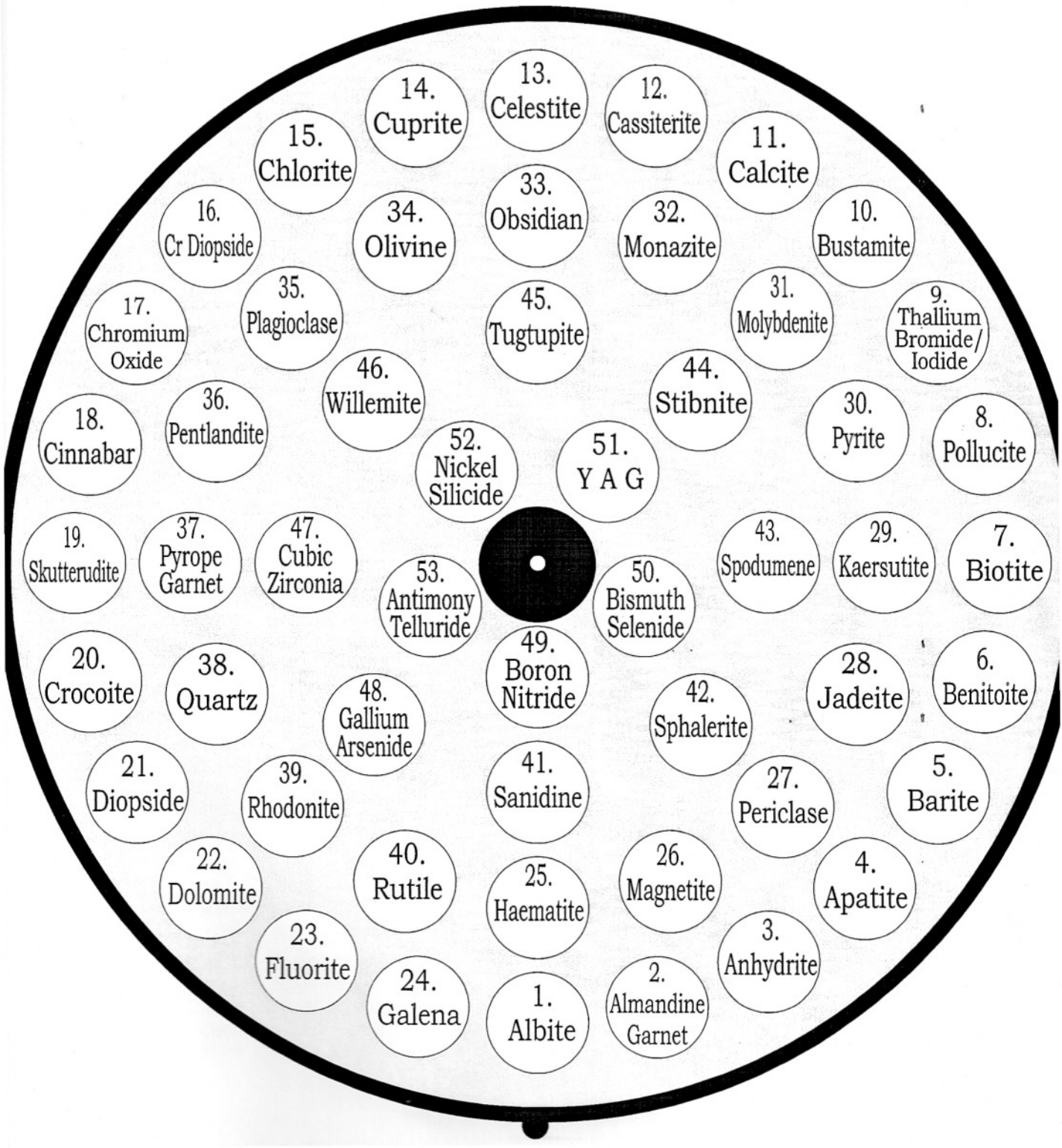


53 Minerals Standard
Serial Number: 05-133



1. **Albite** $\text{NaAlSi}_3\text{O}_8$ Strickland Quarry, Haddam, Conn., U.S.A.

