APOLLO 15 RAKE SAMPLE MICROBRECCIAS AND NON-MARE ROCKS: BULK ROCK, MINERAL AND GLASS ELECTRON MICROPROBE ANALYSES

-ngl- 32-004-063

(GMX)

DRA

Paul F. Hlava, Jonathan A. Green
*Martin Prinz, C. E. Nehru**
Klaus Keil, Eric Dowty
*and T. E. Bunch***

Department of Geology & Institute of Meteoritics
UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico 87131, U.S.A.

Permanent addresses:
*Department of Geology
BROOKLYN COLLEGE OF THE CITY UNIVERSITY OF NEW YORK
Brooklyn, New York 11210, U.S.A.

**Space Science Division
NASA Ames Research Center
Moffett Field, California 94035, U.S.A.

'73 OCT 31 AM 11:35
T.I.S. LIBRARY
RECEIVED
A.I.A.A.

(NASA-TM-X-70079) APOLLO 15 RAKE SAMPLE MICROBRECCIAS AND NON-MARE ROCKS: BULK ROCK, MINERAL AND GLASS ELECTRON MICROPROBE ANALYSES Special Publication No. 11 (NASA) 80 p HC CSCL 03B

N74-23364

Unclas
G3/30 16473

PARTMENT OF GEOLOGY & INSTITUTE OF METEORITICS

e University of New Mexico

buquerque, New Mexico 87131, U.S.A.

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

PRICES SUBJECT TO CHANGE

cial Publication Number 11, UNM INSTITUTE OF METEORITICS (1973)

80

APOLLO 15 RAKE SAMPLE MICROBRECCIAS AND NON-MARE ROCKS: BULK ROCK, MINERAL AND GLASS ELECTRON MICROPROBE ANALYSES

Paul F. Hlava, Jonathan A. Green
*Martin Prinz, C. E. Nehru**
Klaus Keil, Eric Dowty
*and T. E. Bunch***

Department of Geology & Institute of Meteoritics
UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico 87131, U.S.A.

Permanent addresses:
*Department of Geology
BROOKLYN COLLEGE OF THE CITY UNIVERSITY OF NEW YORK
Brooklyn, New York 11210, U.S.A.

**Space Science Division
NASA Ames Research Center
Moffett Field, California 94035, U.S.A.

TABLE OF CONTENTS

	Page
Introduction	1
Bulk analyses of high-alumina basalt rake samples and lithic fragments	3
Bulk analyses of anorthositic-noritic-troctolitic (ANT) rake samples and lithic fragments	4
Mineral data	5
Pyroxene	5
High-alumina basalt rake samples	5
ANT rake samples	13
Olivine	20
High-alumina basalt rake samples	20
ANT rake samples	25
Plagioclase	26
High-alumina basalt rake samples	26
ANT rake samples	35
Barian K-feldspar	40
High-alumina basalt rake sample	40
Spinel	40
High-alumina basalt rake sample	40
Ilmenite	40
High-alumina basalt rake sample	40
Cobaltian metallic nickel-iron	41
High-alumina basalt rake samples	41
SiO_2-K_2O-rich residual glass	42
High-alumina basalt rake samples	42
Glasses	43
Glasses in loose fines	43
Glasses in microbreccias	51
Chondrule data	75
Bulk analyses	75
Matrix glass in different chondrules	77
Matrix glass within a single chondrule	78
Olivine	78
Figures 1-4: major mineral data plots	12

DEPARTMENT OF GEOLOGY & INSTITUTE OF METEORITICS

The University of New Mexico

Albuquerque, New Mexico 87131, U.S.A.

Special Publication Number 11, UNM INSTITUTE OF METEORITICS (1973)

INTRODUCTION

Quantitative electron microprobe data of Apollo 15 non-mare rake samples are presented here. Almost all the data have not been previously published. Some of the interpretation of the data for non-mare rocks and the conclusions drawn are presented in Dowty et al. (1972a and b) and a more complete report is in preparation. Bulk analyses and descriptions of these rocks are given in the Apollo 15 rake sample catalogue by Dowty et al.(1973a). Bulk analyses of lithic fragments in the non-mare rocks (expressed in oxide weight-percent) and the corresponding CIPW molecular norms are given in this publication. The mineralogy of the rocks and lithic fragments are also given; structural formulae for complete analyses and molecular end-members for all mineral analyses are included. The mineral analyses include pyroxene, olivine, plagioclase, barian K-feldspar, spinel and ilmenite, cobaltian metallic nickel-iron as well as SiO_2-K_2O-rich residual glass. Spinel and ilmenite data from some of these samples are presented in Nehru et al. (1973). Data on other minor mineral phases, such as zirkelite and armalcolite, occurring in these rocks will be presented elsewhere.

The standards used for all analyses of lithic fragments are the same as those described in Dowty et al. (1973a). The standards used for mineral analyses are the same as those given in Dowty et al. (1973b). The grain numbers are recorded at the top of each column of analysis and correspond to the numbers marked on photo mosaics on file in the Institute of Meteoritics. Complete mineral analyses were corrected for differential matrix effects by the procedure of Bence and Albee (1968).

Electron microprobe analyses (oxide weight percent) of glasses in loose fines and microbreccia samples and their CIPW molecular norms are presented next. The interpretation of these data and the conclusions drawn are presented in Bunch et al. (1972) and a more complete report is in preparation. The glasses are listed in increasing order of FeO within each sample and classified according to their bulk composition, shape and color. The following abbreviations are used. Note that these abbreviations are used only for convenience and to save space. The compositional groups are defined in Bunch et al. (1972; in preparation).

Color

C	Clear (grayish-white)
P	Pink (pink-lavender)
G	Green
Y	Yellow
O	Orange(orange-brown-amber)
OP	Opaque

Shape

F	Fragment
S	Spherule

Compositional Groups

FP	Feldspathic peridotite (green glass)
IOB	Ilmenite olivine basalt
PIC	Picrite (Ilmenite-bearing)
BAS	Basalt
ANT	Anorthositic-noritic-troctolitic suite
HAB	High-alumina basalt (Low alkali)
AHAB	Alkali-high-alumina basalt (KREEP)
MISC	Miscellaneous

The numbers at the top of each column of analyses correspond to the numbers marked on photo mosaics on file in the Insitute of Meteoritics. The standards used for glass analyses are as follows: pyroxene A209-SiO_2, Al_2O_3 and MnO; pyroxene A207-Cr_2O_3 and Na_2O; synthetic glass C135B3-TiO_2, FeO, MgO, CaO, K_2O, P_2O_5 and ZrO_2.

Electron microprobe data on bulk, mineral, and matrix glass from chondrules are presented last. Standards used are the same as those for glasses. The interpretation of these results and their conclusions are presented in Bunch et al. (1972; in preparation).

Acknowledgments: We thank J. Erlichman for some electron microprobe analyses; W. L. Quaide for some electron microprobe data on green glasses in loose fines; G. Moreland of Smithsonian Institution for preparing excellent polished thin sections for electron microprobe analysis; R. Cox, J. Ethridge, R. D. Fisher, R. Geitgey, G. Honea, J. Hultzen, D. Lange, and D. Lewis for help in data reduction. This work is supported in part by NASA Grant No. 32-004-063. (Klaus Keil, Principal Investigator).

REFERENCES

Bence, A.E. and Albee, A.L. (1968) Empirical correction factors for the electron microanalysis of silicates and oxides. J. Geol. 76, 382-403.

Bunch, T.E., Princ, M., Keil, K., Dowty, E. (1972) Composition and origina of glass and chondrules in Apollo 15 rake samples from Spur Crater (Abstr.) Meteoritics, 8, p. 21-22.

Dowty, E., Prinz, M., Keil, K., and Bunch, T.E. (1972a) Non-mare rock types in Apollo 15 rake samples. (Abstr.) Geol. Soc. Amer. 1972. Ann. Meeting, Abstr. Program 4, p. 491-492.

Dowty, E., Keil, K., and Prinz, M. (1972b) Anorthosite in the Apollo 15 rake sample from Spur Crater. The Apollo 15 Lunar Samples, (editors J.W. Chamberlain and C. Watkins), p. 62-66, The Lunar Science Institute, Houston, Texas.

Dowty, E., Conrad, G. H., Green, J.A., Hlava, P. F., Keil, K., Moore, R. B., Nehru, C.E., and Prinz, M. (1973a) Catalogue of Apollo 15 rake samples from stations 2 (St. George), 7 (Spur Crater) and 9a (Hadley Rille) Spec. Publ. No. 8, Univ. Ner Mexico - Inst. of Meteoritics.

Dowty, E., Prinz, M., Nehru, C.E., Moreland, G., Moore, R.B., Keil, K., Hlava, P. F., and Green, J. A. (1973b) Electron microprobe analyses of minerals from Apollo 15 mare basalt rake samples. Spec. Publ. No. 9, Univ. New Mexico - Inst. of Meteoritics.

Nehru, C.E., Prinz, M., Dowty, E., and Keil, K. (1973) Electron microprobe analyses of spinel group minerals and ilmenite in Apollo 15 rake samples of igneous origin. Spec. Publ. No. 10, Univ. New Mexico - Inst. of Meteoritics.

The following notation is used in all tables.

n.d. Not determined.
* Less than 0.01 weight percent.

Grain number prefixes

c Core
r Rim

TABLE 1: BULK ANALYSES OF HIGH-ALUMINA BASALT RAKE SAMPLES AND LITHIC FRAGMENTS

				Lithic fragments in breccia				
Sample No.	356**	359**	382**	323	342	332	358	342
Frag. No.				1	10	3	1	6
SiO_2	45.6	48.6	52.4	52.7	45.0	49.2	50.8	51.4
TiO_2	1.12	1.08	1.78	.96	1.76	1.46	2.01	1.82
Al_2O_3	20.0	18.0	17.8	19.4	19.0	19.7	18.0	14.7
Cr_2O_3	.17	.32	.21	.24	.08	n.d.	.25	.23
FeO	7.5	9.6	8.6	7.7	8.1	9.4	9.6	11.7
MnO	.11	.10	.10	.16	.08	.08	.13	.11
MgO	13.7	11.0	7.1	6.0	15.3	7.7	8.6	9.9
CaO	10.2	10.3	9.9	10.6	10.8	11.1	9.9	9.7
Na_2O	.68	.66	.96	.81	.45	.93	.92	.38
K_2O	.58	.19	.57	.60	.17	.61	.53	.48
P_2O_5	.34	.25	.55	.54	.05	.27	.48	.42
ZrO_2	n.d.	.14	n.d.	.12	.02	.13	n.d.	.16
S	n.d.	n.d.	n.d.	.08	n.d.	n.d.	n.d.	n.d.
Total	100.00+	100.24	99.97	99.91	100.81	100.08	101.22	101.45
CIPW Molecular Norms								
q	--	--	8.62	--	--	--	--	--
c	.56	--	--	--	--	3.00	--	--
or	3.36	1.12	3.42	.53	.99	--	1.09	.53
ab	5.98	5.91	8.75	5.26	4.23	3.53	5.06	4.45
an	47.41	45.50	43.22	54.97	65.41	54.82	62.21	65.20
di wo	--	1.54	1.19	.52	2.25	--	1.76	2.38
di en	--	1.07	.77	.38	1.51	--	1.29	1.57
di fs	--	.47	.42	.14	.74	--	.47	.81
hy en	16.01	28.87	19.12	25.71	10.68	24.92	14.67	12.89
hy fs	4.28	12.64	10.58	9.14	5.26	7.35	5.34	6.65
ol fo	15.78	.26	--	1.75	5.48	4.50	5.34	3.12
ol fa	4.22	.11	--	.62	2.69	1.33	1.94	1.61
cm	.18	.35	.23	--	.14	.24	.23	.10
il	1.53	1.50	2.52	.83	.44	.25	.43	.43
ap	.70	.52	1.17	.11	.16	.08	.14	.23
z	--	.13	--	.05	.02	--	--	.04

** From Dowty et al.(1973a)

+ Normalized to 100 percent

TABLE 2: BULK ANALYSES OF ANORTHOSITIC-NORITIC-TROCTOLITIC (ANT) RAKE SAMPLES AND LITHIC FRAGMENTS

			Lithic fragments in breccia											
Sample No.	308**	362**	327	332	332	342	249	342	342	342	346	342	342	332
Frag. No.			1	1	4	7	1	12	9	3	1	4	5	2
SiO_2	44.1	44.0	44.6	46.1	44.7	44.0	48.7	46.2	47.2	47.5	46.3	46.6	46.5	47.3
TiO_2	1.24	.03	.07	.16	.39	.10	.10	.30	.42	.32	.18	.31	.32	.59
Al_2O_3	27.3	35.1	32.3	33.8	30.8	29.3	25.8	26.5	26.3	24.6	23.9	25.0	25.4	21.0
Cr_2O_3	.46	.01	.02	n.d.	n.d.	.04	.24	.07	.08	.13	.22	.09	.13	n.d.
FeO	5.9	.24	.76	.99	3.9	4.2	4.2	4.8	5.3	5.9	6.2	6.5	6.6	6.9
MnO	.09	.01	.01	.02	.06	.03	.08	.06	.05	.07	.06	.07	.06	.09
MgO	6.7	.31	3.4	1.07	3.0	8.6	8.5	7.4	8.6	8.6	11.4	6.8	7.2	10.2
CaO	13.3	19.8	18.3	18.7	17.7	15.3	11.9	14.4	12.4	13.9	11.3	14.6	14.7	11.3
Na_2O	.63	.35	.38	.67	.47	.25	.38	.63	.49	.58	.40	.50	.48	.58
K_2O	.17	.04	.07	.09	.05	.05	.06	.24	.20	.19	*	.09	.17	.09
P_2O_5	.11	*	n.d.	.05	.12	.06	.02	.23	.05	.07	.04	.11	.08	.05
ZrO_2	.05	*	.07	.04	.08	*	n.d.	.13	.06	*	*	.04	.02	.05
S	.19	.00	.02	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Total	100.00+	100.00+	100.00+	101.19	101.27	101.87	100.00+	100.96	101.15	101.87	100.00+	100.71	101.66	98.15
CIPW Molecular Norms														
q	--	--	5.89	--	4.40	1.16	--	9.54	.31	--	.16	--	--	4.34
c	2.36	--	--	--	--	--	--	--	--	--	3.05	1.23	--	3.81
or	1.00	.26	2.86	.98	3.13	3.61	.41	3.60	.52	1.39	1.16	.28	.29	.35
ab	5.64	2.51	3.44	3.93	8.25	8.37	3.38	7.38	5.90	5.55	4.30	2.16	4.17	3.37
an	65.05	94.00	37.31	47.93	43.36	47.92	85.47	48.27	87.33	67.51	59.83	72.81	80.92	58.25
di wo	--	1.24	3.38	1.52	1.02	2.21	1.80	.62	1.36	.45	--	--	2.07	--
di en	--	.85	2.15	1.23	.67	1.39	1.62	.38	.94	.34	--	--	1.23	--
di fs	--	.40	1.23	.30	.34	.83	.18	.24	.43	.12	--	--	.83	--
hy en	12.33	--	25.40	14.50	23.03	19.92	1.80	16.44	1.96	10.93	23.21	4.51	2.10	23.20
hy fs	4.85	--	14.49	3.49	11.73	11.86	.20	10.45	.89	3.78	7.47	1.21	1.42	6.25
ol fo	4.58	--	--	18.98	--	--	4.41	--	--	6.58	--	13.78	3.64	--
ol fa	1.79	--	--	4.57	--	--	.49	--	--	2.28	--	3.71	2.46	--
cm	.50	--	.25	.09	.27	--	.02	.27	--	.08	.09	.04	--	.26
il	1.70	.05	2.56	2.38	2.80	2.04	.10	1.36	.22	.41	.57	.13	.54	.14
ap	.23	.11	.89	.10	1.00	.57	--	1.15	.10	.47	.10	.12	.25	.04
z	--	--	.15	.02	--	.12	.06	.11	.04	.12	.05	--	.07	--
ne	--	.38	--	--	--	--	--	--	--	--	--	--	--	--

** From Dowty et al.(1973a)

+ Normalized to 100 percent

PYROXENE

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 3: PYROXENES IN HIGH-ALUMINA BASALT RAKE SAMPLES AND LITHIC FRAGMENTS

	15323								15332,1-3
	6	3	9	8	4	2	7	1	1
SiO_2	54.3	53.6	53.1	52.1	53.4	53.0	48.6	50.9	52.3
TiO_2	.20	.82	.68	1.11	.36	.78	1.25	2.01	1.87
Al_2O_3	2.40	2.80	2.53	8.8	.85	1.16	3.5	3.1	.72
Cr_2O_3	.51	1.01	.88	1.07	.40	.58	.79	.41	.46
FeO	11.4	11.7	12.9	13.7	16.5	19.7	21.8	22.1	20.7
MnO	.19	.21	.22	.18	.31	.27	.35	.38	.40
MgO	30.3	28.8	27.6	19.5	26.0	21.3	17.6	9.0	22.0
CaO	1.27	2.18	2.31	5.0	2.24	3.0	5.9	13.1	1.18
Na_2O	*	.04	*	.05	.12	*	.06	.06	*
Total	100.57	101.16	100.22	101.51	100.18	99.79	99.85	101.06	99.63
Number of Ions on the Basis of 6 (O)									
Si	1.917	1.894	1.904	1.852	1.946	1.968	1.853	1.944	1.946
Ti	.005	.022	.018	.030	.010	.022	.036	.058	.082
Al	.100	.116	.107	.369	.036	.051	.157	.140	.020
Cr	.014	.028	.025	.030	.012	.017	.024	.012	.014
Fe	.337	.346	.387	.407	.503	.612	.695	.706	.644
MnO	.006	.006	.007	.005	.010	.008	.011	.012	.013
Mg	1.594	1.516	1.475	1.033	1.412	1.179	1.000	.512	1.220
Ca	.048	.082	.089	.191	.088	.119	.241	.536	.047
Na	--	.003	--	.003	.003	--	.004	.004	--
Sum	4.021	4.013	4.012	3.920	4.025	3.976	4.021	3.924	3.986
Molecular End Members									
En	80.6	73.0	75.7	63.3	70.5	61.7	51.7	3.9	63.8
Wo	2.4	4.2	4.5	11.7	4.4	6.3	12.4	41.5	2.5
Fs	17.0	17.3	19.8	25.0	25.1	32.0	35.9	54.6	33.7

TABLE 3: CONTINUED

15356,1-1

	1	12	5	8	2	4	3	13	11	7	6	9	10
SiO_2	55.1	53.6	53.9	54.8	54.2	55.7	55.1	53.9	55.0	54.3	54.8	54.6	54.4
TiO_2	.88	1.27	.94	1.01	.91	1.10	1.10	.87	1.06	1.34	1.04	1.01	.73
Al_2O_3	1.73	1.63	2.07	1.98	1.69	1.61	1.98	1.69	1.63	1.77	1.79	1.65	.93
Cr_2O_3	.41	.36	.44	.44	.38	.33	.42	.39	.35	.35	.38	.35	.27
FeO	10.4	11.1	11.4	11.5	11.7	12.2	12.3	12.3	12.4	12.5	12.6	12.8	12.9
MnO	.23	.27	.22	.24	.29	.20	.25	.24	.20	.22	.27	.22	.24
MgO	25.9	21.3	27.9	26.7	27.3	27.6	25.7	26.9	25.1	25.1	25.8	26.1	25.7
CaO	3.6	7.2	3.0	3.6	3.0	3.0	4.3	3.7	5.4	4.3	4.1	3.9	4.6
Na_2O	*	.01	.05	*	.07	*	.02	*	*	.01	*	.03	.02
Total	98.25	96.74	99.92	100.27	99.54	101.74	101.17	99.99	101.14	99.89	100.78	100.66	99.79
Number of Ions on the Basis of 6 (O)													
Si	1.986	1.993	1.926	1.950	1.944	1.954	1.953	1.935	1.957	1.953	1.953	1.949	1.965
Ti	.024	.036	.025	.027	.025	.029	.029	.024	.028	.036	.028	.027	.020
Al	.074	.071	.087	.083	.072	.067	.083	.072	.068	.075	.075	.070	.040
Cr	.012	.011	.012	.012	.011	.009	.012	.011	.010	.010	.011	.010	.008
Fe	.314	.345	.341	.342	.351	.358	.365	.369	.369	.376	.376	.382	.390
Mn	.007	.009	.007	.007	.009	.006	.008	.007	.006	.007	.008	.007	.007
Mg	1.391	1.180	1.486	1.416	1.459	1.443	1.358	1.439	1.331	1.345	1.371	1.389	1.384
Ca	.141	.287	.113	.137	.119	.113	.163	.144	.206	.166	.155	.149	.178
Na	--	.001	.004	--	.005	--	.001	--	--	.001	--	.002	.001
Sum	3.949	3.933	4.001	3.974	3.995	3.979	3.972	4.001	3.975	3.969	3.977	3.985	3.993
Molecular End Members													
En	75.4	65.1	76.6	74.7	75.7	75.4	72.0	73.7	69.8	71.3	72.1	72.3	70.9
Wo	7.6	15.8	5.8	7.2	6.1	5.9	8.6	7.4	10.8	8.8	8.1	7.8	9.1
Fs	17.0	19.1	17.6	18.1	18.2	18.7	19.4	18.9	19.4	19.9	19.8	19.9	20.0

TABLE 3: CONTINUED

15356,1-1 Continued

	18	19	21	20	15	17	24	16	22	23	14	25
FeO	9.8	9.8	9.9	10.0	11.3	11.8	11.8	11.9	12.1	12.3	12.6	13.1
MnO	.18	.14	.14	.18	.20	.20	.21	.26	.24	.24	.28	.25
MgO	30.2	31.0	27.4	31.2	28.4	27.2	27.9	22.9	27.5	27.0	27.1	25.0
CaO	1.82	1.77	3.3	2.00	3.0	3.1	2.98	7.3	3.3	3.6	3.9	5.6
Molecular End Members												
En	81.6	82.1	77.5	81.5	76.9	75.4	76.1	65.7	75.0	74.0	73.3	68.7
Wo	3.5	3.4	6.7	3.8	5.9	6.2	5.8	15.1	6.5	7.1	7.6	11.1
Fs	14.8	14.6	15.7	14.6	17.1	18.3	18.0	19.2	18.5	18.9	19.2	20.2

TABLE 3: CONTINUED

15358

	1	11	5	4	7	15	3	9	14	8	12	6	13	10	2
SiO_2	51.9	52.5	51.9	52.1	52.4	52.8	52.7	51.6	51.7	51.0	51.5	50.0	51.2	50.1	51.5
FeO	11.2	11.7	13.3	13.9	14.3	14.4	15.6	16.6	17.2	18.2	18.6	19.8	19.9	20.2	20.3
MgO	28.5	27.2	27.3	26.5	26.0	25.1	24.9	23.2	22.5	20.9	20.8	17.9	19.7	15.7	20.7
CaO	2.22	2.31	2.25	2.25	2.33	2.49	2.41	2.83	3.0	3.6	3.4	5.9	3.4	7.5	2.85
Molecular End Members															
En	78.3	76.7	75.0	73.8	72.8	71.8	70.4	67.1	65.6	61.9	61.7	53.7	59.1	48.3	60.6
Wo	4.4	4.7	4.4	4.5	4.7	5.1	4.9	5.9	6.3	7.7	7.3	12.9	7.4	16.7	6.0
Fs	17.3	18.5	20.5	21.7	22.5	23.1	24.7	26.9	28.1	30.2	30.9	33.4	33.4	34.9	33.3

TABLE 3: CONTINUED

15358 Continued

	Scan A						Scan B			
	1	2	3	4	5	6	3	4	5	6
SiO_2	51.9	51.6	51.8	51.1	50.4	49.6	49.3	51.1	51.5	49.3
FeO	13.9	15.3	16.8	19.4	21.6	20.9	20.8	20.9	19.2	23.5
MgO	25.8	24.8	23.3	21.1	18.8	18.1	14.6	19.4	20.9	15.7
CaO	2.45	2.53	2.71	3.1	3.5	4.5	6.9	3.4	3.2	4.9
Molecular End Members										
En	72.9	70.4	67.1	61.7	56.2	54.7	46.7	57.8	61.5	48.5
Wo	4.9	5.1	5.6	6.5	7.5	9.8	15.9	7.2	6.7	10.8
Fs	22.1	24.3	27.1	31.9	36.2	35.4	37.3	34.9	31.7	40.7

TABLE 3: CONTINUED

	15359									
	2	13	1	17	5	8	6	4	12	10
SiO_2	51.7	53.4	51.6	51.3	50.2	53.2	53.0	53.3	54.9	53.5
TiO_2	1.28	.73	1.10	1.70	1.66	.55	.55	.55	.55	.91
Al_2O_3	2.02	1.37	1.82	2.43	2.67	1.22	1.49	.85	.95	1.38
Cr_2O_3	.42	.35	.43	.49	.51	.41	.37	.24	.27	.36
FeO	7.3	7.3	7.5	7.7	7.9	13.7	15.5	15.6	15.7	16.2
MnO	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
MgO	15.9	16.3	15.5	16.0	15.8	26.1	25.4	25.7	26.3	25.2
CaO	19.6	20.6	19.5	19.4	18.9	1.67	1.71	1.99	1.85	2.41
Na_2O	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Total	98.22	100.05	97.45	99.02	97.64	96.85	98.02	98.23	100.52	99.96
Number of Ions on the Basis of 6 (O)										
Si	1.936	1.963	1.949	1.910	1.899	1.970	1.956	1.965	1.974	1.947
Ti	.036	.020	.031	.048	.047	.015	.015	.015	.015	.025
Al	.089	.060	.081	.107	.119	.053	.065	.037	.040	.059
Cr	.012	.010	.013	.015	.015	.012	.011	.007	.008	.010
Fe	.230	.225	.236	.241	.249	.425	.479	.481	.473	.493
Mn	--	--	--	--	--	--	--	--	--	--
Mg	.885	.894	.871	.887	.891	1.441	1.397	1.412	1.407	1.366
Ca	.789	.810	.791	.774	.766	.066	.068	.079	.071	.094
Na	--	--	--	--	--	--	--	--	--	--
Sum	3.977	3.982	3.972	3.982	3.986	3.982	3.991	3.996	3.988	3.994
Molecular End Members										
En	46.7	46.3	46.0	46.7	46.7	74.6	71.9	71.6	72.2	70.0
Wo	41.3	42.1	41.5	40.7	40.2	3.4	3.5	4.0	3.6	4.8
Fs	12.0	11.6	12.5	12.6	13.1	22.0	24.6	24.4	24.2	25.2

TABLE 3: CONTINUED

	15382												
	28	27	10	36	9	40	58	12	5	8	42	6	7
SiO_2	53.8	53.8	54.3	52.5	54.3	52.8	53.3	53.6	53.3	53.4	53.3	53.3	53.7
TiO_2	.60	.65	.64	.84	.64	.72	.69	.78	.81	.73	.72	.85	.81
Al_2O_3	4.1	4.2	2.57	4.4	2.43	4.0	2.17	2.45	2.75	2.29	2.31	2.34	2.29
Cr_2O_3	1.05	1.01	.74	1.06	.71	.96	.77	.76	.81	.70	.77	.77	.75
FeO	9.8	10.4	11.8	12.0	13.3	13.6	13.8	14.3	14.4	15.0	15.6	15.6	15.8
MnO	.12	.13	.22	.17	.25	.18	.17	.28	.25	.27	.23	.27	.30
MgO	29.1	28.5	27.2	27.3	26.4	26.6	26.5	25.0	25.2	25.1	25.1	24.5	24.4
CaO	1.65	1.47	2.08	1.67	2.26	1.58	2.15	2.53	2.46	2.24	2.62	2.57	2.53
Na_2O	.02	*	.02	.01	.02	.01	*	*	*	*	*	*	.01
Total	100.24	100.16	99.57	99.95	100.31	100.45	99.55	99.70	99.98	99.73	100.65	100.20	100.59
Number of Ions on the Basis of 6 (O)													
Si	1.892	1.896	1.941	1.874	1.943	1.888	1.928	1.940	1.925	1.938	1.924	1.934	1.940
Ti	.016	.017	.017	.023	.017	.019	.019	.021	.022	.020	.020	.023	.022
Al	.171	.176	.108	.187	.103	.170	.093	.105	.117	.098	.098	.100	.097
Cr	.029	.028	.021	.030	.020	.027	.022	.022	.023	.020	.022	.022	.021
Fe	.289	.307	.353	.358	.397	.408	.419	.434	.436	.456	.471	.473	.477
Mn	.004	.004	.007	.005	.007	.005	.005	.009	.008	.008	.007	.008	.009
Mg	1.528	1.501	1.450	1.455	1.405	1.416	1.427	1.347	1.356	1.356	1.353	1.322	1.313
Ca	.062	.055	.080	.064	.087	.061	.083	.098	.095	.087	.101	.100	.098
Na	.001	--	.001	.001	.001	.001	--	--	--	--	--	--	.001
Sum	3.992	3.984	3.978	3.997	3.980	3.995	3.996	3.976	3.982	3.983	3.996	3.982	3.978
Molecular End Members													
En	81.3	80.5	77.0	77.5	74.4	75.2	74.0	71.7	71.9	71.5	70.2	69.8	69.5
Wo	3.3	3.0	4.2	3.4	4.6	3.2	4.3	5.2	5.0	4.6	5.3	5.3	5.2
Fs	15.4	16.5	18.7	19.1	21.0	21.6	21.6	23.0	23.0	23.9	24.5	24.9	25.3

