\text{-}8^{o}$W	26^{o}	ω	$\{10\ \bar{1}\ 3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 IS 2 **(From 211.41 m depth)**	**Grain 1**	155°, H **336°, H	12°E 12°W	Set 1	154^o **334^o	At C-axis	1^o	c	(0001)
				Set 2	177^o **358^o	10^oE 10^oW	21-22^o	ω	$\{10\bar{1}3\}$
	Grain 2	71°, H **252°, H	0° inclination	Set 1	72^o **251^o	At C-axis	0^o	c	(0001)
	Grain 3	89°, H **270°, H	0° inclination	Set 1	117^o **298^o	8-10°E 10°W	28--29^o	π	$\{10\bar{1}2\}$
				Set 2	90^o **270^o	At C-axis	0^o	c	(0001)
	Grain 4	90°, H **272°, H	0° inclination	Set 1	107^o **288^o	6-8°E 6-8°W	16-18^o	e	$\{10\bar{1}4\}$
				Set 2	86^o **266^o	At C-axis	4^o	c	(0001)
	Grain 5	152°, H **332°, H	10°E 6-7°W	Set 1	169^o **350^o	2^oE 2^oW	17-20^o	Unindexed	
				Set 2	151^o **332^o	At C-axis	1-6^o	c	(0001)
				Set 3	173^o **354^o	18^oE 18^oW	21-23^o	ω	$\{10\bar{1}3\}$
	Grain 6	315°, H **135°, H	7°E 7°W	Set 1	291^o **111^o	5°E 5°W	23^o	ω	$\{10\bar{1}3\}$
				Set 2	318^o **139^o	At C-axis	2-3^o	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 IS-2 (***Continued…***)	**Grain 7**	347°, H **168°, H	0° inclination	Set 1	340^{o} **160^{o}	At C-axis	7-7^{o}	Unindexed	
				Set 2	5^{o} **183^{o}	9°E 9°W	17-19^{o}	e	$\{10\bar{1}4\}$
	Grain 8	107°, H **286°, H	0° inclination	Set 1	133^{o} **314^{o}	20-24°E 20°W	32--35^{o}	π	$\{10\bar{1}2\}$
				Set 2	83^{o} **264^{o}	14^{o}E 14^{o}W	25-26^{o}	ω	$\{10\bar{1}3\}$
				Set 3	106^{o} **287^{o}	At C-axis	0^{o}	c	(0001)
	Grain 9	333°, H **153°, H	20°E 24°W	Set 1	310^{o} **130^{o}	25^{o}E 25^{o}W	21-22^{o}	ω	$\{10\bar{1}3\}$
				Set 2	328^{o} **148^{o}	20^{o}E 24^{o}W	5-7^{o}	Unindexed	
	Grain 10	95°, H **276°, H	18°E 18°W	Set 1	78^{o} **260^{o}	6^{o}E 6^{o}W	19-20^{o}	e + ω	$\{10\bar{1}3\}$ + $\{10\bar{1}4\}$
				Set 2	113^{o} **295^{o}	3-4^{o}E 3-4^{o}W	22-23^{o}	ω	$\{10\bar{1}3\}$
	Grain 11	17°, H **203°, H	28°E 27°W	Set 1	18^{o} **200^{o}	At C-axis	0-2^{o}	c	(0001)
	Grain 12	102°, H **282°, H	0° inclination	Set 1	98^{o} **277^{o}	At C-axis	3-4^{o}	c	(0001)
				Set 2	89^{o} **270^{o}	8^{o}E 8^{o}W	13-14^{o}	e	$\{10\bar{1}4\}$
	Grain 13	146°, H **330°, H	15°E 20°W	Set 1	148^{o} **326^{o}	At C-axis	2-7^{o}	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 IS-2 (***Continued…***)	**Grain 14**	142°, H **320°, H	11°E 14°W	Set 1	161^{o} **339^{o}	10^{o}E 10^{o}W	17-20^{o}	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
				Set 2	141^{o} **320^{o}	At C-axis	2-7^{o}	c	(0001)
				Set 3	122^{o} **302^{o}	17^{o}E 17^{o}W	18^{o}	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
	Grain 15	313°, H **133°, H	20°E 19°W	Set 1	331^{o} **150^{o}	4^{o}E 4^{o}W	22-23^{o}	ω	$\{10\ \bar{1}\ 3\}$
	Grain 16	61°, H **241°, H	0° inclination	Set 1	256^{o} **76^{o}	10^{o}E 10^{o}W	17^{o}	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
				Set 2	220^{o} **38^{o}	4^{o}E 4^{o}W	21-23^{o}	Unindexed	
	Grain 17	94°, H **276°, H	14°E 13°W	Set 1	255^{o} **74^{o}	7^{o}E 7^{o}W	28-29^{o}	Unindexed	
				Set 2	116^{o} **296^{o}	13^{o}E 13^{o}W	20^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 3	95^{o} **276^{o}	At C-axis	0-1^{o}	c	(0001)
	Grain 18	197°, H **17°, H	8°E 8°W	Set 1	196^{o} **16^{o}	At C-axis	0^{o}	c	(0001)
				Set 2	20^{o} **203^{o}	8^{o}E 8^{o}W	16-17^{o}	e	$\{10\ \bar{1}\ 4\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 FZ -2 **(From 219.30 m depth)**	**Grain 1**	204°, H **23°, H	24°E 26°W	Set 1	169^o **350^o	19°E 20°W	31--33^o	π	$\{10\bar{1}2\}$
				Set 2	200^o **20^o	At C-axis	3-6^o	c	(0001)
				Set 3	189^o **10^o	15-18°E 18°W	13-17^o	e	$\{10\bar{1}4\}$
	Grain 2	42°, H **222°, H	0° inclination	Set 1	200^o **19^o	7^oE 7^oW	23^o	ω	$\{10\bar{1}3\}$
				Set 2	242^o **60	12^oE 12^oW	21-23^o	e + ω	$\{10\bar{1}3\}$ + $\{10\bar{1}4\}$
				Set 3	292^o **112^o	15^oE 15-20^oW	70-71^o	ρ	$\{21\bar{3}1\}$
	Grain 3	178°, H **360°, H	0° inclination	Set 1	154^o **336^o	10-12°E 10-12°W	25-26^o	ω	$\{10\bar{1}3\}$
				Set 2	178^o **358^o	At C-axis	0^o	c	(0001)
	Grain 4	78°, H **260°, H	0° inclination	Set 1	236^o **60^o	12-14^{o}E 12-14^{o}W	24-26^o	ω	$\{10\bar{1}3\}$
				Set 2	76^o **256^o	At C-axis	2^o	c	(0001)
	Grain 5	47°, H **228°, H	0° inclination	Set 1	22^o **204^o	22^oE 22^oW	31-32^o	π	$\{10\bar{1}2\}$
				Set 2	47^o **228^o	At C-axis	0^o	c	(0001)
	Grain 6	56°, H **236°, H	0° inclination	Set 1	53^o **233^o	At C-axis	0^o	c	(0001)

Polar angle is defined as the angle between the pole to plane and quartz c-axis.

**** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 FZ-2 (***Continued***…)	**Grain 7**	131°, H **310°, H	0° inclination	Set 1	330^{o} **147^{o}	6-8°E 6-8°W	17--21^{o}	e	$\{10\bar{1}4\}$
				Set 2	126^{o} **308^{o}	At C-axis	2-4^{o}	c	(0001)
	Grain 8	159°, H **337°, H	28°E 31°W	Set 1	154^{o} **333^{o}	At C-axis	3-6^{o}	c	(0001)
				Set 2	170^{o} **350^{o}	5^{o}E 5^{o}W	26-29^{o}	π	$\{10\bar{1}2\}$
	Grain 9	221°, H **42°, H	0° inclination	Set 1	226^{o} **45^{o}	At C-axis	3-4^{o}	c	(0001)
	Grain 10	156°, H **339°, H	0° inclination	Set 1	177^{o} **360^{o}	20^{o}E 20^{o}W	27-29^{o}	π	$\{10\bar{1}2\}$
				Set 2	141^{o} **323^{o}	8^{o}E 8^{o}W	16-18^{o}	e	$\{10\bar{1}4\}$
	Grain 11	95°, H **273°, H	30°E 25-28°W	Set 1	64^{o} **246^{o}	20^{o}E 20^{o}W	26-29^{o}	π	$\{10\bar{1}2\}$
				Set 2	104^{o} **283^{o}	20^{o}E 20^{o}W	11-15^{o}	e	$\{10\bar{1}4\}$
				Set 3	84^{o} **265^{o}	7^{o}E 7^{o}W	22-27^{o}	ω	$\{10\bar{1}3\}$
	Grain 12	72°, H **253°, H	0° inclination	Set 1	225^{o} **46^{o}	5^{o}E 5^{o}W	26-27^{o}	Unindexed	
				Set 2	242^{o} **63^{o}	13^{o}E 13^{o}W	16^{o}	e	$\{10\bar{1}4\}$
				Set 3	90^{o} **270^{o}	13^{o}E 13^{o}W	0-1^{o}	Unindexed	
	Grain 13	46°, H **226°, H	0° inclination	Set 1	40^{o} **219^{o}	22^{o}E 22^{o}W	22-23^{o}	ω	$\{10\bar{1}3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 FZ-2 (***Continued…***)	**Grain 14**	214°, H **35°, H	9°E 10-12°W	Set 1	58^{o} **238^{o}	14^{o}E 14^{o}W	26^{o}	π	$\{10\bar{1}2\}$
				Set 2	212^{o} **31^{o}	At C-axis	2-5^{o}	c	(0001)
				Set 3	200^{o} **20^{o}	23^{o}E 23^{o}W	0-1^{o}	e + ω	$\{10\bar{1}3\}$ + $\{10\bar{1}4\}$
	Grain 15	175°, H **354°, H	40°E 40°W	Set 1	179^{o} **360^{o}	At C-axis	3-4^{o}	c	(0001)
				Set 2	149^{o} **330^{o}	38^{o}E 38^{o}W	19^{o}	e	$\{10\bar{1}4\}$
	Grain 16	114°, H **293°, H	0° inclination	Set 1	268^{o} **90^{o}	16^{o}E 16^{o}W	28-30^{o}	π	$\{10\bar{1}2\}$
				Set 2	111^{o} **296^{o}	At C-axis	2^{o}	c	(0001)
	Grain 17	149°, H **330°, H	0° inclination	Set 1	164^{o} **340^{o}	10-12^{o}E 10-12^{o}W	14-18^{o}	e	$\{10\bar{1}4\}$
	Grain 18	112°, H **294°, H	0° inclination	Set 1	268^{o} **88^{o}	13^{o}E 13^{o}W	28^{o}	π	$\{10\bar{1}2\}$
				Set 2	112^{o} **292^{o}	At C-axis	0^{o}	c	(0001)
	Grain 19	89°, H **271°, H	23°E 25-27°W	Set 1	74^{o} **255^{o}	9-10^{o}E 10^{o}W	20-25^{o}	ω	$\{10\bar{1}3\}$
	Grain 20	209°, H **28°, H	23°E 23°W	Set 1	230^{o} **48^{o}	11^{o}E 15^{o}W	21-22^{o}	ω	$\{10\bar{1}3\}$
				Set 2	208^{o} **27^{o}	At C-axis	0^{o}	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-17 **(from 274.62 m depth)**	**Grain 1**	215°, H **36°, H	0° inclination	Set 1	213^{o} **34^{o}	At C-axis	1-2^{o}	c	(0001)
	Grain 2	168°, H **350°, H	0° inclination	Set 1	11^{o} **192^{o}	5°E 5°W	22-23^{o}	ω	$\{10\bar{1}3\}$
				Set 2	161^{o} **340^{o}	At C-axis	8-9^{o}	Unindexed	
	Grain 3	54°, H **235°, H	19°E 21°W	Set 1	53^{o} **233^{o}	At C-axis	1-3^{o}	c	(0001)
	Grain 4	245°, H **65°, H	16°E 15°W	Set 1	261^{o} **81^{o}	8°E 8°W	16-17^{o}	e	$\{10\bar{1}4\}$
				Set 2	248^{o} **66^{o}	At C-axis	1-3^{o}	c	(0001)
	Grain 5	207°, H **25°, H	9°E 8°W	Set 1	224^{o} **42^{o}	11°E 10°W	15-18^{o}	e	$\{10\bar{1}4\}$
				Set 2	204^{o} **24^{o}	At C-axis	2^{o}	c	(0001)
	Grain 6	190°, H **9°, H	0° inclination	Set 1	35^{o} **215^{o}	6^{o}E 5-6^{o}W	26^{o}	ω	$\{10\bar{1}3\}$
				Set 2	184^{o} **362^{o}	22-24^{o}E 22^{o}W	22-23^{o}	ω	$\{10\bar{1}3\}$
				Set 3	191^{o} **10^{o}	At C-axis	0-1^{o}	c	(0001)
	Grain 7	224°, H **42°, H	0° inclination	Set 1	218^{o} **40^{o}	At C-axis	2-4^{o}	c	(0001)
				Set 2	262^{o} **80^{o}	6^{o}E 6-7^{o}W	37-39^{o}	π	$\{10\bar{1}2\}$
				Set 3	241^{o} **60^{o}	8^{o}E 8^{o}W	18-19^{o}	e	$\{10\bar{1}4\}$

Polar angle is defined as the angle between the pole to plane and quartz c-axis.

