

**Appendix 3: Normalized Analyses of Samples in the North Verde Volcanic Field in Weight Percent and CIPW Norms in Weight Percent.**

Sample Name	HM-W olivine mela- nephelinite*	US-77 hypersthene mugearite	S182-1 hypersthene benmoreite	S185-1 monzo- diorite	S186-1 nepheline hawaiite	S187-1 nepheline mugearite	S190-1 nepheline hawaiite	S191-1 nepheline hawaiite
Field I.R.S.	dike VAS	flow VTS	plug VTS	plug? VTS	flow VTS	dike VTS	flow VTS	flow VTS
SiO <sub>2</sub>	41.96	54.48	56.22	53.76	49.48	51.80	48.97	49.11
TiO <sub>2</sub>	1.76	1.19	0.99	2.18	2.08	1.54	1.75	1.76
Al <sub>2</sub> O <sub>3</sub>	12.22	18.19	17.67	16.77	13.98	16.32	14.11	14.21
FeO	10.84	7.63	7.07	8.33	11.35	9.22	10.37	10.33
MnO	0.19	0.14	0.14	0.14	0.17	0.15	0.16	0.16
MgO	13.93	2.99	2.54	3.07	7.57	4.79	8.96	8.59
CaO	12.65	7.40	6.72	6.73	9.20	9.91	9.54	9.76
Na <sub>2</sub> O	3.47	4.62	5.30	4.56	4.37	3.99	3.87	3.78
K <sub>2</sub> O	1.54	2.56	2.64	3.23	1.01	1.70	1.49	1.53
P <sub>2</sub> O <sub>5</sub>	1.44	0.80	0.70	1.25	0.80	0.59	0.79	0.79
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	69.64	41.12	39.08	39.62	54.34	48.10	60.65	59.74
%AN	100.00	33.96	25.88	27.80	31.30	37.73	38.08	38.79
Q	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00
or	0.67	15.06	15.42	19.08	5.91	10.03	8.70	8.95
ab	0.10	41.25	47.14	40.89	33.96	35.54	26.86	27.00
an	12.86	21.21	16.46	15.74	15.47	21.53	16.52	17.11
lc	6.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ne	18.15	0.00	0.00	0.00	2.99	0.15	4.46	3.93
di	31.17	8.10	9.63	7.55	19.73	18.93	20.09	20.56
hy	0.00	6.59	3.87	6.94	0.00	0.00	0.00	0.00
ol	21.94	1.64	2.05	0.00	13.60	7.23	15.91	14.97
mt	3.36	2.85	2.62	3.91	3.79	3.22	3.42	3.42
il	2.39	1.65	1.36	3.03	2.88	2.13	2.41	2.42
ap	2.93	1.65	1.45	2.61	1.66	1.23	1.64	1.63

Mg#: 100MgO/(MgO+FeO), where the oxides are first divided by their molecular weights.  
 %AN: 100an/(an+ab)

Notes: Aphanitic rocks are assigned volcanic names. Phaneritic rocks are assigned plutonic names.  
 \*olivine melanephelinite is based on CIPW norm; basanitic nephelinite is based on mode.  
 \*\*monchiquite is based on mode; basanite is based on chemistry.

I.R.S.: Igneous-Rock Series:

VAS: Verde alkaline series

VTS: Verde transitional series

VSS: Verde subalkaline series

CIPW norms calculated by Iqpet For Windows (M.J. Carr, 1994) with FeO/Fe<sub>2</sub>O<sub>3</sub> adjusted by the formula used by Irvine and Baragar (1971).

Abbreviations of CIPW norm minerals:

ab: albite  
 an: anorthite  
 ap: apatite  
 C: corundum  
 di: diopside  
 hem: hematite  
 hy: hypersthene  
 il: ilmenite  
 lc: leucite  
 mt: magnetite  
 ne: nepheline  
 ol: olivine  
 or: orthoclase  
 Q: quartz