TABLE 3: CONTINUED

15382 Continued

	14	16	1	17	2	11	32	44	35	34	3	46	22
SiO_2	50.3	52.5	53.3	53.1	52.9	53.1	52.8	53.6	49.9	50.1	52.2	52.5	52.3
TiO_2	1.40	.73	.72	.67	.97	.64	.80	.79	1.40	.73	.98	1.06	.69
Al_2O_3	2.10	1.56	1.98	1.38	2.09	1.99	1.86	1.67	2.20	1.06	1.98	1.76	2.48
Cr_2O_3	.47	.41	.61	.55	.69	.65	.67	.45	.51	.32	.75	.66	.79
FeO	16.1	16.2	16.3	16.7	17.1	17.1	17.3	17.5	17.7	18.4	18.4	19.1	19.3
MnO	.41	.39	.27	.33	.34	.35	.28	.25	.32	.31	.36	.20	.29
MgO	13.0	24.4	23.9	23.3	22.9	24.0	24.0	23.8	13.0	12.4	21.3	23.3	21.7
CaO	15.7	2.40	2.34	3.8	2.72	2.26	2.71	2.30	15.1	15.6	3.2	2.23	3.2
Na_2O	.06	.02	*	.02	.03	.02	*	*	.11	.05	*	*	*
Total	99.54	98.61	99.42	99.85	99.74	100.11	100.42	100.36	100.24	98.97	99.17	100.81	100.75
Number of Ions on the Basis of 6 (O)													
Si	1.922	1.943	1.950	1.951	1.942	1.940	1.929	1.955	1.905	1.946	1.944	1.924	1.924
Ti	.040	.020	.020	.019	.027	.018	.022	.022	.040	.021	.027	.029	.019
Al	.095	.068	.085	.060	.091	.086	.080	.071	.099	.049	.087	.076	.107
Cr	.014	.012	.018	.016	.020	.019	.019	.013	.015	.010	.022	.019	.023
Fe	.513	.501	.498	.512	.524	.524	.527	.532	.566	.598	.573	.585	.593
Mn	.013	.012	.009	.010	.010	.011	.009	.008	.010	.010	.011	.006	.009
Mg	.739	1.344	1.307	1.274	1.253	1.304	1.307	1.292	.739	.719	1.181	1.273	1.191
Ca	.644	.095	.092	.150	.107	.089	.106	.090	.619	.650	.127	.088	.126
Na	.005	.001	--	.001	.002	.001	--	--	.008	.004	--	--	--
Sum	3.985	3.996	3.978	3.993	3.976	3.992	3.999	3.983	4.001	4.007	3.972	4.000	3.992
Molecular End Members													
En	39.0	69.3	68.8	65.8	66.5	68.1	67.3	67.5	38.5	36.5	62.8	65.4	62.3
Wo	33.9	4.9	4.8	7.7	5.7	4.6	5.5	4.7	32.1	33.0	6.8	4.5	6.6
Fs	27.1	25.8	26.3	26.5	27.8	27.2	27.2	27.8	29.4	30.4	30.4	30.1	31.1

TABLE 3: CONTINUED

15382 Continued

	20	13	18	38	15	50	4	33	26	30	24	19
SiO_2	52.2	52.1	51.4	52.3	52.0	52.3	51.4	50.6	52.6	51.2	50.3	51.0
TiO_2	.84	.97	1.01	.94	.83	.75	.83	.58	.74	.84	.87	*
Al_2O_3	1.28	1.25	1.31	1.25	1.35	1.36	1.29	1.12	1.86	1.27	1.20	1.05
Cr_2O_3	.50	.48	.44	.47	.32	.50	.44	.29	.65	.40	.34	.28
FeO	20.9	21.0	21.2	21.3	21.7	22.3	23.4	24.4	24.5	24.8	26.3	27.4
MnO	.36	.35	.25	.33	.39	.33	.45	.32	.31	.40	.49	.44
MgO	19.1	19.5	19.5	19.7	19.6	19.3	18.1	12.8	17.3	17.3	15.4	14.5
CaO	3.1	4.2	4.3	4.0	3.8	4.0	4.1	10.5	4.4	4.9	5.1	5.5
Na_2O	.01	.02	.11	.01	.04	*	.02	.07	*	*	.02	.02
Total	98.29	99.87	99.52	100.30	100.03	100.84	100.03	100.68	102.36	101.11	100.02	100.19
Number of Ions on the Basis of 6 (O)												
Si	1.981	1.955	1.943	1.943	1.953	1.954	1.950	1.952	1.951	1.938	1.943	1.973
Ti	.024	.027	.029	.027	.023	.021	.024	.017	.021	.024	.025	--
Al	.057	.055	.059	.056	.060	.060	.058	.051	.081	.057	.055	.048
Cr	.015	.014	.013	.014	.009	.015	.013	.009	.019	.012	.010	.009
Fe	.663	.659	.670	.655	.681	.695	.742	.789	.762	.786	.850	.887
Mn	.012	.011	.008	.010	.013	.011	.014	.011	.010	.013	.016	.014
Mg	1.081	1.092	1.095	1.139	1.096	1.074	1.023	.736	.958	.974	.887	.838
Ca	.125	.168	.173	.150	.152	.159	.165	.435	.177	.200	.211	.229
Na	.001	.002	.008	.001	.003	--	.002	.005	--	--	.002	.002
Sum	3.959	3.983	3.998	3.995	3.990	3.989	3.991	4.005	3.979	4.004	3.999	4.000
Molecular End Members												
En	57.8	56.9	56.5	57.1	56.8	55.6	53.0	37.6	50.6	49.8	45.5	42.9
Wo	6.7	8.8	9.0	8.3	7.9	8.3	8.6	22.2	9.2	10.1	10.8	11.7
Fs	35.5	34.3	34.5	34.6	35.3	36.1	38.4	40.2	40.2	40.1	43.6	45.4

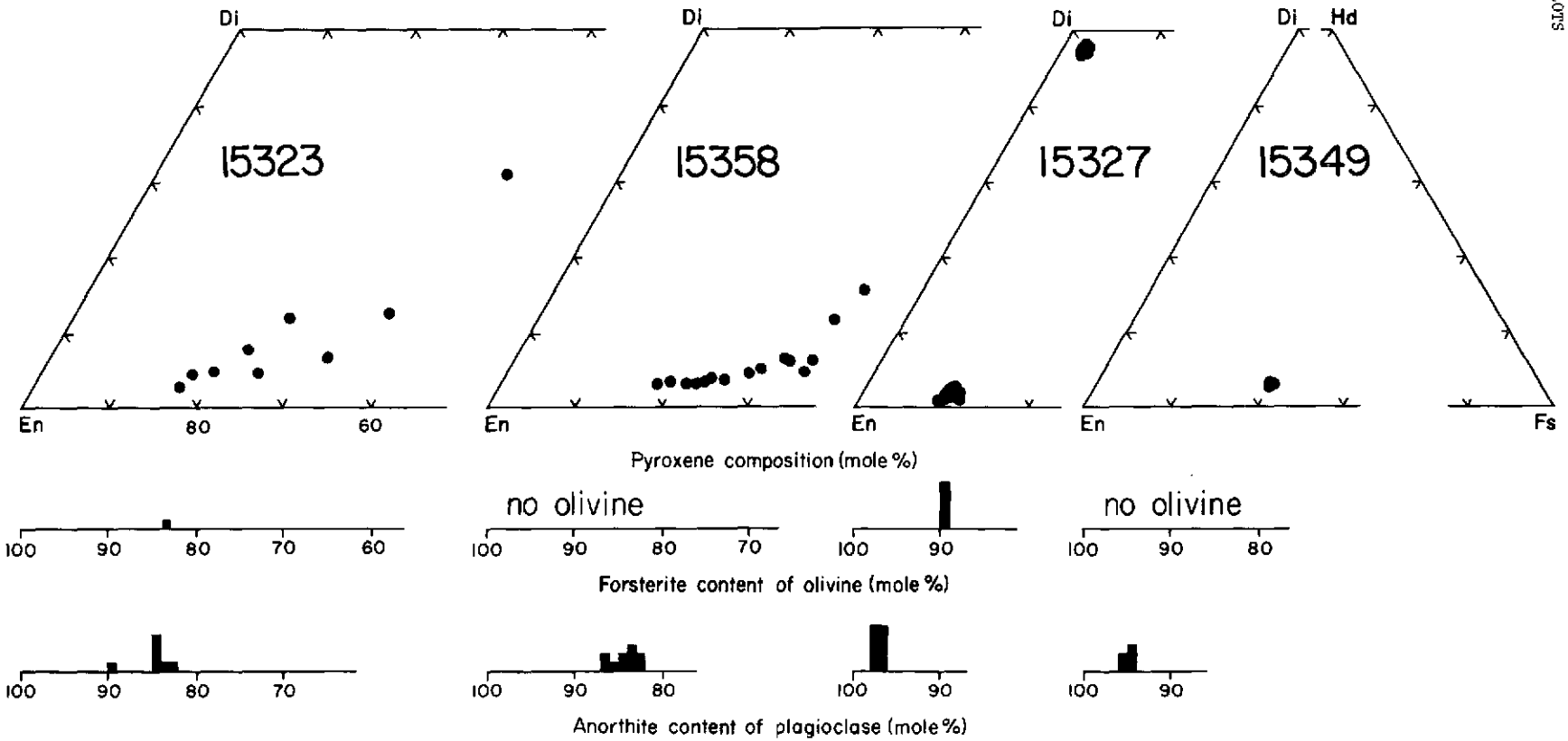

FIGURE 1 FIGURE 2 FIGURE 3 FIGURE 4

MINERAL DATA PLOTS

TABLE 4: PYROXENES IN ANORTHOSITIC-NORITIC-TROCTOLITIC RAKE SAMPLES AND LITHIC FRAGMENTS

15308

	Cataclastic area								Shock-blackened area						
	12	8	15	13	10	9	14	11	3	2	6	5	4	7	1
SiO_2	51.6	51.8	50.6	52.0	51.9	50.8	52.4	51.9	51.4	51.6	51.3	52.0	51.2	51.1	50.2
TiO_2	1.60	.60	.63	.58	.65	.59	.51	.54	.55	.62	.56	.64	.64	.59	.60
Al_2O_3	3.4	.65	1.72	1.04	.74	.99	.79	.90	.62	.65	.55	.58	.59	.62	.80
Cr_2O_3	.49	.25	.74	.20	.23	.23	.22	.22	.29	.32	.25	.26	.27	.26	.37
FeO	12.1	20.3	20.9	21.3	23.1	23.2	23.4	23.8	21.3	21.4	22.0	22.1	23.4	23.7	25.0
MnO	.22	.38	.39	.32	.39	.44	.39	.39	.34	.38	.43	.41	.40	.44	.41
MgO	13.9	18.7	9.8	18.2	18.5	19.0	19.4	19.0	21.3	20.1	18.7	19.9	19.1	19.2	19.2
CaO	18.1	7.0	4.0	4.5	4.8	4.0	3.2	3.4	2.94	4.5	5.4	4.2	3.9	3.8	2.53
Na_2O	.07	.05	*	.12	.01	.04	.02	*	.02	.01	*	.05	.02	.04	.04
Total	101.48	99.73	98.78	98.26	100.32	99.29	100.13	100.15	98.76	99.58	99.19	100.14	99.52	99.75	99.15
Number of Ions on the Basis of 6 (O)															
Si	1.903	1.959	1.926	1.936	1.962	1.942	1.969	1.963	1.951	1.951	1.959	1.958	1.953	1.948	1.934
Ti	.044	.017	.018	.017	.018	.017	.014	.015	.016	.018	.016	.018	.018	.017	.017
Al	.148	.029	.077	.047	.033	.045	.035	.040	.028	.029	.025	.026	.026	.028	.036
Cr	.014	.008	.003	.006	.007	.007	.007	.007	.009	.010	.008	.008	.008	.008	.011
Fe	.373	.642	.665	.680	.730	.742	.738	.753	.676	.677	.703	.696	.746	.756	.805
MnO	.007	.012	.013	.010	.012	.014	.012	.012	.011	.012	.014	.013	.013	.014	.013
Mg	.764	1.054	.123	1.036	1.042	1.083	1.090	1.070	1.205	1.133	1.064	1.117	1.086	1.091	1.102
Ca	.715	.284	.163	.184	.194	.164	.129	.138	.120	.182	.221	.170	.159	.155	.104
Na	.005	.004	--	.009	.001	.003	.002	--	.002	.001	--	.004	.002	.003	.003
Sum	3.973	4.009	3.997	3.975	3.999	4.017	3.996	3.999	4.018	4.013	4.010	4.010	4.011	4.020	4.025
Molecular End Members															
En	41.3	53.3	57.5	54.5	53.0	54.5	55.7	54.6	60.2	56.9	53.6	56.4	54.5	54.5	54.8
Wo	33.6	14.3	5.4	54.5	9.9	8.2	6.6	7.0	6.0	9.1	11.1	8.5	8.0	7.8	5.2
Fs	20.1	32.4	34.1	35.3	37.1	37.3	37.7	33.4	33.8	34.0	35.3	35.1	37.5	37.7	40.0

TABLE 4: CONTINUED

15308 Continued

Devitrified glass area

	16	19	17	18	18
SiO_2	53.4	52.4	54.1	52.4	52.3
TiO_2	.45	.97	.21	.54	.66
Al_2O_3	1.32	1.61	.60	1.19	2.63
Cr_2O_3	.48	.45	.22	.44	.39
FeO	12.7	13.3	15.3	18.4	21.2
MnO	.19	.21	.27	.27	.30
MgO	30.0	28.4	28.8	20.3	22.6
CaO	1.47	2.60	.87	4.6	1.78
Na_2O	*	*	*	.06	.04
Total	100.01	99.71	100.37	98.00	101.90

Number of Ions on the Basis of 6 (O)

Si	1.913	1.891	1.947	1.974	1.910
Ti	.012	.026	.006	.015	.018
Al	.056	.069	.026	.053	.011
Cr	.014	.013	.006	.013	.011
Fe	.331	.405	.461	.582	.647
Mn	.006	.006	.008	.009	.009
Mg	1.602	1.533	1.545	1.144	1.230
Ca	.056	.101	.034	.186	.070
Na	--	--	--	.004	.003
Sum	4.096	4.042	4.033	3.980	3.909

Molecular End Members

En	78.5	75.2	75.8	59.9	63.2
Wo	2.3	5.0	1.6	9.7	3.6
Fa	13.7	19.8	22.6	30.4	33.2

TABLE 4: CONTINUED

15327

	Diopside								Orthopyroxene-low minor elements				
	6	3	2	1	1	23	16	4	14	2	7	11	5
SiO_2	55.7	55.5	55.8	56.3	55.4	54.9	55.5	55.8	55.4	58.1	58.5	57.8	58.5
TiO_2	.47	.29	.38	.43	.33	.28	.27	.33	.40	.20	.16	.14	.17
Al_2O_3	1.10	.89	1.14	1.18	1.06	.85	1.03	1.13	1.30	.98	1.02	.85	.90
Cr_2O_3	.18	.09	.09	.15	.13	.10	.10	.08	.19	.07	.08	.09	.09
FeO	1.54	1.58	1.60	1.61	1.64	1.67	1.71	1.75	6.6	6.7	6.7	7.7	8.5
MgO	17.3	17.8	17.5	17.8	17.9	18.0	17.9	17.6	32.4	33.7	33.7	33.8	34.0
CaO	23.6	24.7	24.2	24.4	25.0	24.5	24.5	24.5	1.26	.46	.46	.82	.48
Total	99.89	100.85	100.71	101.87	101.46	100.30	101.01	101.19	97.55	100.21	100.62	101.20	102.64
Number of Ions on the Basis of 6 (O)													
Si	2.010	1.994	2.001	1.997	1.981	1.985	1.990	1.996	1.942	1.971	1.976	1.956	1.956
Ti	.013	.008	.011	.012	.009	.008	.008	.009	.011	.005	.004	.004	.004
Al	.048	.038	.049	.050	.045	.037	.044	.048	.055	.040	.041	.034	.036
Cr	.005	.003	.003	.004	.004	.003	.003	.002	.005	.002	.002	.002	.002
Fe	.046	.047	.048	.047	.049	.050	.051	.052	.192	.188	.187	.216	.235
Mg	.972	.995	.977	.983	.996	1.013	.999	.989	1.768	1.780	1.772	1.781	1.770
Ca	.857	.893	.874	.871	.900	.892	.884	.882	.044	.016	.016	.028	.016
Sum	3.951	3.978	3.963	3.964	3.984	3.988	3.979	3.969	4.017	4.002	3.998	4.021	3.784
Molecular End Members													
En	49.2	48.9	48.9	49.1	48.7	49.2	49.1	48.6	87.5	89.2	89.2	87.3	86.9
Wo	48.3	48.7	48.6	48.4	48.8	48.2	48.3	48.7	2.5	.9	.9	1.5	.9
Fs	2.5	2.4	2.5	2.5	2.5	2.6	2.6	2.7	10.0	9.9	9.9	11.2	12.2

TABLE 4: CONTINUED

15327 Continued

Orthopyroxene-high minor elements

	4	13	25	12	20	26	3	17	18	19	21	27	22	10	8
SiO_2	57.1	57.4	57.1	56.3	57.1	58.0	56.6	56.8	58.0	57.3	57.8	57.0	56.0	56.5	56.2
TiO_2	.59	.43	.69	.65	.53	.55	.57	.51	.42	.51	.53	.68	.72	.53	.84
Al_2O_3	2.76	2.05	2.12	2.93	2.42	2.34	2.33	2.53	2.00	2.34	1.68	2.60	2.42	2.24	3.0
Cr_2O_3	.41	.35	.44	.53	.44	.51	.39	.45	.42	.48	.29	.47	.45	.37	.56
FeO	6.3	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.9	7.0	7.7
MgO	32.4	32.8	31.8	32.6	32.4	32.2	32.7	32.4	33.2	32.9	32.9	32.0	32.1	32.9	32.4
CaO	.94	1.01	.60	1.25	1.18	.80	.92	1.28	.95	1.26	1.33	1.34	1.51	.88	1.06
Total	100.50	100.64	99.35	100.96	100.77	101.10	100.31	100.77	101.79	101.59	101.33	100.89	100.10	100.42	101.76
Number of Ions on the Basis of 6 (O)															
Si	1.934	1.945	1.956	1.908	1.935	1.954	1.927	1.927	1.944	1.928	1.949	1.931	1.918	1.924	1.898
Ti	.016	.011	.018	.017	.014	.014	.015	.014	.011	.013	.014	.018	.019	.014	.022
Al	.112	.083	.087	.119	.098	.094	.095	.103	.080	.094	.068	.106	.099	.091	.121
Cr	.011	.009	.012	.014	.012	.013	.010	.012	.011	.013	.008	.012	.012	.010	.015
Fe	.177	.185	.187	.188	.188	.187	.192	.191	.189	.190	.190	.191	.196	.197	.215
Mg	1.708	1.730	1.695	1.720	1.709	1.688	1.733	1.711	1.732	1.732	1.726	1.688	1.711	1.744	1.703
Ca	.032	.034	.021	.043	.040	.027	.032	.044	.032	.043	.045	.046	.052	.030	.036
Sum	3.990	3.997	3.976	4.009	3.996	3.977	4.004	4.002	3.999	4.004	4.000	3.992	4.007	4.010	4.010
Molecular End Members															
En	88.5	88.1	88.5	87.5	87.5	88.1	87.9	87.2	88.1	87.5	87.3	87.0	86.6	87.8	86.5
Wo	1.8	2.0	1.2	2.4	2.3	1.6	1.8	2.5	1.8	2.4	2.6	2.6	2.9	1.7	2.0
Fs	9.7	9.9	10.3	10.1	10.2	10.3	10.3	10.3	10.1	10.1	10.1	10.4	10.5	10.5	11.5

TABLE 4: CONTINUED

	15332,1-1		15349		
	1	2	1	2	3
SiO_2	52.0	51.4	56.2	56.1	55.8
Al_2O_3	2.47	1.00	.30	.23	.30
TiO_2	2.10	1.09	.98	1.06	1.00
Cr_2O_3	.46	.24	.54	.58	.56
FeO	8.8	17.1	12.9	12.9	13.0
MnO	.26	.35	.21	.21	.21
MgO	16.3	26.0	27.9	28.1	27.3
CaO	18.3	2.13	1.52	1.34	1.43
Na_2O	.15	*	*	*	*
Total	100.84	99.13	100.55	100.52	99.60
Number of Ions on the Basis of 6 (O)					
Si	1.906	1.902	1.991	1.987	1.996
Al	.107	.044	.003	.006	.008
Ti	.058	.030	.041	.044	.042
Cr	.013	.007	.015	.016	.016
Fe	.270	.529	.382	.382	.389
Mn	.008	.011	.006	.006	.006
Mg	.891	1.434	1.473	1.483	1.455
Ca	.719	.085	.058	.051	.055
Na	.010	--	--	--	--
Sum	3.982	4.042	3.974	3.975	3.967
Molecular End Members					
En	47.4	70.0	77.0	77.4	76.6
Wo	38.2	4.2	3.0	2.7	2.9
Fs	14.4	25.8	20.0	19.9	20.5

TABLE 4: CONTINUED

15362,1-1

	4A	2	3	4B	6A	5C	5D	5B	1	7	5A	8	5E	6B	6C
SiO_2	52.3	52.3	51.6	51.7	51.3	51.7	51.2	51.4	51.7	52.4	52.6	52.3	52.2	52.1	52.3
TiO_2	.56	.49	.56	.53	.50	.52	.48	.56	.49	.28	.42	.30	.51	.31	52.3
Al_2O_3	1.38	1.70	1.74	1.40	1.67	1.13	1.12	1.11	1.57	.79	.87	1.09	.76	1.16	1.25
Cr_2O_3	1.38	.26	.28	.22	.23	.26	.24	.26	.27	.16	.14	.15	.14	.16	.15
FeO	10.0	10.3	10.9	11.3	11.5	11.6	11.6	11.9	12.0	26.0	26.2	26.2	26.4	26.4	27.3
MnO	.17	.20	.22	.18	.25	.23	.26	.26	.30	.49	.49	.53	.50	.41	.52
MgO	14.1	13.8	13.7	13.9	13.7	13.6	13.4	13.5	13.1	19.0	19.0	19.2	19.0	19.0	19.0
CaO	21.3	20.9	21.0	20.8	20.9	20.9	20.8	21.0	20.6	1.43	1.06	1.13	1.38	1.67	1.69
Total	100.02	100.05	100.00	100.03	100.05	99.94	100.10	99.99	100.03	100.60	100.80	100.90	100.90	101.20	102.50
Number of Ions on the Basis of 6 (O)															
Si	1.957	1.958	1.940	1.945	1.933	1.956	1.964	1.944	1.956	1.971	1.970	1.956	1.957	1.943	1.918
Ti	.016	.014	.016	.015	.014	.015	.014	.016	.014	.008	.012	.009	.015	.008	.009
Al	.061	.075	.077	.062	.074	.050	.050	.049	.070	.035	.039	.049	.034	.052	.057
Cr	.006	.008	.008	.007	.007	.008	.007	.008	.008	.005	.004	.005	.004	.005	.005
Fe	.313	.323	.342	.356	.363	.367	.364	.376	.377	.828	.833	.835	.844	.846	.878
Mn	.005	.006	.007	.006	.008	.007	.008	.008	.010	.016	.016	.017	.016	.013	.017
Mg	.783	.767	.765	.777	.769	.765	.750	.760	.735	1.079	1.079	1.092	1.083	1.084	1.090
Ca	.853	.836	.846	.838	.844	.844	.839	.850	.833	.058	.043	.046	.056	.068	.070
Sum	3.999	3.988	4.001	4.006	4.012	4.007	3.994	4.012	3.997	4.000	3.997	4.008	4.008	4.020	4.043
Molecular End Members															
En	40.2	39.9	39.2	39.4	38.9	38.7	38.4	38.2	37.8	54.8	55.1	55.3	54.5	54.2	53.5
Wo	43.7	43.4	43.2	42.4	42.7	42.7	48.9	42.7	42.7	3.0	2.2	2.3	2.9	3.4	3.4
Fs	16.0	16.7	17.5	18.0	18.3	18.5	18.7	18.9	19.4	3.0	42.6	42.3	42.5	42.3	43.1

TABLE 4: CONTINUED

15362,1-2

	3C	5	4A	1B	1A	2B	1C	2C	3B	4B	3D
SiO_2	52.6	52.7	53.4	52.7	52.2	51.3	51.2	51.3	50.9	50.6	51.3
TiO_2	.52	.50	.29	.54	.61	.26	.29	.27	.28	.28	.20
Al_2O_3	1.20	1.08	.90	1.32	1.21	.62	.77	.73	.67	.85	.87
Cr_2O_3	.23	.26	.24	.26	.25	.17	.13	.13	.13	.18	.17
FeO	10.5	11.2	11.7	12.5	13.3	25.9	26.4	26.6	26.6	26.7	26.8
MnO	.27	.30	.28	.25	.26	.50	.50	.42	.54	.46	.51
MgO	14.2	13.7	13.0	14.1	13.2	18.9	19.3	18.6	19.1	19.0	19.2
CaO	22.0	21.5	21.3	20.5	20.3	1.51	1.39	1.44	1.67	1.47	1.78
Total	101.50	101.20	101.10	101.90	101.30	99.20	100.00	99.50	99.90	99.50	100.80
Number of Ions on the Basis of 6 (O)											
Si	1.947	1.959	1.986	1.946	1.952	1.971	1.955	1.970	1.951	1.948	1.948
Ti	.014	.014	.008	.015	.017	.008	.008	.008	.008	.008	.060
Al	.052	.047	.039	.057	.053	.028	.035	.033	.030	.039	.039
Cr	.007	.008	.007	.008	.007	.005	.004	.004	.004	.005	.005
Fe	.325	.348	.364	.386	.416	.832	.844	.854	.853	.859	.851
Mn	.008	.009	.009	.008	.008	.016	.016	.014	.018	.015	.016
Mg	.783	.759	.723	.775	.735	1.082	1.099	1.063	1.092	1.086	1.086
Ca	.872	.855	.847	.811	.812	.062	.057	.059	.039	.061	.072
Sum	4.009	3.980	3.984	4.006	4.001	4.004	4.017	4.004	4.024	4.021	4.024
Molecular End Members											
En	39.5	38.6	37.2	39.3	37.4	54.7	43.8	53.8	54.2	54.2	54.0
Wo	44.0	43.6	43.9	41.4	41.4	3.1	2.7	3.0	3.4	3.0	3.6
Fs	16.4	17.7	18.8	19.6	21.2	42.1	33.6	43.1	42.3	42.7	42.3

OLIVINE

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 5: OLIVINES IN HIGH-ALUMINA BASALT RAKE SAMPLES AND LITHIC FRAGMENTS

	15323
	1
SiO_2	40.7
Al_2O_3	.16
FeO	15.0
MnO	.15
MgO	42.6
CaO	.21
Total	98.82
Number of Ions on the Basis of 4 (O)	
Si	1.030
Al	.005
Fe	.318
Mn	.003
Mg	1.607
Ca	.006
Z	1.035
X	1.934
Sum	2.969
Molecular End Members	
Fo	16.5
Fa	83.5