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-17 (***Continued…***)	**Grain 8**	189°, H **9°, H	0° inclination	Set 1	342^{o} **160^{o}	4-5°E 4-5°W	$27\text{--}29^{o}$	π	$\{10\ \bar{1}\ 2\}$
				Set 2	295^{o} **115^{o}	2°E 3^{o}W	74^{o}	-	$\{31\ \bar{4}1\}$
				Set 3	188^{o} **7^{o}	At C-axis	$0\text{-}1^{o}$	c	(0001)
	Grain 9	120°, H **300°, H	15°E 15°W	Set 1	122^{o} **300^{o}	At C-axis	$0\text{-}1^{o}$	c	(0001)
	Grain 10	300°, H **121°, H	42°E 43°W	Set 1	58^{o} **239^{o}	53°E 48°W	$70\text{-}74^{o}$	ρ	$\{21\bar{3}1\}$
	Grain 11	78°, H **258°, H	18°E 10°W	Set 1	269^{o} **88^{o}	2^{o}E 2^{o}W	$18\text{-}26^{o}$	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
				Set 2	79^{o} **258^{o}	18^{o}E 10^{o}W	$3\text{-}11^{o}$	c	(0001)
				Set 3	58^{o} **236^{o}	9^{o}E 8^{o}W	$20\text{-}25^{o}$	ω	$\{10\ \bar{1}\ 3\}$
	Grain 12	18°, H **199°, H	10-13°E 14°W	Set 1	16^{o} **198^{o}	At C-axis	$2\text{-}6^{o}$	c	(0001)
	Grain 13	182°, H **2°, H	0° inclination	Set 1	75^{o} **253^{o}	20°E 17°W	$72\text{-}74^{o}$	-	$\{31\ \bar{4}1\}$
				Set 2	61^{o} **242^{o}	38^{o}E 36^{o}W	$66\text{-}67^{o}$	s	$\{11\bar{2}1\}$
	Grain 14	215°, H **35°, H	0° inclination	Set 1	215^{o} **34^{o}	At C-axis	0^{o}	c	(0001)
				Set 2	54^{o} **232^{o}	12^{o}E 13^{o}W	$21\text{-}23^{o}$	ω	$\{10\ \bar{1}\ 3\}$
	Grain 15	78°, H **257°, H	0° inclination	Set 1	74^{o} **255^{o}	At C-axis	$2\text{-}3^{o}$	c	(0001)
				Set 2	270^{o} **91^{o}	10^{o}E 11^{o}W	$16\text{-}18^{o}$	e	$\{10\ \bar{1}\ 4\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 GG-17 (***Continued***...)	**Grain 16**	16°, H **194°, H	0° inclination	Set 1	18^{o} **199^{o}	At C-axis	$2\text{-}3^{o}$	c	(0001)
				Set 2	34^{o} **214^{o}	5^{o}E 5^{o}W	19^{o}	e + ω	$\{10\bar{1}3\}$ + $\{10\bar{1}4\}$
				Set 3	73^{o} **252^{o}	4^{o}E $4\text{-}5^{o}$W	$57\text{-}58^{o}$	Unindexed	
	Grain 17	260°, H **80°, H	0° inclination	Set 1	54^{o} **234^{o}	3^{o}E $3\text{-}5^{o}$W	26^{o}	Unindexed	
				Set 2	255^{o} **76^{o}	At C-axis	$3\text{-}4^{o}$	c	(0001)
				Set 3	100^{o} **281^{o}	12^{o}E 10^{o}W	$22\text{-}24^{o}$	ω	$\{10\bar{1}3\}$
	Grain 18	298°, H **116°, H	8°E 9°W	Set 1	284^{o} **105^{o}	30^{o}E 29^{o}W	$23\text{-}25^{o}$	ω	$\{10\bar{1}3\}$
				Set 2	318^{o} **140^{o}	2^{o}E 2^{o}W	$21\text{-}23^{o}$	ω	$\{10\bar{1}3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-2 **(from 338.15 m depth)**	**Grain 1**	35°, H **217°, H	22°E 20°W	Set 1	64^o **243^o	16°E 17°W	26^o	ω	$\{10\bar{1}3\}$
	Grain 2	132°, H **313°, H	14°E 14°W	Set 1	178^o **360^o	32^oE 32^oW	$45\text{-}46^o$	ξ	$\{11\bar{2}2\}$
				Set 2	114^o **293^o	30^oE 33^oW	$24\text{-}25^o$	ω	$\{10\bar{1}3\}$
	Grain 3	148°, H **328°, H	14°E 17°W	Set 1	150^o **329^o	At C-axis	$1\text{-}4^o$	c	(0001)
				Set 2	307^o **126^o	22^oE 18^oW	$39\text{-}45^o$	ξ	$\{11\bar{2}2\}$
	Grain 4	131°, H **314°, H	0° inclination	Set 1	111^o **291^o	30°E 30°W	35^o	π	$\{10\bar{1}2\}$
				Set 2	136^o **317^o	At C-axis	$3\text{-}4^o$	c	(0001)
	Grain 5	339°, H **160°, H	0° inclination	Set 1	140^o **320^o	14°E 14°W	24^o	ω	$\{10\bar{1}3\}$
				Set 2	341^o **161^o	At C-axis	1^o	c	(0001)
	Grain 6	230°, H **49°, H	0° inclination	Set 1	205^o **22^o	24°E 30°W	$35\text{-}37^o$	π	$\{10\bar{1}2\}$
				Set 2	47^o **228^o	At C-axis	$1\text{-}2^o$	c	(0001)
	Grain 7	270°, H **90°, H	0° inclination	Set 1	110^o **288^o	12°E 12-13°W	$21\text{-}23^o$	ω	$\{10\bar{1}3\}$
				Set 2	72^o **250^o	26°E 27°W	32^o	π	$\{10\bar{1}2\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-2 (***Continued...***)	**Grain 8**	185°, H **3°, H	0° inclination	Set 1	354^{o} **175^{o}	// to C-axis	$10\text{-}21^{o}$	e	$\{10\ \bar{1}\ 4\}$
	Grain 9	120°, H **301°, H	20^{o}E 20^{o}W	Set 1	118^{o} **298^{o}	At C-axis	2^{o}	c	(0001)
	Grain 10	151°, H **332°, H	0° inclination	Set 1	153^{o} **332^{o}	At C-axis	$0\text{-}1^{o}$	c	(0001)
				Set 2	92^{o} **273^{o}	5^{o}E 5^{o}W	$58\text{-}59^{o}$	Unindexed	
				Set 3	125^{o} **306^{o}	$8\text{-}10^{o}$E $8\text{-}10^{o}$W	$26\text{--}27^{o}$	ω	$\{10\ \bar{1}\ 3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-1 **(From 340.70 m depth)**	**Grain 1**	71°, H **253°, H	37°E 38-42°W	Set 1	72^o **252^o	At C-axis	2-7^o	c	(0001)
				Set 2	39^o **222^o	35^oE 34^oW	24--27^o	ω	$\{10\bar{1}3\}$
	Grain 2	351°, H **168°, H	29°E 30°W	Set 1	329^o **149^o	15^oE 15^oW	23^o	ω	$\{10\bar{1}3\}$
				Set 2	354^o **173^o	At C-axis	3-4^o	c	(0001)
	Grain 3	178°, H **360°, H	20-23°E 23°W	Set 1	9^o **190^o	// to C-axis	21-24^o	ω	$\{10\bar{1}3\}$
				Set 2	164^o **344^o	13-15^oE 15^oW	15-18^o	Unindexed	
	Grain 4	10°, H **181°, H	0° inclination	Set 1	199^o **18^o	20-22°E 23°W	24-27^o	ω	$\{10\bar{1}3\}$
				Set 2	8^o **189^o	At C-axis	23-25^o	c	(0001)
	Grain 5	270°, H **91°, H	20°E 17°W	Set 1	155^o **334^o	14°E 14°W	69-71^o	ρ	$\{21\bar{3}1\}$
	Grain 6	144°, H **323°, H	0° inclination	Set 1	146^o **327^o	At C-axis	2-3^o	c	(0001)
				Set 2	160^o **341^o	8°E 7°W	17-18^o	e	$\{10\bar{1}4\}$
				Set 3	117^o **298^o	2°E 3°W	25-26^o	Unindexed	
	Grain 7	74°, H **255°, H	38°E 40°W	Set 1	69^o **251^o	At C-axis	2-5^o	c	(0001)
	Grain 8	185°, H **5°, H	33°E 29°W	Set 1	208^o **26^o	21°E 20°W	20-22^o	ω	$\{10\bar{1}3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-1 (***Continued...***)	**Grain 9**	330°, H **150°, H	14^{o}E 17^{o}W	Set 1	303^{o} **127^{o}	5^{o}E 8^{o}W	23--28^{o}	ω	$\{10\ \bar{1}\ 3\}$
	Grain 10	174°, H **355°, H	0° inclination	Set 1	175^{o} **356^{o}	At C-axis	0-1^{o}	c	(0001)
				Set 2	206^{o} **25^{o}	10-13^{o}E 10-13^{o}W	31-33^{o}	π	$\{10\ \bar{1}\ 2\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-5 (from 362.63 m depth)	**Grain 1**	290°, H **111°, H	25-30^{o}E 25-31^{o}W	Set 1	267^{o} **84^{o}	21^{o}E 19^{o}W	26--29^{o}	ω	$\{10\ \bar{1}\ 3\}$
	Grain 2	328°, H **149°, H	0° inclination	Set 1	331^{o} **151^{o}	At C-axis	21-22^{o}	c	(0001)
	Grain 3	116°, H **299°, H	41^{o}E 37^{o}W	Set 1	96^{o} **276^{o}	19-20°E 22-23°W	24-30^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	136^{o} **313^{o}	36°E 36°W	12-15^{o}	e	$\{10\ \bar{1}\ 4\}$
				Set 3	337^{o} **156^{o}	30°E 34°W	77-85^{o}	-	$\{31\ \bar{4}1\}$
	Grain 4	111°, H **291°, H	40°E 36°W	Set 1	94^{o} **274^{o}	17°E 17°W	25-28^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	130^{o} **310^{o}	15°E 15-20°W	24-31^{o}	Unindexed	
	Grain 5	281°, H **99°, H	33°E 33°W	Set 1	300^{o} **118^{o}	26°E 26°W	17-18^{o}	e	$\{10\ \bar{1}\ 4\}$
				Set 2	262^{o} **80^{o}	30°E 32°W	15-17^{o}	Unindexed	
	Grain 6	99°, H **280°, H	33°E 33°W	Set 1	81^{o} **258^{o}	18°E 18°W	22-24^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	98^{o} **278^{o}	At C-axis	1^{o}	c	(0001)
	Grain 7	116°, H **298°, H	0° inclination	Set 1	113^{o} **294^{o}	At C-axis	2-3^{o}	c	(0001)

