

## Supplementary Materials for **Quantifying gas emissions from the “Millennium Eruption” of Paektu volcano, Democratic People’s Republic of Korea/China**

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Published 30 November 2016, *Sci. Adv.* **2**, e1600913 (2016)

DOI: 10.1126/sciadv.1600913

### **The PDF file includes:**

- table S1. Whole-rock pumice compositions by XRF, microprobe, and FTIR.
- table S2. Major, trace, and volatile element analyses in ME MIs.
- table S3. Compositions of phases used in least squares linear regression modeling.
- table S4. Results of least squares linear regression modeling of the derivation of PEK-62 comendite from CBS-TPUM trachyte.
- table S5. H<sub>2</sub>O contents in comenditic MI and modeled saturation pressures.

### **Other Supplementary Material for this manuscript includes the following:**

(available at [advances.sciencemag.org/cgi/content/full/2/11/e1600913/DC1](http://advances.sciencemag.org/cgi/content/full/2/11/e1600913/DC1))

- table S6. Excel file listing raw FTIR data, all values necessary for calculation of H<sub>2</sub>O and CO<sub>2</sub> concentrations from FTIR data, and associated errors of measured and calculated values.
- table S7. Excel file listing all values used to calculate volatile fluxes and associated errors.

**Supplementary Materials:**

**table S1. Whole-rock pumice compositions by XRF, microprobe, and FTIR.** Major oxides normalized to 100% with original analysis totals given. Major oxides and H<sub>2</sub>O given in wt %, all others given in ppm. Major and trace elements by XRF. Cl, F, SO<sub>3</sub> in matrix glass by microprobe. H<sub>2</sub>O in matrix glass by FTIR. XRF measurements performed at the Washington State University GeoAnalytical Lab.

	PKTU-TP	PEK-26	PEK-56	PEK-62	CBS-TPUM
SiO <sub>2</sub>	73.68	74.67	74.66	74.59	65.09
TiO <sub>2</sub>	0.225	0.219	0.214	0.210	0.573
Al <sub>2</sub> O <sub>3</sub>	11.38	10.47	10.51	10.58	15.98
FeO*	4.08	4.24	4.21	4.21	5.13
MnO	0.079	0.078	0.077	0.077	0.135
MgO	0.01	0.04	0.03	0.02	0.36
CaO	0.28	0.26	0.23	0.22	1.52
Na <sub>2</sub> O	5.58	5.56	5.60	5.58	5.52
K <sub>2</sub> O	4.69	4.46	4.46	4.51	5.58
P <sub>2</sub> O <sub>5</sub>	0.008	0.009	0.008	0.007	0.116
Total	96.04	97.59	96.42	96.63	95.78
Cl	4166			4167	736
F	2808			3541	546
SO <sub>3</sub>	208			71	389
H <sub>2</sub> O				0.3 ± 0.2	
Total alkalis	10.27	10.02	10.06	10.09	11.10
Subtotal	96.76			97.43	95.95
O=(Cl,F) <sub>2</sub>	0.21			0.24	0.04
Total	96.55			97.19	95.91
Ni	3	5	4	3	4
Cr	2	5	3	3	4
Sc	1	1	1	0	4
V	2	1	2	4	8
Ba	14	14	10	13	125
Rb	348	390	384	385	140
Sr	2	3	3	2	49
Zr	1979	2171	2138	2136	677
Y	123	138	138	136	45
Nb	234.4	263.9	261.0	261.5	85.5
Ga	41	43	41	42	33
Cu	7	11	10	9	8
Zn	265	312	306	302	133
Pb	38	43	44	43	14
La	155	155	153	152	79
Ce	299	307	303	301	154
Th	46	53	52	53	16
Nd	122	126	125	120	63
U	9	12	12	11	3

**table S2. Major, trace, and volatile element analyses in ME MIs.** (a) *c* comendite, *t* trachyte; (b) major element analysis by electron microprobe (EMP) and given in wt%; (c) molar (Na+K)/Al; (d) Cl by EMP, F and S by SHRIMP, H<sub>2</sub>O by FTIR. Analyses in ppm unless noted. (\*) FeO given as FeO total. (†) Na<sub>2</sub>O value corrected for Na loss during EMP analysis (see Materials and Methods). (‡) Measured by ATR (See Materials and Methods). *Host* is the phenocryst type hosting the inclusion (fsp=feldspar; cpx=clinopyroxene; ol=olivine; qtz=quartz). A blank space means no analysis was performed. Sample names refer to those in table S1: PKTU=PKTU-TP; P-62=PEK-62, etc. Analyses are normalized to 100% anhydrous with original major element totals given. Details of the determinations of uncertainties given in Materials and Methods.

