APPENDIX 4

Representative chemical analyses and structural formulae of spinels (K = 3) and ilmenite (K = 2) from the Popiel Hill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	2701	2701	2702	2702	2702	2703	2703	2703	2704	2704	2704	2704	2704	AK3201	AK3202	AK3202	AK3202	AK3205	AK3207	AK3207	AK3210	AK3210	AK3210	AK3211	AK3211	AK3211	AK3212	AK3212	AK3214	AK3214	AK3216	AK3216
SiO_2	0.01	0.00	0.05	0.03	2.46	0.54	0.01	0.00	0.08	0.00	0.08	0.00	0.05	0.26	0.05	1.17	0.64	0.03	0.03	0.01	0.06	0.02	0.07	1.06	0.98	0.18	0.02	0.06	0.02	0.01	0.02	0.22
TiO_2	0.07	1.74	0.04	0.04	0.65	0.00	2.64	0.03	51.93	0.05	0.11	1.84	1.17	0.07	51.06	0.08	0.04	2.63	2.46	0.02	50.73	0.01	0.74	0.31	42.29	0.00	0.09	0.18	49.81	0.06	0.06	0.15
Al_2O_3	53.99	2.58	58.82	55.75	0.63	4.71	1.91	59.37	0.03	49.85	62.35	1.43	0.49	53.61	0.00	1.04	54.93	2.02	1.93	54.99	0.00	58.45	0.58	5.09	0.03	61.85	50.84	0.16	0.02	59.55	53.90	1.58
Cr_2O_3	8.59	7.05	3.93	5.68	3.55	0.61	4.51	3.19	0.52	10.19	1.07	7.56	7.30	7.60	0.28	0.15	6.97	5.90	4.44	6.78	0.20	4.56	4.96	0.08	0.06	1.34	10.68	0.15	0.22	3.30	7.73	4.87
FeO[1)]	18.68	79.43	19.24	21.54	82.36	87.53	83.03	19.71	40.33	23.62	16.54	80.39	81.60	20.21	39.26	86.90	17.41	78.75	82.20	21.44	43.67	18.67	83.05	84.30	45.80	17.18	23.64	0.01	45.50	19.40	19.03	81.17
MnO	0.22	0.51	0.19	0.23	0.17	0.58	0.38	0.17	4.36	0.14	0.16	0.34	0.43	0.19	1.79	0.10	0.20	0.71	0.37	0.20	1.12	0.16	0.12	0.02	0.67	0.18	0.19	0.20	1.52	0.17	0.20	0.26
NiO	0.36	0.49	0.42	0.41	0.36	0.12	0.38	0.43	0.02	0.22	0.46	0.37	0.27	0.11	0.08	0.09	0.30	0.41	0.41	0.42	0.07	0.43	0.40	0.16	0.03	0.45	0.29	82.62	0.07	0.40	0.36	0.35
MgO	17.38	0.74	16.51	15.25	3.12	2.91	0.90	17.46	2.40	14.92	18.98	0.37	0.53	16.51	5.92	1.75	17.48	0.55	0.90	14.96	2.47	16.89	0.25	0.67	5.55	18.14	13.71	0.10	2.17	17.01	16.92	0.96
CaO	0.01	0.01	0.06	0.03	0.36	0.01	0.00	0.01	0.03	0.04	0.01	0.21	0.07	0.03	0.02	0.02	0.00	0.13	0.01	0.08	0.15	0.01	0.19	0.13	0.01	0.01	0.03	0.65	0.01	0.04	0.01	0.15
Na_2O	0.01	0.00	0.00	0.00	0.00	0.05	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	5.21	0.00	0.00	0.00	0.00
K_2O	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.03	0.00	0.00	0.00	0.35	0.00	0.00	0.02	0.02
Total	99.32	92.56	99.28	98.96	93.67	97.06	93.76	100.38	99.72	99.02	99.75	92.51	91.91	98.58	98.47	91.31	98.03	91.14	92.77	99.12	98.48	99.22	90.37	91.85	95.43	99.32	99.48	89.70	99.32	100.07	98.24	89.72
Si	0.00	0.00	0.00	0.00	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Ti	0.00	0.05	0.00	0.00	0.02	0.00	0.08	0.00	0.97	0.00	0.00	0.05	0.03	0.00	0.94	0.00	0.00	0.08	0.07	0.00	0.96	0.00	0.02	0.01	0.79	0.00	0.00	0.02	0.93	0.00	0.00	0.00
Al	1.70	0.12	1.83	1.77	0.03	0.20	0.09	1.82	0.00	1.62	1.88	0.06	0.02	1.70	0.00	0.05	1.73	0.09	0.09	1.75	0.00	1.82	0.03	0.23	0.00	1.88	1.65	0.01	0.00	1.83	1.71	0.07
Cr	0.18	0.21	0.08	0.12	0.10	0.02	0.13	0.07	0.01	0.22	0.02	0.23	0.22	0.16	0.01	0.00	0.15	0.18	0.13	0.14	0.00	0.10	0.16	0.00	0.00	0.03	0.23	0.16	0.00	0.07	0.16	0.15
Fe^{+3}	0.12	1.57	0.09	0.11	1.65	1.75	1.63	0.12	0.05	0.16	0.09	1.60	1.68	0.12	0.12	1.86	0.09	1.57	1.64	0.11	0.08	0.09	1.77	1.67	0.36	0.08	0.11	1.80	0.13	0.10	0.12	1.75