	15356									
	c6	r6	c2	c4	1	r5	r4	3	r2	7
SiO_2	41.8	41.2	40.1	40.6	40.6	40.5	39.9	40.3	40.9	40.2
TiO_2	.07	.09	.10	.07	.07	.07	.13	.09	.07	.07
Al_2O_3	.48	.45	.42	.42	.48	.43	.51	.38	.45	.47
FeO	11.2	13.4	15.2	15.4	15.5	17.9	18.1	18.3	19.5	19.5
MnO	.11	.13	.17	.20	.17	.20	.24	.21	.24	.23
MgO	47.4	45.6	44.4	44.4	44.5	42.0	41.3	42.1	40.4	41.1
CaO	.17	.21	.21	.21	.22	.29	.32	.24	.34	.19
Total	101.23	101.08	100.60	101.30	101.54	101.39	100.50	101.62	101.90	101.76
Number of Ions on the Basis of 4 (O)										
Si	1.015	1.011	.999	1.005	1.003	1.014	1.009	1.008	1.025	1.010
Ti	.001	.002	.002	.001	.001	.001	.002	.002	.001	.001
Al	.014	.013	.012	.012	.014	.013	.015	.011	.013	.014
Fe	.227	.275	.317	.320	.321	.373	.383	.384	.408	.409
Mn	.002	.003	.003	.004	.003	.004	.005	.004	.005	.005
Mg	1.714	1.671	1.652	1.640	1.640	1.565	1.557	1.569	1.506	1.538
Ca	.004	.005	.006	.006	.006	.008	.009	.007	.009	.005
Z	1.015	1.011	.999	1.005	1.003	1.014	1.009	1.008	1.025	1.010
X	1.962	1.969	1.992	1.983	1.985	1.964	1.971	1.977	1.942	1.972
Sum	2.977	2.980	2.991	2.988	2.988	2.978	2.980	2.985	2.967	2.982
Molecular End Members										
Fo	88.3	85.8	83.9	83.7	83.7	80.7	80.3	80.4	78.7	79.0
Fa	11.7	14.2	16.1	16.3	16.3	19.3	19.7	19.6	21.3	21.0

TABLE 5: CONTINUED

15356 Continued

Olivine 1

	edge				8 micron steps				center
SiO_2	39.3	38.8	39.7	40.2	40.2	40.4	40.1	40.4	40.7
FeO	21.2	20.5	18.3	16.9	15.7	15.0	14.9	14.8	15.2
MgO	40.2	41.1	43.3	44.4	45.6	46.5	46.4	46.7	46.9
CaO	.56	.55	.51	.47	.47	.46	.45	.45	.46
Molecular End Members									
Fo	77.2	78.1	80.8	82.4	83.3	84.7	84.7	84.9	84.6
Fa	22.8	21.9	19.2	17.6	16.2	15.3	15.3	15.1	15.4

15356 Continued

Olivine 2

	edge		8 micron steps			center	edge		2 micron steps						interior
SiO_2	40.5	40.7	41.1	40.6	41.1	41.2	40.8	40.3	40.4	40.6	40.7	40.0	40.1	40.3	40.3
FeO	19.3	17.8	17.0	16.2	15.5	15.0	20.0	19.3	18.6	18.5	18.4	18.1	18.1	17.8	17.7
MgO	42.1	43.6	44.4	45.0	46.0	46.0	41.2	42.0	42.8	42.8	43.0	43.2	43.4	43.2	44.1
CaO	.54	.47	.45	.44	.42	.44	.84	.53	.49	.49	.48	.47	.48	.49	.45
Molecular End Members															
Fo	79.5	81.4	82.3	83.2	84.1	84.5	78.6	79.5	80.4	80.5	80.6	81.0	81.0	81.2	81.6
Fa	20.5	18.6	17.7	16.8	15.9	15.5	21.4	20.5	19.6	19.5	19.4	19.0	19.0	18.8	18.4

15356 Continued

Olivine 4

	edge			2 micron steps					interior	center
SiO_2	39.2	40.0	39.3	39.8	40.0	40.3	40.2	40.2	40.8	35.9
FeO	20.0	19.6	19.2	18.6	17.9	17.2	16.9	16.5	16.3	16.4
MgO	41.3	41.7	42.0	43.2	43.2	44.2	44.5	44.8	45.4	49.1
CaO	.56	.55	.54	.54	.51	.50	.45	.44	.49	.44
Molecular Members										
Fo	78.6	79.1	79.6	80.5	81.1	82.0	82.4	82.9	83.2	84.2
Fa	21.4	20.9	20.4	19.5	18.9	18.0	17.6	17.1	16.8	15.8

TABLE 5: CONTINUED

15356 Continued

Olivine 5

	edge		6 micron steps				center
SiO_2	39.2	39.7	45.8	48.8	40.7	41.3	47.2
FeO	21.2	20.7	15.0	12.0	16.3	15.2	12.3
MgO	41.1	41.6	35.1	34.5	45.4	45.9	41.4
CaO	.60	.58	2.81	1.35	.49	.47	1.07
Molecular End Members							
Fo	77.6	78.2	80.7	83.7	83.2	84.3	85.7
Fa	22.4	21.8	19.3	16.3	16.8	15.7	14.3

15356 Continued

Olivine 6

	edge			2 micron steps				interior	center
SiO_2	39.8	39.3	39.4	39.8	40.0	39.8	40.4	40.7	41.1
FeO	17.8	17.6	17.4	17.0	16.9	16.4	16.1	15.1	9.2
MgO	43.3	43.5	43.9	44.1	44.5	45.3	45.9	46.3	51.7
CaO	.60	.54	.53	.54	.58	.53	.51	.51	.44
Molecular End Members									
Fo	81.3	81.5	81.5	82.2	82.4	83.1	83.6	84.5	90.9
Fa	18.7	18.5	18.2	17.8	17.6	16.9	16.4	15.5	9.1

TABLE 5: CONTINUED

15359

	5	6	8	10	7	4	9	3	1	2
SiO_2	37.7	37.1	37.8	37.3	37.3	37.4	37.8	37.0	36.8	37.2
FeO	24.1	25.9	26.2	26.3	26.4	26.7	26.8	27.1	27.2	27.3
MgO	38.3	36.3	36.1	36.2	35.9	35.9	35.8	35.3	34.9	35.4
CaO	.50	.34	.56	.55	.45	.53	.56	.54	.26	.55
Total	100.60	99.64	100.66	100.35	100.05	100.53	100.96	99.94	99.16	100.45
Number of Ions on the Basis of 4 (O)										
Si	.970	.973	.981	.973	.976	.976	.981	.974	.977	.975
Fe	.513	.563	.563	.568	.572	.577	.576	.591	.598	.592
Mg	1.534	1.482	1.459	1.470	1.463	1.458	1.447	1.447	1.442	1.444
Ca	.013	.009	.015	.014	.012	.014	.015	.014	.007	.015
Z	.970	.973	.981	.973	.976	.976	.981	.974	.977	.975
X	2.060	2.054	2.037	2.052	2.047	2.049	2.038	2.052	2.047	2.051
Sum	3.030	3.027	3.018	3.025	3.023	3.025	3.019	3.026	3.024	3.026
Molecular End Members										
Fo	74.1	71.5	71.0	71.0	70.8	70.5	70.4	69.9	69.5	69.8
Fa	25.9	28.5	29.0	28.9	29.2	29.5	29.6	30.1	30.4	30.2

TABLE 5: CONTINUED

15359 Continued

Olivine 7

	edge						interior	center
SiO_2	38.8	38.2	38.2	38.5	38.1	37.9	38.4	37.7
FeO	24.8	24.9	25.1	25.1	25.1	25.0	25.2	25.4
MgO	37.1	37.2	37.5	37.5	37.2	37.3	37.3	37.5
CaO	.61	.49	.52	.46	.46	.45	.45	.45
Total	101.31	100.79	101.32	101.26	100.86	100.65	101.35	101.05
Number of Ions on the Basis of 4 (O)								
Si	.992	.983	.979	.983	.981	.978	.983	.971
Fe	.525	.531	.533	.531	.535	.534	.534	.542
Mg	1.476	1.490	1.496	1.491	1.491	1.498	1.487	1.504
Ca	.016	.013	.013	.012	.012	.012	.012	.012
Sum	3.009	3.017	3.021	3.017	3.019	3.022	3.016	3.029
Molecular End Members								
Fo	72.7	72.7	72.7	72.7	72.5	72.7	72.5	72.5
Fa	27.3	27.3	27.3	27.3	27.5	27.3	27.5	27.5

15359 Continued

Olivine 9

	edge							interior	center
SiO_2	34.6	35.2	37.1	37.3	37.8	37.8	38.2	37.8	37.2
FeO	22.3	23.4	25.2	25.0	25.0	25.1	25.2	25.3	25.4
MgO	33.4	34.5	36.5	36.5	36.9	36.6	37.0	37.0	37.2
CaO	.63	.55	.54	.55	.50	.47	.50	.49	.51
Total	90.93	93.65	99.34	99.35	100.20	99.97	100.90	100.59	100.31
Number of Ions on the Basis of 4 (O)									
Si	.987	.978	.974	.977	.980	.983	.983	.978	.967
Fe	.527	.538	.548	.542	.537	.540	.537	.542	.547
Mg	1.482	1.491	1.491	1.489	1.490	1.481	1.483	1.490	1.505
Ca	.018	.015	.014	.015	.013	.012	.013	.013	.013
Sum	3.014	3.022	3.027	3.023	3.020	3.016	3.016	3.023	3.032
Molecular End Members									
Fo	72.7	72.4	72.1	72.2	72.5	72.2	72.4	72.3	72.3
Fa	27.3	27.6	27.9	27.8	27.5	27.8	27.6	27.7	27.7

TABLE 6: OLIVINES IN ANORTHOSITIC-NORITIC-TROCTOLITIC RAKE SAMPLES AND LITHIC FRAGMENTS

	15308		
	4	1	2
SiO_2	40.3	39.0	38.6
Al_2O_3	.24	.31	.33
FeO	16.1	23.8	27.1
MnO	.12	.22	.21
MgO	43.7	35.6	33.2
CaO	.28	.27	.21
Total	100.74	99.20	99.65
Number of Ions on the Basis of 4 (O)			
Si	1.007	1.026	1.027
Al	.007	.010	.010
Fe	.337	.524	.603
Mn	.002	.005	.005
Mg	1.628	1.396	1.316
Ca	.008	.008	.006
Z	1.014	1.036	1.037
X	1.975	1.931	1.930
Sum	2.989	2.967	2.967
Molecular End Members			
Fo	82.9	72.7	63.6
Fa	17.1	27.3	31.4

	15327			
	2	3	1	4
SiO_2	40.6	40.8	41.0	40.3
Al_2O_3	.12	.36	.14	.20
FeO	9.9	10.3	9.9	10.0
MnO	.08	.08	.10	.09
MgO	49.4	49.1	49.4	49.0
CaO	.20	.19	.12	.17
Total	100.30	100.83	100.66	99.76
Number of Ions on the Basis of 4 (O)				
Si	.993	.993	.998	.991
Al	.004	.010	.004	.006
Fe	.202	.210	.202	.206
Mn	.002	.002	.002	.002
Mg	1.800	1.782	1.792	1.796
Ca	.005	.005	.003	.005
Z	.997	1.003	1.002	.997
X	2.009	1.999	1.999	2.009
Sum	3.006	3.002	3.001	3.006
Molecular End Members				
Fo	89.9	89.5	89.9	89.7
Fa	10.1	10.5	10.1	10.3

PLAGIOCLASE

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 7: PLAGIOCLASE IN HIGH-ALUMINA BASALT RAKE SAMPLES AND LITHIC FRAGMENTS

	15323						
	1	5	7	2	3	4	6
SiO_2	48.6	48.8	49.0	47.8	49.0	48.9	46.6
TiO_2	.10	.17	.12	.18	.13	.10	.06
Al_2O_3	31.1	32.5	30.2	31.3	31.1	31.2	34.3
FeO	.42	.43	.53	.43	.45	.51	.27
MnO	*	.03	*	.01	.02	*	.02
MgO	.28	.31	.37	.39	.47	.32	.10
CaO	15.9	16.0	16.3	16.4	16.7	16.9	17.8
Na_2O	1.77	1.47	1.56	1.62	1.60	1.57	1.13
K_2O	.22	.16	.24	.18	.16	.17	.08
Total	98.39	99.87	98.32	98.31	99.63	99.67	100.36
Number of Ions on the Basis of 32 (O)							
Si	9.041	8.931	9.132	8.923	1.020	9.005	8.543
Ti	.014	.023	.017	.025	.018	.014	.008
Al	6.821	7.012	6.635	6.888	6.749	6.774	7.413
Fe	.065	.066	.083	.067	.069	.073	.041
Mn	.001	.005	--	.002	.003	--	.003
Mg	.078	.085	.103	.103	.129	.088	.027
Ca	3.170	3.138	3.255	3.280	3.294	3.355	3.496
Na	.638	.522	.564	.586	.571	.561	.402
K	.052	.037	.057	.043	.038	.040	.019
Z	15.876	15.996	15.784	15.836	15.787	15.793	15.964
X	4.003	3.853	4.062	4.086	4.104	4.102	3.988
Sum	19.879	19.819	19.846	19.922	19.891	19.895	19.952
Molecular End Members							
An	82.1	84.9	84.0	83.9	84.4	84.7	89.2
Ab	16.5	14.1	14.5	15.0	14.6	14.3	10.3
Or	1.4	1.0	1.5	1.1	1.0	1.0	.5

	15332,1-3
	1
SiO_2	44.5
Al_2O_3	35.5
FeO	.06
MgO	.04
CaO	19.2
Na_2O	.51
K_2O	.03
Total	99.84
Number of Ions on the Basis of 32 (O)	
Si	8.233
Al	7.741
Fe	.009
Mg	.011
Ca	3.806
Na	.183
K	.007
Z	15.974
X	4.016
Sum	19.990
Molecular End Members	
An	4.6
Ab	95.2
Or	.2

TABLE 7: CONTINUED

15356

	6	1	5	10	4	2	9	7	8	3
SiO_2	44.2	45.7	44.2	45.3	44.1	45.7	45.6	44.2	44.4	45.1
Al_2O_3	35.2	35.9	35.2	35.5	35.4	34.5	35.3	36.0	36.0	36.3
FeO	.20	.19	.19	.32	.19	.28	.13	.25	.25	.21
CaO	18.7	19.2	19.6	19.1	19.1	18.1	19.4	19.5	19.4	19.1
Na_2O	.41	.63	.48	.76	.59	1.09	.58	.42	.51	.65
K_2O	.14	.14	.09	.11	.08	.15	.13	.10	.08	.09
Total	98.85	101.76	99.76	101.09	99.46	99.82	101.14	100.47	100.64	101.45
Number of Ions on the Basis of 32 (O)										
Si	8.256	8.296	8.208	8.288	8.204	8.444	8.332	8.144	8.164	8.212
Al	7.752	7.680	7.708	7.656	7.764	7.516	7.604	7.820	7.804	7.792
Fe	.032	.028	.028	.048	.028	.044	.020	.040	.040	.032
Ca	3.774	3.732	3.900	3.744	3.808	3.584	3.796	3.852	3.824	3.728
Na	.148	.220	.172	.268	.212	.392	.204	.152	.184	.228
K	.032	.032	.020	.024	.020	.036	.032	.024	.020	.020
Z	16.008	15.976	15.916	15.944	15.968	15.960	15.936	15.964	15.968	16.004
X	3.956	4.012	4.120	4.084	4.068	4.056	4.052	4.068	4.068	4.008
Sum	19.964	19.988	20.036	20.028	20.036	20.016	19.988	20.032	20.036	20.012
Molecular End Members										
An	95.4	93.7	95.3	92.7	94.2	89.5	94.0	95.9	95.1	93.7
Ab	3.7	5.5	4.1	6.8	5.3	9.7	5.2	3.6	4.4	5.8
Or	.9	.8	.6	.5	.6	.8	.8	.6	.6	.6

TABLE 7: CONTINUED

15356 Continued

Plagioclase 1 Traverse 1

	edge						2 micron steps							interior
FeO	.94	.41	.34	.25	.27	.26	.23	.24	.25	.27	.22	.25	.25	.25
CaO	16.9	17.6	18.9	19.5	19.6	19.3	19.4	19.4	19.6	19.6	19.8	19.7	19.6	19.6
Na_2O	1.07	1.29	.72	.42	.35	.40	.44	.48	.42	.38	.41	.38	.38	.42
K_2O	.25	.25	.19	.15	.17	.18	.15	.16	.18	.19	.17	.21	.17	.20
Molecular End Members														
An	88.3	87.0	92.5	95.4	95.9	95.3	95.2	94.9	95.3	95.5	95.4	95.5	95.6	95.1
Ab	11.5	6.4	3.7	3.1	3.6	3.9	4.2	4.2	3.7	3.4	3.6	3.3	3.4	3.7
Or	1.6	1.5	1.1	.9	1.0	1.1	.9	.9	1.0	1.1	1.0	1.2	1.0	1.2

15356 Continued

Plagioclase 1 Traverse 2

	edge			2 micron steps				interior	midway	center
FeO	.53	.41	.39	.35	.29	.26	.25	.24	.34	.25
CaO	17.5	17.9	18.1	18.4	19.6	19.4	19.6	19.5	19.6	19.6
Na_2O	1.10	1.10	1.03	.87	.37	.44	.37	.45	.42	.43
K_2O	.23	.24	.23	.18	.12	.10	.18	.15	.14	.16
Molecular End Members										
An	88.5	88.7	89.4	91.1	96.0	95.5	95.7	95.1	95.5	95.3
Ab	10.1	9.9	9.2	7.8	3.3	3.9	3.3	4.0	3.7	3.8
Or	1.4	1.4	1.4	1.1	.7	.6	1.0	.9	.8	.9

15356 Continued

	Plagioclase 2 Traverse 1					Traverse 2						
	edge	2 micron steps			interior	edge	2 micron steps			interior	midway	center
FeO	.54	.36	.36	.33	.33	.49	.35	.33	.33	.40	.28	.25
CaO	18.2	19.0	19.4	19.2	19.3	18.0	19.0	19.1	19.2	19.3	19.3	19.4
Na_2O	.93	.61	.60	.57	.66	1.04	.67	.66	.64	.65	.65	.63
K_2O	.23	.18	.16	.16	.17	.26	.18	.18	.18	.17	.22	.19
Molecular End Members												
An	90.3	93.5	93.8	94.0	93.2	89.2	93.0	93.1	93.3	93.3	93.0	93.4
Ab	8.3	5.4	5.3	5.1	5.8	9.3	5.9	5.8	5.6	5.7	5.7	5.5
Or	1.4	1.1	.9	.9	1.0	1.5	1.1	1.1	1.1	1.0	1.3	1.1

TABLE 7: CONTINUED

15356 Continued

Plagioclase 3

	edge		2 micron steps				interior	midway	center
FeO	.41	.42	.37	.34	.32	.33	.33	.24	.29
CaO	19.0	19.5	19.5	19.2	19.4	19.5	19.7	19.6	19.7
Na_2O	.56	.43	.55	.49	.41	.43	.40	.42	.54
K_2O	.20	.16	.27	.33	.18	.16	.19	.12	.13
Molecular End Members									
An	93.8	95.3	93.7	93.8	95.3	95.3	95.8	95.6	94.6
Ab	5.0	3.8	4.8	4.3	3.6	3.8	3.5	3.7	4.7
Or	1.2	.9	1.5	1.9	1.1	.9	.7	.7	.7

15356 Continued

Plagioclase 9 Traverse 1

	edge		2 micron steps			interior
FeO	.29	.29	.25	.27	.22	.19
CaO	18.2	18.5	18.6	18.6	18.5	18.7
Na_2O	1.80	1.26	1.47	1.38	.92	1.34
K_2O	.24	.21	.21	.19	.26	.21
Molecular End Members						
An	83.7	88.0	86.4	87.2	90.4	87.5
Ab	15.0	10.8	12.4	11.7	8.1	11.3
Or	1.3	1.2	1.2	1.1	1.5	1.2

15356 Continued

Plagioclase 9 Traverse 2

	edge		2 micron steps				interior	midway	center
FeO	.34	.32	.30	.30	.36	.35	.31	.31	.23	.20
CaO	17.8	18.0	17.6	17.4	17.6	17.7	17.6	17.6	17.7	18.2
Na_2O	1.34	1.19	2.00	2.13	1.92	2.05	2.00	1.86	1.26	1.03
K_2O	.24	.26	.27	.34	.30	.45	.35	.32	.32	.24
Molecular End Members										
An	86.8	88.0	81.7	80.3	82.1	80.7	81.4	82.4	86.9	89.4
Ab	11.8	10.5	16.8	17.8	16.2	16.9	16.7	15.8	11.2	9.2
Or	1.4	1.5	1.5	1.9	1.7	2.4	1.9	1.8	1.9	1.4

TABLE 7: CONTINUED

15358	9	4	8	2	3	6	5	1	7	10
FeO	--	.46	--	.45	.45	--	--	.51	--	--
CaO	16.2	16.3	16.5	16.6	16.6	16.6	16.8	17.1	17.1	17.3
Na_2O	1.69	1.86	1.68	1.77	1.57	1.59	1.76	1.48	1.40	1.37
K_2O	.28	.15	.19	.15	.16	.15	.18	.19	.16	.19
Molecular End Members										
An	82.7	82.1	83.4	83.1	84.5	84.5	83.2	85.5	86.2	86.5
Ab	15.6	17.0	15.4	16.0	14.5	14.6	15.8	13.4	12.8	12.4
Or	1.7	.9	1.1	.9	1.0	.9	1.1	1.1	1.0	1.1

15359	7C	7B	7A	6	4	2C	2B	2A	1B	1C
FeO	.17	.13	.26	.29	.28	.19	.22	.32	.16	.19
CaO	20.2	20.1	20.0	19.8	19.3	19.2	19.2	19.1	19.1	18.9
Na_2O	.32	.32	.32	.38	.52	.51	.48	.58	.68	.58
K_2O	.07	.07	.07	.08	.10	.11	.13	.11	.15	.15
Molecular End Members										
An	96.8	96.8	96.8	96.2	94.8	94.8	94.9	94.2	93.1	93.9
Ab	2.8	2.8	2.8	3.3	4.6	4.5	4.3	5.2	6.0	5.2
Or	.4	.4	.4	.5	.6	.7	.8	.7	.9	.9

15359 Continued	1A	8A	8B	3B	3A	3C	9A	9B	9C	5
FeO	.33	.24	.31	.16	1.00	.15	.33	.18	.17	.37
CaO	18.9	18.9	18.8	18.8	18.7	18.3	18.2	17.9	17.9	17.4
Na_2O	.70	.77	.70	.76	.51	1.05	1.16	1.28	1.29	1.32
K_2O	.15	.18	.16	.18	.10	.23	.28	.27	.29	.30
Molecular End Members										
An	92.9	92.2	92.8	92.2	94.7	89.4	88.2	87.1	87.0	86.4
Ab	6.2	6.8	6.3	6.7	4.7	9.3	10.2	11.3	11.3	11.9
Or	.9	1.1	.9	1.1	.6	1.3	1.6	1.6	1.7	1.8

TABLE 7: CONTINUED

15382

	r10	r9	r8	r7	c6	r1	c10	c8	r6	c3
SiO_2	51.8	51.6	47.5	48.0	49.1	49.4	49.4	49.3	48.8	48.9
Al_2O_3	30.7	30.8	31.6	31.7	32.8	32.8	32.5	32.8	32.8	32.7
FeO	.62	.47	.44	.49	.46	.21	.45	.26	.53	.19
CaO	14.7	15.4	16.2	16.5	16.8	16.9	17.0	17.0	17.0	17.0
Na_2O	2.44	1.45	1.48	1.38	1.62	.56	1.89	1.52	1.57	1.36
K_2O	.49	.25	.25	.25	.16	.05	.25	.15	.18	.12
Total	100.75	99.97	97.47	98.32	100.94	99.92	101.49	101.03	100.88	100.27
Number of Ions on the Basis of 32 (O)										
Si	9.367	9.374	8.931	8.951	8.914	9.004	8.939	8.934	8.879	8.924
Al	6.653	6.706	7.121	7.085	7.137	7.165	7.048	7.124	7.153	7.152
Fe	.093	.071	.069	.076	.069	.032	.067	.039	.080	.029
Ca	2.676	2.817	3.066	3.097	3.071	3.101	3.097	3.101	3.114	3.123
Na	.920	.549	.580	.537	.614	.213	.713	.575	.596	.518
K	.115	.059	.061	.060	.038	.012	.059	.035	.042	.028
	16.020	16.080	16.052	16.036	16.051	16.169	15.987	16.058	16.032	16.076
	3.804	3.496	3.776	3.770	3.792	3.358	3.936	3.750	3.832	3.698
Sum	19.824	19.576	19.828	19.806	19.843	19.527	19.923	19.808	19.864	19.774
Molecular End Members										
An	74.6	84.1	84.4	85.5	84.3	94.1	82.1	85.3	84.7	86.7
Ab	22.4	14.3	14.0	13.0	14.7	5.6	16.5	13.8	14.2	12.6
Or	3.0	1.6	1.6	1.5	1.0	.3	1.4	.9	1.1	.7

15382 Continued

	r3	r5	c7	c2	c9	r2	r4	c5	c4	c1
SiO_2	49.0	48.9	48.9	48.8	49.0	48.8	48.7	49.0	48.1	45.7
Al_2O_3	32.9	33.2	32.5	32.9	32.7	32.9	33.4	33.2	34.0	35.2
FeO	.29	.32	.37	.24	.34	.37	.31	.21	.17	.18
CaO	17.0	17.1	17.1	17.1	17.2	17.2	17.2	17.2	17.6	19.1
Na_2O	1.37	1.44	1.38	1.40	1.41	1.40	1.40	1.35	1.33	.61
K_2O	.12	.13	.12	.11	.15	.17	.13	.21	.11	.05
Total	100.68	101.09	100.37	100.55	100.80	100.84	101.14	101.08	101.31	100.84
Number of Ions on the Basis of 32 (O)										
Si	8.909	8.863	8.928	8.888	8.911	8.876	8.826	8.876	8.714	8.370
Al	7.169	7.212	7.112	7.182	7.128	7.172	7.255	7.208	7.382	7.726
Fe	.044	.048	.056	.036	.051	.056	.047	.032	.026	.027
Ca	3.112	3.120	3.143	3.135	3.149	3.149	3.138	3.136	3.210	3.522
Na	.520	.544	.526	.532	.535	.531	.529	.510	.503	.233
K_2O	.028	.031	.028	.026	.035	.040	.031	.028	.026	.012
	16.078	16.075	16.040	16.070	16.039	16.048	16.081	16.084	16.096	16.096
	3.704	3.743	3.753	3.729	3.770	3.776	3.745	3.706	3.765	3.794
Sum	19.782	19.818	19.793	19.799	19.809	19.824	19.826	19.790	19.861	19.890
Molecular End Members										
An	86.7	86.1	86.6	86.5	86.3	86.3	86.5	87.0	87.3	94.3
Ab	12.6	13.1	12.7	12.8	12.8	12.7	12.7	12.3	12.0	5.4
Or	.7	.8	.7	.7	.9	1.0	.8	.7	.7	.3

TABLE 7: CONTINUED

15382 Continued

	Large phenocryst							
	edge						center	
	F	G	H	I	J	K	D	D
SiO_2	46.0	48.0	47.2	52.5	48.6	49.0	45.1	44.9
Al_2O_3	35.0	32.9	33.3	30.3	32.6	32.0	34.9	35.0
FeO	.29	.27	.48	.46	.40	.41	.18	.22
CaO	19.0	17.4	17.8	15.3	17.2	16.6	19.0	19.2
K_2O	.11	.14	.18	1.37	.23	.20	.09	.08
Na_2O	.56	1.32	1.20	1.46	1.65	1.21	.51	.62
Total	100.96	100.03	100.16	101.39	100.63	99.42	99.78	100.02
Number of Ions on the Basis of 32 (O)								
Si	8.414	8.810	8.683	9.456	8.870	9.013	8.351	8.308
Al	7.673	7.237	7.342	6.541	7.131	7.055	7.746	7.762
Fe	.044	.041	.073	.690	.060	.062	.028	.034
Ca	3.499	3.215	3.296	2.774	3.160	3.074	3.542	3.577
K	.026	.033	.043	.320	.054	.048	.022	.019
Na	.214	.505	.460	.549	.628	.464	.197	.239
Z	16.087	16.047	16.025	15.997	16.001	16.068	16.097	16.070
X	3.783	3.794	3.872	3.712	3.902	3.648	3.789	3.869
Sum	19.870	19.841	19.897	19.709	19.903	19.716	19.886	19.939
Molecular End Members								
An	94.3	87.2	88.1	78.2	84.1	87.2	94.9	94.0
Ab	5.0	12.0	10.8	13.5	14.6	11.5	4.6	5.5
Or	.7	.8	1.1	8.3	1.3	1.3	.5	.5