Sample	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	
Mi no.	1	2	3	4a	4b	5	6	7	8	9	10	GM-9	PX-2a	PX-2b	PX-3	PX-4a	PX-4b	GM-7	
Host	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	cpx	cpx	cpx	cpx	cpx	ol	
Type <sup>a</sup>	c	c	c	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c	
SiO <sub>2</sub>																			
(wt%) <sup>b</sup>	76.34	75.87	75.26	74.51	73.60	76.62	67.84	75.83	75.72	76.16	76.05	75.67	75.91	74.26	75.77	75.50	76.69	75.25	
TiO <sub>2</sub>	0.21	0.23	0.22	0.24	0.22	0.18	0.01	0.22	0.21	0.20	0.21	0.20	0.22	0.27	0.24	0.30	0.23	0.21	
Al <sub>2</sub> O <sub>3</sub>	10.15	10.19	10.41	11.64	12.22	10.03	17.78	9.77	9.97	9.99	9.94	10.68	9.75	9.76	9.82	9.72	9.87	10.55	
FeO*	3.62	3.98	3.73	3.78	3.35	3.15	0.55	4.06	4.03	3.69	3.74	4.03	4.91	6.22	4.21	4.37	4.22	5.19	
MnO	--	--	--	--	--	--	--	--	--	--	--	0.09	--	--	--	--	--	0.14	
MgO	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
CaO	0.19	0.20	0.22	0.33	0.37	0.23	0.00	0.19	0.23	0.21	0.19	0.21	0.26	0.26	0.25	0.26	0.26	0.26	
Na <sub>2</sub> O	5.04†	5.09†	5.55†	4.96†	5.52†	5.50	7.98†	5.21†	5.42†	5.61	5.56†	4.79	4.58	4.83	4.74†	4.63†	4.44	4.18	
K <sub>2</sub> O	4.46	4.45	4.60	4.54	4.71	4.29	5.83	4.72	4.41	4.14	4.33	4.33	4.37	4.38	4.27	4.33	4.30	4.21	
Subtotal	89.61	94.96	93.59	94.36	92.70	94.34	100.55	83.03	96.10	95.16	97.78	94.45	97.14	91.34	98.45	97.90	97.15	95.90	
O=(Cl,F) <sub>2</sub>	0.23		0.25	0.21	0.10	0.23		0.22	0.22		0.23	0.26	0.26			0.24	0.23	0.20	
Total	89.38	94.96	93.34	94.15	92.60	94.11	100.55	82.81	95.88	95.16	97.55	94.19	96.89	91.34	98.45	97.66	96.92	95.69	
Alkalinity <sup>c</sup>	1.29	1.30	1.36	1.12	1.16	1.36	1.09	1.40	1.37	1.37	1.39	1.18	1.26	1.30	1.27	1.27	1.21	1.08	
<i>Volatiles<sup>d</sup></i>																			
Cl	3911	4137	4192	3133	2860	3621		3914	4043	4153	4058	4261	4181	3732	4632	4169	4062	4351	
F	3448		3590	3354	853	3435		3022	3130		3272	3917	3822			3360	3302	2479	
S	119		117	145	189	103		102	109		91	114	113			100	106	68	
H <sub>2</sub> O wt%	2.73	1.77	2.95	2.42	2.02	2.73	2.94	1.65	2.70	2.28	2.18				2.25‡	2.82‡			
<i>Trace Elements via SHRIMP (ppm)</i>																			
Li	60.8		59.8	45.2	44.8	47.1		50.8	66.2		53.3	89.1	63.5			60.0	70.7	43.4	
Be	20.6		20.9	14.3	14.5	18.1		15.7	21.4		18.8	20.9	19.1			19.3	20.2	16.8	
B	29.3		29.1	17.4	22.0	26.5		24.2	30.6		26.7	26.6	27.5			27.6	28.5	25.3	
Mg	149.4		153.5	102.1	88.3	165.5		112.4	138.8		120.4	138.7	148.9			127.9	138.4	119.1	
P	6.9		6.7	11.7	9.9	6.8		5.7	7.0		6.3	6.0	6.7			7.0	7.0	6.2	
Cu	12.2		13.5	15.7	14.3	15.2		10.5	15.5		12.1		14.6			13.7	15.8		
Rb	372.2		372.1	351.4	364.7	329.7		372.2	337.0		304.4	344.3	384.5			341.7	339.5	268.4	
Sr	1.8		1.9	0.6	0.6	3.4		2.3	1.6		2.2	1.8	1.9			1.7	1.7	1.2	
Y	105.0		98.0	95.0	75.9	106.6		86.6	100.1		85.0	100.0	108.4			100.5	101.6	101.0	
Zr	2283		2057	1956	2135	2220		1968	2146		1828	2232	2381			2161	2191	2511	
Nb	320.0		282.0	287.1	244.7	292.5		278.7	272.1		239.9	308.6	409.2			283.9	284.3	298.2	
Cs	5.2		5.3	4.6	4.6	4.6		4.8	4.6		4.2	4.5	5.6			4.8	4.8	3.8	
Ba	6.6		6.1	1.9	1.8	13.9		10.4	4.9		7.9	5.9	6.2			5.5	5.6	5.6	
La	90.8		83.7	129.0	103.4	90.2		75.2	87.8		75.9	84.2	99.1			90.2	91.1	89.0	
Sm	20.3		19.6	22.7	18.1	21.3		17.5	19.6		17.6	19.9	22.8			20.7	20.4	20.2	
Ta	5.0		5.0	5.1	3.9	5.9		4.1	5.3		4.3	5.8	6.2			5.6	5.6	5.9	
Yb	11.7		11.8	11.2	8.9	13.5		9.1	12.6		10.6	13.3	14.7			13.7	13.3	14.4	
Hf	77.6		66.9	61.9	69.3	73.0		65.0	69.9		56.2	84.1	83.2			72.8	72.2	78.3	
Pb	98.5		99.4	81.9	67.0	107.1		80.9	105.8		82.8	91.1	104.9			105.7	104.7	91.8	
Th	46.4		43.6	41.5	38.4	50.0		37.5	44.9		37.3	55.0	52.9			47.4	47.6	46.8	
U	11.0		10.3	9.5	8.7	11.4		9.3	10.1		8.6	12.0	12.2			10.6	10.8	10.3	

table S2 (continued, p2)