O	Na	Al	Si	K	Ca	Sum
48.76	8.60	10.34	32.03	0.18	0.09	100.0
Na_2O	Al_2O_3	SiO_2	K_2O	CaO	Sum	
11.59	19.54	68.52	0.22	0.13	100.0	

2. **Almandine Garnet** $\text{Fe}_3\text{Al}_2\text{Si}_3\text{O}_{12}$ New York State, U.S.A.

O	Mg	Al	Si	Ca	Mn	Fe	Sum
42.01	6.45	11.67	18.32	3.00	0.46	18.09	100.0
MgO	Al_2O_3	SiO_2	CaO	MnO	FeO	Sum	
10.70	22.05	39.19	4.20	0.59	23.27	100.0	

3. **Anhydrite** CaSO_4 locality unknown

O	S	Ca	Sum
47.01	23.55	29.44	100.0
SO_3	CaO	Sum	
58.81	41.19	100.0	

4. **Apatite** $\text{Ca}_5(\text{PO}_4)_3\text{F}$ Ontario, Canada

O	F	P	Ca	Sum
38.07	3.77	18.42	39.74	100.0

5. **Barite** BaSO_4 Sardinia, Italy

O	S	Sr	Ba	Sum
27.33	13.80	0.26	58.62	100.2
SO_3	SrO	BaO	Sum	
34.45	0.31	65.45	100.2	

6. **Benitoite** $\text{BaTiSi}_3\text{O}_9$ S. Benito Co., California, U.S.A.

O	Si	Ti	Ba	Sum
34.82	20.38	11.58	33.21	100.0
SiO_2	TiO_2	BaO	Sum	
43.60	19.32	37.08	100.0	

7. **Biotite** $\text{K}(\text{Mg},\text{Fe})_3\text{AlSi}_3\text{O}_{10}(\text{OH})_2$ locality unknown

H	O	Mg	Al	Si	K	Ca	Ti	Mn	Fe	Sum
0.46	43.95	11.77	8.01	18.10	8.23	0.07	1.06	0.03	8.33	100.0
H_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	TiO_2	MnO	FeO	Sum	
4.11	19.52	15.13	38.72	9.91	0.10	1.77	0.04	10.72	100.0	

8. **Pollucite** $\text{CsSi}_2\text{AlO}_6$ Bernic Lake, Manitoba, Canada -- See Note 1 at the end of this list

H	Li	O	Na	Al	Si	K	Rb	Cs	Sum
0.20	0.20	36.70	1.30	8.50	22.00	0.10	0.70	30.00	99.7
H_2O	Li_2O	Na_2O	Al_2O_3	SiO_2	K_2O	Rb_2O	Cs_2O	Sum	
1.79	0.43	1.75	16.06	47.07	0.12	0.77	31.81	99.8	

9. **Thallium Bromide/Iodide** (synthetic single crystal) Atomergic Chemetals Corp., NY, U.S.A.

Br	I	Tl	Sum
10.77	23.62	65.61	100.0
TlBr	TlI	Sum	
42.00	58.00	100.0	

10. **Bustamite** $(\text{Mn},\text{Ca})\text{SiO}_3$ Broken Hill, N.S.W. Australia

O	Na	Mg	Al	Si	K	Ca	Mn	Fe	Zn	Sum
38.39	0.04	0.13	0.02	22.46	0.05	13.56	18.83	6.32	0.20	100.0
Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	MnO	FeO	ZnO	Sum	
0.05	0.22	0.04	48.05	0.06	18.97	24.31	8.13	0.25	100.0	

11. **Calcite** CaCO_3 Iceland Spar

C	O	Mg	Ca	Mn	Sum
12.02	47.98	0.01	39.98	0.01	100.0
CO_2	MgO	CaO	MnO	Sum	
44.04	0.02	55.94	0.01	100.0	

12. **Cassiterite** (Synthetic) SnO_2 Alfa Aesar, MA, U.S.A.