Polar angle is defined as the angle between the pole to plane and quartz c-axis.
***** *Second measurement, after 180° rotation of the microscope stage.*

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-5 (***Continued…***)	**Grain 8**	133, H **316°, H	32^{o}E 28^{o}W	Set 1	118^{o} **298^{o}	15^{o}E 15^{o}W	$21\text{-}24^{o}$	ω	$\{10\,\bar{1}\,3\}$
	Grain 9	87°, H **268°, H	0° inclination	Set 1	241^{o} **60^{o}	2-4°E 5-7°W	27^{o}	ω	$\{10\,\bar{1}\,3\}$
				Set 2	96^{o} **276^{o}	14^{o}E 13^{o}W	$15\text{-}16^{o}$	e	$\{10\,\bar{1}\,4\}$
	Grain 10	143°, H **324°, H	0° inclination	Set 1	360^{o} **182^{o}	18^{o}E 18^{o}W	$19\text{-}20^{o}$	ω	$\{10\,\bar{1}\,3\}$
	Grain 11	215°, H **37°, H	30^{o}E 26^{o}W	Set 1	191^{o} **11^{o}	25°E 26°W	22^{o}	ω	$\{10\,\bar{1}\,3\}$
				Set 2	75^{o} **255^{o}	26^{o}E $25\text{-}26^{o}$W	$61\text{-}65^{o}$	Unindexed	
	Grain 12	324°, H **145°, H	40^{o}E 39^{o}W	Set 1	168^{o} **352^{o}	41^{o}E 38^{o}W	$79\text{-}84^{o}$	x	$\{51\,\bar{6}1\}$
	Grain 13	287°, H **106°, H	44^{o}E 45^{o}W	Set 1	86^{o} **267^{o}	30^{o}E 29^{o}W	$74\text{-}76^{o}$	-	$\{22\,\bar{4}1\}$
	Grain 14	105°, H **280°, H	$10\text{-}12^{o}$E 9^{o}W	Set 1	268^{o} **88^{o}	4°E 2°W	$19\text{-}22^{o}$	ω	$\{10\,\bar{1}\,3\}$
				Set 2	304^{o} **123^{o}	5°E 5°W	$25\text{-}28^{o}$	Unindexed	
				Set 3	301^{o} **120^{o}	10°E 10°W	$26\text{-}29^{o}$	Unindexed	
	Grain 15	171°, H **349°, H	28^{o}E $30\text{-}35^{o}$W	Set 1	182^{o} **1^{o}	22^{o}E 22^{o}W	$10\text{-}14^{o}$	e	$\{10\,\bar{1}\,4\}$
				Set 2	142^{o} **321^{o}	18^{o}E $18\text{-}20^{o}$W	$27\text{-}32^{o}$	π	$\{10\,\bar{1}\,2\}$
	Grain 16	302°, H **118°, H	29^{o}E 32^{o}W	Set 1	296^{o} **116^{o}	At C-axis	$3\text{-}5^{o}$	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5A Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 AM-5 (***Continued…***)	**Grain 17**	117°, H **299°, H	43°E 45°W	Set 1	120^{o} **300^{o}	At C-axis	1-3^{o}	c	(0001)
	Grain 18	323°, H **142°, H	19°E 20°W	Set 1	339^{o} **160^{o}	8°E 8-10°W	18-19^{o}	e	$\{10\ \bar{1}\ 4\}$
	Grain 19	153°, H **335°, H	37°E 35°W	Set 1	160^{o} **340^{o}	At C-axis	4-5^{o}	c	(0001)
	Grain 20	104°, H **286°, H	10°E 10°W	Set 1	300^{o} **119^{o}	18°E 16-20°W	29-33^{o}	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	260^{o} **81^{o}	5-8°E 8°W	29^{o}	Unindexed	

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B: Crystallographic measurements of PDF from selected quartz grain from representative M4 impactites

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 S-7 **(From 146 depth)**	**Grain 1**	147°, H **330°, H	11°E 9°W	Set 1	124^{o} **305^{o}	6^{o}E 4^{o}W	23-25^{o}	ω	$\{10\bar{1}3\}$
	Grain 2	326°, H **147°, H	30°E 30°W	Set 1	322^{o} **146^{o}	At C-axis	0-3^{o}	c	(0001)
	Grain 3	235°, H **54°, H	0° inclination	Set 1	235^{o} **55^{o}	At C-axis	0-3^{o}	c	(0001)
				Set 2	40^{o} **222^{o}	10-13^{o}E 10^{o}W	18^{o}	e	$\{10\bar{1}4\}$
	Grain 4	87°, H **268°, H	0° inclination	Set 1	19^{o} **200^{o}	15-18^{o}E 12-15^{o}W	68^{o}	s	$\{11\bar{2}1\}$
	Grain 5	327°, H **150°, H	30-36°E 25°W	Set 1	124^{o} **305^{o}	6^{o}E 4^{o}W	4-6^{o}	c	(0001)