15382 Continued

				edge	edge	edge	center
	D	D	D	D	E	C	C
SiO_2	45.8	47.5	47.7	48.0	49.1	47.9	45.3
Al_2O_3	34.4	33.2	32.6	31.9	32.4	32.8	35.1
FeO	.24	.30	.37	.33	.57	.35	.20
CaO	18.6	17.1	16.8	16.9	16.4	17.3	19.0
K_2O	.08	.19	.16	.18	.23	.17	.11
Na_2O	.60	1.35	1.42	1.33	1.38	1.16	.59
Total	99.72	99.64	99.05	98.64	100.08	99.68	100.03
Number of Ions on the Basis of 32 (O)							
Si	8.469	8.752	8.833	8.928	8.977	8.820	8.346
Al	7.624	7.331	7.235	7.111	7.100	7.238	7.751
Fe	.037	.046	.057	.051	.860	.053	.031
Ca	3.463	3.172	3.132	3.146	3.019	3.207	3.524
K	.019	.045	.038	.043	.054	.041	.026
Na	.231	.519	.548	.516	.526	.446	.227
Z	16.093	16.083	16.068	16.039	16.077	16.058	16.097
X	3.750	3.782	3.775	3.756	3.685	3.747	3.808
Sum	19.843	19.865	19.843	19.975	19.762	19.805	19.905
Molecular End Members							
An	94.0	86.4	85.9	86.6	85.6	88.3	94.1
Ab	5.5	12.4	13.1	12.3	13.0	10.7	5.3
Or	.5	1.2	1.0	1.1	1.4	1.0	.6

TABLE 7: CONTINUED

15382 Continued

	edge					center			edge	
	2C	2D	2E	2F	2G	2I	2J	2K	3C	3D
SiO_2	47.6	47.2	50.6	49.6	48.6	48.3	49.0	48.2	50.0	48.9
Al_2O_3	32.3	33.3	30.7	30.9	32.4	32.4	31.8	32.6	31.6	32.1
FeO	.66	.50	.77	.61	.53	.30	.45	.32	.41	.50
CaO	17.3	18.0	15.8	16.3	17.2	17.5	17.4	16.8	15.6	17.1
Na_2O	1.46	1.31	2.10	1.77	1.62	1.37	1.39	1.65	1.77	1.36
K_2O	.24	.18	.33	.29	.23	.14	.14	.21	.20	.21
Total	99.56	100.49	100.30	99.47	100.58	100.01	100.18	99.78	99.58	100.17
Number of Ions on the Basis of 32 (O)										
Si	8.809	8.666	9.235	9.138	8.885	8.871	8.981	8.862	9.152	8.957
Al	7.164	7.328	6.715	6.823	7.099	7.132	6.985	7.184	6.932	7.047
Fe	.101	.076	.116	.093	.080	.046	.068	.049	.062	.076
Ca	3.223	3.327	2.903	3.023	3.166	3.236	3.210	3.110	2.875	3.153
Na	.564	.502	.799	.680	.618	.525	.531	.633	.675	.520
K	.058	.043	.078	.069	.054	.033	.033	.050	.047	.050
Z	15.973	15.994	15.950	15.961	15.984	16.003	15.966	16.046	16.084	16.004
X	3.946	3.948	3.896	3.865	3.918	3.840	3.842	3.842	3.659	3.799
Sum	19.919	19.942	19.846	19.826	19.902	19.843	19.808	19.888	19.743	19.803
Molecular End Members										
An	85.5	87.5	79.0	82.1	84.3	86.9	86.7	83.9	81.9	86.3
Ab	13.1	11.5	19.0	16.2	14.4	12.3	12.5	14.9	16.8	12.4
Or	1.4	1.0	2.0	1.7	1.3	.8	.8	1.2	1.3	1.3

15382 Continued

	edge		center							
	3E	3F	3G	3H	4C	4E	5C	5E	7E	8E
SiO_2	49.5	50.1	48.7	48.8	47.5	48.2	48.3	48.9	48.0	48.0
Al_2O_3	32.0	31.7	32.3	32.0	32.8	32.5	32.7	32.4	32.0	32.8
FeO	.32	.39	.26	.30	.30	.35	.29	.37	.56	.47
CaO	16.9	16.5	17.1	17.1	17.9	17.6	17.5	17.2	16.9	17.0
Na_2O	1.63	1.71	1.43	1.48	1.31	1.27	1.32	1.40	1.61	1.39
K_2O	.16	.22	.13	.13	.11	.12	.15	.16	.19	.23
Total	100.51	100.62	99.92	99.81	99.92	100.04	100.26	100.43	99.26	99.89
Number of Ions on the Basis of 32 (O)										
Si	9.020	9.107	8.932	8.903	8.752	8.852	8.846	8.930	8.888	8.824
Al	6.989	6.906	7.100	7.044	7.243	7.154	7.178	7.091	7.102	7.227
Fe	.048	.059	.039	.046	.046	.053	.044	.056	.086	.072
Ca	3.100	3.019	3.157	3.162	3.320	3.254	3.227	3.162	3.151	3.146
Na	.620	.648	.547	.567	.503	.487	.504	.533	.622	.533
K	.038	.052	.031	.031	.026	.029	.036	.038	.046	.055
Z	16.009	16.013	16.032	16.007	15.995	16.006	16.024	16.021	15.990	16.051
X	3.806	3.778	3.774	3.806	3.895	3.823	3.811	3.789	3.905	3.806
Sum	19.815	19.791	19.806	19.813	19.890	19.829	19.835	19.810	19.895	19.857
Molecular End Members										
An	84.3	83.1	86.2	85.8	87.8	87.8	87.2	86.3	84.4	85.9
Ab	14.7	15.6	13.0	13.4	11.6	11.5	11.9	12.7	14.5	12.7
Or	1.0	1.3	.8	.8	.6	.7	.9	1.0	1.1	1.4

TABLE 7: CONTINUED

15382 Continued

	11A	11B	11C	11D	13A	13B	13C	13D
SiO_2	48.5	48.6	48.9	49.0	50.2	49.2	49.3	48.3
Al_2O_3	32.3	31.8	31.6	31.4	31.0	31.7	31.9	32.3
FeO	.39	.26	.43	.43	.53	.48	.38	.45
CaO	17.0	16.9	16.1	16.2	15.7	16.7	16.8	17.2
Na_2O	1.51	1.58	1.86	1.59	1.97	1.75	1.59	1.55
K_2O	.14	.16	.25	.23	.35	.19	.20	.20
Total	99.84	99.30	99.14	99.85	99.75	100.02	100.17	100.00
Number of Ions on the Basis of 32 (O)								
Si	8.911	8.971	9.031	9.068	9.197	9.020	9.017	8.877
Al	7.113	7.036	6.994	6.964	6.807	6.965	6.993	7.115
Fe	.059	.040	.066	.066	.080	.073	.058	.068
Ca	3.144	3.141	2.993	3.018	2.896	3.082	3.093	3.183
Na	.579	.608	.717	.614	.753	.669	.607	.594
K	.033	.038	.060	.055	.083	.045	.047	.048
Z	16.024	16.007	16.025	16.032	16.004	15.985	16.010	15.992
X	3.815	3.827	3.836	3.753	3.812	3.869	3.805	3.893
Sum	19.839	19.834	19.861	19.785	19.816	19.854	19.815	19.885
Molecular End Members								
An	85.5	84.7	81.5	83.7	79.8	83.1	84.4	84.9
Ab	13.7	14.3	17.0	14.9	18.1	15.8	14.4	13.9
Or	.8	1.0	1.5	1.4	2.1	1.1	1.2	1.2

TABLE 8: PLAGIOCLASE IN ANORTHOSITIC-NORITIC-TROCTOLITIC RAKE SAMPLES AND LITHIC FRAGMENTS

15308

	Cataclastic area							Shock-blackend area				
	6	10	9	7	11	12	8	3	1	2	4	5
SiO_2	44.1	43.8	44.0	43.4	43.9	43.7	43.5	43.9	44.2	43.8	43.8	44.0
TiO_2	.04	.06	.07	.04	.03	.07	.14	.10	.04	.10	.03	.05
Al_2O_3	35.5	34.7	35.7	35.4	35.1	35.7	35.2	35.5	35.6	35.8	35.5	35.6
FeO	.14	.12	.14	.15	.11	.12	.10	.20	.16	.23	.19	.11
MnO	.01	.02	*	*	*	.02	*	*	*	.02	*	*
MgO	.10	.10	.11	.09	.04	.06	.08	.04	.05	.06	.04	.03
CaO	19.5	19.6	19.7	19.9	19.9	20.1	20.2	19.6	19.7	19.8	19.8	19.8
Na_2O	.48	.51	.50	.43	.48	.54	.52	.47	.48	.38	.47	.42
K_2O	.06	.04	.07	.04	.04	.06	.05	.06	.05	.04	.08	.06
Total	99.93	99.15	99.99	99.45	100.20	100.37	99.79	99.87	100.28	100.23	99.91	100.07
Number of Ions on the Basis of 32 (O)												
Si	8.171	8.187	8.156	8.099	8.123	8.806	8.101	8.146	8.165	8.103	8.132	8.147
Ti	.006	.008	.010	.006	.004	.010	.020	.014	.006	.014	.004	.007
Al	7.754	7.691	7.736	7.788	7.788	7.738	7.728	7.766	7.753	7.808	7.770	7.771
Fe	.022	.019	.022	.023	.017	.019	.016	.031	.025	.036	.030	.017
Mn	.002	.003	--	--	--	.003	--	.009	.009	.030	.009	.009
Mg	.028	.028	.030	.025	.011	.016	.022	.011	.014	.016	.011	.008
Ca	3.871	3.926	3.913	3.979	3.945	3.985	4.031	3.897	3.899	3.925	3.939	3.928
Na	.172	.185	.180	.156	.172	.194	.188	.169	.172	.136	.169	.151
K	.014	.010	.017	.010	.009	.014	.012	.014	.012	.009	.019	.014
Z	15.931	15.886	15.902	15.893	15.915	15.884	15.849	15.926	15.924	15.925	15.906	15.925
X	4.109	4.171	4.162	4.193	4.154	4.231	4.269	4.169	4.122	4.125	4.168	4.118
Sum	20.040	20.057	20.064	20.086	20.069	20.115	20.118	20.095	20.046	20.050	20.074	20.043
Molecular End Members												
An	95.4	95.3	95.2	96.0	95.6	95.0	95.3	95.5	95.5	96.4	95.4	96.0
Ab	4.2	4.5	4.4	3.8	4.2	4.6	4.4	4.1	4.2	3.4	4.1	3.6
Or	.4	.2	.4	.2	.2	.4	.3	.4	.3	.2	.5	.4

TABLE 8: CONTINUED

15308 Continued

Devitrified glass area

	15	19	20	13	14	16	17	18
SiO_2	49.8	49.0	45.5	44.0	44.0	43.9	43.9	43.7
TiO_2	.07	.09	.04	.04	.04	.06	.06	.07
Al_2O_3	37.6	31.3	35.2	35.4	35.8	35.3	35.2	35.4
FeO	.24	.77	.09	.09	.12	.19	.27	.17
MnO	.02	*	*	.01	*	.01	*	*
MgO	.22	.33	.07	.10	.10	.12	.43	.14
CaO	15.9	16.9	19.0	19.4	19.9	20.0	20.2	20.4
Na_2O	20.5	1.41	.87	.42	.40	.52	.37	.38
K_2O	.73	.29	.09	.12	.06	.04	.04	.03
Total	100.63	110.09	100.86	99.58	100.42	100.14	100.47	100.29
Number of Ions on the Basis of 32 (O)								
Si	1.074	8.997	8.332	8.178	8.122	8.138	8.119	8.097
Ti	.010	.012	.006	.006	.006	.008	.008	.010
Al	6.788	6.775	7.599	7.757	7.790	7.715	7.675	7.733
Fe	.037	.118	.014	.014	.019	.030	.042	.026
MnO	.003	--	--	.002	--	.002	--	--
Mg	.060	.090	.019	.028	.028	.033	.113	.039
Ca	3.104	3.325	3.728	3.864	3.936	3.973	4.003	4.050
Na	.724	.502	.309	.151	.143	.187	.133	.136
K	.170	.068	.021	.028	.014	.010	.009	.007
Z	15.872	15.784	15.937	15.941	15.918	15.891	15.802	15.840
X	4.098	4.103	4.091	4.087	4.140	4.235	4.305	4.258
Sum	19.970	19.887	20.028	20.028	20.053	20.126	20.107	20.098
Molecular End Members								
An	77.7	85.4	91.9	95.5	96.2	95.3	96.6	96.5
Ab	8.1	12.9	7.6	3.8	3.5	4.5	3.2	3.3
Or	4.2	1.7	.5	.7	.3	.2	.2	.2

TABLE 8: CONTINUED

	15327									
	2	4	9	1	10	3	5	8	6	7
SiO_2	43.8	43.4	43.8	43.6	43.4	43.3	43.6	42.9	43.5	43.4
TiO_2	.02	*	.02	.09	.04	.03	.04	.02	.02	.03
Al_2O_3	36.4	35.6	35.3	35.8	35.6	35.9	36.3	35.3	35.9	35.4
FeO	.05	.05	.02	.06	.05	.06	.02	.04	.08	.06
MnO	.02	*	*	*	*	*	*	*	*	*
CaO	19.7	19.7	19.7	19.9	20.0	20.1	20.1	20.1	20.2	20.3
Na_2O	.34	.29	.41	.31	.26	.29	.33	.34	.31	.31
K_2O	.05	.04	.06	.04	.03	.05	.04	.03	.05	.06
Total	100.43	99.08	99.31	99.87	99.46	99.78	100.49	98.81	100.26	99.79
Number of Ions on the Basis of 32 (O)										
Si	8.074	8.112	8.167	8.091	8.090	8.051	8.044	8.061	8.053	8.078
Ti	.003	--	.003	.013	.006	.004	.006	.003	.003	.004
Al	7.910	7.844	7.760	7.832	7.823	7.869	7.896	7.820	7.835	7.768
Fe	.008	.008	.003	.009	.008	.009	.003	.006	.012	.009
MnO	.003	--	--	--	--	--	--	--	--	--
Mg	.014	--	--	.019	.022	.014	.016	.022	.055	.064
Ca	3.891	3.945	3.936	3.957	3.994	4.004	3.974	4.047	4.007	4.048
Na	.122	.105	.148	.112	.094	.105	.118	.124	.111	.112
K	.012	.010	.014	.010	.007	.012	.009	.007	.012	.014
Z	15.987	15.956	15.930	15.936	15.919	15.924	15.946	15.884	15.891	15.850
X	4.050	4.068	4.101	4.107	4.125	4.144	4.120	4.206	4.197	4.247
Sum	20.037	20.024	20.031	20.043	20.044	20.068	20.066	20.090	20.088	20.097
Molecular End Members										
An	96.7	97.2	96.0	97.0	97.5	97.2	96.9	96.9	97.0	97.0
Ab	3.0	2.6	3.6	2.8	2.3	2.5	2.9	2.9	2.7	2.7
Or	.3	.2	.4	.2	.2	.3	.2	.2	.3	.3

TABLE 8: CONTINUED

	15332,1-1	
	2	1
SiO_2	45.8	45.5
Al_2O_3	34.4	34.8
FeO	.12	.04
MgO	.03	.02
CaO	18.1	18.6
Na_2O	1.19	.81
K_2O	.18	.15
Total	99.82	99.92
Number of Ions on the Basis of 32 (O)		
Si	8.461	8.397
Al	7.490	7.569
Fe	.019	.006
Mg	.008	.005
Ca	3.583	3.678
Na	.426	.290
K	.042	.035
Z	15.951	15.966
X	4.078	4.014
Sum	20.029	19.980
Molecular End Members		
An	10.5	7.2
Ab	88.4	91.9
Or	1.1	.9

	15349				
	4	1	5	2	3
SiO_2	44.5	44.5	45.0	44.9	44.4
TiO_2	.06	.05	.03	.02	.06
Al_2O_3	34.5	35.0	35.3	35.1	34.7
FeO	.22	.19	.20	.14	.18
MnO	*	*	.02	.01	.02
MgO	.16	.15	.13	.13	.18
CaO	19.2	19.5	19.5	19.6	19.6
Na_2O	.53	.56	.49	.59	.50
K_2O	.08	.08	.10	.10	.10
Total	99.25	100.03	100.77	100.59	99.94
Number of Ions on the Basis of 32 (O)					
Si	8.296	8.239	8.262	8.264	8.232
Ti	.008	.007	.004	.003	.008
Al	7.582	7.639	7.641	7.616	7.628
Fe	.034	.029	.031	.022	.028
Mn	--	--	.003	.002	.003
Mg	.044	.041	.036	.036	.052
Ca	3.835	3.868	3.836	3.866	3.894
Na	.192	.201	.174	.211	.180
K	.019	.019	.023	.024	.024
Z	15.886	15.885	15.907	15.883	15.868
X	4.124	4.158	4.103	4.161	4.179
Sum	20.010	20.043	20.010	20.044	20.047
Molecular End Members					
An	94.8	94.6	95.1	94.3	95.0
Ab	4.7	4.9	4.3	5.1	4.4
Or	.5	.5	.6	.6	.6

TABLE 8: CONTINUED

	15362,1-1				15362,1-2				
	1	4	3	10	12	2	1	3	4
SiO_2	44.3	43.3	43.9	43.5	43.9	44.1	43.3	44.1	44.0
Al_2O_3	35.4	35.9	35.7	35.8	35.4	35.7	36.4	36.0	35.8
FeO	.08	.07	.07	.07	.08	.10	.10	.10	.13
MgO	.02	*	*	.02	.03	.03	.04	.05	.03
CaO	19.6	19.7	19.5	19.3	19.4	20.0	19.5	19.7	19.8
Na_2O	.34	.24	.33	.36	.43	.34	.52	.41	.35
K_2O	.03	.03	.04	.04	.04	.04	.05	.05	.05
Total	99.77	99.24	99.54	99.09	99.28	100.31	99.91	100.41	100.16
Number of Ions on the Basis of 32 (O)									
Si	8.212	8.080	8.156	8.120	8.180	8.144	8.032	8.132	8.136
Al	7.772	7.896	7.820	7.876	7.776	7.776	7.960	7.824	7.804
Fe	.012	.012	.012	.012	.012	.016	.016	.016	.020
Mg	.004	--	--	.004	.008	.008	.012	.012	.008
Ca	3.892	3.940	3.884	3.860	3.872	3.960	3.876	3.892	3.924
Na	.124	.088	.120	.132	.156	.120	.188	.148	.124
K	.008	.008	.008	.008	.008	.008	.012	.012	.012
Z	15.984	15.976	15.976	15.996	15.956	15.920	15.992	15.956	15.940
X	4.004	4.048	4.024	4.016	4.056	4.112	4.104	4.080	4.088
Sum	19.988	20.024	20.000	20.012	20.012	20.032	20.096	20.036	20.028
Molecular End Members									
An	96.8	97.7	96.8	96.5	95.9	96.8	95.1	96.9	96.6
Ab	3.1	2.2	3.0	3.3	3.8	3.0	4.6	3.6	3.1
Or	.2	.2	.2	.2	.2	.2	.3	.3	.3

	15362,1-1 Shocked, opaque, apparently feldspar								
	2A	1C	6	4	5	3	1D	7	1B
SiO_2	44.0	43.6	42.2	44.4	44.2	44.8	44.4	44.4	43.7
Al_2O_3	36.3	36.4	38.2	36.4	36.2	36.4	36.3	36.7	36.4
FeO	.03	*	.02	.04	*	.02	.09	*	.03
CaO	19.7	19.8	18.9	19.7	19.8	19.6	19.5	20.0	19.9
Na_2O	.20	.16	.31	.27	.27	.34	.32	.28	.27
K_2O	*	*	*	.02	.02	.03	.03	.04	.04
Total	100.23	99.96	99.63	100.83	100.49	101.19	100.64	101.42	100.34
Number of Ions on the Basis of 32 (O)									
Si	8.123	8.077	7.831	8.147	8.142	8.184	8.160	8.108	8.074
Al	8.032	8.082	8.496	8.005	7.993	7.970	7.996	8.033	8.060
Fe	.005	--	.003	.006	--	.003	.014	--	.005
Ca	3.662	3.693	3.531	3.639	3.672	3.605	3.608	3.677	3.701
Na	.077	.062	.120	.103	.104	.130	.123	.107	.104
K	--	--	--	.005	.005	.077	.007	.009	.010
Z	16.155	16.159	16.327	16.152	16.135	16.154	16.156	16.141	16.134
X	3.744	3.755	3.654	3.753	3.885	3.745	3.752	3.793	3.820
Sum	19.899	19.914	19.981	19.905	20.020	19.890	19.908	19.934	19.954
Molecular End Members									
An	98.2	98.5	97.1	97.4	97.4	96.7	96.9	97.3	97.4
Ab	1.8	1.5	2.9	2.4	2.4	3.0	2.9	2.5	2.4
Or	**	**	**	.1	.1	.2	.2	.2	.2

BARIAN K-FELDSPAR

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 9: BARIAN K-FELDSPAR IN HIGH-ALUMINA BASALT RAKE SAMPLE 15356,1-1

	2	7	3
SiO_2	56.9	59.5	64.0
TiO_2	1.16	.64	.98
Al_2O_3	21.9	18.7	18.2
FeO	1.69	.64	1.23
CaO	9.4	5.5	1.55
Na_2O	1.04	.38	.23
K_2O	5.1	11.1	11.6
BaO	5.4	4.7	4.2
	--	.49	--
Total	102.59	101.65	101.99
Number of Ions on the Basis of 32 (O)			
Si	10.574	11.191	11.794
Ti	.163	.090	.136
Al	4.794	4.152	3.958
Fe	.263	.101	.190
Ca	1.883	1.101	.306
Na	.375	.137	2.728
K	1.214	2.676	.084
Ba	.396	.346	.304
P	--	.102	--
Z	15.531	15.433	15.888
X	4.131	4.463	3.612
Sum	19.662	19.896	19.500
Molecular End Members			
An	48.7	26.0	9.0
Ab	9.7	3.3	2.4
Or	31.4	62.6	79.7
Cn	10.2	8.1	8.9

SPINEL

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 10: SPINEL FROM HIGH-ALUMINA BASALT RAKE SAMPLE 15358

	2	1
SiO_2	1.35	.95
TiO_2	23.9	27.3
Al_2O_3	1.41	4.6
Cr_2O_3	22.2	17.3
V_2O_3	.45	.36
FeO	43.7	47.8
MgO	4.6	3.9
Total	97.61	102.21
Number of Ions on the Basis of 32 (O)		
Si	.383	.256
Ti	5.315	5.730
Al	.480	1.469
Cr	4.946	3.639
V	.105	.080
Fe	10.267	10.610
Mg	2.041	1.637
R^{+3}	10.846	10.918
R^{+2}	12.691	12.503
Sum	23.537	23.421
Molecular End Members		
Uv	71.5	76.4
Cm	--	--
Pc	28.4	23.6
Hc	--	--
Sp	--	--

ILMENITE

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 11: ILMENITE IN HIGH-ALUMINA BASALT RAKE SAMPLE 15323

	4	5
SiO_2	.39	.50
TiO_2	51.2	51.1
Al_2O_3	.53	.83
Cr_2O_3	.47	.42
V_2O_3	.80	.83
FeO	43.2	39.7
MnO	.33	.31
MgO	2.11	4.2
CaO	.32	.47
ZrO_2	.71	.71
Total	100.06	99.07
Number of Ions on the Basis of 6 (O)		
Si	.019	.025
Ti	1.910	1.894
Al	.021	.032
Cr	.019	.017
V	.047	.048
Fe	1.792	1.636
Mn	.014	.013
Mg	.156	.309
Ca	.017	.025
Zr	.017	.017
R^{+3}	2.016	2.016
R^{+2}	1.996	2.000
Sum	4.012	4.016

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 12: COBALTIAN METALLIC NICKEL-IRON IN HIGH-ALUMINA RAKE SAMPLES

15356,1-1

	5	4	3	7	2	6	1	9	8	10
Fe	94.7	95.0	96.0	94.3	95.3	93.9	94.2	93.0	92.5	92.8
Ni	4.1	4.4	4.6	4.6	4.9	4.9	5.2	5.7	5.9	5.9
Co	.45	.41	.47	.41	.46	.42	.46	.52	.44	.47
Sum	99.3	99.8	101.1	99.3	100.7	99.2	99.9	99.2	98.8	99.2

15359

	7	3	8	1	2	4	6	5
Fe	93.5	93.9	93.9	91.9	92.3	93.0	91.2	90.5
Ni	4.4	4.6	5.1	5.8	5.9	5.9	6.9	7.5
Co	.97	1.16	.92	.84	.96	.98	.96	.94
Sum	98.9	99.7	99.9	98.5	99.2	99.9	99.1	98.9

15382

	5	7	6	3	10	8	4	2	1	9
Fe	97.4	97.1	98.7	97.6	97.3	97.5	97.7	97.2	96.3	95.5
Ni	.06	.07	.11	.18	.18	.19	.21	.27	.55	.96
Co	.95	.67	.67	.90	1.18	.87	.97	1.59	1.25	1.23
Sum	98.4	97.8	99.5	98.7	98.7	98.6	98.9	99.0	98.1	97.7

COLBATIAN METALLIC NICKEL-IRON

SiO_2-K_2O-RICH RESIDUAL GLASS

HIGH-ALUMINA BASALT RAKE SAMPLES

TABLE 13: SiO_2-K_2O-RICH RESIDUAL GLASS IN HIGH-ALUMINA BASALT RAKE SAMPLES AND LITHIC FRAGMENTS

	15323		15356,1-1			15382						
	1		4	6		2	8	4	5	1	6	7
SiO_2	77.1	SiO_2	67.5	63.3	SiO_2	73.2	73.9	74.8	75.3	73.3	73.8	74.7
TiO_2	.79	TiO_2	.35	1.15	TiO_2	.32	.76	.59	.66	.68	.66	.55
Al_2O_3	11.6	Al_2O_3	15.6	19.5	Al_2O_3	12.9	12.3	11.9	11.8	12.3	13.0	12.5
Cr_2O_3	.00	Cr_2O_3	.00	.00	Cr_2O_3	.00	.00	.00	.00	.00	.00	.00
FeO	2.34	FeO	.50	1.05	FeO	.59	1.73	1.55	1.72	1.85	1.82	1.14
MnO	.00	MnO	.00	.00	MnO	.00	.00	.00	.00	.00	.00	.00
MgO	.16	MgO	.00	.00	MgO	.00	.00	.00	.00	.00	.00	.00
CaO	1.87	CaO	2.76	2.67	CaO	2.45	2.29	1.17	1.51	1.85	1.48	1.56
Na_2O	1.04	Na_2O	.58	.57	Na_2O	1.23	1.01	1.26	.89	.98	.90	.97
K_2O	5.7	K_2O	7.4	10.8	K_2O	6.3	6.5	6.9	7.1	7.2	7.4	7.6
P_2O_5	.00	P_2O_5	.14	.54	P_2O_5	.00	.00	.00	.00	.00	.00	.00
BaO	.44	BaO	1.21	2.71	BaO	.50	.78	.20	.33	1.09	.93	.78
Total	101.04	Total	96.11	102.29	Total	97.49	99.27	98.37	99.31	99.25	99.99	99.80
CIPW Molecular Norm		CIPW Molecular Norms			CIPW Molecular Norms							
q	40.79	q	27.02	8.78	q	35.00	35.29	36.37	36.88	32.80	32.86	33.56
or	34.52	or	46.87	63.20	or	39.36	40.04	42.36	43.85	44.27	45.16	46.47
ab	9.57	ab	5.52	5.04	ab	11.57	9.44	11.79	8.25	9.10	8.20	8.95
an	10.41	an	19.13	18.49	an	11.62	10.19	6.88	7.39	8.00	9.79	7.36
di wo	.53	di wo	.30	.03	di wo	.49	1.68	.08	.85	1.99	1.00	1.03
di en	.08	di en	--	--	di en	--	--	--	--	--	--	--
di fs	.46	di fs	.30	.03	di fs	.49	1.68	.08	.85	1.99	1.00	1.03
hy en	.37	wo	.02	1.75	hy en	--	--	--	--	--	--	--
hy fs	2.13	il	.52	1.59	hy fs	--	--	1.58	.97	--	.95	--
il	1.13	ap	.52	1.11	il	.47	1.10	.87	.96	.99	.95	.79