Sample	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	PKTU	P-26	P-26	P-26	P-56	P-56	P-56	P-56	P-56	P-56	P-62	P-62
Mi no.	GM-8	GM-10a	GM-10b	GM-10c	GM-11	GM-12	GM-14	1	PX-1a	PX-1b	2	PX-1a	PX-1b	PX-1c	PX-3a	PX-3b	1	2a
Host	qtz	qtz	qtz	qtz	qtz	qtz	qtz	fsp	cpx	cpx	fsp	cpx	cpx	cpx	cpx	cpx	fsp	fsp
Type <sup>a</sup>	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
SiO <sub>2</sub> (wt%) <sup>b</sup>	76.52	76.22	75.87	75.81	75.54	75.39	75.37	74.75	74.03	74.41	75.45	76.22	74.87	74.34	74.35	73.85	75.32	75.52
TiO <sub>2</sub>	0.17	0.19	0.20	0.13	0.19	0.22	0.19	0.21	0.23	0.23	0.20	0.20	0.00	0.60	0.23	0.23	0.20	0.23
Al <sub>2</sub> O <sub>3</sub>	10.41	10.51	10.28	10.52	10.41	10.19	10.50	10.72	10.39	10.63	10.66	10.57	10.60	10.43	10.66	10.66	10.46	10.14
FeO*	4.20	4.21	4.30	4.11	4.28	4.46	4.23	4.11	4.34	4.59	3.99	4.72	5.00	5.15	5.00	4.36	3.91	4.32
MnO	0.10	0.09	0.11	0.06	0.10	0.09	0.10	0.10	0.11	0.12	0.07	0.09	0.00	0.11	0.16	0.23	0.09	0.10
MgO	0.01	<0.01	0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.17	<0.01	<0.01
CaO	0.25	0.21	0.20	0.18	0.20	0.21	0.23	0.20	0.25	0.26	0.19	0.25	0.00	0.20	0.36	2.06	0.21	0.19
Na <sub>2</sub> O	4.26	4.40	4.73	4.88	4.78	5.05	4.91	5.22	6.26	5.36	5.04	4.61	5.00	4.73	4.95	4.28	5.38	5.15
K <sub>2</sub> O	4.08	4.16	4.30	4.31	4.50	4.37	4.47	4.68	4.38	4.41	4.40	3.36	4.53	4.43	4.27	4.15	4.43	4.35
Subtotal	93.06	95.64	94.59	94.50	93.69	95.19	94.22	92.15	94.75	91.88	95.23	94.24	91.96	93.11	92.38	93.05	93.86	91.38
O=(Cl,F) <sub>2</sub>	0.27	0.26	0.27	0.22	0.26	0.26	0.25	0.22	0.25	0.24	0.24						0.21	0.22
Total	92.79	95.38	94.32	94.28	93.43	94.93	93.97	91.93	94.50	91.64	94.99	94.24	91.96	93.11	92.38	93.05	93.65	91.16
Alkalinity <sup>c</sup>	1.10	1.12	1.21	1.21	1.22	1.28	1.23	1.27	1.45	1.28	1.23	1.06	1.24	1.21	1.20	1.08	1.30	1.30
<i>Volatiles<sup>d</sup></i>																		
Cl	4400	4200	4500	3600	4500	4500	4300	4352	4337	4171	3985	4540	0	4228	3869	3059	3995	4033
F	3950	3809	3931	3346	3717	3734	3651	2915	3585	3411	3460						2880	3061
S	126	112	126	160	121	116	124	109	115	118	92						107	118
H <sub>2</sub> O wt%								2.94	4.36	2.62							3.00	1.85
<i>Trace Elements via SHRIMP (ppm)</i>																		
Li	68.7	2.6	84.9	13.7	72.9	69.9	59.2	63.7	56.8	49.0	65.4						60.4	62.3
Be	22.5	4.0	21.8	19.0	22.0	19.4	16.0	17.6	18.7	18.0	18.8						16.9	20.5
B	29.4	26.8	28.1	37.5	28.9	25.7	21.9	25.0	28.6	28.2	24.8						23.4	29.6
Mg	139.0	147.8	148.7	149.2	139.8	296.9	153.2	136.3	776.6	750.2	125.6						144.8	262.7
P	7.1	7.6	6.9	13.7	7.2	6.7	7.2	6.0	7.3	6.8	6.6						6.1	7.8
Cu								13.9	14.8	14.2							14.0	13.6
Rb	386.2	354.1	360.5	329.3	355.8	362.3	357.4	366.2	342.4	335.7	281.7						325.2	338.1
Sr	1.5	1.9	1.8	1.7	1.6	1.3	2.0	1.7	1.9	1.7	1.8						1.7	2.2
Y	105.8	107.3	107.5	57.5	103.3	101.9	110.5	95.6	127.5	121.5	98.2						97.3	94.9
Zr	2386	2513	2449	2019	2353	2525	2570	2018	2340	2383	2252						2030	2168
Nb	302.0	302.9	302.4	256.1	285.5	319.6	296.1	268.7	297.7	303.7	300.0						272.4	291.2
Cs	5.5	4.6	4.8	4.5	4.9	4.7	4.7	5.0	5.0	5.1	3.4						4.4	4.5
Ba	6.3	7.1	6.5	6.1	5.7	5.6	7.0	6.0	5.3	4.9	6.0						5.4	8.0
La	87.9	90.4	91.8	52.0	86.0	85.8	89.2	80.9	119.2	112.6	84.6						82.9	88.5
Sm	21.2	19.9	20.4	14.0	20.0	19.7	21.8	18.7	28.2	28.0	19.6						18.8	18.2
Ta	6.3	5.4	5.7	3.3	5.3	5.9	6.9	5.1	7.6	7.5	5.7						5.0	4.7
Yb	15.3	12.8	15.6	6.1	12.3	13.9	15.2	11.5	18.7	19.1	13.4						11.4	11.2
Hf	74.0	79.7	87.3	49.9	73.5	92.2	95.5	69.1	74.5	75.9	83.0						67.2	72.6
Pb	125.0	103.7	107.4	73.1	108.3	96.9	102.5	96.4	113.6	105.5	81.4						98.0	97.4
Th	48.0	50.5	53.9	34.9	46.6	56.0	57.3	44.1	54.6	51.5	51.1						43.8	41.9
U	9.6	10.6	11.2	7.6	10.5	12.2	12.3	10.2	12.1	11.5	11.5						10.1	10.3

table S2 (continued, p3)