Polar angle is defined as the angle between the pole to plane and quartz c-axis.
****Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 S 2(2) **(From 165.35 m depth)**	**Grain 1**	262°, H **81°, H	0° inclination	Set 1	259^o **80^o	At C-axis	1-2^o	c	(0001)
	Grain 2	207°, H **31°, H	0° inclination	Set 1	210^o **31^o	At C-axis	1^o	c	(0001)
	Grain 3	173°, H **351°, H	24^oE 18-20^oW	Set 1	176^o **356^o	24^oE 18-20^oW	4-9^o	c	(0001)
				Set 2	200^o **18^o	13^oE 16^oW	25-26^o	ω	$\{10\ \bar{1}\ 3\}$
	Grain 4	267°, H **87°, H	0° inclination	Set 1	69^o **251^o	20^oE 20^oW	26-27^o	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	63^o **245^o	14^oE 16^oW	27-28^o	Unindexed	
				Set 3	264^o **88^o	At C-axis	0-2^o	c	(0001)
	Grain 5	36°, H **215°, H	35°E 31°E	Set 1	30^o **212^o	35^oE 31^oW	3-7^o	c	(0001)
				Set 2	10^o **191^o	14^oE 14^oW	29-32^o	π	$\{10\ \bar{1}\ 2\}$
	Grain 6	319°, H **141°, H	24°E 20°W	Set 1	341^o **162^o	14°E 11°W	21-22^o	ω	$\{10\ \bar{1}\ 3\}$
	Grain 7	236°, H **58°, H	14°E 14°W	Set 1	246^o **65^o	15°E 14°W	7-8^o	Unindexed	
	Grain 8	33°, H **212°, H	0° inclination	Set 1	240^o **60^o	6°E 6°W	23-24^o	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	229^o **48^o	At C-axis	1-2^o	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 S-2(2) (***Continued...***)	**Grain 9**	224°, H **45°, H	0° inclination	Set 1	240^{o} **60^{o}	6°E 6°W	16^{o}	e	$\{10\bar{1}4\}$
	Grain 10	44°, H **222°, H	18°E 16°W	Set 1	64^{o} **244^{o}	14-16°E 13-14°W	20-21^{o}	ω	$\{10\bar{1}3\}$
				Set 2	42^{o} **233^{o}	At C-axis	0-3^{o}	c	(0001)
	Grain 11	132°, H **314°, H	0° inclination	Set 1	332^{o} **152^{o}	8°E 8-10°W	20-21^{o}	ω	$\{10\bar{1}3\}$
				Set 2	132^{o} **312^{o}	At C-axis	0^{o}	c	(0001)
	Grain 12	169°, H **350°, H	0° inclination	Set 1	170^{o} **352^{o}	At C-axis	0-2^{o}	c	(0001)
				Set 2	12^{o} 190^{o}	8-9^{o}E 8^{o}W	22-24^{o}	ω	$\{10\bar{1}3\}$
	Grain 13	120°, H **302°, H	0° inclination	Set 1	118^{o} **298^{o}	At C-axis	2^{o}	c	(0001)
				Set 2	96^{o} **274^{o}	4^{o}E 4^{o}W	25-27^{o}	ω	$\{10\bar{1}3\}$
				Set 3	310^{o} **131^{o}	2-5^{o}E 5^{o}W	9-11^{o}	Unindexed	
	Grain 14	227°, H **56°, H	0° inclination	Set 1	212^{o} **32^{o}	5^{o}E 5^{o}W	19^{o}	e	$\{10\bar{1}4\}$
				Set 2	72^{o} **251^{o}	16^{o}E 16^{o}W	25-26^{o}	Unindexed	
				Set 3	226^{o} **58^{o}	At C-axis	5-6^{o}	Unindexed	
	Grain 15	23°, H **205°, H	19°E 19°W	Set 1	8^{o} **186^{o}	15°E 15°W	15-17^{o}	e	$\{10\bar{1}4\}$
				Set 2	50^{o} **227^{o}	20°E 25°W	21-24^{o}	ω	$\{10\bar{1}3\}$

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 A-INJ (From 189.00 m depth)	**Grain 1**	249°, H **70°, H	0° inclination	Set 1	256^{o} **77^{o}	At C-axis	6-7^{o}	Unindexed	
	Grain 2	226°, H **44°, H	0° inclination	Set 1	226^{o} **46^{o}	At C-axis	0^{o}	c	(0001)
	Grain 3	258°, H **80°, H	0° inclination	Set 1	50^{o} **231^{o}	4^{o}E 4^{o}W	28-29^{o}	π	$\{10\bar{1}2\}$
				Set 2	78^{o} **260^{o}	At C-axis	2^{o}	c	(0001)
	Grain 4	201°, H **22°, H	0° inclination	Set 1	205^{o} **26^{o}	At C-axis	3-4^{o}	c	(0001)
				Set 2	179^{o} **2^{o}	8-10^{o}E 8-10^{o}W	21-23^{o}	ω	$\{10\bar{1}3\}$
	Grain 5	141°, H **322°, H	0° inclination	Set 1	143^{o} **320^{o}	At C-axis	1^{o}	c	(0001)
				Set 2	171^{o} **350^{o}	10^{o}E 10^{o}W	29-30^{o}	π	$\{10\bar{1}2\}$
	Grain 6	151°, H **332°, H	0° inclination	Set 1	150^{o} **329^{o}	At C-axis	1-2^{o}	c	(0001)
				Set 2	132^{o} **311^{o}	11-12°E 10°W	22^{o}	ω	$\{10\bar{1}3\}$
	Grain 7	236°, H **58°, H	0° inclination	Set 1	62^{o} **242^{o}	8°E 8°W	10^{o}	Unindexed	
				Set 2	22^{o} **203^{o}	4°E 4-6°W	34-35^{o}	π	$\{10\bar{1}2\}$
	Grain 8	231°, H **52°, H	0° inclination	Set 1	26^{o} **208^{o}	10°E 10°W	25-27^{o}	ω	$\{10\bar{1}3\}$
				Set 2	229^{o} **48^{o}	At C-axis	2-3^{o}	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 A-INJ (***Continued...***)	**Grain 9**	237°, H **60°, H	0° inclination	Set 1	32^{o} **212^{o}	10-12°E 12°W	$28\text{-}29^{o}$	π	$\{10\ \bar{1}\ 2\}$
				Set 2	232^{o} **51^{o}	At C-axis	$6\text{-}7^{o}$	Unindexed	
	Grain 10	216°, H **34°, H	0° inclination	Set 1	219^{o} **40^{o}	At C-axis	$3\text{-}4^{o}$	c	(0001)
	Grain 11	231°, H **52°, H	0° inclination	Set 1	37^{o} **215^{o}	8-9°E 8-9°W	$17\text{-}18^{o}$	e	$\{10\ \bar{1}\ 4\}$
				Set 2	236^{o} **56^{o}	At C-axis	4^{o}	c	(0001)
	Grain 12	261°, H **82°, H	0° inclination	Set 1	61^{o} **242^{o}	10°E 12°W	22^{o}	ω	$\{10\ \bar{1}\ 3\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 IM -2 **(From 234.53 m depth)**	**Grain 1**	19°, H **204°, H	0° inclination	Set 1	360^o **182^o	18^oE 18^oW	25--27^o	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	22^o **202^o	At C-axis	0^o	c	(0001)
	Grain 2	20°, H **201°, H	39°E 33-36°W	Set 1	34^o **215^o	25°E 26-28°W	14-20^o	e	$\{10\ \bar{1}\ 4\}$
	Grain 3	250°, H **69°, H	0° inclination	Set 1	87^o **269^o	15°E 14°W	22--24^o	ω	$\{10\ \bar{1}\ 3\}$
	Grain 4	268°, H **87°, H	20°E 27°W	Set 1	275^o **108^o	2°E 2-3°W	16-28^o	ω	$\{10\ \bar{1}\ 3\}$
				Set 2	250^o **68^o	17^oE 15^oW	16-20^o	e + ω	$\{10\ \bar{1}\ 3\}$ + $\{10\ \bar{1}\ 4\}$
	Grain 5	219°, H **40°, H	42°E 39-42°W	Set 1	212^o **31^o	19-22°E 19-21°W	16-22^o	Unindexed	
				Set 2	251^o **66^o	30^oE 34^oW	23-25^o	ω	$\{10\ \bar{1}\ 3\}$
	Grain 6	283°, H **103°, H	12-13°E 12°W	Set 1	284^o **103^o	At C-axis	0-1^o	c	(0001)
	Grain 7	260°, H **76°, H	0° inclination	Set 1	94^o **274^o	3°E 3°W	16^o	e	$\{10\ \bar{1}\ 4\}$
				Set 2	78^o **258^o	At C-axis	1^o	c	(0001)
	Grain 8	206°, H **28°, H	25°E 25°W	Set 1	211^o **30^o	At C-axis	3-5^o	c	(0001)
	Grain 9	181°, H **360°, H	0° inclination	Set 1	200^o **19^o	10°E 10°W	20-21^o	ω	$\{10\ \bar{1}\ 3\}$
	Grain 10	337°, H **163°, H	30°E 29-32°W	Set 1	342^o **161^o	At C-axis	1-4^o	c	(0001)