GLASSES IN LOOSE FINES

TABLE 14: GREEN GLASSES IN LOOSE FINES 15101,107

	1	2	3	4	5	6	7	8	9	10	11	12
SiO_2	45.1	44.9	44.6	45.5	45.2	45.2	46.3	45.3	45.3	45.0	45.0	44.7
TiO_2	.38	.45	.43	.44	.42	.39	.39	.39	.43	.06	.41	.40
Al_2O_3	7.9	7.7	7.4	7.7	7.5	7.8	7.7	7.6	7.6	7.6	7.4	7.5
Cr_2O_3	.41	.40	.41	.41	.39	.42	.42	.42	.40	.41	.41	.41
FeO	18.5	19.4	19.5	19.5	19.5	19.6	19.6	19.8	19.8	19.9	20.0	20.0
NiO	.08	.09	.08	.08	.09	.07	.08	.09	.09	.08	.07	.06
MgO	16.9	17.9	17.8	17.9	17.7	17.1	17.0	17.1	17.5	17.1	17.3	17.2
CaO	8.6	8.1	8.1	8.2	8.2	8.3	8.7	8.4	8.0	8.3	8.3	8.4
Na_2O	.16	.10	.14	.14	.11	.13	.14	.14	.14	.12	.15	.17
K_2O	.27	.26	.24	.25	.27	.25	.25	.24	.26	.27	.25	.26
P_2O_5	.04	.03	.04	.03	.04	.05	.03	.02	.03	.02	.02	.04
ZrO_2	.03	*	.03	.05	.04	.04	*	.02	.05	.03	.04	*
Total	98.64	99.33	98.77	100.20	99.46	99.35	100.61	99.52	99.60	98.89	99.35	99.14
CIPW Molecular Norms												
z	.03	--	.03	.05	.04	.04	--	.02	.05	.03	.04	--
or	1.63	1.56	1.44	1.48	1.61	1.50	1.48	1.44	1.55	1.62	1.50	1.56
ab	1.47	.91	1.28	1.26	1.00	1.19	1.26	1.28	1.27	1.10	1.37	1.55
an	20.30	19.98	19.14	19.76	19.23	20.12	19.75	19.57	19.43	19.81	19.11	19.21
di	18.32	16.11	16.91	16.63	17.19	17.03	18.61	17.84	16.45	17.62	17.97	17.16
hy	26.16	26.05	24.85	26.14	25.56	27.02	28.47	26.68	27.35	25.08	24.78	23.29
ol	30.91	34.28	35.16	33.58	33.84	31.99	29.39	32.14	32.81	34.13	31.16	35.16
cm	.46	.45	.46	.46	.44	.47	.47	.47	.45	.46	.46	.46
il	.54	.64	.61	.62	.59	.55	.55	.55	.61	.09	.58	.57
ap	.09	.07	.09	.07	.09	.11	.07	.05	.07	.05	.05	.09

TABLE 14: CONTINUED

	13	14	15	16	17	18	19	20	21	22	23
SiO_2	45.3	44.2	44.4	44.7	45.4	44.7	45.4	46.3	46.2	44.7	46.0
TiO_2	.42	.45	.43	.44	.45	.39	.41	.46	.47	.52	.45
Al_2O_3	7.3	7.3	7.5	7.5	7.4	7.5	7.5	7.2	7.3	7.6	7.4
Cr_2O_3	.38	.45	.38	.41	.42	.43	.41	.42	.42	.44	.38
FeO	20.0	20.0	20.1	20.2	20.3	20.3	20.3	21.1	21.2	21.4	21.4
NiO	.09	*	.07	.09	.08	.09	.09	.09	.10	.11	.10
MgO	17.4	16.6	17.4	17.6	17.1	17.2	17.3	17.3	17.3	17.9	17.5
CaO	8.1	8.1	8.2	8.3	8.2	8.5	8.4	8.3	8.2	8.1	8.8
Na_2O	.16	.26	.12	.13	.11	.14	.15	*	*	.12	.05
K_2O	.27	.09	.26	.25	.24	.26	.25	.03	.03	.05	.04
P_2O_5	.03	.13	.14	.03	.05	.02	.03	*	.01	.02	.03
ZrO_2	.02	.02	.02	.03	.04	*	.02	*	.05	.03	.03
Total	99.47	97.60	98.92	99.67	99.79	99.53	100.27	101.21	101.29	100.98	102.15
CIPW Molecular Norms											
z	.02	.02	.02	.03	.04	--	.02	--	.05	.03	.03
or	1.62	.55	1.56	1.49	1.44	1.56	1.49	.18	.18	.30	.24
ab	1.46	2.41	1.10	1.18	1.00	1.28	1.36	--	--	1.08	.45
an	18.60	19.08	19.41	19.21	19.26	19.18	19.24	19.67	19.92	20.14	19.59
di	17.50	17.02	17.44	17.60	17.15	18.48	17.73	17.06	16.53	15.78	18.80
hy	26.68	26.39	23.27	23.21	28.18	22.67	25.46	34.57	34.19	24.51	27.66
ol	33.08	32.55	36.07	36.12	31.67	35.73	33.65	27.44	28.02	36.90	32.17
cm	.43	.52	.43	.46	.47	.48	.46	.47	.47	.49	.42
il	.60	.65	.61	.62	.64	.55	.58	.65	.66	.73	.63
ap	.07	.29	.09	.07	.11	.05	.07	--	.03	.05	.05

TABLE 15: GREEN GLASSES IN LOOSE FINES 15201,15

	1	2	3	4	5	6	7	8	9	10	11	12	13
SiO_2	44.6	44.8	45.2	44.3	45.5	45.2	45.1	44.9	44.7	45.0	45.6	45.3	45.4
TiO_2	.44	.40	.38	.41	.47	.46	.39	.44	.40	.46	.41	.44	.44
Al_2O_3	7.5	7.7	7.7	7.2	7.6	7.6	7.6	7.5	7.4	7.4	7.8	7.5	7.6
Cr_2O_3	.38	.41	.42	.41	.41	.40	.41	.41	.41	.40	.40	.42	.41
FeO	18.9	18.9	19.3	199.4	19.5	19.5	19.6	19.6	19.7	19.7	19.7	19.8	19.9
NiO	.09	.05	.09	.08	.09	.08	.07	.08	*	.07	.11	.09	.09
MgO	17.8	16.9	17.1	17.5	18.4	18.1	17.4	17.4	17.3	17.6	17.4	18.1	18.0
CaO	7.7	8.1	8.3	7.9	8.1	8.0	7.5	8.0	7.9	8.1	8.2	8.0	8.0
Na_2O	.11	.08	.11	.10	.11	.16	.19	.11	.10	.11	.12	.07	.12
K_2O	.03	.03	.04	.03	.04	.03	.03	.03	.01	.03	.03	.03	.03
P_2O_5	*	*	*	.01	.01	*	*	*	*	*	*	*	*
ZrO_2	.02	.02	.02	.02	.02	*	*	.04	.02	*	.02	*	*
Total	97.62	97.39	98.66	97.43	100.25	99.53	98.69	98.51	97.94	98.87	99.79	99.77	99.99
CIPW Molecular Norms													
z	.02	.02	.02	.02	.02	--	--	.04	.02	--	.02	--	--
or	.19	.19	.25	.19	.24	.18	.19	.19	.07	.19	.18	.18	.18
ab	1.02	.75	1.01	.93	.99	1.45	.83	1.01	.93	1.01	1.09	.64	1.09
an	20.39	21.39	20.76	19.74	20.24	20.09	20.64	20.36	20.23	20.05	20.89	20.31	20.12
di	15.24	16.27	16.89	16.63	15.96	15.78	15.78	16.02	16.04	16.53	16.00	15.56	15.92
hy	31.55	32.94	31.44	29.99	29.11	29.18	32.16	31.20	31.90	30.31	31.47	30.88	29.85
ol	30.52	27.43	28.65	31.40	32.34	32.26	29.41	30.12	29.81	30.84	29.36	31.37	31.79
cm	.43	.47	.48	.47	.46	.45	.46	.47	.47	.45	.45	.47	.46
il	.64	.58	.55	.59	.66	.65	.56	.63	.58	.66	.58	.62	.62
ap	--	--	--	.03	.03	--	--	--	--	--	--	--	--

TABLE 15: CONTINUED

	14	15	16	17	18	19	20	21	22	23	24	225	26
SiO_2	45.1	45.7	45.3	45.4	45.4	45.1	45.0	45.6	45.5	45.0	45.6	45.6	44.8
TiO_2	.41	.44	.46	.44	.43	.40	.40	.45	.44	.44	.43	.45	.50
Al_2O_3	7.4	8.9	7.6	7.4	7.7	7.3	7.5	7.5	7.7	7.3	7.4	7.5	7.5
Cr_2O_3	.40	.46	.44	.42	.42	.41	.41	.39	.41	.43	.42	.42	.42
FeO	19.9	19.9	20.0	20.2	20.2	20.2	20.2	20.2	20.2	20.4	20.4	20.5	20.6
NiO	.05	.10	.06	.08	.09	.09	.08	.14	.09	.11	.07	.05	.09
MgO	17.7	16.6	18.1	17.6	17.1	17.6	17.2	17.9	17.4	17.8	18.0	17.7	17.1
CaO	7.8	9.3	8.0	8.1	8.4	8.0	8.3	8.1	8.3	8.1	8.0	8.2	9.3
Na_2O	.11	.09	.10	.17	.09	.08	.07	.14	.07	.10	.15	.08	.25
K_2O	.04	.03	.02	.05	.03	.04	.02	.03	.03	.04	.03	.03	.02
P_2O_5	*	*	.01	*	*	*	*	*	*	.02	*	.02	*
ZrO_2	*	*	.11	*	*	*	.02	.02	.02	.13	*	*	*
Total	98.91	101.52	100.20	99.86	99.96	99.27	99.20	100.47	100.16	99.87	100.50	100.55	100.58
CIPW Molecular Norms													
z	--	--	.10	--	--	--	.02	.02	.02	.12	--	--	--
or	.25	.18	.12	.30	.18	.24	.13	.18	.18	.24	.18	.18	.12
ab	1.01	.81	.91	1.54	.82	.73	.64	1.26	.64	.91	1.35	.73	2.26
an	20.00	23.76	20.19	19.53	20.70	19.79	20.53	19.90	20.68	19.44	19.51	20.11	19.45
di	15.53	17.53	15.59	16.76	17.24	16.56	16.98	16.18	16.80	16.78	16.30	16.38	21.50
hy	31.40	26.33	29.84	29.07	30.38	30.48	30.05	29.51	30.39	28.35	29.20	30.55	18.91
ol	30.82	30.30	32.13	31.73	29.63	31.13	30.65	31.92	30.25	33.04	31.42	30.95	36.62
cm	.45	.51	.49	.47	.47	.46	.46	.43	.46	.48	.47	.47	.47
il	.59	.61	.65	.62	.61	.64	.57	.63	.62	.62	.60	.63	.70
ap	--	--	.03	--	--	--	--	--	--	.05	--	.05	--

TABLE 16: GREEN GLASSES IN LOOSE FINES 15211,36

	1	2	3	4	5	6	7	8	9	10	11	12	13
SiO_2	45.6	44.8	45.5	45.6	46.3	45.5	45.2	45.3	46.4	46.3	45.1	45.9	45.7
TiO_2	.53	.49	.43	.42	.45	.48	.45	.46	.46	.44	.46	.49	.47
Al_2O_3	7.6	7.4	7.4	7.7	7.1	7.3	7.5	7.3	7.4	7.3	7.4	7.6	7.3
Cr_2O_3	.40	.41	.39	.40	.38	.41	.38	.39	.38	.38	.43	.40	.40
FeO	19.2	19.4	19.4	19.4	19.4	19.5	19.5	19.6	19.6	19.6	19.8	19.9	19.9
NiO	.09	.10	.12	.10	.12	.07	.11	.12	.11	.10	.10	.10	.10
MgO	17.0	17.7	17.6	16.7	18.2	17.3	17.7	17.8	18.0	17.7	18.5	17.2	17.5
CaO	8.0	7.9	8.0	8.4	8.0	8.1	8.0	7.9	8.0	8.0	8.1	8.5	8.0
Na_2O	.10	.06	.07	.09	.13	.06	.07	.07	.11	.08	.06	.08	.09
K_2O	.03	.03	.03	.02	.02	.05	.02	.02	.03	.02	.02	.03	.03
P_2O_5	*	*	*	*	*	*	*	*	.02	*	*	*	*
ZrO_2	.02	.02	.12	.06	.10	.05	.03	.05	.05	*	.02	.08	*
Total	98.57	98.31	99.06	98.89	100.20	98.82	98.96	99.01	100.56	99.92	99.99	100.28	99.49
CIPW Molecular Norms													
z	.02	.02	.12	.06	.10	.05	.03	.05	.05	--	.02	.08	--
or	.19	.19	.19	.13	.12	.31	.13	.13	.18	.12	.12	.18	.18
ab	.92	.56	.64	.83	1.18	.55	.64	.64	.99	.73	.55	.73	.82
an	20.67	20.30	20.12	20.99	18.73	19.91	20.31	19.88	19.59	19.66	19.95	20.44	19.69
di	15.96	15.85	16.19	17.27	17.02	6.89	16.07	15.94	16.15	16.28	16.33	17.63	16.43
hy	35.63	31.88	33.48	33.64	33.44	34.02	32.21	32.92	34.16	35.88	28.47	31.76	33.63
ol	25.45	30.07	28.26	26.08	28.39	27.17	29.59	29.38	27.81	26.32	33.48	28.09	28.16
cm	.45	.47	.44	.45	.42	.46	.43	.44	.42	.43	.48	.45	.45
il	.76	.70	.61	.60	.63	.69	.64	.66	.65	.62	.65	.69	.67
ap	--	--	--	--	--	--	--	--	.05	--	--	--	--

TABLE 16: CONTINUED

	14	15	16	17	18	19	20	21	22	23	24	25	26
SiO_2	45.6	44.9	44.8	45.4	45.7	45.5	45.1	46.0	45.1	44.7	45.3	44.7	44.5
TiO_2	.49	.44	.45	.46	.44	.45	.41	.58	.46	.46	.45	.45	.44
Al_2O_3	7.2	7.4	7.0	7.2	7.0	7.1	7.1	7.3	7.2	7.1	7.3	7.1	6.9
Cr_2O_3	.40	.44	.40	.39	.40	.39	.39	.39	.39	.40	.41	.40	.39
FeO	20.0	20.2	20.2	20.2	20.2	20.2	20.3	20.3	20.4	20.4	20.5	20.7	21.1
NiO	.07	.10	.10	.12	.11	.09	.13	.12	.10	.13	.11	.12	.12
MgO	17.4	17.6	17.0	16.9	17.5	17.1	17.1	17.7	17.5	17.6	17.0	17.7	17.7
CaO	8.0	8.1	8.0	8.3	8.1	8.1	8.2	8.6	8.1	8.5	8.2	8.1	8.7
Na_2O	.17	.10	.09	.07	.07	.09	.06	.21	.08	.08	.11	.08	.12
K_2O	.03	.03	.03	.03	.03	.02	.02	.24	.03	.03	.02	.03	.04
P_2O_5	.02	*	*	*	*	*	*	.03	*	*	*	*	*
ZrO_2	.04	.02	.06	*	.03	*	.09	.05	.05	.03	.08	.11	.04
Total	99.32	99.13	98.13	99.07	99.58	99.04	98.90	101.52	99.41	99.53	99.48	99.49	100.05
CIPW Molecular Norms													
z	.04	.02	.06	--	.03	--	.09	.05	.05	.03	.08	.11	.04
or	.18	.19	.19	.19	.18	.13	.13	1.41	.19	.18	.13	.18	.24
ab	1.55	.92	.84	.65	.64	.83	.56	1.88	.73	.73	1.01	.73	1.09
an	18.98	19.98	19.17	19.66	18.96	19.29	19.42	18.14	19.38	19.18	19.57	19.15	18.34
di	16.96	16.70	17.38	17.76	17.43	17.52	17.75	19.23	17.02	19.25	17.46	17.46	20.18
hy	32.32	29.32	31.90	32.86	33.19	33.23	31.63	24.54	30.58	25.51	31.11	27.43	21.93
ol	28.81	31.81	29.40	27.83	28.53	27.96	29.44	33.50	31.01	34.05	29.58	33.89	37.16
cm	.45	.50	.46	.44	.45	.44	.44	.43	.44	.45	.46	.45	.44
il	.70	.63	.65	.66	.63	.64	.59	.81	.66	.65	.64	.64	.62
ap	--	--	--	--	--	--	--	.07	--	--	--	--	--

TABLE 17: GREEN GLASSES IN LOOSE FINES 15221,56

	1	2	3	4	5	6	7	8
SiO_2	45.7	43.9	46.1	46.2	44.3	45.5	46.1	46.3
TiO_2	.43	.41	.41	.15	.45	.47	.43	.44
Al_2O_3	7.8	7.0	7.9	7.6	7.2	7.3	7.2	7.4
Cr_2O_3	.40	.38	.42	.39	.39	.36	.41	.40
FeO	18.9	19.4	19.6	19.6	19.9	19.9	20.0	20.0
NiO	.12	.12	.09	.10	.06	.09	.10	.08
MgO	16.7	16.7	17.2	18.1	17.0	17.7	18.7	17.5
CaO	8.5	7.9	8.6	8.2	8.2	8.1	8.0	8.2
Na_2O	.63	3.2	.10	.15	1.04	.45	.16	.19
K_2O	.03	.04	.05	.04	.03	.04	.04	.04
P_2O_5	*	.01	.01	*	*	*	*	.01
ZrO_2	*	*	*	*	*	.03	*	*
Total	99.31	99.06	100.48	100.53	98.57	99.94	101.14	100.48

CIPW Molecular Norms

z	--	--	--	--	--	.03	--	--
or	.18	.24	.30	.24	.18	.24	.24	.24
ab	5.73	9.25	.91	1.35	9.49	4.07	1.43	1.72
an	18.53	4.65	20.95	19.86	15.18	17.81	18.56	19.14
di	19.52	27.31	17.52	16.73	20.92	17.90	16.82	17.31
hy	22.66	--	31.33	30.36	9.69	24.47	29.33	32.00
ol	32.35	46.00	27.96	30.85	43.50	34.47	32.61	28.55
cm	.45	.42	.47	.43	.44	.40	.45	.45
il	.61	.57	.58	.21	.64	.66	.60	.62
ap	--	.03	.03	--	--	--	--	.03

	9	10	11	12	13	14	15	16
SiO_2	45.8	46.2	45.6	45.7	45.7	45.8	45.9	44.7
TiO_2	.45	.50	.45	.44	.40	.44	.49	.44
Al_2O_3	7.3	7.4	7.1	7.4	7.1	7.1	7.1	7.2
Cr_2O_3	.42	.41	.42	.39	.41	.39	.39	.44
FeO	20.1	20.1	20.3	20.4	20.5	20.5	20.5	20.8
NiO	.09	.10	.10	.10	.12	.10	.06	.13
MgO	17.9	17.6	17.1	17.8	17.8	17.9	18.2	17.6
CaO	8.1	8.3	8.3	8.1	8.1	7.9	8.2	8.2
Na_2O	.13	.12	*	.16	.15	.28	.16	.07
K_2O	.04	.04	.03	.04	.04	.04	.05	.01
P_2O_5	.01	.02	*	.01	*	.01	*	*
ZrO_2	*	*	.03	*	*	*	.05	.05
Total	100.34	100.79	99.43	100.54	100.32	100.46	101.10	99.64

CIPW Molecular Norms

z	--	--	.03	--	--	--	.05	.05
or	.24	.24	.19	.24	.24	.24	.30	.06
ab	1.18	1.08	--	1.44	1.36	2.52	1.44	.64
an	19.20	19.58	19.70	19.39	18.54	18.14	18.49	19.64
di	16.97	17.08	17.91	16.69	17.60	16.88	17.55	17.38
hy	30.67	32.23	33.73	29.39	29.64	28.43	28.42	27.38
ol	30.66	28.62	27.37	31.80	31.63	32.76	32.69	33.77
cm	.47	.46	.47	.43	.46	.43	.43	.49
il	.63	.70	.64	.62	.56	.62	.68	.63
ap	.03	.05	--	.03	--	.03	--	--

TABLE 18: GREEN GLASSES IN LOOSE FINES 15231,64

	1	2	3	4	5	6	7	8	9	10	11
SiO_2	46.1	45.6	45.8	45.9	46.1	45.7	45.7	45.5	45.9	45.4	45.5
TiO_2	.40	.47	.43	.44	.45	.44	.44	.47	.46	.41	.44
Al_2O_3	7.4	7.1	7.4	7.3	7.1	6.9	7.1	7.1	7.0	6.7	6.9
Cr_2O_3	.40	.40	.41	.40	.39	.40	.40	.38	.38	.38	.40
FeO	19.2	19.4	19.4	19.4	19.5	19.6	19.7	19.7	19.8	19.8	19.8
NiO	.11	.06	.07	.12	.09	.09	.05	.05	.05	.10	.06
MgO	17.7	18.2	17.7	17.7	17.1	17.2	17.9	17.2	18.0	17.3	17.6
CaO	8.1	7.9	8.1	8.1	8.2	8.5	8.0	8.2	8.2	8.1	8.1
Na_2O	.11	.13	.13	.11	.12	.08	.13	.10	*	.14	.13
K_2O	.04	.05	.06	.05	.06	.03	.04	.07	.07	.06	*
P_2O_5	*	*	*	*	.01	*	*	.01	*	*	*
ZrO_2	*	.06	*	*	.04	.04	*	*	.04	.04	.04
Total	99.56	99.37	99.50	99.52	99.11	98.98	99.46	98.78	99.90	98.43	98.97
CIPW Molecular Norms											
z	--	.06	--	--	.04	.04	--	--	.04	.04	.04
or	.24	.30	.36	.30	.37	.19	.24	.43	.42	.37	--
ab	1.00	1.18	1.18	1.00	1.10	.74	1.19	.92	--	1.29	1.19
an	19.65	18.89	19.51	19.43	18.84	18.73	18.75	19.06	19.11	17.88	18.65
di	16.77	16.61	17.02	16.79	18.03	19.32	17.24	17.98	17.45	18.76	17.88
hy	34.28	31.62	32.12	33.56	35.13	32.88	31.97	32.68	33.44	31.90	32.12
ol	27.07	30.62	28.77	27.88	25.43	27.07	29.57	27.84	28.50	28.78	29.08
cm	.45	.45	.46	.45	.44	.45	.45	.43	.43	.43	.45
il	.57	.67	.61	.63	.64	.63	.62	.67	.65	.59	.63
ap	--	--	--	--	.03	--	--	.03	--	--	--

	12	13	14	15	16	17	18	19	20	21	22
SiO_2	45.4	45.7	45.6	45.5	45.7	46.1	46.0	45.4	45.7	45.9	46.2
TiO_2	.44	.44	.46	.45	.44	.40	.44	.45	.43	.40	.35
Al_2O_3	6.9	6.9	6.9	6.9	7.0	7.0	7.1	7.0	6.9	7.0	6.5
Cr_2O_3	.41	.40	.41	.39	.40	.37	.40	.40	.41	.40	.37
FeO	20.0	20.0	20.1	20.2	20.2	20.2	20.2	20.4	20.4	20.4	20.5
NiO	.10	.05	.08	.06	.09	.09	.09	.07	.06	.07	.09
MgO	17.7	17.4	17.6	17.5	17.5	17.4	17.0	17.2	17.5	16.8	17.6
CaO	8.0	8.3	7.9	8.0	8.1	8.2	8.2	8.1	8.0	8.3	8.1
Na_2O	.19	.12	.10	.13	.11	.15	.15	.13	.12	.10	.01
K_2O	.08	.03	.07	.04	.04	.03	.05	.05	.04	.07	.02
P_2O_5	.01	.01	*	.01	.01	.02	.01	*	.01	*	.01
ZrO_2	.02	*	.04	*	.11	*	*	.04	*	*	*
Total	99.25	99.35	99.30	101.18	99.70	99.96	99.64	99.24	99.57	99.44	99.75
CIPW Molecular Norms											
z	.02	--	.04	--	.11	--	--	.04	--	--	--
or	.48	.19	.43	.24	.24	.18	.30	.31	.24	.43	.12
ab	1.74	1.10	.92	1.17	1.01	1.36	1.37	1.19	1.10	.92	.10
an	17.92	18.41	18.49	23.44	18.68	18.55	18.82	18.61	18.44	18.70	17.97
di	17.84	18.57	17.11	12.87	17.46	17.77	18.02	17.68	17.45	18.59	18.17
hy	29.66	32.20	32.95	29.16	32.40	33.03	33.13	31.69	32.52	33.49	36.07
ol	31.27	28.47	29.00	32.08	39.05	28.12	27.30	29.43	29.19	26.89	26.67
cm	.63	.45	.45	.43	.45	.42	.45	.45	.46	.45	.42
il	.03	.63	.66	.63	.63	.57	.63	.64	.61	.57	.50
ap	--	.03	--	.03	.03	.05	.03	--	.03	--	.03

TABLE 19: GLASSES IN MICROBRECCIA RAKE SAMPLE 15315,2-1

	6	1	13	3	16	2	4	7	14	9	12	5	8	15
SiO_2	48.4	41.9	43.2	45.2	43.3	45.5	45.1	37.4	36.9	42.6	38.6	42.8	43.6	42.8
TiO_2	1.38	9.8	.45	.48	.50	.43	.48	13.9	13.9	.48	3.6	3.7	.68	1.24
Al_2O_3	19.2	9.0	8.3	7.4	7.7	7.5	7.6	8.9	8.6	7.7	8.6	8.7	8.4	8.9
Cr_2O_3	.04	.22	.42	.40	.42	.39	.40	.32	.45	.44	.48	.46	.47	.42
FeO	9.1	17.9	18.5	19.5	19.7	19.8	19.9	20.1	20.6	20.2	20.6	21.6	21.8	21.9
MnO	*	.07	.13	.12	.13	.10	.11	.12	.11	.13	.19	.15	.13	.14
MgO	7.3	7.4	21.6	17.2	20.3	17.7	18.1	9.9	10.6	21.3	18.6	12.9	16.1	16.0
CaO	13.0	10.7	8.7	8.3	8.3	8.4	8.5	8.8	8.5	8.4	8.4	8.6	8.4	8.7
BaO	.09	.16	.08	.08	.08	.06	.06	.18	.18	.08	.10	.09	.09	.11
Na_2O	.88	.47	.09	.16	.13	.10	.12	.57	.57	.13	.41	.41	.36	.41
K_2O	.11	.23	.04	.05	.04	.04	.03	.19	.18	.05	.10	.11	.10	.11
P_2O_5	.05	.18	.04	.05	.05	.04	.04	.13	.12	.04	.06	.09	.09	.10
ZrO_2	.15	.30	.18	.14	.18	.16	.14	.21	.30	.22	.18	.20	.21	.24
Total	99.70	98.33	101.73	99.08	100.93	100.22	100.58	100.72	101.01	101.77	99.92	99.81	100.43	101.07
CIPW Molecular Norms														
q	1.01	3.60	--	--	--	--	--	--	--	--	--	--	--	--
z	.14	.30	.16	.13	.17	.15	.13	.21	.29	.20	.16	.19	.20	.22
or	.66	1.48	.23	.31	.24	.24	.18	1.20	1.14	.29	.60	.68	.60	.66
ab	8.01	4.60	.79	1.47	1.16	.91	1.08	5.47	5.45	1.14	1.29	3.83	3.27	.71
an	48.78	23.72	21.50	19.68	20.07	20.03	20.13	22.59	21.54	19.70	21.53	22.41	21.25	22.27
di	13.16	26.52	16.27	17.66	16.36	17.41	17.38	18.55	18.28	16.71	16.10	17.18	16.38	16.38
hy	26.17	24.27	8.88	29.72	13.47	29.27	25.59	25.84	22.92	6.50	.00	25.73	17.12	11.72
ol	--	--	51.06	29.83	47.32	30.90	34.34	4.93	9.03	54.27	53.14	23.88	39.53	42.66
cm	.05	.27	.45	.45	.46	.44	.44	.38	.53	.48	.53	.53	.53	.47
il	1.95	14.87	.61	.69	.69	.61	.67	20.59	20.60	.66	5.06	5.42	.96	1.74
ap	.11	.41	.09	.11	.11	.09	.09	.30	.27	.09	.13	.20	.20	.22
Color	C	Y	G	G	G	G	G	O	G	O	O	Y	Y	Y
Group	HAB	MISC	FP	FP	FP	FP	FP	IOB	FP	IOB	MISC	IOB	FP	MISC