Sample	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62
Mi no.	2b	3	6	7a	7b	7c	8	9	10	12a	12b	14	15	16	17	18	GM-1	GM-2
Host	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp	fsp
Type <sup>a</sup>	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
SiO <sub>2</sub> (wt%) <sup>b</sup>	75.65	76.14	75.47	73.98	73.80	75.12	75.42	75.05	75.48	74.67	74.96	75.29	75.55	74.95	73.04	73.87	76.02	76.73
TiO <sub>2</sub>	0.24	0.26	0.20	0.41	0.38	0.23	0.18	0.20	0.21	0.20	0.20	0.20	0.19	0.19	0.18	0.18	0.19	0.09
Al <sub>2</sub> O <sub>3</sub>	10.00	10.20	10.39	10.57	10.50	10.56	10.45	10.46	10.54	10.46	10.65	10.64	10.57	10.62	14.80	12.34	10.76	10.46
FeO*	4.17	3.92	3.88	4.94	5.02	3.87	3.88	3.97	3.90	4.07	3.99	3.90	4.09	3.92	2.20	3.35	4.22	4.11
MnO	0.09	0.11	0.10	0.16	0.15	0.10	0.10	0.08	0.10	0.11	0.09	0.09	0.09	0.09	0.09	0.10	0.07	0.05
MgO	<0.01	0.03	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
CaO	0.20	0.22	0.21	0.53	0.57	0.35	0.17	0.18	0.21	0.21	0.18	0.21	0.20	0.18	0.05	0.13	0.22	0.14
Na <sub>2</sub> O	5.28	4.71†	5.27	4.99	5.16	5.26	5.46	5.65	5.23	5.89	5.40	5.22	4.96	5.66	4.53	5.11	4.47	4.29
K <sub>2</sub> O	4.37	4.39	4.48	4.43	4.43	4.50	4.34	4.41	4.34	4.38	4.51	4.45	4.35	4.39	5.10	4.91	4.04	4.14
Subtotal	92.92	91.14	91.70	93.42	93.42	93.56	94.48	94.18	94.49	94.21	92.10	93.40	94.28	92.58	92.89	93.33	94.46	93.77
O=(Cl,F) <sub>2</sub>	0.22		0.20	0.26	0.24	0.24	0.23	0.23	0.24			0.24		0.25	0.24	0.23	0.24	0.21
Total	92.69	91.14	91.50	93.16	93.18	93.32	94.25	93.95	94.25	94.21	92.10	93.16	94.28	92.34	92.65	93.10	94.22	93.56
Alkalinity <sup>c</sup>	1.34	1.23	1.30	1.23	1.26	1.28	1.31	1.34	1.26	1.38	1.29	1.26	1.22	1.33	0.88	1.11	1.09	1.10
<i>Volatiles<sup>d</sup></i>																		
Cl	4134	3310	3775	4452	4545	4045	4173	3925	3968	4163	4215	4190	4010	4054	4050	4054	4400	3000
F	3104		2668	3677	3233	3612	3259	3268	3549			3373		3653	3459	3277	3419	3445
S	108		78	165	132	122	109	113	99			107		103	112	122	112	89
H <sub>2</sub> O wt%	2.39	1.48	3.30	1.39	1.88	2.32	2.82	3.31	1.71	1.77	2.33	1.82	2.90	4.23		1.71		
<i>Trace Elements via SHRIMP (ppm)</i>																		
Li	62.4		41.6	65.0	54.8	59.9	58.4	57.0	54.1			62.9		70.1	84.0	55.5	69.1	66.7
Be	20.0		15.6	17.8	14.9	19.7	20.6	18.9	19.3			20.1		20.6	20.7	20.3	21.9	20.5
B	30.2		21.6	25.9	20.7	29.9	29.3	27.2	27.8			26.8		27.2	27.1	25.6	28.9	26.4
Mg	125.3		87.4	259.0	213.6	179.2	144.4	128.3	166.9			173.1		118.4	127.6	130.2	143.6	115.2
P	8.2		5.5	23.3	18.9	3.9	6.8	6.8	6.6			7.6		6.8	6.1	7.4	6.8	6.0
Cu	15.2		9.7	20.5	17.4	16.1	15.0	15.3	15.1									
Rb	336.8		282.4	323.4	295.5	360.2	363.9	362.2	361.8			320.6		348.9	357.9	327.4	362.5	295.3
Sr	1.5		3.2	2.3	2.6	1.8	1.8	1.6	2.3			2.2		1.5	1.4	1.5	1.6	1.8
Y	104.5		72.0	102.6	84.9	109.1	104.5	108.3	107.4			102.6		104.2	96.7	99.5	106.1	83.5
Zr	2274		1595	2475	2036	2364	2191	2324	2255			2181		2266	2170	2383	2239	1839
Nb	292.6		217.9	291.6	238.6	306.7	288.6	302.1	292.1			294.7		289.9	285.7	277.4	288.6	245.9
Cs	4.8		3.5	4.5	3.8	5.5	5.0	5.2	5.0			4.6		4.7	4.2	4.5	5.2	4.0
Ba	5.0		13.9	6.7	9.7	6.2	6.0	5.5	10.5			8.9		5.5	5.3	6.1	6.1	6.3
La	84.7		60.0	182.5	150.7	99.5	88.1	90.4	91.8			87.3		85.7	85.9	83.9	82.0	71.0
Sm	19.8		14.6	26.1	22.1	22.6	20.5	21.4	21.3			20.9		20.8	19.6	20.7	20.3	18.5
Ta	5.3		3.8	6.3	5.0	5.7	5.5	5.7	5.7			5.9		6.4	5.8	6.5	6.1	5.4
Yb	12.7		8.5	14.5	12.7	13.9	12.1	13.6	13.9			14.2		13.6	13.1	13.3	13.6	12.2
Hf	71.3		51.3	83.2	69.9	78.6	71.6	75.7	74.6			76.8		76.3	84.4	85.0	72.0	62.6
Pb	103.0		62.8	142.4	122.2	116.4	106.3	108.8	106.4			105.6		109.4	95.8	110.4	114.9	93.9
Th	46.1		31.5	51.7	43.5	50.2	47.5	49.2	49.8			50.7		52.3	50.9	50.0	48.7	44.6
U	10.7		7.5	10.7	8.9	11.5	10.9	11.4	11.2			11.4		11.3	11.7	12.0	10.7	10.3

table S2 (continued, p4)