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 IM -6 **(From 271.17 m depth)**	**Grain 1**	113°, H **290°, H	0° inclination	Set 1	244^{o} **61^{o}	7^{o}E 7-10^{o}W	48-50^{o}	ξ	$\{11\bar{2}2\}$
	Grain 2	118°, H **299°, H	0° inclination	Set 1	116^{o} **298^{o}	At C-axis	0-2^{o}	c	(0001)
				Set 2	274^{o} **95^{o}	8^{o}E 8^{o}W	25-66^{o}	ω	$\{10\bar{1}3\}$
	Grain 3	135°, H **315°, H	0° inclination	Set 1	128^{o} **308^{o}	At C-axis	6-6^{o}	Unindexed	
	Grain 4	61°, H **242°, H	0° inclination	Set 1	359^{o} **18^{o}	2-5^{o}E 3^{o}W	61-62^{o}	s	$\{11\bar{2}1\}$
	Grain 5	188°, H **10°, H	0° inclination	Set 1	185^{o} **7^{o}	At C-axis	1-3^{o}	c	(0001)
				Set 2	210^{o} **32^{o}	7-12^{o}E 10-12^{o}W	21-25^{o}	ω	$\{10\bar{1}3\}$
	Grain 6	58°, H **240°, H	0° inclination	Set 1	53^{o} **233^{o}	At C-axis	5-5^{o}	Unindexed	
				Set 2	41^{o} **222^{o}	12-14^{o}E 12-14^{o}W	20-21^{o}	ω	$\{10\bar{1}3\}$
				Set 3	282^{o} **101^{o}	10-12^{o}E 8-12^{o}W	42-44^{o}	ξ	$\{11\bar{2}2\}$

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***

***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 S-5 **(From 285.97 m depth)**	**Grain 1**	45°, H **226°, H	30°E 32°W	Set 1	23° **204°	13°E 12°W	26--29°	π	$\{10\bar{1}2\}$
	Grain 2	329°, H **151°, H	20°E 20°W	Set 1	314° **135°	4°E 4°W	21--22°	ω	$\{10\bar{1}3\}$
	Grain 3	185°, H **6°, H	28°E 26°W	Set 1	189° **11°	28°E 25-26°W	3-5°	c	(0001)
	Grain 4	247°, H **68°, H	9°E 9°W	Set 1	252° **71°	9°E 9°W	3--4°	c	(0001)
	Grain 5	283°, H **102°, H	22°E 18°W	Set 1	262° **84°	12°E 10-12°W	18-22°	e	$\{10\bar{1}4\}$
	Grain 6	61°, H **240°, H	27°E 29°W	Set 1	60° **236°	27°E 29°W	1-4°	c	(0001)
	Grain 7	88°, H **270°, H	26°E 30°W	Set 1	69° **248°	17°E 17°W	21-24°	ω	$\{10\bar{1}3\}$
	Grain 8	43°, H **223°, H	0° inclination	Set 1	45° **226°	At C-axis	1-2°	c	(0001)
	Grain 9	38°, H **221°, H	8°E 10°W	Set 1	16° **196°	1°E 1-2°W	24-25°	ω	$\{10\bar{1}3\}$
				Set 2	40° **221°	8°E 10°W	1-3°	c	(0001)
	Grain 10	64°, H **244°, H	0° inclination	Set 1	253° **74°	10°E 10°W	13-14°	e	$\{10\bar{1}4\}$
	Grain 11	154°, H **336°, H	0° inclination	Set 1	34° **213°	10°E 8-9°W	58-59°	Unindexed	
	Grain 12	161°, H **341°, H	0° inclination	Set 1	172° **352°	5°E 5°W	11°	Unindexed	

**** Polar angle is defined as the angle between the pole to plane and quartz c-axis.***
***** Second measurement, after 180° rotation of the microscope stage.***

Appendix 5B Continued…

Sample number	Axis of orientation			Plane of orientation					
	Number of grains investigated	C-axis orientation	E-W inclination	Number of PDF sets	PDF Azimuth	E-W inclination	*Polar Angle	Symbol	Miller-Bravais Indices
M4 S-5 (*Continued…*)	**Grain 13**	98°, H **279°, H	0° inclination	Set 1	94^{o} **274^{o}	At C-axis	4^{o}	c	(0001)
	Grain 14	161°, H **340°, H	0° inclination	Set 1	136^{o} **318^{o}	4-5^{o}E 5^{o}W	23-24^{o}	ω	$\{10\ \bar{1}\ 3\}$
	Grain 15	102°, H **284°, H	0° inclination	Set 1	97^{o} **278^{o}	At C-axis	4-5^{o}	c	(0001)

Polar angle is defined as the angle between the pole to plane and quartz c-axis.
***** *Second measurement, after 180° rotation of the microscope stage.***

Appendix 5C: Histograms showing frequency distribution of angles between c-axis and poles to PDF in 5° intervals.