TABLE 20: GLASSES IN MICROBRECCIA RAKE SAMPLE 15318

	40	6	33	42	30	5	31	29	13	20	36	11	25
SiO_2	44.3	46.6	46.1	46.4	48.2	48.3	49.8	49.9	51.4	45.3	43.7	44.6	44.5
TiO_2	.49	1.34	1.38	1.02	1.28	1.35	1.49	1.47	2.12	.42	4.8	.39	.42
Al_2O_3	25.1	19.3	19.4	19.2	18.8	18.1	17.1	17.5	15.6	7.7	10.2	7.4	7.2
Cr_2O_3	.10	.17	.13	.16	.23	.21	.20	.17	.23	.49	.28	.49	.48
FeO	6.2	8.0	8.3	8.4	8.9	9.2	9.8	10.3	10.3	18.7	20.2	20.4	20.4
MnO	.07	.07	.09	.08	.11	.12	.13	.12	.13	.25	.26	.27	.28
MgO	10.2	12.5	12.7	12.7	11.2	10.2	10.2	9.6	9.1	18.9	10.2	18.2	18.5
CaO	13.6	11.5	11.4	11.4	11.1	10.9	10.5	10.6	9.9	8.7	9.9	8.8	8.6
Na_2O	.64	.79	.61	.57	.64	.68	.77	.67	.74	.09	.48	.07	.08
K_2O	.21	.08	.34	.30	.32	.40	.44	.48	.55	.03	.21	.04	.02
P_2O_5	.15	.04	.11	.20	.25	.33	.34	.14	.57	.05	.19	.02	.05
ZrO_2	.02	.04	.03	.02	.10	.04	.10	.03	.16	*	.07	*	*
Total	101.08	100.43	100.59	100.45	101.13	99.83	100.87	100.98	100.80	100.63	100.49	100.68	100.53
CIPW Molecular Norms													
q	--	--	--	--	--	--	1.34	1.64	5.74	--	--	--	--
z	.02	.03	.03	.02	.09	.04	.09	.03	.21	--	--	--	--
or	1.21	.46	1.97	1.74	1.86	2.37	2.59	2.83	3.27	.18	1.29	.24	.12
an	63.25	48.05	48.31	48.14	46.82	45.32	41.76	43.25	37.75	20.39	26.06	19.75	19.23
ab	5.59	6.97	5.38	5.03	5.66	6.13	6.89	6.00	7.00	.80	4.48	.63	.72
di	1.16	6.22	5.20	4.96	4.69	5.42	6.34	6.66	6.38	17.74	18.96	19.00	18.48
hy	4.26	21.29	19.66	22.38	33.50	37.71	37.99	37.06	35.30	25.08	29.10	21.62	22.16
ol	23.45	14.88	17.20	17.76	4.85	.20	--	--	--	34.59	12.36	37.64	38.07
cm	.11	.18	.14	.17	.25	.23	.22	.19	.18	.53	.32	.54	.53
il	.66	1.83	1.89	1.40	1.76	1.89	2.07	2.04	2.97	.58	6.95	.54	.59
ap	.31	.08	.22	.41	.52	.69	.71	.29	1.20	.10	.41	.04	.10
Color	C	C	C	C	C	C	C	C	O	G	Y	G	G
Shape	F	F	S	F	F	F	F	F	F	S	F	S	S
Group	FP	HAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	FP	PIC	FP	FP

TABLE 20: CONTINUED

	8	22	34	18	46	17	43	50	3	4	14	16	23
SiO_2	44.6	44.4	44.5	44.1	44.4	44.1	44.2	44.1	44.3	44.3	44.2	43.9	43.6
TiO_2	.47	.39	.41	.49	.44	.46	.49	.48	.46	.41	.43	.44	.41
Al_2O_3	7.0	7.2	7.4	6.9	7.0	6.8	7.0	6.8	6.8	6.8	6.9	6.8	7.0
Cr_2O_3	.48	.47	.48	.48	.47	.48	.47	.48	.51	.51	.49	.50	.46
FeO	20.5	20.6	20.6	20.7	20.7	21.0	21.0	21.0	21.1	21.1	21.1	21.1	21.1
MnO	.28	.30	.27	.27	.28	.28	.26	.28	.29	.27	.24	.27	.28
MgO	19.2	18.3	18.1	19.1	18.4	18.9	18.6	18.9	19.1	18.5	18.6	18.8	18.6
CaO	8.2	8.7	8.8	8.3	8.6	8.3	8.5	8.5	8.2	8.4	8.5	8.2	8.4
Na_2O	.11	.11	.11	.09	.17	.13	.13	.06	.13	.11	.11	.09	.07
K_2O	.03	.03	.04	.04	.02	.02	.03	.04	.04	.03	.02	.03	.02
P_2O_5	.05	.05	.04	.03	.05	.04	.04	.04	.02	.04	.04	.03	.03
ZrO_2	*	*	*	*	*	*	*	.01	*	*	*	*	*
Total	100.92	100.55	100.75	100.50	100.53	100.51	100.72	100.69	100.95	100.47	100.63	100.16	99.97
CIPW Molecular Norms													
q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	--	--	--	--	--	--	--	--	--	--	--	--	--
or	.18	.18	.24	.23	.12	.12	.18	.24	.23	.18	.12	.18	.12
ab	.98	.99	.99	.81	1.53	1.17	1.16	.54	1.16	.99	.99	.81	.63
an	18.42	19.08	19.58	18.29	18.29	17.91	18.41	18.15	17.77	18.01	18.28	18.14	18.85
di	17.36	19.02	19.04	18.11	19.26	18.39	18.75	18.96	18.06	18.78	18.90	18.00	18.32
hy	22.20	20.65	20.68	20.15	20.07	19.85	19.56	19.77	19.97	21.53	20.02	20.50	19.01
ol	39.66	38.92	38.31	41.14	39.51	23.23	40.65	41.05	41.55	39.58	40.47	41.14	41.94
cm	.43	.52	.53	.53	.52	.53	.52	.53	.56	.56	.54	.55	.51
il	.65	.54	.57	.68	.61	.53	.68	.67	.64	.57	.60	.55	.57
ap	.10	.10	.08	.06	.10	.08	.08	.08	.04	.08	.08	.06	.06
Color	G	G	G	G	G	G	G	G	G	G	G	G	G
Shape	S	S	S	F	S	S	S	S	S	F	S	S	SS
Group	FP	FP	FP	FP	FP	FP	FP	FP	FP	FP	FP	FP	FP

TABLE 20: CONTINUED

	44	49	12	28	24	48	1	19	37	41	7	35	47
SiO_2	44.4	44.5	44.1	44.6	36.0	35.9	35.5	42.0	35.5	35.4	35.2	42.2	42.1
TiO_2	.45	.43	.47	.47	14.0	14.2	14.5	3.8	14.5	14.3	14.5	3.7	3.7
Al_2O_3	6.9	7.1	7.0	7.1	8.2	8.2	7.2	8.2	7.3	6.9	7.0	8.2	8.2
Cr_2O_3	.50	.47	.47	.46	.51	.50	.63	.50	.58	.70	.72	.52	.51
FeO	21.1	21.1	21.2	21.3	21.6	21.7	22.4	22.5	22.5	22.5	22.6	22.7	22.7
MnO	.30	.29	.28	.27	.24	.28	.29	.30	.28	.30	.27	.32	.32
MgO	18.9	18.4	18.6	18.7	10.8	10.5	12.4	13.3	11.5	12.3	12.6	13.6	13.7
CaO	8.4	8.5	8.5	8.7	8.8	8.7	8.1	8.6	8.3	8.2	8.0	8.7	8.6
Na_2O	.06	.10	.08	.08	.54	.53	.42	.31	.44	.44	.40	.32	.36
K_2O	.03	.02	.02	.05	.22	.19	.15	.11	.19	.18	.17	.11	.11
P_2O_5	.05	.03	.02	.03	.11	.14	.08	.10	.08	.06	.08	.09	.08
ZrO_2	*	*	*	.02	.09	.08	.09	.03	.06	.04	.12	.03	.02
Total	101.09	100.94	100.74	101.78	101.11	100.92	101.76	99.75	101.23	101.32	101.66	100.49	100.40

CIPW Molecular Norms

q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	--	--	--	.02	.09	.08	.09	.03	.06	.04	.11	.03	.02
or	.18	.12	.12	.29	1.38	1.19	.93	.68	1.19	1.12	1.06	.67	.67
ab	.54	.90	.72	.77	5.14	5.07	3.97	2.89	4.19	4.17	3.78	2.96	3.33
an	18.38	18.83	18.67	18.67	20.47	20.07	18.22	21.48	18.45	17.25	17.70	21.25	21.07
di	18.20	18.44	18.66	19.07	20.05	19.42	18.80	17.76	19.76	20.26	18.84	18.10	17.90
hy	21.30	21.45	19.79	19.37	16.34	18.48	17.79	23.11	18.10	16.17	16.78	21.45	20.50
ol	40.12	39.10	40.82	40.66	15.03	13.10	18.05	27.77	15.95	18.99	19.44	29.44	30.44
cm	.55	.51	.51	.50	.59	.58	.73	.57	.68	.81	.83	.59	.58
il	.62	.60	.65	.65	20.67	21.06	21.25	5.50	21.44	21.05	21.27	5.31	5.31
ap	.10	.06	.04	.06	.24	.31	.17	.22	.18	.13	.18	.19	.17
Color	G	G	G	G	O	O	O	Y	O	O	O	Y	Y
Shape	S	S	S	F	S	S	S	F	S	S	S	F	F
Group	FP	FP	FP	FP	IOB	IOB	IOB	PIC	IOB	IOB	IOB	PIC	PIC

TABLE 20: CONTINUED

	27	32	2	45	15	26	10	39	21	9
SiO_2	42.9	42.3	42.4	42.2	41.8	42.4	37.2	41.4	40.8	40.5
TiO_2	3.6	3.8	4.2	3.7	3.7	3.7	11.6	4.3	5.3	5.7
Al_2O_3	8.2	8.5	8.7	8.0	8.1	8.4	6.4	8.4	9.1	8.4
Cr_2O_3	.52	.53	.50	.53	.56	.52	.66	.48	.44	.39
FeO	22.8	22.8	22.9	22.9	23.0	23.3	23.4	23.4	23.5	25.3
MnO	.29	.30	.31	.30	.29	.28	.31	.31	.30	.32
MgO	13.4	13.2	12.5	13.7	13.8	13.2	13.0	12.3	10.4	9.8
CaO	8.7	8.9	9.0	8.7	8.5	8.8	7.6	8.9	9.6	9.5
Na_2O	.09	.37	.40	.32	.31	.38	.41	.38	.38	.37
K_2O	*	.11	.13	.11	.11	.09	.18	.13	.14	.15
P_2O_5	.04	.09	.12	.07	.03	.08	.09	.08	.09	.12
ZrO_2	.02	.03	.07	.03	.01	.03	.11	.03	.05	.01
Total	100.56	100.91	101.23	100.56	100.21	101.18	100.96	100.11	100.10	100.56

CIPW Molecular Norms

q	--	--	--	--	--	--	--	--	--	--
z	.02	.03	.07	.03	.01	.03	.10	.03	.05	.01
or	--	.67	.79	.67	.67	.54	1.12	.80	.87	.93
ab	.83	3.41	3.69	2.96	2.87	3.50	3.88	3.56	3.59	3.51
an	22.71	21.80	22.18	20.68	21.07	21.50	15.90	21.72	23.92	22.00
di	17.30	18.38	18.35	18.66	17.84	18.20	18.56	19.01	20.48	21.58
hy	30.27	20.32	21.59	20.93	20.09	20.48	20.71	19.01	18.38	18.42
ol	23.02	29.18	26.47	30.02	31.41	29.70	21.73	28.92	24.23	24.45
cm	.59	.60	.56	.60	.63	.58	.76	.55	.51	.45
il	5.18	5.41	6.05	5.31	5.33	5.29	17.02	6.24	7.77	8.39
ap	.09	.19	.26	.15	.06	.17	.20	.17	.20	.27
Color	Y	Y	Y	Y	Y	Y	O	Y	Y	Y
Shape	S	F	F	F	S	F	S	S	F	S
Group	PIC	PIC	PIC	PIC	PIC	PIC	IOB	PIC	PIC	PIC

TABLE 21: GLASSES IN MICROBRECCIA RAKE SAMPLE 15323

15323 - Chip A

	3	14	5	4	11	12	1	9	2	10	8	15	13	6	16
SiO_2	46.7	48.8	49.1	50.3	47.9	45.2	44.2	44.7	43.9	44.6	44.1	44.2	42.5	42.4	42.8
TiO_2	2.03	1.45	1.64	1.72	1.75	.44	.47	.45	.48	.45	.46	.45	3.7	3.8	3.7
Al_2O_3	16.8	17.5	17.1	16.3	16.2	7.7	7.6	7.3	7.3	7.1	7.0	6.9	7.9	8.2	8.0
Cr_2O_3	.18	.18	.23	.22	.18	.41	.46	.42	.46	.42	.42	.43	.51	.49	.54
FeO	9.7	9.8	10.0	10.3	10.6	19.2	20.3	20.4	20.4	20.9	20.9	21.3	22.6	22.6	23.5
MnO	.12	.12	.13	.12	.12	.26	.28	.28	.26	.28	.32	.32	.33	.31	.31
MgO	13.0	10.9	10.4	9.3	10.0	18.3	17.9	18.1	18.4	18.7	19.1	18.5	13.2	13.6	11.5
CaO	10.4	10.8	10.7	9.9	10.5	9.0	8.7	8.7	8.5	8.4	8.5	8.6	8.7	8.9	9.2
Na_2O	.45	.76	.72	.78	.69	.17	.14	.15	.14	.09	.12	.18	.41	.32	.26
K_2O	.19	.41	.38	.46	.54	*	*	*	*	*	.02	.03	.08	.06	.03
P_2O_5	.13	.30	.31	.34	.59	.01	.02	.01	.02	.01	.01	.03	.05	.08	.04
Total	99.70	101.02	100.71	99.74	99.07	100.69	100.07	100.53	99.86	100.95	100.95	100.94	99.98	100.76	99.88
CIPW Molecular Norms															
q	--	--	.59	3.67	.36	--	--	--	--	--	--	--	--	--	--
or	1.12	2.40	2.24	2.75	3.25	--	--	--	--	--	.12	.18	.49	.36	.18
ab	4.03	6.76	6.45	7.10	6.30	1.52	1.26	1.35	1.26	.80	1.07	1.61	3.82	2.95	2.45
an	43.21	42.73	42.21	40.16	40.22	20.16	20.23	19.27	19.41	18.90	18.40	17.88	20.21	21.35	21.59
di	5.98	6.72	6.98	5.89	7.10	19.38	18.44	18.99	18.30	18.04	18.76	19.58	19.37	18.80	20.82
hy	34.21	35.72	38.36	36.84	38.83	22.31	30.84	22.04	19.76	22.16	17.81	17.62	22.64	21.86	28.06
ol	8.16	2.85	--	--	--	35.54	38.02	37.20	40.03	38.99	42.72	41.98	27.43	28.50	20.79
cm	.20	.20	2.28	2.43	.21	.45	.51	.46	.51	.46	.46	.47	.58	.55	.62
il	2.82	2.00	.25	.24	2.48	.61	.66	.63	.67	.62	.64	.62	5.34	5.44	5.41
ap	.27	.62	.65	.76	1.26	.02	.04	.06	.04	.02	.02	.06	.11	.17	.09
Color	C	C	C	C	C	C	C	C	C	C	C	C	Y	O	Y
Shape	F	F	F	F	F	S	S	S	F	S	S	S	S	F	R
Group	AHAB	AHAB	AHAB	AHAB	AHAB	FP	FP	FP	FP	FP	FP	FP	PIC	PIC	PIC

R Rim of entire sample

TABLE 21: CONTINUED

15323 - Chip B

	25	27	32	17	16	31	29	23	18	26	19	30	21	22	20	24
SiO_2	48.0	49.2	46.5	46.4	46.1	44.4	45.0	44.0	44.8	44.7	43.6	42.9	35.4	35.4	42.2	40.2
TiO_2	1.34	1.50	1.27	1.42	1.31	.46	.48	.48	.45	.49	.50	3.8	14.8	14.7	3.8	5.0
Al_2O_3	18.8	17.1	16.8	16.3	16.2	7.1	7.3	7.0	7.4	6.9	6.9	8.1	7.2	7.3	8.2	8.8
Cr_2O_3	.21	.17	.25	.23	.25	.49	.51	.49	.44	.47	.46	.55	.47	.61	.45	.42
FeO	9.3	10.8	12.1	12.6	12.7	20.5	20.7	21.0	21.3	21.4	21.4	22.2	22.4	22.8	23.1	23.9
MnO	.09	.17	.14	.18	.17	.30	.27	.29	.31	.30	.29	.29	.32	.30	.30	.33
MgO	10.4	9.9	11.7	12.1	12.2	19.1	16.9	19.0	17.2	17.8	19.3	13.5	10.8	11.1	13.1	11.4
CaO	11.4	10.7	11.1	11.1	11.0	8.1	8.7	8.6	8.9	8.5	8.4	8.8	8.8	8.1	9.0	9.7
Na_2O	.63	.67	.48	.98	.35	.13	.08	.13	.13	.09	.13	.40	.49	.46	.37	.39
K_2O	.34	.42	.22	.16	.13	*	.03	*	*	.01	*	.06	.17	.14	.08	.13
P_2O_5	.24	.43	.18	.13	.07	*	.04	.02	.04	.02	.01	.11	.11	.04	.07	.07
Total	100.75	101.06	100.74	101.10	100.48	100.58	100.01	101.01	100.97	100.68	100.99	100.71	100.96	100.95	100.67	100.34

CIPW Molecular Norms

q	--	.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--
or	1.99	2.48	1.29	.94	.77	--	.18	--	--	.06	--	.36	1.07	.88	.49	.80
ab	5.62	6.00	4.29	4.28	3.14	1.16	.73	1.16	1.17	.81	1.16	3.69	4.70	4.41	3.43	3.66
an	47.14	42.33	42.89	41.58	42.25	18.74	19.72	18.42	19.66	18.47	18.14	20.70	18.09	18.62	21.13	22.88
di	5.97	6.26	8.64	9.82	9.48	17.06	18.98	19.10	19.47	18.99	18.57	18.76	22.20	19.19	19.57	21.56
hy	32.95	38.88	27.48	26.22	27.92	21.91	27.52	17.23	22.67	24.05	19.53	24.10	16.86	20.11	19.50	11.47
ol	3.75	--	12.99	14.68	14.19	39.94	31.56	42.85	35.83	36.36	45.38	26.09	14.29	14.14	29.48	31.71
cm	.23	.19	.27	.25	.27	.54	.57	.53	.48	.52	.50	.62	.55	.71	.51	.48
il	1.85	2.08	1.76	1.96	1.82	.64	.68	.66	.63	.68	.69	5.44	22.00	21.85	5.46	7.28
ap	.50	.90	.37	.27	.15	--	.08	.04	.08	.04	.02	.24	.24	.09	.15	.15
Color	C	C	G	G	G	C	C	C	C	C	Y	O	O	O	O	Y
Shape	F	F	R	R	R	S	F	S	S	S	S	F	F	F	F	S
Group	AHAB	AHAB	AHAB	AHAB	HAB	FP	FP	FP	FP	FP	FP	PIC	IOB	IOB	PIC	PIC

R Rim of entire sample

TABLE 22: GLASSES IN MICROBRECCIA RAKE SAMPLE 15327

	20	16	19	8	13	11	12	13A	10	9	15	17	14
SiO_2	42.2	47.0	48.9	49.5	49.5	50.6	49.6	51.5	44.6	44.4	44.3	42.2	41.9
TiO_2	.21	1.32	1.42	1.63	1.61	1.99	2.30	1.86	.45	.52	.44	3.8	4.3
Al_2O_3	30.6	18.1	17.7	16.8	17.2	13.5	16.2	14.6	7.5	7.1	7.1	8.6	8.6
Cr_2O_3	.08	.22	.22	.21	.18	.33	.21	.28	.51	.51	.49	.55	.51
FeO	4.2	7.8	9.4	10.0	10.1	10.9	11.4	11.9	20.7	21.0	21.3	22.5	22.8
MnO	.05	.12	.29	.13	.10	.13	.17	.13	.26	.27	.30	.32	.30
MgO	7.0	11.7	10.7	10.0	9.8	11.9	9.6	8.2	17.9	18.6	17.0	13.6	12.8
CaO	16.7	11.4	11.1	10.6	11.1	9.4	10.6	9.7	8.6	8.6	9.0	9.1	9.1
Na_2O	.06	2.37	.75	.71	.68	.62	.67	1.02	.11	.12	.11	.46	.39
K_2O	*	.70	.35	.45	.40	.28	.52	.86	.01	.01	.02	.08	.09
P_2O_5	*	.20	.19	.45	.18	.39	.37	.56	.01	.04	.04	.08	.07
Total	101.01	100.93	100.86	100.48	100.85	100.04	101.64	100.61	100.65	100.48	100.10	101.29	100.86
CIPW Molecular Norms													
q	+	--	--	1.79	1.20	3.63	1.97	4.53	--	--	--	--	--
or		4.01	2.05	2.66	2.36	1.67	3.06	5.15	.06	.06	.12	.48	.55
ab		14.30	6.68	6.39	6.10	5.61	6.00	9.28	.99	1.07	1.00	4.22	3.61
an		35.56	43.55	41.42	42.65	33.48	39.59	33.17	19.97	18.71	19.05	21.61	22.12
di		14.39	7.88	6.66	8.93	8.74	8.38	9.52	18.14	18.77	20.69	19.16	19.16
hy		--	35.40	37.62	35.94	42.92	36.79	34.23	22.74	20.03	21.48	16.38	19.11
ol		25.54	1.86	--	--	--	--	--	36.88	40.00	36.40	31.97	28.57
cm		.23	.24	.23	.20	.36	.23	.31	.56	.56	.54	.62	.58
il		1.78	1.96	2.28	2.24	2.79	3.20	2.62	.63	.72	.62	5.40	6.15
ap		.41	.39	.94	.38	.82	.77	1.19	.02	.08	.08	.17	.15
Color	C	C	C	C	C	C	Y	Y	C	O	OP	O	O
Shape	F	F	F	F	F	F	F	F	F	F	F	F	F
Group	ANT	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	FP	FP	FP	PIC	PIC

+ Insufficient SiO_2 for olivine

TABLE 23: MELT MATRIX AND GLASSES IN MICROBRECCIA RAKE SAMPLE 15332,1-1

	Melt Matrix			Spherule and fragmental inclusions									
	12	10	8	16	15	13	6	4	5	9	1	2	3
SiO_2	46.7	46.4	46.8	50.0	50.8	51.4	50.5	49.7	49.4	50.6	46.3	43.2	44.2
TiO_2	1.39	1.40	1.43	1.53	1.75	2.04	2.98	1.72	1.74	4.2	.38	13.5	3.2
Al_2O_3	16.9	16.5	16.5	16.5	15.6	14.8	14.1	13.8	13.8	9.9	7.1	7.1	8.5
Cr_2O_3	.19	.20	.12	.18	.23	.24	.11	.21	.22	.10	.41	.48	.33
FeO	10.8	11.1	11.4	9.1	9.4	9.7	11.3	12.0	12.1	15.4	19.8	21.0	21.0
MnO	.18	.19	.14	.17	.19	.17	.20	.22	.23	.24	.35	.33	.36
MgO	10.2	10.4	10.4	8.9	8.5	8.7	7.0	10.0	11.1	6.1	17.0	11.7	11.5
CaO	11.3	11.3	11.1	10.5	9.9	9.7	9.8	10.4	9.9	9.0	8.5	8.1	9.2
BaO	.07	.04	.09	.09	.10	.11	.21	.07	.09	.21	.03	.12	.08
Na_2O	.59	.49	.56	.63	.79	.64	.93	.63	.59	1.03	.07	.51	.36
K_2O	.27	.24	.24	.49	.64	.51	.82	.41	.48	1.05	.03	.15	.09
P_2O_5	.26	.25	.26	.24	.20	.22	.22	.25	.23	.21	.20	.17	.22
ZrO_2	.08	.08	.21	.17	.17	.33	.14	.09	.58	.15	.03	.09	.09
Total	98.93	98.59	98.85	98.48	98.27	98.40	98.50	99.55	100.03	98.72	100.40	99.45	99.21
CIPW Molecular Norms													
q	--	--	--	6.35	5.74	7.81	6.65	2.44	.96	7.70	--	--	--
z	.08	.08	.20	.15	.16	.16	.32	.13	.14	.56	.03	.09	.09
or	1.45	1.45	1.45	3.85	3.91	3.12	5.07	2.48	2.88	6.62	.18	.96	.56
ab	5.40	4.50	5.12	1.58	7.33	5.95	8.73	5.78	5.37	9.87	.64	4.93	3.40
an	43.54	43.06	42.54	43.84	38.33	37.25	33.33	34.33	34.01	20.57	19.16	17.89	22.37
di	9.56	10.13	9.56	6.86	8.97	9.01	13.13	13.46	11.49	20.80	17.73	19.48	19.35
hy	31.72	32.13	30.55	34.48	32.39	33.04	27.85	38.20	42.00	26.97	35.86	22.38	34.39
ol	5.54	5.93	7.91	--	--	--	--	--	--	--	25.02	13.15	14.22
cm	.22	.23	.14	.21	.27	.28	.13	.24	.25	.12	.46	.57	.39
il	1.98	2.00	2.03	2.21	2.52	2.94	4.34	2.45	2.46	6.36	.54	20.21	4.80
ap	.56	.54	.56	.52	.44	.48	.49	.54	.49	.47	.43	.39	.49
Group	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	MISC	FP	IOB	PIC