O	Sn	Sum
21.24	78.76	100.0
SnO ₂	Sum	
100.00	100.0	

13. **Celestite** SrSO_4 Madagascar

O	S	Ca	Sr	Sum
34.81	17.38	0.30	47.52	100.0
SO ₃	CaO	SrO	Sum	
43.40	0.42	56.20	100.0	

14. **Cuprite** (Synthetic) Cu_2O

O	Cu	Sum
11.18	88.82	100.0
Cu ₂ O	Sum	
100.00	100.0	

15. **Chlorite, var. clinochlore** $\text{Mg}_6\text{AlSi}_3\text{O}_{10}(\text{OH})_8$ West Chester Co., PA, U.S.A.

H	C	O	F	Mg	Al	Si	Ca	Cr	Fe	Ni	Sum
1.54	0.02	51.14	0.02	20.21	9.57	14.04	0.02	0.67	2.57	0.19	100.0
H ₂ O	CO ₂	F	MgO	Al ₂ O ₃	SiO ₂	CaO	Cr ₂ O ₃	FeO	NiO	Sum	
13.76	0.07	0.02	33.51	18.08	30.04	0.03	0.98	3.31	0.24	100.0	

16. **Cr Diopside** $(\text{Mg,Cr})\text{CaSi}_2\text{O}_6$ Bathjerg, E. Greenland

O	Na	Mg	Si	Ca	Ti	Cr	Fe	Sum
43.92	0.33	10.34	25.52	18.23	0.06	0.34	1.08	100.0
Na ₂ O	MgO	SiO ₂	CaO	TiO ₂	Cr ₂ O ₃	FeO	Sum	
0.44	17.14	54.59	25.50	0.10	0.50	1.39	100.0	

17. **Chromium Oxide** (Synthetic 99.7%) Cr_2O_3 -- See Note 2 at the end of this list

O	Cr	Sum
31.57	68.43	100.0
Cr ₂ O ₃	Sum	
100.00	100.0	

18. **Cinnabar** HgS Nikitovka Mine, Ukraine

S	Hg	Sum
13.78	86.22	100.0

19. **Skutterudite** $(\text{Co,Ni})\text{As}_3$ locality unknown

S	Fe	Co	Ni	As	Sum
0.12±0.06	0.95±0.24	15.45±0.54	4.39±0.54	79.09±0.39	100.0

20. **Crocoite** PbCrO_4 Dundas, Tasmania, Australia

O	Cr	Pb	Sum
19.80	16.09	64.11	100.0
CrO ₃	PbO	Sum	
30.94	69.06	100.0	

21. **Diopside** $\text{MgCaSi}_2\text{O}_6$ Wakefield, Quebec, Canada

O	Mg	Al	Si	Ca	Ti	Mn	Fe	Sum
44.30	11.23	0.05	25.88	18.39	0.05	0.04	0.04	100.0
MgO	Al ₂ O ₃	SiO ₂	CaO	TiO ₂	MnO	FeO	Sum	
18.62	0.09	55.37	25.73	0.08	0.05	0.05	100.0	

22. **Dolomite** $\text{MgCa}(\text{CO}_3)_2$ locality unknown

C	O	Mg	Ca	Mn	Fe	Sr	Sum
13.03	51.96	13.05	21.73	0.02	0.02	0.17	100.0
CO ₂	MgO	CaO	MnO	FeO	SrO	Sum	
47.74	21.64	30.41	0.03	0.03	0.20	100.0	

23. Fluorite (Synthetic) CaF₂ Harshaw Chemical Corp., U.S.A.

F	Ca	Sum
48.67	51.33	100.0

24. Galena PbS locality unknown

S	Pb	Sum
13.40	86.60	100.0

25. Haematite Fe₂O₃ Arizona, USA

O	Fe	Sum
30.06	69.94	100.0
Fe ₂ O ₃	Sum	
100.00	100.0	

26. Magnetite Fe₃O₄ Serra Minas Gerais, Brazil

O	Cr	Fe	Sum
27.67	0.14	72.19	100.0
Cr ₂ O ₃	FeO	Fe ₂ O ₃	Sum
0.20	31.03	68.76	100.0