Sample	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	P-62	CBS	CBS	CBS
Mi no.	GM-4	GM-5	GM-9a	GM-9b	GM-10	GM-11	PX-1a	PX-1b	PX-2a	PX-2b	PX-3	GM-7	GM-6	GM-8	GM-3	1a	1b	2a
Host	fsp	fsp	fsp	fsp	fsp	fsp	cpx	cpx	cpx	cpx	cpx	cpx	ol	ol	qtz	fsp	fsp	fsp
Type <sup>a</sup>	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	t	t	c
SiO <sub>2</sub> (wt%) <sup>b</sup>	76.11	75.97	76.25	76.79	76.62	76.28	74.59	73.97	74.45	74.82	70.86	76.64	74.64	76.63	75.98	65.41	65.27	74.04
TiO <sub>2</sub>	0.19	0.19	0.20	0.14	0.19	0.21	0.20	0.17	0.27	0.20	0.27	0.18	0.20	0.16	0.18	0.43	0.42	0.23
Al <sub>2</sub> O <sub>3</sub>	10.40	10.51	10.57	10.50	10.16	10.48	11.13	10.75	11.44	10.82	13.63	10.63	10.47	10.09	10.74	15.87	16.28	10.74
FeO*	4.47	4.03	4.20	3.81	4.05	4.03	4.27	4.74	4.10	4.47	3.77	4.54	5.61	5.02	4.27	4.59	4.51	4.30
MnO	0.07	0.08	0.10	0.09	0.08	0.09	0.10	0.16	0.12	0.11	0.10	0.11	0.14	0.11	0.08	0.15	0.18	0.10
MgO	0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.16	0.17	0.01
CaO	0.22	0.23	0.21	0.22	0.21	0.22	0.26	0.46	0.26	0.59	0.25	0.27	0.23	0.22	0.21	1.33	1.39	0.22
Na <sub>2</sub> O	4.52	4.86	4.34	4.39	4.57	4.48	4.79	5.25	4.77	4.55	6.15	3.48	4.59	3.79	4.39	6.25	5.87	5.88
K <sub>2</sub> O	4.01	4.13	4.13	4.05	4.11	4.21	4.66	4.50	4.60	4.43	4.97	4.15	4.11	3.97	4.15	5.82	5.90	4.49
Subtotal	93.83	95.46	94.47	95.71	94.74	94.14	92.16	95.46	92.60	93.52	94.82	94.87	96.20	97.02	95.09	97.60	95.89	93.78
O=(Cl,F) <sub>2</sub>	0.23	0.24	0.24	0.22	0.24	0.24						0.22	0.28	0.23	0.23			0.23
Total	93.60	95.22	94.23	95.49	94.50	93.90	92.16	95.46	92.60	93.52	94.82	94.65	95.92	96.79	94.86	97.60	95.89	93.55
Alkalinity <sup>c</sup>	1.13	1.19	1.10	1.11	1.18	1.14	1.16	1.26	1.12	1.13	1.14	0.96	1.15	1.05	1.09	1.04	0.99	1.35
<i>Volatiles<sup>d</sup></i>																		
Cl	3900	4200	4100	3700	4100	4161	3777	4093	4056	4001	2580	3900	5166	3808	3800	858	979	3976
F	3482	3440	3398	3331	3500	3455						3061	3872	3448	3544			3427
S	106	109	106	103	109	110						140	117	103	111			73
H <sub>2</sub> O wt%											1.58					1.17		2.26
<i>Trace Elements via SHRIMP (ppm)</i>																		
Li	69.4	66.1	72.1	70.0	86.7	78.2						73.2	81.2	77.8	62.5			92.2
Be	19.4	18.7	20.2	20.1	22.1	20.8						19.5	21.2	21.0	19.7			19.3
B	26.0	25.2	26.7	26.6	29.0	27.0						25.1	33.0	28.0	27.6			25.1
Mg	144.2	137.4	133.5	144.0	140.9	138.1						2904	146.0	133.0	126.8			179.7
P	8.0	7.1	7.0	8.4	7.2	7.5						6.7	22.6	7.1	7.0			9.1
Cu																		
Rb	346.4	351.0	345.5	368.3	353.0	350.8						313.0	411.1	348.4	355.5			351.4
Sr	1.8	1.7	1.8	1.9	1.7	1.8						3.1	2.2	1.6	1.6			1.8
Y	102.4	102.2	101.4	106.8	103.2	101.4						113.8	110.2	98.1	106.4			91.9
Zr	2266	2274	2118	2246	2270	2230						1933	2988	2180	2419			2136
Nb	288.6	288.8	280.3	296.5	294.9	283.9						249.6	371.1	282.1	304.9			288.2
Cs	4.8	4.8	4.8	5.2	5.0	4.9						4.5	6.1	4.8	5.0			4.9
Ba	6.4	5.9	6.0	7.0	5.9	6.0						5.1	5.8	5.2	5.6			7.7
La	91.3	91.8	89.0	93.2	92.9	91.6						96.4	86.0	86.9	91.8			89.9
Sm	21.0	20.9	20.4	21.6	21.8	21.7						29.1	21.7	20.1	21.3			20.8
Ta	5.7	5.3	5.6	5.8	5.7	5.8						7.7	6.4	5.4	6.1			4.8
Yb	13.0	13.1	13.7	13.4	12.9	13.3						20.4	14.0	12.7	14.1			11.4
Hf	71.9	72.8	69.8	76.7	71.9	71.3						62.0	97.8	71.7	79.5			70.7
Pb	104.0	101.9	104.2	111.0	105.1	104.6						90.3	132.8	96.1	111.4			80.7
Th	48.7	47.9	46.3	50.8	49.2	47.0						40.1	67.5	45.1	53.0			44.9
U	10.7	11.3	10.1	11.5	11.4	10.7						8.6	15.8	10.1	12.0			10.2

table S2 (continued, p5)

