Table 1: Criteria for Identifying Volcanic Rocks

Quartz - Alkali Feldspar - Plagioclase ratios
Feldspathoid - Alkali Feldspar - Plagioclase ratios
Plagioclase composition
Olivine Composition
Presence or absence of Ca-poor pyroxene
Color
Color Index
Grain size
Texture
Al_2O_3 - K_2O, Na_2O, CaO ratios
SiO_2 content
Alkali - Lime Index
Differentiation Index
Silica Activity
SiO_2 versus $Na_2O + K_2O$ (TAS)
CIPW Norm values
Mg Number
Glass Content

Table 2: Levels of Silica Saturation

Rock Type	Mineral Characteristics
Saturated	Rock contains silica polymorphs, usually quartz
Undersaturated	Rock contains neither silica polymorph nor feldspathoid
Critically Undersaturated	Rock contains feldspathoids, melilite

Table 3: Al_2O_3 ratios and rock types

Ratio	Rock Type
$Al_2O_3 > Na_2O + K_2O + CaO$	Peraluminous
$Na_2O + K_2O + CaO > Al_2O_3 > Na_2O + K_2O$	Metaluminous
$Na_2O + K_2O > Al_2O_3 > K_2O$	Peralkaline
$K_2O > Al_2O_3$	Hyperperalkaline*

*Rocks with this characteristic have not been assigned names in this classification. Hyperperalkaline is a name we coined for these rocks. Many authors have applied the term ultrapotassic to rocks in this category. However, rocks with high K_2O contents that do not possess the requisite Al_2O_3 ratio have also been called ultrapotassic. Rocks with Hyperperalkaline ratios are truly rare; they occur in the Leucite Hills of Wyoming (Cross, 1897), the west Kimberly area of Western Australia (Wade and Prider, 1940), and near Jumilla, Spain (Carmichael, 1967).

Table 4: Mineral Assemblages and Mafic Index.

Character of Mineral Assemblage	Range of Mafic Index
Felsic	0 - 30
Intermediate	30 - 60
Mafic	60 - 90
Ultramafic	90 - 100

We propose calling the volume percentage of mafic minerals in a rock the mafic index. In holocrystalline rocks, the mafic index and color index are identical. For rocks that contain glass, the two indices would differ if glass is considered a mafic phase and part of the mafic assemblage that makes up the color index.

Table 5: Modes in Nephelinites from Volcano Mountain, Yukon Territory, Canada (From Trupia, 1992).

Phase	XE02	VM2C	VM6C	VM4S
Augite	57.30	46.63	65.53	48.78
Olivine	23.42	18.49	25.36	23.99
Oxide	6.08	3.62	5.56	7.85
Leucite	8.55	9.52	—	—
Nepheline	2.89	—	1.77	—
Glass	1.76	21.74	1.78	19.38

Table 6: Al_2O_3 Rock Types and Mineral characteristics.

Rock Type	Mineral Characteristics
Peraluminous	White mica (muscovite) and epidote in plutonic rocks, topaz in volcanic rocks.
Metaluminous	Plagioclase
Peralkaline	No or very subordinate plagioclase (important). Aegirine augite or aegirine, alkali amphiboles, aenigmatite, anorthoclase or sanidine.
Hyperperalka-line	Magnesian mafic minerals, alkali amphiboles, wadeite, priderite, sanidine.

Table 7: Normative Characteristics and Al_2O_3 Ratios.

Rock Type	CIPW Norm Characteristics
Peraluminous	Normative C +/- an
Metaluminous	Normative an
Peralkaline	Normative ac + ns, no normative an
Hyperperalkaline	Normative ks

Table 8: Identification of metaluminous volcanic rocks with color index and activity of silica. The glass index is zero and the presence or absence of Ca-poor pyroxenes is ignored.

	Mafic Index: Felsic	Intermediate	Mafic	Ultra-mafic
Rocks with SiO_2 Polymorph (Quartz)	Rhyolite	Andesite	Basalt	?
Rocks with Neither SiO_2 Polymorph Nor Feldspathoid	Trachyte	Trachybasalt	Basalt	Pic-rite
Rocks with Feldspathoid	Phonolite	Tephrite	Basalt	Neph-elinite
	0	30	60	90

a_{SiO_2}

Table 9: Rock Types in the Basaltic Rock Suites

Approximate Mafic Index	Tholeiite Basalt Suite	Olivine Basalt Suite	Alkali Olivine Basalt Suite
Mafic	Oceanite (<30% feldspar) Olivine Tholeiite (>5% olivine) Tholeiite Basalt	Olivine Basalt	Ankaramite (<30% feldspar) Basanite (>5% nepheline) Alkali Olivine Basalt
Intermediate	Icelandite	Trachybasalt Tristanite	Trachybasalt (>An50) Hawaiite (>An30) Mugearite (>An10)
Felsic	Dacite Rhyolite	Trachyte	Phonolite

Rocks in the Tholeiite Basalt suite contain Ca-poor pyroxene except in the most mafic varieties. Icelandites lack olivine and the basalts usually lack groundmass olivine. Rocks in the Alkali Olivine basalt suite lack Ca-poor pyroxene and can carry olivine as both phenocrysts and in the groundmass. In our classification, rocks in the Alkali Basalt Suite would carry a feldspathoid. Nepheline and leucite are found in basanites from western Canada. Olivine basalts carry neither Ca-poor pyroxene nor feldspathoid. At Craters of the Moon, mafic, intermediate, and felsic rocks carry olivine as phenocrysts and in the groundmass. Many rocks with neither Ca-poor pyroxene nor feldspathoids have been called transitional basalts. We prefer the term olivine basalt.

Table 10: Electron Microprobe Analyses and CIPW Wt Norms of Residual Glasses in a Nephelinite Groundmass.