27. Periclase (synthetic single crystal) MgO

O	Mg	Sum
39.69	60.31	100.0
MgO	Sum	
100.00	100.0	

28. Jadeite NaAlSi₂O₆ China

O	Na	Al	Si	Ca	Fe	Sum
47.40	11.20	13.05	27.74	0.55	0.16	100.1
Na ₂ O	Al ₂ O ₃	SiO ₂	CaO	Fe ₂ O ₃	Sum	
15.10	24.66	59.34	0.77	0.23	100.1	

29. Kaersutite Ca₂Na(Mg,Fe)₄TiSi₆Al₂O₂₂(OH)₂ Kangerdlugssuaq, E. Greenland

H	O	Na	Mg	Al	Si	K	Ca	Ti	Mn	Fe	Sum
0.22	42.83	1.81	7.57	6.54	18.74	0.97	8.26	3.02	0.14	9.51	99.6
H ₂ O	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	K ₂ O	CaO	TiO ₂	MnO	FeO	Sum	
1.97	2.44	12.55	12.36	40.09	1.17	11.56	5.04	0.18	12.23	99.6	

30. Pyrite FeS₂ locality unknown

S	Fe	Sum
53.45	46.55	100.0

31. Molybdenite MoS₂ locality unknown

S	Ni	Cu	Mo	Sum
40.06	0.03	0.03	59.86	100.0

32. Monazite (Ce,La,Y,Th)PO₄ Kulyk Lake, Saskatchewan, Canada

O	P	Ca	La	Ce	Pr	Nd	Th	Sum
25.90	12.10	0.40	12.90	30.80	4.20	8.70	3.80	98.8
P ₂ O ₅	CaO	La ₂ O ₃	Ce ₂ O ₃	Pr ₂ O ₃	Nd ₂ O ₃	ThO ₂	Sum	
27.73	0.56	15.13	36.08	4.92	10.15	4.32	98.9	

33. Obsidian Na,K,Al,Fe silicate glass locality unknown

H	O	F	Na	Mg	Al	Si	Cl	K	Ca	Ti	Mn	Fe	Sum
0.09	48.63	0.07	3.01	0.04	6.94	34.56	0.36	4.18	0.54	0.06	0.05	1.34	99.9
H ₂ O	F	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	Cl	K ₂ O	CaO	TiO ₂	MnO	FeO	Sum	
0.80	0.07	4.06	0.07	13.11	73.94	0.36	5.04	0.76	0.10	0.06	1.72	100.1	

34. Olivine (Mg,Fe)₂SiO₄ locality unknown

O	Mg	Si	Mn	Fe	Ni	Sum
43.89	30.42	19.44	0.08	5.87	0.30	100.0
MgO	SiO ₂	MnO	FeO	NiO	Sum	
50.43	41.58	0.10	7.51	0.38	100.0	

35. Plagioclase An₆₅ (Ca,Na)Al(Al,Si)Si₂O₈ Sonora, Mexico

O	Na	Mg	Al	Si	K	Ca	Ti	Fe	Sr	Ba	Sum
47.08	3.23	0.08	15.10	25.34	0.34	8.43	0.04	0.29	0.07	0.01	100.0
Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	K ₂ O	CaO	TiO ₂	FeO	SrO	BaO	Sum	
4.35	0.13	28.53	54.21	0.41	11.80	0.07	0.37	0.08	0.01	100.0	

36. Pentlandite (Fe,Ni)₉S₈ Manibridge, Ontario, Canada

S	Fe	Co	Ni	Sum
33.01	30.77	0.10	36.12	100.0

37. Pyrope Garnet Mg₃Al₂Si₃O₁₂ Monastery Mine, S.A.

O	Mg	Al	Si	Ca	Ti	Cr	Mn	Fe	Sum
44.30	11.66	11.28	19.38	3.32	0.70	0.39	0.21	8.67	99.9
MgO	Al ₂ O ₃	SiO ₂	CaO	TiO ₂	Cr ₂ O ₃	MnO	FeO	Sum	
19.33	21.32	41.45	4.65	1.16	0.58	0.27	11.15	99.9	