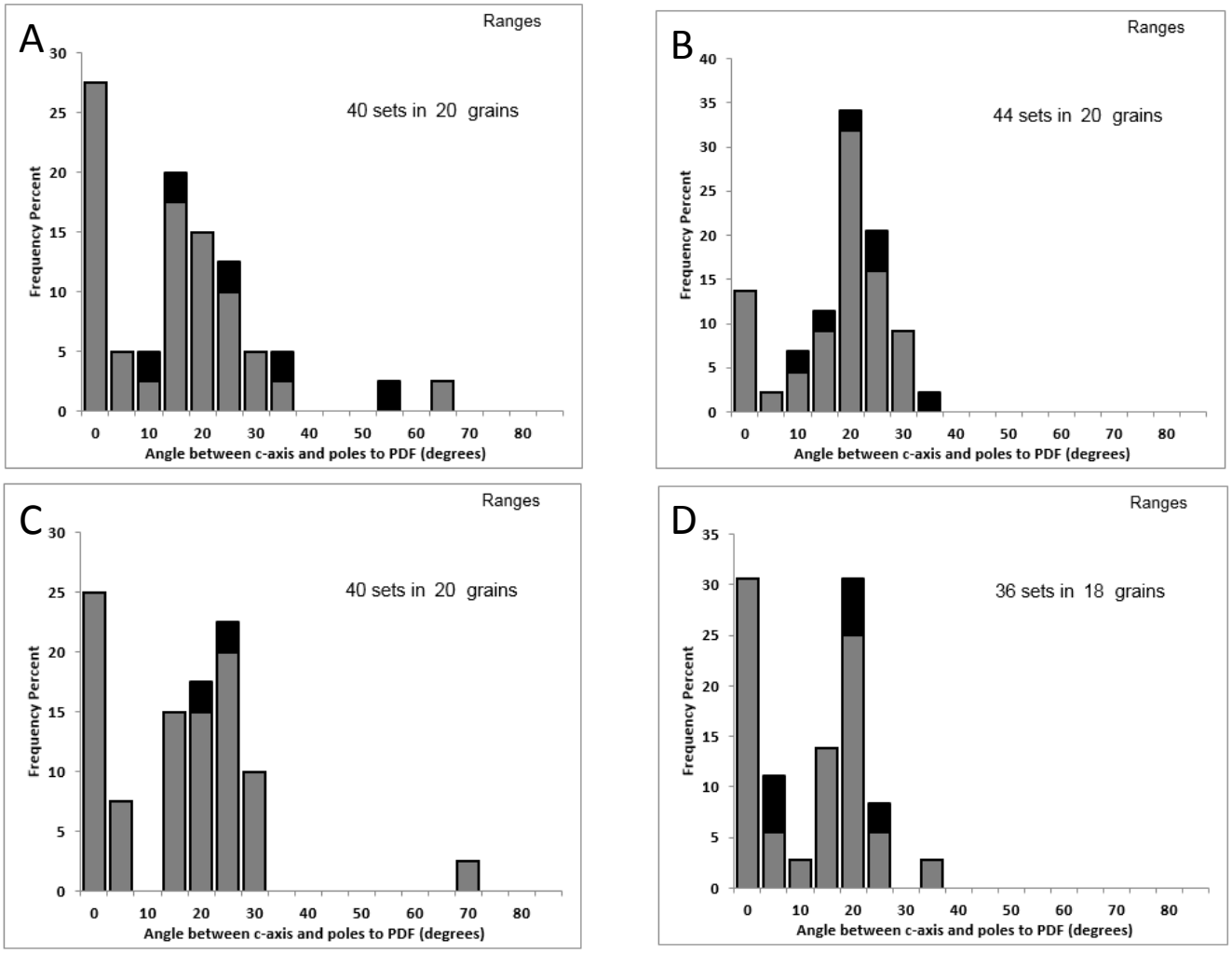


Figure 5C.1: Histograms showing frequency distribution of angles between c-axis and poles to PDF in 5° intervals (measurement error) for indexed PDF crystallographic orientations of quartz clasts from M4 core target rock samples. **A)** Granodioritic gneiss sample M4 GG-4 (depth: 109.20 m). **B)** Granitic gneiss sample M4 GG-2 (depth: 131.90 m). **C)** Trondhjemitic gneiss sample M4 FZ-2 (depth: 219.30 m). **D)** Silicified metadolerite sample M4 IS-2 (depth: 211.41 m). The data was processed on the ANIE program based on ranges of values. Indexed PDF are marked with grey bars, whilst the unindexed PDF are indicated by black bars.

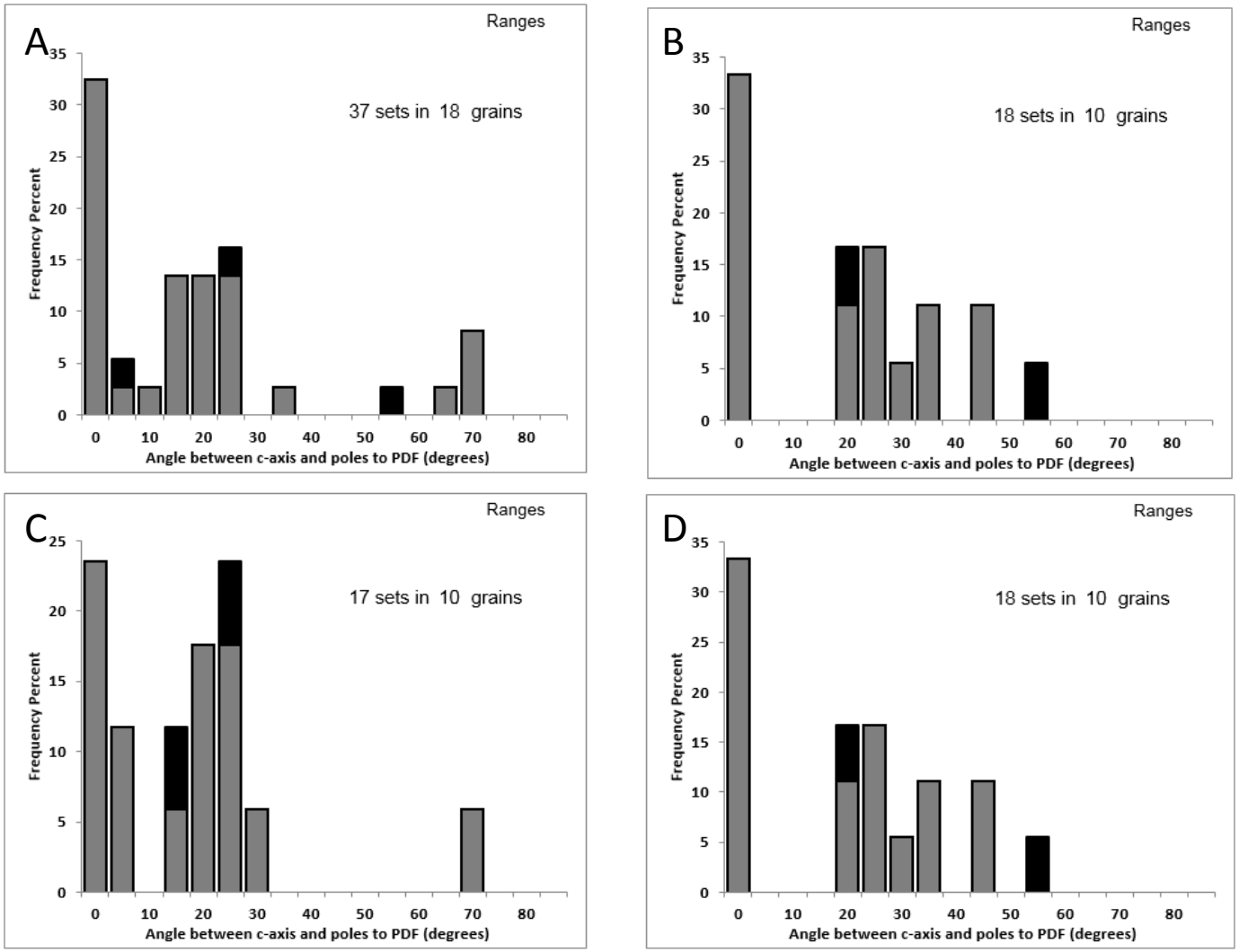


Figure 5C.1: *Continued…*: **E)** Granitic gneiss sample M4 GG-17 (depth: 274.15 m). **F)** Dioritic gneiss sample M4 AM-2 (depth: 338.15 m). **G)** Dioritic gneiss sample M4 AM-1 (depth: 340.70 m). **H)** Dioritic gneiss sample M4 AM-5 (depth: 362.63 m). The data was processed on the ANIE program based on ranges of values. Indexed PDF are marked with grey bars, whilst the unindexed PDF are indicated by black bars.