Sample Name	S192-1 nepheline hawaiiite	S193-1 hypersthene hawaiiite	S194-1 basaltic andesite	S196-1 hypersthene mugearite	S198-1 hypersthene shoshonite	S199-1 nepheline mugearite	S200-1 basaltic andesite	S201-1 basaltic andesite
Field I.R.S.	plug VTS	flow VTS	flow VSS	flow VTS	dike VTS	dike VTS	dike VSS	dike VSS
SiO2	50.07	50.63	53.77	53.10	51.88	51.45	52.89	53.44
TiO2	1.97	2.02	1.54	1.49	1.57	1.52	1.48	1.53
Al2O3	14.45	15.05	15.37	16.36	16.84	16.80	16.25	16.34
FeO	10.25	11.47	9.12	8.22	9.18	8.87	9.42	9.55
MnO	0.16	0.16	0.15	0.17	0.16	0.14	0.18	0.15
MgO	7.47	6.50	5.69	4.92	4.94	4.49	4.84	4.47
CaO	8.53	8.64	9.14	9.78	8.93	9.72	9.44	9.08
Na2O	4.32	3.77	3.39	3.82	3.81	4.39	3.74	3.74
K2O	2.01	1.25	1.43	1.71	2.06	1.97	1.36	1.32
P2O5	0.78	0.53	0.39	0.43	0.64	0.63	0.42	0.38
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	56.52	50.26	52.65	51.66	48.96	47.44	47.81	45.48
%AN	31.52	37.71	42.57	39.60	39.93	38.36	41.23	41.62
Q	0.00	0.00	2.63	0.00	0.00	0.00	0.61	1.99
or	11.73	7.36	8.48	10.08	12.14	11.60	8.04	7.81
ab	30.30	33.85	30.44	34.16	34.17	32.44	33.60	33.67
an	13.95	20.49	22.56	22.40	22.71	20.19	23.57	24.00
ne	4.86	0.00	0.00	0.00	0.00	4.04	0.00	0.00
di	18.30	15.18	16.26	18.52	13.86	18.90	16.47	14.97
hy	0.00	7.60	13.46	8.15	4.20	0.00	11.58	11.38
ol	12.91	7.85	0.00	0.58	6.13	6.22	0.00	0.00
mt	3.64	3.75	3.19	3.13	3.28	3.18	3.18	3.23
il	2.71	2.82	2.15	2.07	2.18	2.11	2.07	2.14
ap	1.60	1.11	0.82	0.90	1.34	1.32	0.87	0.80

Sample Name	S203-1 nepheline shoshonite	S204-1 nepheline monzo- syenite	S204-2 syenitic urtite	S205-1 feldspar ijolite	S205-2 nepheline monzo- syenite	S205-3 feldspar ijolite	S209-1 basanitic* nephelinite	S210-5 nepheline monzo- syenite
Field I.R.S.	flow VTS	dike margin VAS	dike interior VAS	sheet bottom VAS	sheet middle VAS	sheet top VAS	dike VAS	sheet VAS
SiO2	51.79	47.27	45.60	46.39	48.84	44.00	43.66	50.45
TiO2	1.52	1.28	1.67	1.97	0.81	1.88	1.94	1.01
Al2O3	16.45	21.27	20.43	18.90	20.52	18.95	11.84	23.15
FeO	8.97	8.52	9.10	10.06	9.58	9.58	11.45	5.25
MnO	0.15	0.18	0.18	0.19	0.23	0.17	0.19	0.10
MgO	4.86	2.73	3.29	3.77	2.67	4.40	13.52	2.97
CaO	9.73	7.48	9.43	10.29	6.81	10.89	12.28	6.88
Na2O	3.94	5.47	5.60	3.44	5.31	5.60	2.97	5.30
K2O	1.96	4.86	3.48	3.65	4.57	3.06	1.26	4.15
P2O5	0.63	0.94	1.21	1.33	0.66	1.47	0.89	0.72
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	49.17	36.35	39.19	40.08	33.22	45.03	67.83	50.24
%AN	38.28	77.46	75.99	68.90	61.32	94.31	83.13	56.07
or	11.57	28.13	20.19	21.62	26.53	17.72	7.27	23.86
ab	34.38	5.46	6.31	11.46	11.58	1.04	3.03	20.70
an	21.33	18.75	19.96	25.38	18.36	17.22	14.93	26.42
ne	0.53	25.56	25.82	11.68	21.19	28.93	13.87	15.34
di	18.14	9.28	14.52	13.64	8.52	21.08	31.21	1.77
ol	7.41	6.19	5.07	6.94	8.84	4.88	21.68	6.50
mt	3.21	2.97	3.36	3.76	2.52	3.56	3.53	2.57
il	2.11	1.75	2.28	2.75	1.11	2.56	2.65	1.38
ap	1.32	1.92	2.49	2.78	1.35	3.02	1.83	1.47