Oxide	1	2	3	4	5	10
SiO_2	50.45	50.89	50.57	48.83	48.60	48.50
TiO_2	1.11	0.95	1.02	1.44	0.94	1.52
Al_2O_3	21.51	24.39	22.35	21.99	21.65	20.22
FeO(T)	4.88	3.52	4.81	4.47	5.95	6.70
MgO	0.84	0.69	1.16	1.56	0.93	1.19
CaO	1.04	0.71	1.33	2.58	2.44	2.23
Na_2O	11.59	14.57	12.19	13.76	12.05	12.50
K_2O	6.01	3.31	4.37	3.15	4.91	4.45
P_2O_5	1.28	1.03	0.96	1.28	0.84	1.87
F	0.04	0.02	0.01	0.03	0.05	0.06
Sum	98.75	100.08	98.77	99.09	98.36	99.24

Mineral	1	2	3	4	5	10
or	35.52	19.56	25.83	18.62	29.02	26.30
pl	11.18	22.27	19.74	18.67	7.70	15.62
(ab)	11.18	22.27	19.74	18.67	7.70	15.62
ne	35.76	45.91	38.40	41.66	41.35	34.46
ns	4.86	3.79	2.91	4.86	4.18	6.18
di			0.28	3.72	5.72	
(wo)			0.14	1.85	2.76	
(en)			0.04	0.75	0.59	
(fs)			0.10	1.12	2.37	
ol	6.97	4.98	7.44	5.84	6.62	9.64
(fo)	1.47	1.20	2.00	2.20	1.21	2.08
(fa)	5.50	3.78	5.44	3.64	5.41	7.56
il	2.11	1.80	1.94	2.73	1.79	2.89
ap	1.82	1.25	2.22	2.97	1.95	3.92
P_2O_5	0.49	0.49				0.18

Data from Trupia (1992), Sample VM1. Analyses were made at different localities on several disconnected patches of glass.

Table 10: Electron Microprobe Analyses and CIPW Wt Norms of Residual Glasses in a Nephelinite Groundmass (cont.).

Oxide	1	2	3	4	5
SiO_2	54.33	56.23	54.47	53.72	55.99
TiO_2	0.37	0.67	0.33	0.15	0.15
Al_2O_3	24.57	20.88	25.67	27.55	27.45
FeO(T)	1.75	2.50	1.24	0.67	0.83
MgO	0.21	0.35	0.12	0.08	0.09
CaO	0.17	0.34	0.21	0.14	0.22
Na_2O	13.97	8.77	14.35	13.77	9.80
K_2O	2.98	6.37	2.63	1.68	2.52
P_2O_5	0.33	0.72	0.72	0.10	0.11
F	0.00	0.00	0.01	0.05	0.02
Sum	98.68	96.83	99.75	97.91	97.18

Mineral	1	2	3	4	5
C				3.06	8.46
or	17.61	37.64	15.54	9.93	14.89
pl	35.03	30.67	36.14	44.31	58.91
(an)				0.04	0.37
(ab)	35.03	30.67	36.14	44.38	58.54
ne	40.50	22.36	44.02	39.14	13.21
ns	1.96	0.53	0.94		
ol	2.38	3.30	1.55	0.90	1.14
(fo)	0.37	0.61	0.21	0.14	0.16
(fa)	2.01	2.69	1.34	0.76	0.98
il	0.70	1.27	0.63	0.28	0.28
ap	0.30	0.60	0.37	0.23	0.25
P_2O_5	0.20	0.46	0.56		

Data from Trupia (1992), Sample VM6C. Analyses were made at different localities on several disconnected patches of glass.

Table 10: Electron Microprobe Analyses CIPW Wt Norms of Residual Glasses in a Nephelinite Groundmass (cont.).

Oxide	1	2	3	4	5	8
SiO_2	49.09	49.68	49.19	49.63	49.46	50.99
TiO_2	2.08	1.99	1.94	2.03	2.04	1.60
Al_2O_3	19.3	19.57	18.27	18.59	19.83	20.61
FeO(T)	9.35	9.17	8.48	8.39	6.32	6.70
MgO	1.71	1.71	1.34	1.35	0.93	1.20
CaO	3.79	3.8	3.33	3.37	4.38	3.07
Na_2O	7.78	7.72	7.34	7.1	8.26	7.78
K_2O	4.78	4.79	5.19	5.17	4.66	5.35
P_2O_5	1.33	1.44	1.33	1.46	1.48	1.51
F	0.02	0.16	0.06	0.09	0.12	0.14
Sum	99.23	100.03	96.47	97.18	97.48	98.95

Mineral	1	2	3	4	5	8
C						0.05
or	28.25	28.31	30.67	30.55	27.54	31.62
pl	20.30	23.06	20.28	24.56	22.43	27.23
(an)	3.62	4.60	1.57	3.58	3.27	5.37
(ab)	16.68	18.46	18.71	20.98	19.16	21.86
ne	26.63	25.38	23.51	21.18	27.48	23.82
di	5.58	4.16	5.39	3.10	7.57	
(wo)	2.71	2.02	2.61	1.50	3.67	
(en)	0.68	0.51	0.59	0.35	0.86	
(fs)	2.19	1.62	2.19	1.25	3.04	
ol	11.43	11.84	9.78	10.46	5.03	9.55
(fo)	2.51	2.63	1.92	2.11	1.02	2.09
(fa)	8.92	9.21	7.86	8.35	4.01	7.46
il	3.95	3.78	3.68	3.86	3.87	3.04
ap	3.08	3.34	3.08	3.38	3.43	3.50

Data from Trupia (1992), Sample VM4S. Analyses were made at different localities on several disconnected patches of glass.