38. Quartz SiO₂ Minas Gerais, Brazil

O	Si	Sum
53.26	46.74	100.0
SiO ₂	Sum	
100.00	100.0	

39. Rhodonite MnSiO₃ Franklin Furnace, New Jersey, U.S.A.

O	Mg	Si	Ca	Mn	Fe	Zn	Sum
37.08	0.53	21.46	4.56	29.15	1.20	6.02	100.0
MgO	SiO ₂	CaO	MnO	FeO	ZnO	Sum	
0.87	45.98	6.40	37.66	1.55	7.51	100.0	

40. Rutile (synthetic single crystal) TiO₂ Atomergic Chemetals Corp., NY, U.S.A.

O	Ti	Sum
40.06	59.94	100.0
TiO ₂	Sum	
100.00	100.0	

41. Sanidine KAlSi₃O₈ Hohenfels, Germany

O	Na	Al	Si	K	Fe	Ba	Sum
46.28	2.23	9.93	30.23	10.05	0.14	0.98	99.8
Na ₂ O	Al ₂ O ₃	SiO ₂	K ₂ O	FeO	BaO	Sum	
3.01	18.76	64.67	12.11	0.18	1.09	99.8	

42. Sphalerite (Synthetic) ZnS CERAC Inc., Milwaukee, U.S.A.

S	Fe	Zn	Sn	Sum
32.91	0.01	67.07	0.01	100.0

43. Spodumene LiAlSi₂O₆ Minas Gerais, Brazil

Li	O	Al	Si	Sum
3.73	51.59	14.50	30.18	100.0
Li ₂ O	Al ₂ O ₃	SiO ₂	Sum	
8.03	27.40	64.57	100.0	

44. Stibnite Sb₂S₃ locality unknown

S	Sb	Sum
28.32	71.68	100.0

45. Tugtupite Na₄BeAlSi₄O₁₂Cl Greenland

Be	O	Na	Al	Si	Cl	Sum
1.93	41.05	19.66	5.77	24.02	7.58	100.0
BeO	Na ₂ O	Al ₂ O ₃	SiO ₂	Cl	Sum	
5.36	26.50	10.90	51.39	7.58	101.7	

46. Willemite (Zn,Mn)₂SiO₄ Franklin Furnace, New Jersey, U.S.A.

O	Si	Mn	Zn	Sum
29.40	13.13	3.73	53.74	100.0
SiO ₂	MnO	ZnO	Sum	
28.09	4.82	66.89	99.8	

47. Cubic Zirconia (Synthetic) ZrO₂

O	Y	Zr	Hf	Sum
24.91	14.37	59.17	1.51	100.0
Y ₂ O ₃	ZrO ₂	HfO ₂	Sum	
18.25	79.93	1.78	100.0	

48. Gallium Arsenide (Synthetic, 99.999%) GaAs Alfa Aesar, MA, U.S.A.

Ga	As	Sum
48.20	51.80	100.0

49. Boron Nitride (pyrolytic) BN Atomergic Chemetals Corp., NY, U.S.A.

B	N	Sum
43.56	56.44	100.0

50. Bismuth Selenide (Synthetic 99.999%) Bi₂Se₃ Alfa Aesar, MA, U.S.A.

Se	Bi	Sum
36.17	63.83	100.0

51. Yttrium Al Garnet (Synthetic 99.99%) Y₃Al₅O₁₂ Atomergic Chemetals Corp., NY, U.S.A.

O	Al	Y	Sum
33.0	24.4	42.6	100.0
Al ₂ O ₃	Y ₂ O ₃	Sum	
46.0	54.1	100.1	

52. Nickel Silicide (Synthetic) Ni₂Si

Si	Ni	Sum
19.30	80.70	100.0

53. Antimony Telluride (Synthetic 99.999%) Sb₂Te₃ Alfa Aesar, MA, U.S.A.

Sb	Te	Sum
38.88	61.12	100.0

Note 1

In #8 Pollucite CsSi₂AlO₆ beware of minor inclusions of Spodumene LiAlSi₂O₆ which is optically similar to pollucite but is easily distinguished by backscatter imaging or X-ray spectra.

Note 2

In #17 Chromium Oxide Cr₂O₃ this synthetic material has two phases - minor amounts of metallic chromium scattered through the oxide. The two phases are identified clearly by the identifying labels close to the grains and etched in the mounting medium."