Sample	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	
Mi no.	3a	3b	4	5	7	8	9a	9b	GM-8	GM-9	GM-10	GM-11	PX-1a	PX-1c	PX-1d	PX-2	PX-5	PX-8a	
Host Type <sup>a</sup>	fsp t	fsp t	fsp t	fsp t	fsp t	fsp c	fsp t	fsp t	fsp t	fsp t	fsp t	fsp t	fsp t	cpx c	cpx c	cpx c	cpx t	cpx t	cpx t
SiO <sub>2</sub> (wt%) <sup>b</sup>	65.00	64.70	65.41	65.56	65.44	75.51	65.95	64.86	65.66	65.99	66.26	67.48	74.89	74.13	74.14	67.74	66.06	64.98	
TiO <sub>2</sub>	0.45	0.42	0.43	0.40	0.50	0.22	0.43	0.55	0.56	0.42	0.40	0.27	0.20	0.23	0.20	0.37	0.48	0.40	
Al <sub>2</sub> O <sub>3</sub>	16.78	16.82	15.91	17.04	15.81	10.51	16.29	16.05	15.87	16.18	15.76	15.42	10.49	10.35	10.45	15.85	15.88	15.60	
FeO*	4.08	4.07	4.80	3.74	5.07	4.14	4.38	5.66	5.22	4.33	4.69	4.21	4.58	4.66	4.58	3.40	4.82	5.73	
MnO	0.13	0.13	0.15	0.11	0.16	0.09	0.14	0.18	0.18	0.14	0.15	0.13	0.07	0.13	0.11	0.11	0.15	0.20	
MgO	0.20	0.20	0.20	0.19	0.22	0.01	0.14	0.15	0.19	0.18	0.12	0.06	<0.01	0.04	0.01	<0.01	0.13	0.19	
CaO	1.37	1.36	1.35	1.33	1.44	0.24	1.28	1.43	1.51	1.37	1.32	1.13	0.28	1.09	0.38	0.40	1.30	1.65	
Na <sub>2</sub> O	5.84	6.17	5.91	5.33	5.77	4.97	5.60	5.28	5.10	5.54	5.60	5.61	4.86	5.04	5.72	6.31	5.38	5.78	
K <sub>2</sub> O	6.17	6.13	5.82	6.29	5.59	4.32	5.80	5.85	5.71	5.86	5.70	5.69	4.63	4.34	4.41	5.82	5.80	5.46	
Subtotal	96.92	97.63	97.35	96.09	97.09	95.13	96.33	95.18	96.02	96.81	96.36	96.33	90.70	95.13	93.08	94.90	95.81	97.18	
O=(Cl,F) <sub>2</sub>	0.05	0.04	0.05	0.05	0.06	0.21	0.06	0.06	0.06	0.06	0.06	0.06	0.10	0.09	0.24	0.08	0.06	0.06	
Total	96.87	97.59	97.29	96.05	97.03	94.92	96.28	95.12	95.96	96.75	96.30	96.27	90.61	95.04	92.83	94.82	95.75	97.12	
Alkalinity <sup>c</sup>	0.97	1.00	1.01	0.91	0.98	1.22	0.95	0.94	0.92	0.96	0.98	1.00	1.24	1.25	1.36	1.05	0.95	0.99	
<i>Volatiles<sup>d</sup></i>																			
Cl	711	784	810	619	943	3996	849	1113	849	850	1064	943	4280	4018	4037	1401	1124	1037	
F	773	614	864	760	995	2774	853	881	975	858	956	863			3636	1181	930	946	
S	171	153	192	160	224	91	189	193	229	180	190	153			91	164	208	222	
H <sub>2</sub> O wt%	1.26	1.12	1.02	0.83	1.05		1.07						2.51	1.21	2.58	1.39		0.96	
<i>Trace Elements via SHRIMP (ppm)</i>																			
Li	19.3	12.7	22.9	19.0	25.3	61.9	20.5	22.4	28.2	25.7	24.7	24.1			55.4	17.6	26.2	21.9	
Be	3.6	3.1	4.2	3.3	4.6	17.5	4.3	4.3	4.5	4.3	4.9	6.3			18.3	5.6	5.1	4.7	
B	6.1	5.0	5.8	4.8	6.9	23.4	5.8	6.5	6.6	5.5	6.3	7.9			24.5	7.6	7.1	6.2	
Mg	2152	1887	2371	2088	2440	134.7	1681	1780	2259	1839	1383	681.8			163.9	75.8	1632	2127	
P	127.3	114.6	101.2	103.8	125.1	6.6	95.2	96.6	169.9	104.7	99.8	45.5			11.5	61.8	96.7	94.8	
Cu																			
Rb	107.6	94.1	116.0	101.4	135.2	298.8	119.5	125.3	120.7	110.9	121.5	132.4			276.3	134.7	121.4	120.6	
Sr	11.0	22.2	5.2	11.2	3.4	1.0	8.0	4.2	4.7	4.5	6.7	1.7			1.1	2.4	4.0	4.2	
Y	23.2	19.4	26.0	21.5	29.8	85.0	25.2	27.4	26.6	23.4	28.7	35.8			102.1	40.3	27.5	29.4	
Zr	416	357	500	389	566	1886	497	523	482	456	535	704			2299	892	528	549	
Nb	59.2	48.9	67.6	51.1	79.8	246.2	69.1	71.1	64.1	62.3	72.5	93.0			292.7	103.2	74.6	75.1	
Cs	1.1	0.9	1.1	0.8	1.4	4.1	1.1	1.2	1.2	1.0	1.2	1.4			4.0	1.4	1.1	1.2	
Ba	42.4	101.8	19.6	47.4	8.4	5.1	34.3	16.5	41.9	15.8	23.9	4.3			5.8	7.9	14.3	15.0	
La	35.5	30.8	39.9	33.7	46.0	74.5	41.9	44.3	37.2	37.9	49.4	84.7			90.7	88.2	44.3	46.6	
Sm	7.9	6.6	7.9	7.0	9.6	16.3	8.1	8.2	8.2	7.8	9.8	12.7			21.1	13.4	8.7	10.1	
Ta	1.3	1.2	1.5	1.1	1.7	4.1	1.4	1.7	1.6	1.3	1.7	2.1			6.2	2.2	1.4	1.7	
Yb	3.1	2.2	3.4	2.3	4.3	11.1	2.8	3.6	4.0	2.6	4.4	4.7			14.1	5.5	3.6	4.2	
Hf	13.5	11.0	15.2	12.0	16.3	62.6	15.4	13.9	15.7	14.0	15.6	19.7			77.7	24.4	15.0	16.2	
Pb	26.4	23.4	26.6	24.6	28.1	83.9	24.9	26.7	30.4	22.3	27.8	27.8			102.8	31.0	26.4	28.1	
Th	8.6	7.3	9.6	8.0	12.4	37.8	10.2	9.9	10.2	9.0	11.3	15.5			50.0	18.0	10.7	11.6	
U	1.9	1.6	2.1	1.8	2.6	8.5	2.0	2.5	1.7	2.0	2.3	2.9			11.1	3.8	2.4	2.5	

table S2 (continued, p6)