Sample Name	S210-7 feldspar ijolite	S211-1 basaltic andesite	S212-1 hypersthene shoshonite	S213-1 hypersthene mugearite	S214-1 basaltic andesite	S216-1 basaltic andesite	S218-1 basaltic andesite	S220-1 hypersthene benmoreite
Field I.R.S.	sheet VAS	flow VSS	flow VTS	flow VTS	flow VSS	flow VSS	flow VSS	plug VTS
SiO2	45.19	53.41	54.10	54.37	52.98	52.93	52.62	56.13
TiO2	2.09	1.57	1.27	1.23	1.47	1.48	1.53	0.99
Al2O3	16.89	15.80	17.73	17.62	14.57	14.57	14.62	17.47
FeO	9.35	9.50	7.93	8.08	9.95	9.91	9.85	6.92
MnO	0.15	0.16	0.15	0.16	0.15	0.15	0.15	0.14
MgO	5.47	5.06	3.27	3.04	7.16	7.18	7.21	2.54
CaO	13.05	9.17	7.72	7.47	8.72	8.73	8.62	6.84
Na2O	3.63	3.62	4.53	4.69	3.24	3.12	3.37	5.13
K2O	2.26	1.30	2.57	2.57	1.38	1.52	1.59	3.13
P2O5	1.92	0.41	0.72	0.77	0.38	0.41	0.45	0.71
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	51.05	48.72	42.41	40.19	56.23	56.40	56.63	39.52
%AN	67.25	41.44	33.43	31.58	42.07	43.07	39.89	25.02
Q	0.00	2.07	0.00	0.00	0.78	0.90	0.00	0.00
or	13.34	7.72	15.11	15.08	8.12	8.98	9.36	18.32
ab	11.21	32.61	40.49	41.92	29.09	28.04	30.17	45.64
an	23.02	23.07	20.33	19.35	21.13	21.22	20.02	15.23
ne	12.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
di	23.19	15.86	10.47	9.99	15.70	15.50	15.78	11.04
hy	0.00	12.32	3.86	4.11	19.21	19.28	17.02	0.28
ol	5.78	0.00	3.54	3.32	0.00	0.00	1.42	4.06
mt	3.76	3.28	2.93	2.91	3.14	3.16	3.18	2.59
il	2.91	2.20	1.76	1.71	2.04	2.06	2.12	1.37
ap	4.01	0.87	1.50	1.61	0.79	0.86	0.93	1.46

Sample Name	S222-1 hypersthene mugearite	S222-2 monzo- diorite	S224-1H basaltic andesite	S224-1D quartz monzonite	S224-2 micro- diorite	S227-3 basaltic andesite	S229-1 nepheline hawaiiite	S232-1 syenite
Field I.R.S.	dike VTS	small dike VTS	dike VSS	segregation VSS	small dike VTS	dike VSS	dike VTS	small dike VTS
SiO2	53.62	59.13	53.26	63.86	52.04	53.85	50.24	61.45
TiO2	1.27	1.37	1.48	1.42	1.56	1.57	1.74	1.07
Al2O3	17.80	17.51	15.11	17.28	16.52	15.59	14.08	17.76
FeO	8.21	4.87	9.86	3.94	8.91	9.27	10.27	3.70
MnO	0.15	0.11	0.16	0.06	0.15	0.14	0.16	0.11
MgO	3.44	2.24	6.39	1.56	5.18	5.25	9.11	1.48
CaO	7.87	4.20	8.46	2.08	9.38	8.78	8.67	2.69
Na2O	4.55	5.56	3.65	4.65	3.66	3.71	3.90	5.92
K2O	2.34	4.49	1.30	4.87	1.88	1.43	1.26	5.47
P2O5	0.74	0.52	0.34	0.28	0.71	0.40	0.56	0.35
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	42.78	45.05	53.61	41.38	50.91	50.25	61.27	41.66
%AN	34.16	16.11	39.02	16.83	41.28	39.43	33.74	9.75
Q	0.00	0.41	0.46	11.23	0.00	2.07	0.00	0.23
or	13.78	26.10	7.68	28.60	11.09	8.47	7.35	31.64
ab	40.67	49.08	32.73	41.48	32.80	33.32	33.31	52.08
an	21.10	9.43	20.95	8.40	23.06	21.70	16.96	5.63
ne	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.00
C	0.00	0.00	0.00	1.37	0.00	0.00	0.00	0.00
di	10.38	6.17	15.03	0.00	15.02	15.43	17.50	4.15
hy	2.87	3.00	17.27	4.28	7.99	12.76	0.00	1.93
ol	5.00	0.00	0.00	0.00	3.16	0.00	17.20	0.00
mt	2.93	2.68	3.13	0.19	3.21	3.22	3.35	1.20
il	1.75	1.87	2.05	1.96	2.16	2.19	2.39	1.46
hem	0.00	0.19	0.00	1.91	0.00	0.00	0.00	0.96
ap	1.53	1.07	0.70	0.59	1.49	0.84	1.16	0.72