TABLE 24: GLASSES IN MICROBRECCIA RAKE SAMPLE 15337

	46	43	47	5	35	40	51	19	15	12	39	18
SiO_2	43.7	45.0	50.0	49.2	50.9	50.2	52.4	49.6	48.9	45.2	47.6	42.3
TiO_2	.19	.59	1.60	1.44	1.40	1.50	2.06	1.47	1.82	1.12	2.15	8.1
Al_2O_3	23.4	25.0	17.4	17.5	17.1	17.0	15.9	16.7	16.1	14.3	14.4	9.8
Cr_2O_3	.11	.11	.25	.20	.21	.21	.28	.25	.18	.35	.29	.45
FeO	5.1	5.9	9.6	9.8	9.9	10.2	10.4	10.5	12.1	14.5	17.0	17.6
MnO	.09	.09	.16	.17	.12	.16	.17	.16	.17	.21	.26	.29
MgO	14.6	9.5	10.3	10.0	9.2	9.3	8.8	10.0	8.6	13.7	7.8	10.8
CaO	13.0	14.7	10.7	11.1	11.2	10.9	9.9	10.9	11.0	11.2	10.3	11.5
Na_2O	.51	.06	.73	.72	.56	.63	.60	.75	.67	.28	.50	.12
K_2O	.05	.02	.38	.44	.37	.52	.54	.50	.66	.11	.26	.08
P_2O_5	.01	.02	.34	.34	.18	.38	.53	.43	.43	.08	.19	.01
ZrO_2	.01	*	.05	.07	.14	.12	.15	.05	.17	*	.12	.05
Total	100.77	100.99	101.51	100.98	101.23	101.12	101.73	101.31	100.80	100.95	100.87	101.10
CIPW Molecular Norms												
q	--	--	1.62	.42	3.84	2.73	7.57	.75	1.08	--	.67	--
z	.01	--	.04	.06	.13	.11	.14	.04	.16	--	.11	.05
or	.28	.12	2.22	2.59	2.18	3.07	3.19	2.94	3.94	.64	1.58	.49
ab	4.39	.53	6.49	6.43	5.02	5.65	5.39	6.70	6.08	2.50	4.61	1.12
an	58.91	66.61	42.65	43.03	43.00	42.03	39.16	40.52	39.40	37.22	37.31	26.95
di	2.30	3.84	6.16	7.65	9.04	7.65	5.24	8.38	10.34	14.00	11.15	25.76
hy	.26	15.69	37.64	36.88	34.23	35.65	35.01	37.47	35.34	19.90	40.75	29.25
ol	33.45	12.25	--	--	--	--	--	--	--	23.66	--	4.14
cm	.12	.12	.27	.22	.23	.23	.31	.27	.20	.38	.33	.51
il	.25	.81	2.21	2.00	1.95	2.09	2.87	2.04	2.56	1.55	3.08	11.71
ap	.02	.04	.70	.71	.38	.79	1.11	.89	.91	.17	.41	.02
Color	C	C	C	C	C	C	P	C	C	C	O	O
Shape	F	F	F	F	F	F	F	F	S	F	F	F
Group	ANT	ANT	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	BAS	BAS	BAS

TABLE 24: CONTINUED

	20	3	8	6	29	1	22	7	4	24	9	38
SiO_2	42.8	45.4	44.5	46.2	45.1	44.7	45.2	45.0	45.0	43.7	37.1	45.0
TiO_2	4.6	.38	.42	.98	.39	.43	.47	.50	.41	.37	13.9	.45
Al_2O_3	10.4	7.2	7.3	11.3	7.5	7.1	7.0	7.2	7.4	7.0	7.9	7.2
Cr_2O_3	.30	.49	.51	.33	.51	.47	.51	.49	.50	.50	.33	.48
FeO	20.0	20.1	20.2	20.3	20.3	20.4	20.4	20.5	20.5	20.6	20.9	21.0
MnO	.25	.29	.31	.32	.32	.28	.31	.31	.29	.29	.32	.28
MgO	10.2	17.4	18.0	9.1	17.3	17.8	18.0	17.5	17.9	18.8	8.8	8.9
CaO	11.4	8.9	8.7	11.8	8.9	8.5	8.8	8.5	8.6	8.8	10.0	8.9
Na_2O	.46	.19	.08	.20	.12	.16	.11	.08	.12	.08	.56	.14
K_2O	.20	.05	.06	.06	.04	.07	.04	.05	.08	.06	.24	.04
P_2O_5	.20	*	.02	.04	.02	*	.03	*	.08	*	.11	.01
ZrO_2	.04	.04	.04	*	.02	.02	*	.01	*	*	.10	*
Total	100.85	100.44	100.14	100.53	100.52	99.93	100.84	100.14	100.90	100.20	100.26	100.50
CIPW Molecular Norms												
q	--	--	--	--	--	--	--	--	--	--	--	--
z	.04	.04	.04	--	.02	.02	--	.01	--	--	.10	--
or	.22	.30	.36	.37	.24	.42	.24	.30	.47	.36	1.53	.24
ab	4.27	1.71	.72	1.86	1.08	1.45	.99	.72	1.08	.72	5.42	1.26
an	26.60	18.73	19.49	30.77	19.90	18.60	18.48	19.31	19.40	18.60	19.76	19.04
di	14.42	20.48	19.02	23.58	19.46	19.31	19.96	18.57	18.16	20.12	26.33	20.29
hy	16.78	24.22	22.42	29.63	24.43	23.07	24.18	26.71	23.92	16.13	19.61	23.89
ol	19.28	33.44	36.76	11.92	33.72	36.18	34.89	33.13	--	43.01	5.77	34.09
cm	.34	.54	.56	.37	.56	.52	.56	.54	.55	.55	.39	.53
il	6.62	.53	.59	1.41	.54	.60	.65	.70	.57	.52	20.86	.63
ap	.43	--	.04	.09	.04	--	.06	--	.17	--	.25	.02
Color	Y	G	G	C	G	G	G	G	G	G	O	G
Shape	F	F	S	F	S	S	S	S	S	S	F	S
Group	PIC	FP	FP	BAS	FP	FP	FP	FP	FP	FP	IOB	FP

TABLE 24: CONTINUED

	36	21	33	28	50	16	17	2	37	27	14
SiO_2	46.5	43.0	38.9	43.2	43.0	42.6	42.9	43.2	42.7	42.5	42.2
TiO_2	2.97	6.7	9.2	3.6	3.6	3.8	3.7	3.7	3.8	3.6	5.7
Al_2O_3	10.8	7.4	7.1	8.4	8.3	8.2	8.0	7.2	7.5	7.9	8.2
Cr_2O_3	.34	.37	.60	.44	.58	.56	.57	.55	.57	.56	.34
FeO	21.1	21.4	21.9	22.2	22.3	22.4	22.5	22.5	22.6	22.6	24.4
MnO	.32	.30	.34	.30	.33	.29	.31	22.5	.33	.33	.32
MgO	6.7	10.9	13.6	11.6	13.3	13.2	13.2	13.8	13.2	13.4	8.4
CaO	12.1	9.7	8.5	9.6	8.7	9.1	9.1	8.8	9.1	9.2	10.3
Na_2O	.23	.41	.39	.55	.35	.35	.33	.33	.36	.34	.37
K_2O	.11	.17	.14	.20	.14	.14	.14	.12	.14	.13	.18
P_2O_5	.07	.13	.03	.35	.06	.07	.08	.05	.08	.05	.10
ZrO_2	.01	.08	.01	.02	*	.05	.06	.04	.04	.04	.05
Total	101.28	100.56	100.71	100.46	100.66	100.66	100.90	101.60	100.42	100.35	100.56
CIPW Molecular Norms											
q	.39	--	--	--	--	--	--	--	--	--	--
z	.01	.08	.01	.02	--	.05	.06	.04	.04	.04	.05
or	.68	1.05	.86	1.22	.85	.85	.85	.73	.86	.79	1.13
ab	1.88	3.86	3.65	5.12	3.23	3.23	3.05	3.05	3.34	3.15	3.53
an	29.57	8.72	17.94	20.59	21.27	20.99	20.51	18.35	19.07	19.46	21.43
di	16.22	24.43	20.64	21.13	18.20	20.00	20.32	21.02	21.66	21.90	25.70
hy	36.37	31.36	18.43	22.18	24.52	21.12	22.59	24.86	21.91	19.82	25.26
ol	--	9.76	24.36	23.28	25.98	27.52	26.52	25.90	26.84	28.91	13.84
cm	.39	.42	.69	.50	.66	.63	.64	.62	.65	.64	.40
il	4.33	9.78	13.37	5.20	5.16	5.45	5.30	5.31	5.47	5.18	8.43
ap	.15	.28	.06	.76	.13	.15	.17	.11	.17	.11	.22
Color	B	O	O	Y	Y	Y	Y	Y	Y	Y	O
Shape	S	F	S	F	F	F	F	F	S	F	F
Group	BAS	BAS	IOB	PIC	PIC	PIC	PIC	PIC	PIC	PIC	PIC

TABLE 25: GLASSES IN MICROBRECCIA RAKE SAMPLE 15342,2-1

	10	14	2	16	15	20	7	22	30	5	19	27	28	31	8
SiO_2	45.0	47.6	48.0	49.6	49.3	42.9	46.3	45.8	45.3	45.7	45.1	45.8	45.6	45.9	46.2
TiO_2	.20	.99	1.03	1.50	1.65	.90	.53	.46	.41	.41	.44	.33	.40	.40	.49
Al_2O_3	27.9	21.6	20.5	18.8	18.0	15.8	11.2	7.9	7.7	8.1	8.0	8.0	8.1	7.9	9.1
Cr_2O_3	.09	.16	.13	.21	.19	.27	.38	.42	.43	.39	.42	.45	.41	.46	.50
FeO	4.0	7.4	8.3	9.4	9.6	15.9	19.3	19.3	19.4	19.5	19.5	19.5	19.5	19.7	20.0
MnO	.10	.15	.15	.18	.18	.26	.30	.31	.31	.32	.31	.34	.31	.31	.36
MgO	6.8	10.5	8.9	9.2	8.6	12.0	12.4	18.2	19.4	17.1	18.1	17.1	17.4	16.9	14.0
CaO	16.4	12.3	12.7	10.0	10.3	11.5	11.0	7.9	6.9	8.6	7.7	7.1	7.2	7.8	10.9
BaO	.04	.11	.12	.13	.16	.02	.06	.11	.07	.07	.08	.09	.08	.05	.09
Na_2O	.23	.32	.65	.60	2.45	*	.14	.07	.05	.13	.05	.02	.04	.04	.08
K_2O	.02	.33	.41	.58	.57	.04	.05	.06	.05	.05	.05	.05	.06	.05	.05
P_2O_5	.04	.14	.18	.40	.40	.03	.04	.05	.04	.04	.05	.04	.05	.04	.06
ZrO_2	.07	.07	.12	.26	.22	.09	.06	.07	.11	.06	.10	.07	.02	.09	.12
Total	100.89	101.67	101.19	100.86	101.62	100.81	101.76	100.65	100.17	100.47	99.90	98.89	99.17	99.64	101.95
CIPW Molecular Norms															
q	--	--	--	2.71	--	--	--	--	--	--	--	--	--	--	--
z	.07	.07	.11	.24	.20	.09	.06	.07	.10	.06	.10	.07	.02	.09	.11
or	.12	1.91	2.40	3.43	3.31	.24	.30	.36	.30	.30	.30	.31	.37	.30	.30
ab	2.04	2.82	5.79	5.40	21.61	--	1.27	.63	.45	1.18	.46	.19	.37	.37	.73
an	73.80	55.34	51.35	46.93	35.79	43.37	29.98	21.04	20.62	21.46	21.60	22.06	22.11	21.55	21.41
di	4.83	2.97	7.93	.28	9.70	11.37	19.84	14.39	10.76	17.00	13.34	11.06	11.22	14.05	23.70
hy	8.98	29.82	26.52	37.89	11.59	17.33	27.06	32.16	33.41	29.15	31.36	41.31	38.59	37.36	25.09
ol	9.74	5.31	4.00	--	14.54	24.60	20.27	30.18	33.26	29.80	31.38	23.98	26.23	25.15	24.34
cm	.10	.18	.15	.24	.21	.30	.43	.47	.48	.44	.47	.51	.46	.52	.56
il	.28	1.35	1.43	2.10	2.26	2.67	.75	.64	.58	.58	.62	.47	.57	.57	.69
ap	.09	.29	.38	.84	.83	.07	.09	.11	.09	.09	.11	.09	.11	.09	.13
Color	O	C	C	O	C	O	C	C	C	G	G	G	O	O	O
Group	ANT	HAB	AHAB	AHAB	AHAB	BAS	BAS	FP	FP	FP	FP	FP	FP	FP	BAS

TABLE 25: CONTINUED

	25	12	4	24	29	3	6	17	21	23	26	11	18
SiO_2	45.1	45.5	45.1	37.8	45.3	45.6	45.2	45.6	45.2	44.6	45.1	43.4	42.6
TiO_2	.43	.44	.48	13.1	.37	.43	.45	.41	.45	.46	.37	3.5	3.7
Al_2O_3	7.9	7.5	7.6	8.2	7.8	7.5	7.8	8.0	7.8	8.1	7.7	8.8	9.0
Cr_2O_3	.43	.40	.40	.38	.45	.39	.40	.41	.43	.48	.45	.48	.48
FeO	20.0	20.1	20.2	20.2	20.3	20.4	20.4	20.4	20.6	20.6	20.6	21.8	21.8
MnO	.29	.30	.30	.31	.32	.30	.30	.31	.30	.30	.32	.34	.34
MgO	18.4	17.6	18.8	9.6	17.3	17.9	17.7	17.8	17.7	16.6	17.8	12.9	13.0
CaO	7.5	8.3	8.0	9.2	7.4	8.3	8.2	8.1	8.2	8.4	7.7	8.5	8.3
BaO	.07	.06	.09	.19	.10	.06	.08	.09	.08	.09	.07	.10	.14
Na_2O	.06	.08	.09	.49	.04	.11	.10	.06	.07	.09	.08	.31	.37
K_2O	.05	.06	.05	.20	.05	.05	.05	.06	.05	.05	.06	.11	.12
P_2O_5	.04	.09	.04	.13	.04	.04	.04	.04	.05	.06	.04	.10	.09
ZrO_2	.03	.08	.05	.22	.14	.06	.09	.06	.11	1.15	.03	.10	.11
Total	100.30	100.51	101.20	100.05	99.61	101.18	100.81	101.34	101.04	100.98	100.32	100.52	100.07
CIPW Molecular Norms													
q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	.03	.08	.05	.22	.13	.06	.09	.06	.10	1.05	.03	.10	.11
or	.30	.36	.30	1.27	.30	.30	.30	.36	.30	.30	.36	.68	.74
ab	.54	.73	.81	4.73	.37	.99	.90	.54	.63	.82	.73	2.88	3.45
an	21.19	20.01	20.04	21.06	21.28	19.87	20.71	21.29	20.81	21.76	20.59	23.02	23.36
di	12.78	16.69	15.41	21.98	12.74	16.82	15.92	14.90	15.74	16.07	14.16	16.03	15.17
hy	30.81	29.86	25.85	26.36	35.31	27.83	27.47	29.52	27.78	25.16	30.03	29.75	26.16
ol	33.22	31.07	36.40	4.01	28.79	33.06	33.50	32.27	33.46	33.57	33.04	21.68	24.94
cm	.48	.45	.44	.45	.51	.43	.44	.45	.48	.54	.50	.55	.55
il	.61	.62	.67	19.66	.53	.60	.63	.57	.63	.65	.52	5.15	5.37
ap	.09	.19	.09	.30	.09	.09	.09	.09	.11	.13	.09	.22	.20
Color	G	C	G	O	G	G	G	G	G	O	G	Y	Y
Group	FP	FP	FP	IOB	FP	FP	FP	FP	FP	FP	FP	PIC	PIC

TABLE 26: GLASSES IN MICROBRECCIA RAKE SAMPLE 15343

	8	12	14	13	17	11	2	7	6	5	9	1	3	10	4
SiO_2	41.5	43.4	43.9	43.4	44.2	43.7	44.5	43.8	35.2	34.7	36.0	41.6	41.3	41.3	36.7
TiO_2	7.9	.48	.46	.45	.42	.45	.46	.42	14.2	14.0	11.7	4.3	3.6	3.7	11.4
Al_2O_3	10.2	6.8	7.1	6.9	7.2	7.0	7.0	7.0	.10	7.4	8.1	8.7	7.9	8.3	7.2
Cr_2O_3	.33	.43	.42	.44	.37	.41	.46	.40	.47	.54	.40	.48	.52	.42	.51
FeO	18.1	20.1	20.1	20.4	20.5	20.7	20.8	21.0	21.8	21.9	22.5	22.5	22.6	22.8	22.9
MnO	.20	.30	.30	.32	.29	.26	.26	.23	.24	.29	.24	.31	22.6	.26	.26
MgO	10.4	19.0	19.9	19.0	18.6	18.6	18.6	18.4	11.1	11.6	10.6	12.2	13.8	13.7	12.1
CaO	10.9	8.0	8.0	8.2	8.7	8.4	8.3	8.4	8.7	8.1	8.8	9.0	8.4	8.8	8.2
Na_2O	.10	.08	.11	.04	.10	.12	.09	.11	.46	.40	.48	.39	.38	.33	.48
K_2O	.09	.02	*	*	.04	*	*	.02	.17	.13	.14	.08	.08	.11	.18
P_2O_5	.03	.01	.06	.01	.02	.01	.01	*	.05	.06	.04	.08	.08	.07	.08
Total	99.75	98.62	100.35	99.16	100.44	99.65	100.48	99.78	100.49	99.12	99.00	99.64	98.97	99.79	100.01
CIPW Molecular Norms															
or	.56	.12	--	--	.24	--	--	.12	1.07	.83	.89	.49	.49	.67	1.12
ab	.94	.73	.98	.36	.90	1.09	.81	1.00	4.40	3.88	4.65	3.66	3.56	3.07	4.62
an	28.56	18.44	18.79	18.87	19.08	18.72	18.72	18.71	20.84	19.48	21.09	22.74	20.50	21.61	17.84
di	22.54	17.46	16.26	20.05	19.16	18.59	17.94	18.65	19.88	18.83	20.68	18.71	18.00	18.54	19.58
hy	30.51	21.22	19.85	20.34	19.04	19.20	23.12	19.52	15.13	17.95	14.28	21.14	19.05	16.64	13.94
ol	4.85	40.85	42.89	41.51	40.56	41.30	38.24	40.98	16.92	17.17	20.33	26.26	32.38	33.49	25.41
cm	.38	.48	.46	.49	.41	.45	.51	.44	.55	.64	.47	.55	.60	.48	.59
il	11.59	.68	.64	.63	.58	.63	.64	.59	21.09	21.09	17.59	6.26	5.24	5.34	16.73
ap	.07	.02	.12	.02	.04	.02	.02	--	.11	.14	.09	.17	.17	.15	.18
Color	O	C	C	C	C	O	C	C	O	O	O	A	A	A	O
Shape	F	S	S	S	F	S	S	F	F	F	S	S	F	F	S
Group	BAS	FP	FP	FP	FP	FP	FP	FP	IOB	IOB	IOB	PIC	PIC	PIC	IOB

TABLE 27: GLASSES IN MICROBRECCIA RAKE SAMPLE 15346

	9	32	34	3	4	5	8	39	27	53	15	2	29
SiO_2	46.6	46.8	46.8	46.5	46.3	45.9	46.1	46.2	45.0	46.4	41.6	45.7	36.2
TiO_2	1.49	1.46	1.43	1.60	1.64	1.63	1.63	1.62	1.83	1.68	8.3	.39	12.8
Al_2O_3	16.2	16.0	16.4	14.6	14.7	14.4	14.0	14.3	14.2	14.1	10.6	7.5	8.3
Cr_2O_3	.24	.23	.23	.27	.26	.27	.28	.30	.30	.28	.44	.45	.50
FeO	12.7	12.8	12.9	15.0	15.1	15.1	15.4	15.4	15.6	15.8	17.4	19.3	19.3
MnO	.17	.18	.18	.20	.22	.24	.22	.23	.25	.21	.26	.25	.30
MgO	11.1	11.1	11.0	11.2	11.0	11.0	11.0	11.0	10.6	11.1	10.6	18.4	10.6
CaO	11.2	11.1	11.0	10.8	11.1	10.8	10.7	10.3	10.9	10.5	10.9	8.9	8.2
Na_2O	.30	.66	.32	.21	.62	.66	.48	.47	.83	.40	.45	.12	.50
K_2O	.18	.16	.18	.08	.33	.29	.15	.41	.38	.17	.06	.03	.22
P_2O_5	.12	.10	.13	.03	.14	.08	.09	.20	.38	.12	.05	.03	.11
ZrO_2	.05	.09	.05	*	.01	.03	.02	*	*	.03	.01	*	.03
Total	100.35	101.28	100.62	100.49	101.42	100.40	100.07	100.43	100.27	100.79	100.67	101.07	97.06
CIPW Molecular Norms													
q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	.04	.08	.04	--	.01	.03	.02	--	--	.03	.01	--	.03
or	1.07	.95	1.07	.48	1.95	1.73	.90	2.45	2.28	1.02	.37	.18	1.43
ab	2.71	5.93	2.88	1.91	5.57	5.99	4.38	4.27	7.56	3.63	4.20	1.07	4.93
an	42.62	40.28	42.99	39.16	36.39	35.86	36.22	36.16	34.38	36.59	27.78	19.69	21.69
di	10.02	11.31	8.78	11.92	14.24	14.22	13.73	11.41	14.34	12.23	22.45	19.14	17.84
hy	32.73	26.79	33.92	35.46	22.31	22.34	29.42	29.43	17.13	32.20	24.52	25.19	24.96
ol	8.19	12.09	7.58	8.45	16.66	17.07	9.51	13.23	20.59	11.37	8.04	33.63	8.71
cm	.26	.25	.25	.30	.28	.30	.31	.33	.33	.31	.50	.49	.60
il	2.09	2.04	2.00	2.26	2.28	2.29	2.31	2.28	2.58	2.37	12.01	.54	19.57
ap	.25	.21	.27	.06	.29	.17	.19	.42	.81	.25	.11	.06	.25
Color	Y	Y	C	C	C	C	C	C	C	C	O	G	O
Shape	F	F	F	F	F	F	F	S	F	F	F	S	F
Group	BAS	BAS	BAS	BAS	BAS	BAS	BAS	BAS	BAS	BAS	IOB	FP	IOB

TABLE 27: CONTINUED

	43	6	36	48	23	22	37	50	1	12	21	52	16
SiO_2	41.3	43.7	43.6	43.9	44.5	44.4	43.6	44.0	44.4	44.1	44.3	43.8	44.0
TiO_2	9.2	5.2	5.0	.48	.40	.48	4.9	.47	.47	.45	.46	.50	.42
Al_2O_3	9.5	10.4	10.2	6.9	7.1	7.0	9.8	7.2	7.0	6.9	6.9	7.1	6.9
Cr_2O_3	.37	.26	.28	.46	.49	.45	.27	.47	.48	.47	.46	.46	.47
FeO	19.6	20.0	20.1	20.1	20.5	20.6	20.7	20.7	21.0	21.1	21.1	21.2	21.2
MnO	.28	.26	.26	.26	.29	.28	.27	.27	.28	.29	.31	.26	.28
MgO	8.6	8.9	10.1	19.5	18.2	19.0	10.4	18.6	19.1	18.8	18.9	19.0	18.7
CaO	11.0	10.5	9.9	8.2	8.8	8.6	9.7	8.3	8.4	8.4	8.4	8.3	8.5
Na_2O	.38	.46	.41	.07	.08	.10	.50	.05	.09	.12	.09	.07	.11
K_2O	.14	.22	.22	.03	.04	.04	.25	.07	.04	.04	.05	.04	.03
P_2O_5	.11	.20	.18	.03	.02	.03	.20	.02	.01	.02	.02	.02	.03
ZrO_2	.06	.04	.09	.02	*	*	.05	*	*	.03	*	*	*
Total	100.54	100.14	100.34	99.95	100.42	100.98	100.64	100.15	101.27	100.72	100.99	100.75	100.64

CIPW Molecular Norms

q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	.06	.04	.03	.02	--	--	.05	--	--	.03	--	--	--
or	.88	1.36	1.36	.18	.24	.23	1.53	.42	.23	.24	.29	.24	.18
ab	3.61	4.33	3.84	.63	.72	.89	4.66	.45	.80	1.08	.80	.63	.99
an	25.21	26.94	26.43	18.45	18.95	18.43	24.68	19.29	18.43	18.14	18.20	18.90	18.24
di	25.46	21.09	18.84	17.67	19.74	19.04	19.16	17.52	18.27	18.66	18.52	17.64	18.96
hy	28.69	30.47	30.72	20.35	21.27	40.72	28.29	21.23	19.74	18.93	19.83	18.63	18.54
ol	1.85	7.43	10.75	41.46	37.93	40.74	13.80	39.86	41.33	41.74	41.17	42.74	41.92
cm	.43	.30	.32	.51	.54	.49	.31	.52	.52	.52	.50	.50	.52
il	13.57	7.60	7.26	.67	.56	.66	7.09	.66	.65	.62	.64	.69	.58
ap	.24	.44	.39	.06	.04	.06	.43	.05	.02	.04	.04	.04	.06
Color	O	Y	Y	G	G	G	Y	G	G	G	G	G	G
Shape	F	F	F	S	F	S	F	S	S	S	S	F	S
Group	IOB	BAS	BAS	FP	FP	FP	BAS	FP	FP	FP	FP	FP	FP

TABLE 27: CONTINUED

	20	25	13	33	19	31	35	55	40	58	28	47	59
SiO_2	44.0	44.3	44.1	44.1	44.1	44.4	43.2	35.5	36.1	42.9	35.6	35.2	35.5
TiO_2	.47	.45	.43	.43	.48	.44	6.2	14.2	14.2	4.0	14.8	14.4	14.3
Al_2O_3	6.8	7.1	6.9	6.9	6.8	7.0	9.1	8.3	8.4	8.7	7.9	7.3	7.6
Cr_2O_3	.48	.47	.46	.48	.49	.47	.25	.46	.45	.50	.51	.58	.61
FeO	21.3	21.3	21.4	21.4	21.4	21.4	21.7	21.7	21.8	21.8	21.8	22.2	22.4
MnO	.30	.28	.30	.27	.31	.30	.27	.27	.26	.32	.30	.28	.29
MgO	19.1	18.5	18.8	18.6	18.8	18.7	8.9	10.3	10.2	14.3	10.8	11.7	11.5
CaO	8.3	8.6	8.5	8.4	8.6	8.5	10.4	8.8	9.0	9.5	8.7	8.3	8.4
Na_2O	.13	.10	.10	.07	.11	.12	.47	.52	.49	.02	.48	.43	.47
K_2O	.03	.04	.05	.05	.05	.05	.24	.21	.21	.03	.19	.18	.17
P_2O_5	.03	.03	.03	.03	.04	.05	.16	.08	.11	.07	.09	.07	.08
ZrO_2	*	.05	*	.01	*	*	.05	.02	.04	.02	.09	.08	.05
Total	100.94	101.22	101.07	100.74	101.18	101.43	101.94	100.36	101.26	102.16	101.26	100.72	101.37

CIPW Molecular Norms

q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	--	.04	--	.01	--	--	.05	.02	.04	.02	.09	.08	.05
or	.18	.24	.29	.30	.29	.29	1.49	1.33	1.32	.18	1.19	1.13	1.06
ab	1.16	.89	.89	.68	.98	1.07	4.42	5.00	4.67	.18	4.58	4.11	4.46
an	17.80	18.72	18.15	18.36	17.82	18.28	23.10	21.10	21.36	23.85	20.02	18.60	19.19
di	18.39	18.84	18.90	18.48	19.48	18.59	23.94	20.08	20.24	18.70	20.16	19.82	19.49
hy	18.16	19.17	18.17	20.03	17.62	19.17	28.47	16.37	18.19	25.08	18.04	16.97	16.62
ol	43.07	40.89	42.16	41.00	42.50	41.37	8.83	14.21	12.39	25.64	13.22	17.10	17.15
cm	.52	.51	.50	.53	.54	.51	.29	.54	.52	.56	.59	.68	.41
il	.65	.62	.60	.60	.66	.61	9.06	21.18	21.01	5.64	21.90	21.36	21.08
ap	.06	.06	.06	.06	.08	.10	.35	.18	.24	.15	.20	.16	.18
Color	G	O	G	G	G	G	Y	O	O	B	O	O	O
Shape	F	F	S	S	S	S	F	S	F	F	S	F	F
Group	FP	FP	FP	FP	FP	FP	BAS	IOB	IOB	PIC	IOB	IOB	IOB

TABLE 27: CONTINUED

	24	11	61	7	41	54	14	18	45	49	57	26	44
SiO_2	35.0	42.4	42.2	35.1	35.2	41.9	42.2	42.3	42.1	41.6	41.4	36.8	41.8
TiO_2	14.2	3.9	3.6	14.3	14.6	3.7	3.9	3.6	3.6	3.8	3.6	11.9	3.6
Al_2O_3	6.8	8.4	8.7	7.0	7.1	8.2	8.4	7.9	8.1	8.4	7.8	7.9	7.9
Cr_2O_3	.68	.49	.47	.69	.68	.55	.51	.54	.52	.51	.52	.49	.51
FeO	22.6	22.7	22.7	22.8	22.8	22.8	22.9	22.9	22.9	23.0	23.0	23.1	23.1
MnO	.29	.31	.33	.28	.29	.29	.33	.32	.31	.30	.30	.32	.30
MgO	12.5	13.1	12.6	12.7	12.1	13.5	13.1	13.8	13.6	13.6	14.0	11.1	14.2
CaO	8.1	8.8	8.9	8.1	8.2	8.5	8.9	8.6	8.6	8.6	8.2	8.6	8.6
Na_2O	.42	.37	.32	.43	.44	.37	.38	.32	.37	.32	.31	.44	.32
K_2O	.16	.13	.13	.20	.18	.12	.10	.11	.10	.14	.11	.16	.08
P_2O_5	.09	.11	.08	.06	.07	.08	.10	.08	.09	.07	.08	.11	.09
ZrO_2	.04	.05	*	.05	.10	.04	*	.06	.05	.03	.04	.05	.02
Total	100.88	100.76	100.03	101.71	101.76	100.05	10.82	100.53	100.34	100.37	99.36	100.97	100.57