Fe^{+2}	0.30	0.98	0.76	0.86	0.90	0.84	1.00	0.31	0.79	0.38	0.26	1.00	0.98	0.34	0.68	0.94	0.30	1.00	0.99	0.37	0.84	0.32	0.98	1.00	0.60	0.29	0.43	0.96	0.82	0.32	0.31	0.93
Mn	0.00	0.02	0.00	0.01	0.01	0.02	0.01	0.00	0.09	0.00	0.00	0.01	0.01	0.00	0.04	0.00	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.03	0.00	0.00	0.01
Ni	0.01	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Mg	0.69	0.04	0.65	0.61	0.17	0.15	0.05	0.68	0.09	0.61	0.73	0.02	0.03	0.66	0.22	0.10	0.70	0.03	0.05	0.60	0.09	0.66	0.01	0.04	0.21	0.70	0.56	0.01	0.08	0.66	0.68	0.06
Ca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Mg#	0.70	0.04	0.46	0.42	0.16	0.15	0.05	0.68		0.62	0.73	0.02	0.03	0.66		0.10	0.70	0.03	0.05	0.62		0.67	0.01	0.04		0.71	0.57	0.01		0.67	0.69	0.06
cr#	0.10	0.65	0.04	0.06	0.79	0.08	0.61	0.03		0.12	0.01	0.78	0.91	0.09		0.09	0.08	0.66	0.61	0.08		0.05	0.85	0.01		0.01	0.12	0.96		0.04	0.09	0.67

[1)] – total Fe as FeO; 1, 2 – irregular grain (80 μm) of spinel and magnetite within olivine-orthopyroxene aggregate (brown points 1, 2 – Fig. 3A); 3 – 20 μm spinel grain in amphibole-olivine aggregate (brown point 3 – Fig. 3B); 4 – 100 μm, irregular, corroded grain of spinel within orthopyroxene-amphibole aggregate; 5 – 10 μm, rounded grain of magnetite in amphibole-olivine aggregate (brown point 5 – Fig. 3B); 6 – thin needle of magnetite growing on spinel (brown point 6 – Fig. 4B); 7 – 60 μm magnetite grain (brown point 7 – Fig. 4B); 8 – marginal part of spinel embedded in serpentine (brown point 8 – Fig. 4B); 9 –ilmenite part in the ca. 20 μ composite ilmenite/ magnetite grain; 10 – fragment of fractured spinel grain (100 μm) with acicular rims of magnetite; 11 – small (10 μm) spinel grain within orthopyroxene-olivine-amphibole aggregate; 12 – irregular, crushed grain of magnetite embedded in serpentine; 13 – 15 μm, irregular grain in serpentine matrix; 14 – small (5 μm), rounded inclusion of spinel in olivine; 15 – 40 μm grain of ilmenite in serpentine matrix; 16 – 12 μm grain of spinel and magnetite (brown point 16 – Fig. 4A); 17 – 8 μm grain of spinel with magnetite rim (brown point 17 – Fig. 4A); 18 – 30 μm, magnetite grain in olivine-orthopyroxene-amphibole aggregate; 19 – 30 μm grain of magnetite, coexisting with olivine, embedded in serpentine; 20 – 40 μm spinel grain in amphibole; 21 – 30 μm ilmenite grain within amphibole grain; 22 – 25 μm spinel grain in the contact with olivine, embedded in serpentine; 23 – 20 μm grain of magnetite; 24 – small (4 μm), rounded intergrowth of magnetite within olivine (brown point 24 – Fig. 4D); 25 – small (7 μm) grain of ilmenite within olivine (brown point 25 – Fig. 4D); 26 – 10 μm intergrowth of spinel in olivine (brown point 26 – Fig. 4D); 27, 28 – 80 μm grain consisting of magnetite and spinel (brown points 27, 28 – Fig. 4A); 29 – large (125 μm) grain of ilmenite associated with spinel (brown point 29 – Fig. 4C); 30 – large (170 μm), irregular spinel grain in serpentine matrix; 31 – 10 μm, rounded grain in orthopyroxene-amphibole aggregate; 32 – rounded, 20 μm grain of magnetite in amphibole aggregate