Sample Name	S236-3 hypersthene mugearite	S241-1 syenite	S245-1 basaltic andesite	S245-1a duplicate of S245-1	S246-1 hypersthene mugearite	S247-1 basaltic andesite	S248-1 basaltic andesite	S249-1 basaltic andesite
Field I.R.S.	plug VTS	segregation VTS	flow VSS		flow VTS	flow VSS	flow VSS	flow VSS
SiO2	54.59	60.43	54.09	53.98	52.82	54.29	53.75	52.16
TiO2	1.26	1.28	1.57	1.56	1.50	1.58	1.50	1.52
Al2O3	17.77	17.86	15.76	15.76	16.21	15.61	15.42	15.54
FeO	7.43	4.83	8.63	8.83	8.96	8.64	9.21	10.25
MnO	0.15	0.12	0.16	0.15	0.16	0.15	0.14	0.17
MgO	3.13	1.36	5.07	5.03	4.95	5.17	5.67	6.15
CaO	7.53	2.96	9.13	9.12	9.46	8.90	9.00	9.07
Na2O	4.94	5.51	3.73	3.73	3.96	3.71	3.60	3.45
K2O	2.50	5.23	1.44	1.43	1.50	1.55	1.35	1.23
P2O5	0.71	0.43	0.40	0.40	0.48	0.41	0.36	0.45
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	42.87	33.40	51.17	50.40	49.66	51.61	52.34	51.68
%AN	29.95	14.74	39.65	39.72	38.22	39.07	40.45	42.89
Q	0.00	1.73	2.44	2.29	0.00	2.61	1.89	0.00
or	14.66	30.47	8.53	8.47	8.87	9.13	7.99	7.30
ab	43.93	48.79	33.49	33.49	35.49	33.33	32.30	31.01
an	18.79	8.44	22.01	22.07	21.95	21.37	21.94	23.29
di	10.90	2.60	16.56	16.47	17.38	16.07	16.28	15.04
hy	0.73	2.46	10.72	10.99	8.22	11.21	13.62	16.97
ol	4.91	0.00	0.00	0.00	1.85	0.00	0.00	0.15
mt	2.86	2.87	3.22	3.21	3.14	3.22	3.14	3.17
il	1.74	1.75	2.19	2.18	2.09	2.19	2.09	2.13
ap	1.48	0.89	0.84	0.84	1.00	0.86	0.75	0.94