Sample	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS	CBS
Mi no.	PX-8d	PX-8e	PX-8f	PX-9a	PX-9b	GM-1a	GM-1b	GM-1c	GM-1d	GM-1d	GM-2a	GM-2b	GM-2c	GM-2d	GM-3	GM-4a	GM-4b	GM-6
Host	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx	cpx
Type <sup>a</sup>	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t
SiO <sub>2</sub> (wt%) <sup>b</sup>	65.71	65.24	65.17	64.66	64.62	65.58	65.54	65.88	65.65	65.93	66.06	65.98	65.63	66.06	65.42	65.65	65.45	65.94
TiO <sub>2</sub>	0.49	0.42	0.45	0.61	0.55	0.45	0.47	0.45	0.49	0.48	0.45	0.47	0.48	0.44	0.50	0.44	0.46	0.45
Al <sub>2</sub> O <sub>3</sub>	15.37	15.52	15.52	15.82	15.99	15.95	15.79	16.05	15.96	15.73	15.66	16.12	15.80	15.59	15.87	15.90	15.68	16.08
FeO*	6.04	5.65	5.43	5.88	5.64	5.30	4.95	5.25	5.18	5.55	5.51	4.92	4.80	5.48	5.67	5.24	5.51	4.87
MnO	0.50	0.20	0.16	0.17	0.18	0.17	0.15	0.13	0.14	0.14	0.15	0.13	0.15	0.16	0.12	0.16	0.20	0.15
MgO	0.46	0.17	0.15	0.14	0.15	0.21	0.17	0.19	0.18	0.18	0.16	0.16	0.15	0.15	0.22	0.17	0.18	0.18
CaO	2.19	1.52	1.50	1.51	1.42	1.39	1.47	1.38	1.35	1.47	1.51	1.44	1.36	1.56	1.62	1.38	1.43	1.34
Na <sub>2</sub> O	3.75	5.88	5.51	5.53	5.62	5.14	5.84	4.90	5.33	4.56	4.87	5.23	5.83	4.83	4.57	5.24	5.24	5.17
K <sub>2</sub> O	5.49	5.39	6.12	5.67	5.83	5.80	5.61	5.76	5.73	5.96	5.64	5.54	5.80	5.75	6.00	5.81	5.85	5.82
Subtotal	92.64	98.38	97.42	96.14	95.53	95.82	97.79	96.52	97.01	96.07	96.87	98.84	98.49	96.59	96.40	97.40	95.61	95.92
O=(Cl,F) <sub>2</sub>	0.01	0.07	0.06	0.02	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.07	0.07	0.06
Total	92.63	98.32	97.36	96.12	95.47	95.76	97.73	96.46	96.95	96.01	96.81	98.78	98.43	96.52	96.34	97.33	95.54	95.85
Alkalinity <sup>c</sup>	0.79	1.00	1.01	0.96	0.97	0.92	0.99	0.89	0.94	0.89	0.90	0.91	1.00	0.91	0.88	0.94	0.95	0.92
<i>Volatiles<sup>d</sup></i>																		
Cl	457	1103	1096	995	1113	820	753	901	798	1029	1057	987	1096	1241	986	1104	928	993
F	891	975	749		790	934	986	944	945	933	881	936	900	891	884	1057	1087	1001
S	196	197	285		199	209	201	202	207	199	207	180	275	210	179	210	177	205
H <sub>2</sub> O wt%				1.40	1.14													
<i>Trace Elements via SHRIMP (ppm)</i>																		
Li	23.7	17.9	23.0	20.5	20.8	23.8	23.6	24.5	23.4	21.2	23.9	25.8	25.5	13.3	21.7	19.9	22.1	19.1
Be	5.0	4.6	4.4	4.3	4.3	4.7	5.0	4.8	4.6	4.7	5.4	4.9	4.7	3.2	4.6	4.1	4.1	4.4
B	6.7	6.2	6.0	5.8	5.8	6.2	9.2	6.4	6.2	6.0	6.9	6.3	6.4	4.4	5.9	6.4	6.0	6.1
Mg	2484	2072	12804	1680	1791	1999	1829	2022	2032	1865	1701	1665	10570	1714	1624	3957	1466	1938
P	96.8	98.5	90.0	95.2	151.7	122.2	109.3	119.3	121.5	118.9	103.8	113.6	113.5	114.0	84.5	105.7	107.8	122.6
Cu																		
Rb	114.4	118.0	109.6	119.5	94.1	116.5	125.4	116.2	117.7	114.4	121.7	126.8	113.2	145.7	113.9	121.9	117.8	118.4
Sr	4.1	4.1	4.0	8.0	8.1	5.8	6.6	5.6	5.7	5.4	4.5	4.6	4.6	5.1	6.2	5.4	5.9	5.1
Y	28.3	30.4	31.8	25.2	26.6	27.0	28.6	27.8	26.8	28.3	28.7	26.7	28.3	33.2	25.1	25.2	24.5	25.8
Zr	527	565	524	497	444	506	533	511	501	511	509	500	454	598	476	522	507	505
Nb	70.2	74.1	65.8	69.1	60.1	68.9	75.6	70.0	69.8	70.1	70.0	69.1	61.9	79.8	65.7	62.7	62.5	69.5
Cs	1.0	1.1	1.0	1.1	0.8	1.1	1.2	1.1	1.2	1.2	1.3	1.1	1.1	1.5	1.1	1.1	1.1	1.2
Ba	14.0	13.8	13.0	34.3	39.5	21.4	22.6	21.4	21.3	20.1	15.8	17.1	15.9	17.7	23.9	20.7	23.9	18.5
La	44.4	48.2	44.2	41.9	35.4	40.4	43.1	41.2	40.6	40.9	45.0	42.1	39.1	53.1	42.0	39.2	39.0	41.2
Sm	8.3	10.5	9.6	8.1	7.3	8.1	9.2	8.6	7.9	8.9	8.8	8.7	8.2	10.3	8.6	8.4	8.3	8.6
Ta	1.7	1.8	1.9	1.4	1.3	1.6	1.2	1.7	1.5	1.7	1.7	1.7	1.8	2.3	1.6	1.6	1.6	1.5
Yb	3.9	4.5	3.7	2.8	3.5	3.1	4.5	3.7	4.5	4.5	4.0	2.8	4.1	4.9	3.7	3.0	2.6	3.7
Hf	16.9	17.9	17.1	15.4	13.4	14.1	17.1	14.3	15.3	15.9	15.1	16.8	13.8	19.4	13.0	15.1	15.2	15.6
Pb	31.0	32.6	30.9	24.9	21.7	25.2	25.7	29.5	28.1	33.7	29.3	28.1	28.3	35.1	26.2	17.3	18.9	26.0
Th	11.4	12.8	10.0	10.2	8.2	11.0	11.4	10.5	10.6	10.2	10.9	10.7	9.1	12.2	10.1	9.1	9.2	9.9
U	2.3	2.5	2.3	2.0	1.7	2.4	2.4	2.1	2.5	1.9	1.8	2.3	1.9	2.1	2.1	2.2	2.2	2.2



table S2 (continued, p7)