CIPW Molecular Norms

q	--	--	--	--	--	--	--	--	--	--	--	--	--
z	.04	.05	--	.05	.10	.04	--	.06	.05	.03	.04	.05	.02
or	1.00	.79	.80	1.24	1.12	.73	.61	.67	.61	.85	.68	1.00	.48
ab	4.00	3.42	2.98	4.06	4.16	3.44	3.51	2.96	3.43	2.96	2.90	4.18	2.95
an	17.20	21.51	22.77	17.43	17.79	21.09	21.54	20.40	20.80	21.76	20.38	20.24	20.45
di	19.85	18.18	18.04	19.52	19.70	17.64	18.60	18.42	18.10	17.46	17.16	19.34	18.26
hy	15.45	21.89	22.18	13.71	15.63	20.57	20.38	21.61	20.45	18.69	11.97	17.47	18.81
ol	20.49	27.77	27.31	22.11	19.12	30.37	28.97	29.94	47.45	32.06	32.37	19.33	33.05
cm	.79	.55	.54	.80	.79	.62	.58	.61	.59	.58	.59	.57	.63
il	20.98	5.60	5.21	20.94	21.44	5.34	5.59	5.17	5.18	5.46	5.22	17.55	5.16
ap	.20	.24	.17	.13	.15	.17	.22	.17	.19	.15	.17	.24	.19
Color	O	Y	Y	O	O	Y	Y	Y	Y	Y	Y	O	Y
Shape	S	F	F	F	F	F	F	S	F	F	S	F	F
Group	IOB	PIC	PIC	IOB	IOB	PIC	PIC	PIC	PIC	PIC	PIC	IOBB	PIC

TABLE 27: CONTINUED

	46	56	38	42	30	60	17	51
SiO_2	41.5	36.0	43.0	36.5	44.0	36.7	41.3	41.8
TiO_2	4.2	11.8	6.6	11.7	3.2	12.0	2.30	1.40
Al_2O_3	8.2	8.1	9.6	7.4	8.3	8.2	8.2	8.0
Cr_2O_3	.49	.49	.18	.54	.54	.47	.40	.50
FeO	23.2	23.2	23.4	23.4	23.5	23.8	24.6	25.7
MnO	.30	.30	.33	.30	.31	.30	.34	.31
MgO	12.7	10.9	5.3	11.8	11.6	10.9	14.3	12.6
CaO	8.8	8.4	11.8	8.4	9.7	8.9	8.9	9.7
Na_2O	.43	.47	.34	.48	.32	.55	.32	.18
K_2O	.15	.19	.19	.16	.12	.18	.07	.09
P_2O_5	.10	.10	.37	.10	.09	.08	.04	.06
ZrO_2	.05	.03	.07	.08	.03	.04	.04	.01
Total	100.12	100.47	101.18	100.86	101.66	102.12	100.61	100.35
CIPW Molecular Norms								
q	--	--	.22	--	--	--	--	.00
z	.05	.03	.07	.08	.03	.04	.04	.01
or	.92	1.20	1.20	1.00	.73	1.11	.42	.55
ab	4.01	4.51	3.26	4.56	2.95	5.17	2.95	1.68
an	20.80	20.79	25.76	18.58	21.45	20.30	20.72	21.53
di	19.13	18.46	27.36	19.84	22.20	20.32	19.46	22.38
hy	18.07	14.73	31.26	14.38	25.19	11.52	9.91	11.74
ol	30.16	21.89	--	23.48	22.17	23.30	43.68	39.39
cm	.56	.58	.21	.63	.61	.54	.45	.57
il	6.08	17.58	9.82	17.23	4.58	17.51	3.29	2.02
ap	.22	.22	.83	.22	.08	.18	.08	.13
Color	Y	O	O	O	Y	O	Y	Y
Shape	F	S	F	S	S	S	S	S
Group	PIC	IOB	BAS	IOB	PIC	IOB	PIC	BAS

TABLE 28: GREEN GLASSES IN MICROBRECCIA RAKE SAMPLE 15349,2

	11	8	7	10	17	9	2
SiO_2	46.5	45.5	45.2	45.6	45.2	44.7	45.5
TiO_2	.49	.43	.46	.53	.47	.45	.45
Al_2O_3	8.5	8.1	7.6	7.8	7.5	7.6	7.8
Cr_2O_3	.39	.40	.39	.40	.40	.40	.39
FeO	19.2	19.6	20.1	20.1	20.4	20.4	20.8
MnO	.30	.32	.31	20.1	.32	.31	.30
MgO	16.4	16.1	17.0	17.3	16.6	16.4	16.9
BaO	.03	.02	*	.04	.03	.03	.04
CaO	8.6	8.6	8.1	8.1	8.3	8.5	8.3
Na_2O	.20	.23	.20	.19	.16	.20	.21
K_2O	.07	.05	.06	.07	.05	.06	.06
P_2O_5	.04	.03	.03	.04	.03	.03	.05
ZrO_2	.03	.04	.04	.03	.04	.04	.03
Total	100.69	99.36	99.46	100.48	99.43	99.05	100.56
CIPW Molecular Norms							
z	.03	.04	.04	.03	.04	.04	.04
or	.41	.30	.36	.42	.30	.36	.36
ab	1.80	2.10	1.82	1.71	1.46	1.83	1.89
an	22.10	21.29	19.96	20.30	19.95	20.09	20.23
di	16.37	17.62	16.50	15.97	17.52	18.35	16.76
hy	32.01	29.44	29.13	29.30	29.54	26.04	27.42
ol	26.09	28.09	31.05	31.01	31.02	32.14	32.14
cm	.43	.45	.43	.44	.45	.45	.43
il	.68	.61	.65	.74	.67	.64	.63
ap	.08	.06	.06	.08	.06	.06	.10

TABLE 29: GLASSES IN MICROBRECCIA RAKE SAMPLE 15352

	38	10	41	2	35	17	29	7	36	45	40	34	37	30	28
SiO_2	46.8	46.6	48.0	49.2	49.4	50.0	50.9	49.7	49.8	50.2	54.4	48.0	45.6	42.2	44.5
TiO_2	1.12	.86	1.57	.31	1.08	1.28	1.34	1.51	1.32	1.41	.61	4.0	1.32	7.8	4.5
Al_2O_3	20.3	18.7	19.4	17.8	18.5	17.1	18.0	17.2	17.5	16.6	13.9	18.3	16.3	10.4	10.9
Cr_2O_3	.14	.16	.14	.33	.21	.22	.18	.22	.21	.24	.43	.12	.30	.46	.29
FeO	8.0	8.0	8.5	8.6	9.4	9.4	9.6	9.7	9.8	10.0	10.1	11.2	12.4	18.2	19.5
MnO	.10	.09	.12	.14	.16	.11	.15	.19	.12	.13	.18	.19	.16	.30	.26
MgO	11.7	13.6	11.0	12.7	9.8	10.1	8.1	10.2	9.5	9.4	11.0	5.8	12.2	10.4	9.8
CaO	12.2	11.5	11.1	11.9	11.2	10.9	11.1	10.9	10.8	10.4	9.2	12.2	10.8	10.9	10.1
Na_2O	.09	.60	.58	.06	.62	.64	.69	.64	.55	.68	.16	.46	.44	.32	.48
K_2O	.07	.26	.34	.03	.38	.46	.56	.43	.40	.52	.03	.14	.19	.12	.30
P_2O_5	.01	.15	.09	*	.16	.29	.53	.41	.17	.43	*	.03	.17	.05	.16
ZrO_2	.06	.02	.12	*	.12	.12	.11	.08	.13	.12	*	.32	.06	.01	.07
Total	100.59	100.54	100.96	101.07	101.03	100.62	101.26	101.18	100.20	100.13	100.01	100.76	99.94	101.16	100.86
CIPW Molecular Norms															
q	--	--	--	--	.68	1.91	4.46	1.56	2.58	3.30	10.41	5.93	--	--	--
z	.05	.02	.11	--	.11	.11	.10	.07	.12	.11	--	.30	.05	.01	.06
or	.41	1.50	1.98	.17	2.23	2.71	3.31	2.52	2.38	3.10	.18	.85	1.13	.73	1.83
ab	.80	5.27	5.14	.53	5.53	5.74	6.20	5.71	4.96	6.16	1.45	4.24	3.96	2.98	4.46
an	54.15	46.53	48.72	47.42	46.29	42.39	44.39	42.55	44.35	41.07	37.55	48.74	42.11	27.57	27.62
di	4.48	6.64	4.06	8.50	6.30	7.78	5.78	6.84	6.72	6.52	6.89	10.56	8.44	2.52	18.50
hy	32.28	20.43	33.30	41.75	36.80	36.73	32.58	38.56	36.45	36.58	42.19	23.46	25.90	27.36	30.38
ol	6.11	17.95	4.18	.83	--	--	--	--	--	--	--	--	15.85	6.93	9.99
cm	.15	.17	.15	.36	.23	.24	.20	.24	.23	.26	.19	.14	.33	.52	.33
il	1.54	1.17	2.16	.42	1.49	1.78	1.87	2.09	1.85	1.98	1.67	5.72	1.84	11.26	6.48
ap	.02	.31	.18	--	.33	.61	1.11	.85	.36	.91	--	.06	.36	.11	.34
Color	C	C	C	C	C	C	C	P	C	C	C	Y	G	O	Y
Shape	F	S	F	F	S	F	F	F	S	F	F	F	R	F	F
Group	HAB	AHAB	AHAB	HAB	AHAB	AHAB	AHAB	AHAB	AHAB	AHAB	MISC	MISC	HAB	BAS	BAS

TABLE 29: CONTINUED

	44	3	22	16	4	47	42	1	24	6	20	19	32	49
SiO_2	45.1	44.9	44.3	44.9	45.4	44.0	44.3	45.3	36.5	36.0	36.4	42.2	42.2	41.8
TiO_2	.38	.45	.39	.43	.47	.39	.44	.39	13.4	14.2	13.8	3.7	4.0	4.2
Al_2O_3	7.4	7.3	7.7	7.1	7.1	7.1	7.0	6.9	8.6	7.9	8.2	8.6	8.8	8.6
Cr_2O_3	.51	.51	.52	.52	.51	.51	.49	.50	.48	.62	.59	.57	.49	.51
FeO	20.2	20.5	20.6	20.8	21.0	21.1	21.2	21.3	21.3	21.6	21.6	22.2	22.8	23.2
MnO	.28	.30	.30	.30	.31	.29	.27	.32	.29	.32	.31	22.2	.28	.30
MgO	17.8	17.6	17.7	17.8	17.0	18.4	18.2	17.6	10.3	10.4	10.6	12.9	12.0	12.1
CaO	8.6	8.6	8.9	8.6	8.6	8.4	8.6	8.6	9.0	8.9	9.0	9.1	9.6	9.0
Na_2O	.10	.13	.11	.14	.16	.14	.13	.16	.48	.45	.46	.39	.32	.33
K_2O	.07	.04	.06	.07	.07	.07	.06	.05	.21	.17	.20	.11	.12	.14
P_2O_5	.02	.03	*	.01	.02	*	.03	.02	.10	.05	.08	.07	.08	.09
ZrO_2	*	*	.01	.01	.04	.01	.04	.01	.06	.04	.05	.07	.06	.05
Total	100.46	100.36	100.59	100.68	100.68	100.41	100.76	101.15	100.72	100.65	101.28	100.22	100.45	100.32

CIPW Molecular Norms

q	--	--	--	--	--	--	--	--	--	--	--	--	--	--
z	--	--	.01	.01	.04	.01	.04	.01	.06	.04	.05	.06	.06	.05
or	.41	.24	.36	.41	.42	.41	.35	.30	1.32	1.07	1.25	.67	.74	.86
ab	.90	1.17	.99	1.26	1.44	1.26	1.17	1.44	4.59	4.32	4.38	3.62	2.98	3.08
an	19.60	19.32	20.38	18.58	18.56	18.58	18.35	17.96	22.03	20.36	20.90	22.14	23.08	22.46
di	18.45	18.70	23.09	19.28	19.38	18.54	19.31	19.64	19.84	21.20	20.68	19.28	19.43	18.72
hy	25.16	24.62	19.46	22.95	26.48	18.56	19.55	24.21	18.98	19.81	18.67	19.80	21.84	21.40
ol	34.34	34.69	38.60	36.30	32.41	41.52	40.02	35.31	12.54	11.20	12.84	28.29	25.35	26.56
cm	.56	.56	.57	.57	.56	.56	.54	.55	.56	.73	.69	.65	.56	.58
il	.53	.63	.54	.60	.66	.54	.61	.64	19.86	21.14	20.37	5.33	5.78	6.09
ap	.04	.06	--	.02	.04	--	.06	.04	.22	.11	.18	.15	.17	.20
Color	G	G	GP	G	G	G	G	G	O	O	O	Y	Y	Y
Shape	F	F	F	S	F	S	S	S	F	S	S	S	S	F
Group	FP	FP	FP	FP	FP	FP	FP	FP	IOB	IOB	IOB	PIC	PIC	PIC

TABLE 30: GREEN GLASS SPHERULES IN MICROBRECCIA RAKE SAMPLE 15365,1-1

	14	28	31	18	11	40	29	22	3	4	7	17	20	25	12
SiO_2	44.9	43.7	44.1	43.6	44.4	43.8	43.4	43.6	43.8	43.0	43.8	44.2	43.3	43.8	43.4
TiO_2	.43	.40	.42	.43	.43	.44	.45	.48	.38	.42	.41	.41	.44	.42	.45
Al_2O_3	8.7	7.9	7.6	7.4	7.8	7.2	7.7	7.2	7.3	8.2	7.6	7.5	7.1	7.4	7.4
Cr_2O_3	.48	.49	.52	.48	.51	.49	.48	.52	.49	.48	.51	.49	.51	.51	.50
FeO	20.1	20.5	20.6	21.3	21.5	21.6	21.7	21.7	21.8	21.8	21.8	21.8	21.8	21.8	22.1
MnO	.22	.27	.27	.25	.28	.22	.24	.24	.28	.27	.26	.26	.25	.29	.30
MgO	15.7	16.3	15.9	16.2	16.5	15.9	16.3	16.4	16.1	16.0	16.2	16.4	16.1	16.2	16.2
CaO	8.3	8.4	8.7	8.8	9.1	8.8	8.4	9.0	8.6	8.5	9.1	8.8	8.7	8.8	8.4
Na_2O	.09	.08	.14	.11	.13	.11	.10	.14	.12	.11	.10	.08	.11	.11	.16
K_2O	.02	.04	.05	.05	.05	.04	.03	.05	.04	.05	.04	.04	.05	.05	.06
P_2O_5	.03	.04	.02	.04	.04	.04	.04	.03	.02	.04	.03	.03	.03	.04	.04
Total	99.97	98.12	98.32	98.66	100.74	98.64	98.84	99.35	98.93	98.87	99.85	100.01	98.39	99.42	99.01
CIPW Molecular Norms															
or	.12	.24	.30	.30	.30	.24	.13	.30	.24	.30	.24	.24	.30	.30	.36
ab	.83	.74	1.30	1.02	1.18	1.02	.92	1.28	1.11	1.01	.91	.73	1.02	1.01	1.48
an	23.86	21.77	20.61	20.12	20.70	19.64	21.04	19.29	19.80	22.34	20.54	20.31	19.37	20.00	19.82
di	14.51	16.79	19.05	19.63	19.60	20.10	17.21	20.92	19.13	16.58	20.18	19.08	20.04	19.50	18.16
hy	32.52	26.01	25.55	21.99	20.70	23.62	22.90	19.08	23.21	20.34	19.91	23.13	21.34	21.76	21.18
ol	26.94	33.23	31.96	35.69	36.27	34.10	36.48	37.79	35.36	38.19	37.01	35.32	36.65	36.16	37.71
cm	.54	.56	.59	.55	.56	.56	.54	.58	.55	.54	.57	.56	.55	.57	.56
il	.61	.58	.60	.58	.60	.63	.64	.68	.54	.60	.58	.64	.63	.60	.56
ap	.06	.09	.04	.09	.08	.09	.08	.06	.04	.08	.06	.06	.06	.08	.08

BULK ANALYSES

TABLE 31: *CHONDRULES OF GREEN GLASS COMPOSITION IN MICROBRECCIA RAKE SAMPLE 15365,1-1*

	35	32	33	13	15	30	23	21	8	16	24
SiO_2	44.4	44.7	45.1	43.0	44.1	44.1	43.4	43.7	44.2	44.3	43.8
TiO_2	.43	.48	.46	.44	.51	.44	.40	.44	.42	.42	.50
Al_2O_3	8.9	9.1	8.9	9.3	9.4	8.7	8.4	8.0	8.3	7.7	8.8
Cr_2O_3	.48	.50	.50	.48	.49	.51	.50	.49	.47	.49	.53
FeO	20.3	20.4	20.4	20.5	20.5	20.5	20.7	20.8	20.9	20.9	21.2
MnO	.25	.24	.25	.25	.28	.26	.26	.25	.26	.25	.29
MgO	14.6	15.5	15.6	14.9	13.3	15.0	15.2	15.1	15.2	15.5	15.2
CaO	8.7	8.9	8.6	9.0	9.6	8.5	9.2	9.2	9.2	8.6	9.5
Na_2O	.10	.10	.12	.11	.13	.11	.10	.15	.11	.10	.11
K_2O	.04	.03	.03	.05	.05	.03	.05	.03	.06	.04	.02
P_2O_5	.04	.05	.04	.04	.06	.05	.04	.03	.03	.03	.05
Total	98.24	100.00	100.00	98.07	98.42	98.20	98.25	98.19	99.15	98.33	100.00
CIPW Molecular Norms											
or	.24	.18	.18	.31	.31	.18	.31	.18	.36	.24	.12
ab	.93	.91	1.09	1.02	1.21	1.02	.93	1.40	1.01	.93	1.01
an	24.60	24.67	24.02	25.64	25.93	24.00	23.11	21.84	22.56	21.16	23.89
di	15.91	15.86	15.22	16.29	18.57	15.49	19.08	20.21	19.27	18.23	19.01
hy	30.68	27.37	30.10	21.48	26.38	29.53	21.74	22.73	23.98	28.58	20.23
ol	26.38	29.66	28.09	33.99	26.18	28.45	33.60	32.37	31.61	29.62	34.33
cm	.55	.56	.56	.55	.56	.58	.57	.58	.53	.56	.59
il	.62	.68	.65	.64	.74	.64	.58	.64	.60	.61	.71
ap	.09	.11	.08	.09	.13	.11	.09	.06	.06	.06	.11

TABLE 31: CONTINUED

	6	27	38	10	1	2	34	9	19	37	5	36	39	26
SiO_2	43.3	44.2	43.3	44.1	43.6	43.6	44.4	43.9	43.1	43.4	42.9	43.5	44.6	44.2
TiO_2	.46	.43	.45	.40	.46	.48	.46	.48	.46	.39	.42	.48	.48	.45
Al_2O_3	8.9	9.0	8.3	8.7	9.2	8.7	8.0	8.6	8.5	8.3	8.0	9.2	8.4	7.9
Cr_2O_3	.50	.54	.48	.49	.49	.50	.50	.49	.52	.50	.49	.48	.51	.49
FeO	21.3	21.3	21.3	21.3	21.4	21.5	21.5	21.5	21.6	21.7	21.7	21.8	22.0	22.0
MnO	.25	.26	.24	.26	.27	.25	.26	.26	.28	.24	.26	.24	.27	.27
MgO	14.7	15.1	15.8	15.4	15.5	16.3	14.7	15.0	15.2	14.5	15.6	13.6	14.4	15.5
CaO	9.0	9.0	9.0	8.6	8.9	8.5	8.7	9.1	9.1	9.2	8.6	9.5	9.4	9.0
Na_2O	.15	.09	.10	.11	.11	.10	.16	.12	.10	.09	.14	.10	.13	.11
K_2O	.04	.03	.04	.04	.03	.02	.04	.05	.05	.02	.03	.02	.04	.04
P_2O_5	.05	.05	.04	.02	.04	.05	.04	.03	.03	.03	.05	.04	.04	.04
Total	98.65	100.00	99.05	99.42	100.00	100.00	98.76	99.53	98.94	98.37	98.19	98.96	100.27	100.00
CIPW Molecular Norms														
or	.24	.18	.24	.24	.18	.12	.24	.30	.30	.12	.18	.12	.24	.24
ab	1.39	.82	.92	1.01	1.00	.91	1.49	1.10	.92	.84	1.30	.93	1.19	1.01
an	24.28	24.52	22.65	23.67	24.93	23.57	21.72	23.34	23.28	23.06	21.88	25.49	22.69	21.36
di	17.22	16.51	18.30	15.88	15.75	15.10	18.13	18.16	18.41	19.33	17.59	18.46	19.72	19.12
hy	21.75	24.91	20.06	25.71	21.21	22.22	28.19	22.72	19.54	22.88	20.80	22.74	24.60	23.29
ol	33.77	31.73	36.55	32.31	35.64	36.74	28.95	33.07	36.24	32.56	36.97	30.94	30.21	33.71
cm	.57	.60	.54	.55	.55	.56	.57	.55	.59	.57	.56	.55	.57	.55
il	.66	.61	.64	.57	.65	.68	.62	.68	.66	.56	.61	.69	.68	.64
ap	.11	.11	.08	.04	.08	.11	.09	.06	.06	.06	.11	.09	.08	.08

TABLE 32: LARGE CHONDRULE AND ITS INTERSTITIAL GLASS IN MICROBRECCIA RAKE SAMPLE 15315,2-2

	37	23	8	19	15	27	38	32	36	24	9	39	6
SiO_2	49.4	48.7	47.4	48.5	48.3	47.8	47.3	46.6	47.8	46.2	45.6	46.6	45.9
TiO_2	.68	.65	.58	.64	.63	.65	.60	.61	.63	.56	.49	.58	.53
Al_2O_3	11.1	11.0	9.2	10.2	10.4	9.9	9.9	8.9	10.1	9.7	7.9	8.5	8.2
Cr_2O_3	.49	.54	.47	.53	.51	.62	.60	.52	.64	.56	.55	.52	.55
FeO	18.2	18.9	19.3	19.5	19.8	19.8	20.0	20.3	20.6	20.9	21.1	21.2	21.8
MnO	.43	.44	.40	.44	.42	.47	.45	.40	.46	.45	.44	.49	.44
MgO	4.8	6.1	8.8	6.8	7.3	7.1	6.6	7.6	7.0	8.7	10.7	9.8	9.8
CaO	13.9	12.8	10.8	12.6	12.6	13.1	12.2	12.9	12.7	11.7	11.1	11.6	11.3
Na_2O	.20	.15	.14	.13	.17	.11	.11	.11	.11	.12	.09	.11	.10
K_2O	*	*	*	*	*	*	*	*	*	*	*	*	*
P_2O_5	.02	.03	.04	.04	.04	.03	.02	.04	.02	.03	.01	.01	.02
Total	99.22	99.31	97.13	99.38	100.67	99.58	97.78	97.98	100.06	98.92	97.98	99.41	98.64
CIPW Molecular Norms													
q	4.92	3.19	.81	2.24	.76	.62	1.63	--	.40	--	--	--	--
ab	1.91	1.43	1.35	1.24	1.60	1.04	1.06	1.06	1.04	1.14	.86	1.04	.95
an	31.30	31.11	26.30	28.85	28.93	28.01	28.60	25.52	28.50	27.43	22.45	23.84	23.24
di	33.60	28.79	24.78	29.63	29.02	32.33	29.22	34.27	30.16	27.00	28.73	29.21	28.82
hy	26.66	33.83	45.25	36.39	38.10	36.26	37.83	34.77	38.20	34.74	32.56	34.34	33.49
ol	--	--	.00	--	--	--	--	2.75	--	8.16	14.01	10.11	12.04
cm	.57	.63	.55	.62	.59	.72	.71	.61	.74	.65	.64	.60	.64
il	1.01	.96	.87	.94	.92	.96	.90	.91	.92	.82	.72	.85	.78
ap	.04	.07	.09	.09	.09	.07	.04	.09	.04	.07	.02	.02	.04

MATRIX GLASS WITHIN A SINGLE CHONDRULE

TABLE 33: GLASS MATRIX IN GREEN GLASS CHONDRULES FROM MICROBRECCIA RAKE SAMPLE 15365,1-1

	Large Chondrule +	Interstitial glass 8	11	10	13	12	9	6
SiO_2	45.8	47.5	46.5	46.0	46.7	47.2	45.0	45.7
TiO_2	.46	.61	.45	.48	.53	.49	.50	.44
Al_2O_3	8.6	10.0	9.0	9.8	9.6	9.9	9.2	8.1
Cr_2O_3	.52	.55	.56	.52	.58	.55	.57	.56
FeO	19.7	19.6	20.2	20.3	20.5	20.8	21.4	21.5
MnO	.30	.54	.57	.52	.63	.58	.53	.50
MgO	15.2	7.9	9.8	8.3	8.4	8.5	10.3	12.2
CaO	9.3	12.5	11.3	12.1	11.9	11.5	11.4	10.6
Na_2O	.01	.14	.14	.13	.09	.20	.13	.09
K_2O	.08	*	.01	*	*	.01	*	*
P_2O_5	.03	.03	.01	.02	.02	.02	.04	.03
Total	100.00	99.37	98.54	98.17	98.95	98.75	99.07	99.72
CIPW Molecular Norms								
or	.06	--	.06	--	--	.06	--	--
ab	.73	1.32	1.33	1.24	.86	1.88	1.22	.84
an	23.46	28.09	25.24	27.88	27.31	27.36	25.75	22.50
di	18.59	29.63	27.11	28.76	28.04	25.87	26.68	25.45
hy	32.02	38.27	36.03	33.16	37.34	37.90	26.48	30.11
ol	23.84	1.09	8.90	7.59	4.96	5.54	18.39	19.56
cm	.58	.64	.64	.61	.67	.63	.66	.64
il	.65	.90	.66	.71	.78	.72	.73	.64
ap	.06	.07	.02	.04	.04	.04	.09	.06

+ 3.8 mm in diameter

OLIVINE

TABLE 34: SKELETAL OLIVINES IN LARGE CHONDRULE FROM MICROBRECCIA RAKE SAMPLE 15315,2-2

	7	4	2	5	3	6	1
SiO_2	39.2	39.0	39.3	39.3	39.6	39.1	39.3
TiO_2	.03	.05	.04	.05	.03	.05	.10
Cr_2O_3	.43	.43	.45	.38	.48	.47	.44
FeO	21.0	21.1	21.2	21.4	21.5	22.0	22.6
MnO	.31	.31	.32	.32	.31	.29	.35
MgO	38.2	38.8	38.2	38.8	36.4	36.2	37.3
CaO	.73	.86	.97	1.11	.92	.70	1.79
Total	99.90	100.55	100.48	101.36	99.24	98.81	101.88
Number of Ions on the Basis of 4 (O)							
Si	1.015	1.005	1.013	1.006	1.033	1.028	1.008
Ti	.001	.001	.001	.001	.001	.001	.002
Cr	.009	.009	.009	.008	.010	.010	.009
Fe	.455	.455	.457	.458	.469	.484	.485
Mn	.007	.007	.007	.007	.007	.007	.008
Mg	1.474	1.490	1.468	1.480	1.416	1.418	1.426
Ca	.020	.024	.027	.030	.026	.020	.049
Z	1.015	1.005	1.013	1.006	1.033	1.028	1.008
X	1.966	1.986	1.969	1.984	1.929	1.940	1.975
Sum	2.981	2.991	2.982	2.990	2.962	2.968	2.987
Molecular End Members							
Fo	76.4	76.6	76.3	76.4	75.1	74.6	74.6
Fa	23.6	23.4	23.7	23.6	24.9	25.4	25.4