Sample Name	S250-1 basaltic andesite	S267-1 hawaiitic quartz subalkali basalt	LM331-2 basanite	MUMT341 basanite	MUMT342 monchiquite or basanite**	PS356 basanitic nephelinite	S363 basanite	CB364 basanitic alkali basalt
Field I.R.S.	flow VSS	bomb VSS	flow VAS	flow VAS	flow VAS	flow VAS	flow VAS	flow VAS
SiO2	53.21	50.94	41.71	44.15	47.01	41.75	44.69	45.14
TiO2	1.53	2.15	3.29	1.40	1.59	1.96	2.48	2.67
Al2O3	15.41	14.70	12.23	13.46	12.69	11.87	12.28	12.52
FeO	9.00	9.13	14.18	10.94	10.51	11.71	12.91	11.75
MnO	0.15	0.13	0.19	0.19	0.15	0.20	0.18	0.18
MgO	6.30	7.96	7.68	11.60	9.77	13.16	10.64	11.08
CaO	9.08	9.75	13.71	11.95	8.66	13.18	10.83	11.16
Na2O	3.56	2.78	3.72	4.15	5.22	3.55	3.40	3.27
K2O	1.37	1.49	1.30	0.89	2.77	0.91	1.55	1.36
P2O5	0.40	0.97	1.99	1.26	1.64	1.71	1.04	0.89
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	55.51	60.88	49.13	65.41	62.37	66.73	59.53	62.72
%AN	40.77	48.20	68.79	66.50	17.40	96.15	52.80	52.71
Q	0.80	1.04	0.00	0.00	0.00	0.00	0.00	0.00
or	8.05	8.81	7.75	5.13	15.92	5.26	9.05	7.94
ab	31.89	24.94	5.86	7.60	13.83	0.54	12.12	13.74
an	21.95	23.21	12.92	15.09	2.91	13.47	13.56	15.32
ne	0.00	0.00	16.63	17.24	19.09	18.37	10.91	9.16
di	16.30	15.04	33.97	27.72	22.77	31.67	26.39	26.96
hy	14.90	18.10	0.00	0.00	0.00	0.00	0.00	0.00
ol	0.00	0.00	9.00	19.75	16.82	20.98	18.25	17.03
mt	3.15	3.84	5.07	2.98	3.17	3.55	4.14	4.33
il	2.12	2.99	4.61	1.90	2.15	2.67	3.43	3.68
ap	0.83	2.03	4.18	2.58	3.33	3.49	2.15	1.84

Sample Name	PS378 nepheline mugearite	PS387-1 hawaiitic subalkali basalt	PS389 basanitic alkali basalt	MMT-24 basanitic nephelinite	CB-12 basanitic nephelinite	CB-13 nepheline monzo- syenite	CB-40E hawaiitic subalkali basalt	CB-37 hawaiitic basanitic alkali basalt
Field I.R.S.	flow VAS	flow VSS	dike VAS	dike VAS	dike VAS	segregation VAS	flow VSS	flow VTS
SiO2	49.75	51.48	46.04	43.50	42.15	49.88	50.94	48.10
TiO2	1.22	1.50	2.22	1.80	1.71	1.25	1.53	1.56
Al2O3	14.58	14.43	14.10	12.65	13.75	21.88	14.77	14.47
FeO	9.12	11.13	11.53	9.89	9.67	6.36	9.41	9.47
MnO	0.16	0.16	0.18	0.00	0.18	0.16	0.12	0.15
MgO	7.78	7.86	8.61	14.57	15.40	2.77	7.92	10.39
CaO	8.98	8.67	11.02	12.13	12.06	8.00	10.71	10.34
Na2O	5.27	3.62	3.67	3.35	3.31	4.45	3.02	3.80
K2O	1.83	0.85	1.64	1.23	0.80	4.10	0.94	0.96
P2O5	1.30	0.28	1.00	0.89	0.98	1.15	0.62	0.76
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mg#	60.34	55.75	57.09	72.44	73.97	43.66	60.02	66.19
%AN	27.80	38.80	51.98	92.94	99.47	55.87	46.91	44.71
or	10.56	5.03	9.59	7.03	4.53	23.84	5.53	5.58
ab	27.19	32.37	15.76	1.16	0.10	21.52	27.04	23.76
an	10.47	20.52	17.06	15.34	19.57	27.24	23.89	19.21
ne	11.44	0.00	10.15	16.77	17.13	10.71	0.00	5.78
di	19.80	16.37	24.55	29.83	25.56	3.57	20.01	20.96
hy	0.00	12.08	0.00	0.00	0.00	0.00	13.62	0.00
ol	13.42	7.82	13.86	22.30	25.59	6.14	3.29	17.88
mt	2.80	3.13	3.88	3.34	3.25	2.89	3.19	3.14
il	1.66	2.08	3.07	2.43	2.30	1.71	2.13	2.12
ap	2.66	0.59	2.08	1.80	1.97	2.38	1.30	1.56