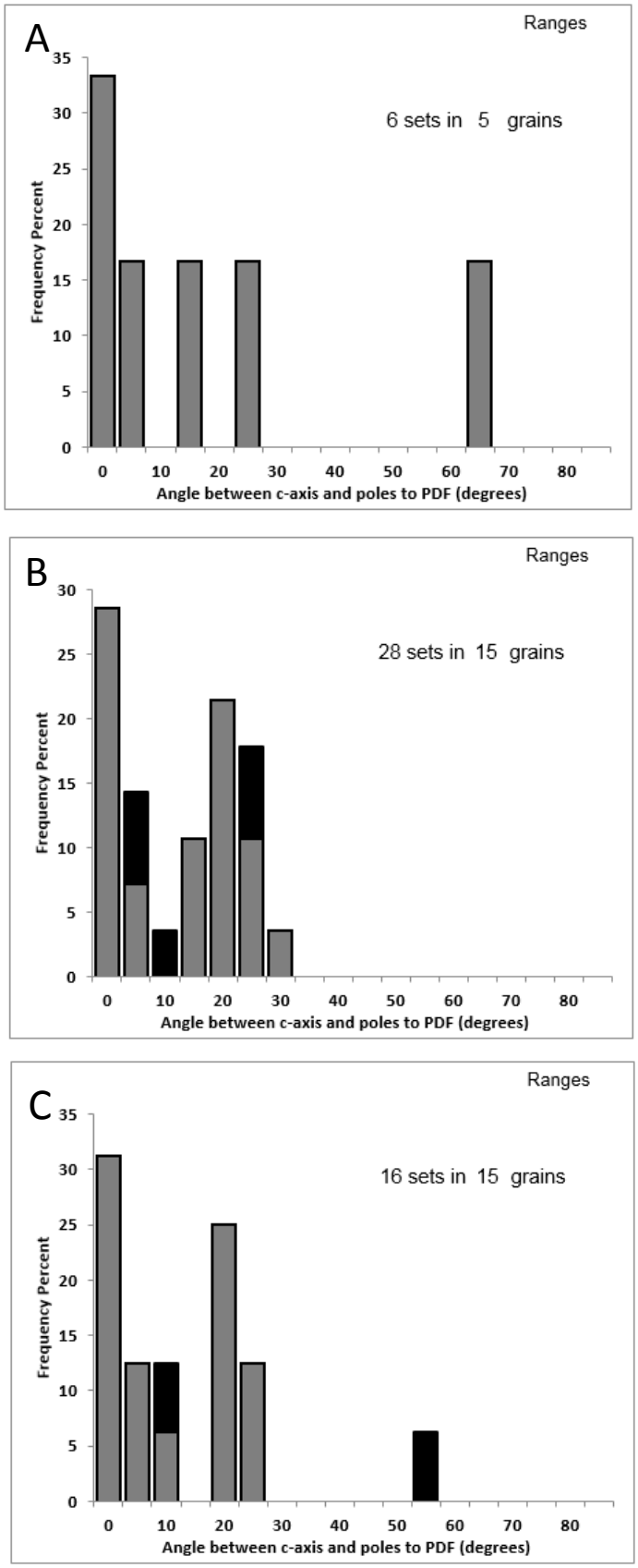


Figure 5C.2: Histograms showing frequency distribution of angles between c-axis and poles to PDF in 5° intervals (measurement error) for indexed PDF crystallographic orientations of quartz clasts in M4 core suevite samples. **A)** M4 S-7 (depth: 146.00 m). **B)** M4 S-2 (depth: 165.35 m). **C)** Sample M4 S-5 (depth: 285.97 m). The data was processed on the ANIE program based on ranges of values. Indexed PDF are marked with grey bars, whilst the unindexed PDF are indicated by black bars.

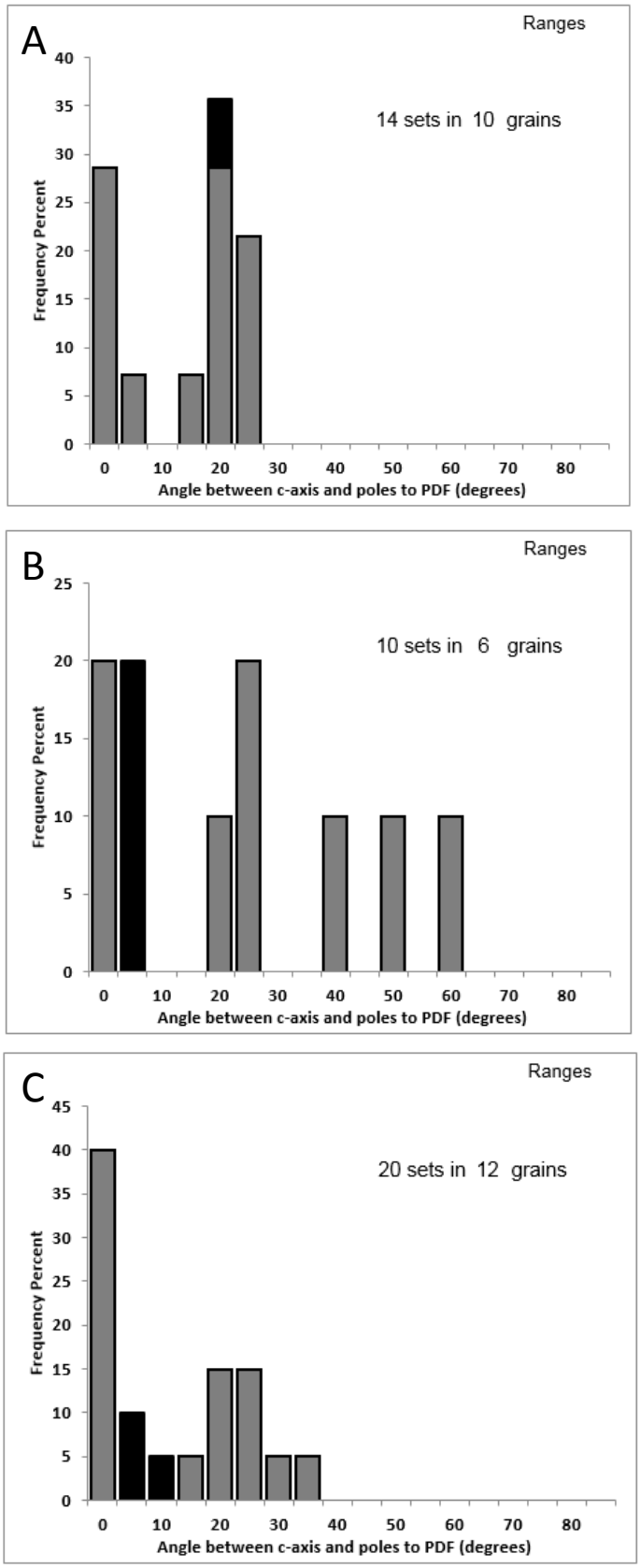


Figure 5C.3: Histograms showing absolute frequency percent for indexed PDF crystallographic orientations of quartz clasts from M4 core MMBr samples. **A)** PDF data from M4 IM-2 (depth: 234.33 m). **B)** Data for sample M4 IM-6 (depth: 271.17 m). **C)** MMBr injection dyke sample M4 A-INJ from 189.00 m depth. The data was processed on the ANIE program based on ranges of values. Indexed PDF are marked with grey bars, whilst the unindexed PDF are indicated by black bars.