Sample	CBS OL- 1a	CBS OL- 1b	CBS OL- 2b	CBS OL- 2c	CBS OL-3	CBS GM- 7	Average Trachytic MI	Average Comenditic MI	Relative Error %
Mi no.	ol	ol	ol	ol	ol	ol			
Host Type <sup>a</sup>	t	t	t	t	t	t			
SiO <sub>2</sub> (wt%) <sup>b</sup>	64.80	65.03	67.19	66.74	64.94	65.54	65.67	75.23	2.3
TiO <sub>2</sub>	0.42	0.36	0.41	0.40	0.42	0.43	0.44	0.21	8.4
Al <sub>2</sub> O <sub>3</sub>	15.71	15.32	15.43	15.92	15.03	15.60	15.91	10.59	3.4
FeO*	5.93	6.55	4.51	4.35	7.41	5.91	4.99	4.23	5.2
MnO	0.20	0.22	0.14	0.22	0.24	0.18	0.17	0.10	15.6
MgO	0.15	0.13	0.10	0.18	0.22	0.16	0.17	0.02	7.5
CaO	1.30	1.36	1.40	1.06	1.34	1.39	1.35	0.28	5.8
Na <sub>2</sub> O	5.93	5.84	5.75	5.79	4.88	5.11	5.57	5.00	5.9
K <sub>2</sub> O	5.56	5.18	5.07	5.33	5.53	5.69	5.73	4.37	3.6
Subtotal	97.37	97.95	97.87	97.85	96.29	96.87	96.84	93.96	1.8
O=(Cl,F) <sub>2</sub>	0.07	0.07			0.06	0.06	0.06	0.23	4.1
Total	97.30	97.89	97.87	97.85	96.22	96.81	96.79	93.79	1.8
Alkalinity <sup>c</sup>	1.00	0.99	0.97	0.96	0.93	0.93	0.97	1.23	4.8
<i>Volatiles<sup>d</sup></i>									
Cl	967	1332	1579	1304	990	906	986	3974	5.4
F	1064	902			973	996	919	3355	3.1
S	184	160			197	188	197	112	2.5
H <sub>2</sub> O wt%	1.21						1.71	2.58	12.6
<i>Trace Elements via SHRIMP (ppm)</i>									
Li	16.9	21.0			21.2	17.5	21.7	62.1	8.9
Be	5.0	4.8			5.5	4.6	4.6	18.9	7.4
B	6.6	9.1			7.4	6.0	6.4	26.8	5.0
Mg	2314	1368			2186	1652	2458.7	222.9	2.5
P	86.7	81.5			90.5	110.0	105.3	8.1	1.8
Cu								14.5	12.0
Rb	118.5	167.3			120.1	118.2	119.9	342.4	4.2
Sr	3.2	1.3			4.8	3.9	5.6	1.8	4.3
Y	31.1	34.1			28.3	29.4	28.0	100.1	4.2
Zr	603	928			547	502	534.0	2224.8	3.3
Nb	80.5	122.4			75.1	70.6	71.6	288.3	3.5
Cs	1.3	1.8			1.2	1.2	1.2	4.7	3.4
Ba	10.9	3.6			14.6	13.1	22.2	6.4	3.4
La	52.4	129.6			46.7	45.4	47.4	91.5	3.8
Sm	10.0	14.1			8.8	9.8	9.1	20.7	5.0
Ta	2.1	2.0			1.8	1.8	1.6	5.6	6.7
Yb	4.5	4.8			3.9	4.7	3.8	13.1	15.1
Hf	18.0	29.8			17.7	16.0	16.2	73.9	8.4
Pb	35.2	38.6			33.8	28.8	27.8	101.1	4.7
Th	13.1	20.7			11.3	10.3	11.0	47.5	7.8
U	2.9	4.1			2.7	2.3	2.3	10.7	6.1

**table S3.** Compositions of phases use in least squares linear regression modeling. Observed trachyte and comendite are average matrix glass compositions from CBS-TPUM and PEK-62, respectively.

	Observed Trachyte	Observed Comendite	Feldspar An <sub>0</sub> Ab <sub>66</sub> Or <sub>34</sub>	Feldspar An <sub>10</sub> Ab <sub>51</sub> Or <sub>39</sub>	Pyroxene Wo <sub>43</sub> En <sub>03</sub> Fe <sub>54</sub>	Pyroxene Wo <sub>44</sub> En <sub>20</sub> Fe <sub>36</sub>	Olivine Fa <sub>98</sub>	Quartz	Ilmenite	Apatite
SiO <sub>2</sub>	65.65	75.22	67.33	65.64	48.92	50.20	29.68	99.97	0	0
TiO <sub>2</sub>	0.44	0.21	0	0.43	0.27	0.51	0.02	0.01	51.07	0
Al <sub>2</sub> O <sub>3</sub>	15.91	10.58	18.49	15.84	0.17	0.82	0.24	0.02	0	0
FeO*	4.99	4.23	0.59	5.00	29.24	20.12	66.87	0	47.59	0.02
MnO	0.17	0.10	0	0.17	0.93	0.79	2.38	0	1.24	0.02
MgO	0.17	0.02	0	0.06	0.82	6.93	0.57	0	0.05	0
CaO	1.35	0.28	0.01	1.36	18.23	20.15	0.21	0	0.05	57.68
Na <sub>2</sub> O	5.57	4.99	7.49	5.67	1.38	0.48	0.01	0	0	0
K <sub>2</sub> O	5.73	4.36	6.09	5.88	0.02	0	0.03	0	0	0
P <sub>2</sub> O <sub>5</sub>	0.02	0.001	0	0.01	0	0	0	0	0	42.28

**table S4. Results of least squares linear regression modeling of the derivation of PEK-62 comendite from CBS-TPUM trachyte.** “Observed Trachyte” represents the average composition of trachytic matrix glass in sample CBS-TPUM. “Estimated Trachyte” 1 and 2 represent the most successful results of least squares linear regression modeling performed using the compositions in Table S3. Numbers below the major element compositions represent the coefficients (phase proportions) calculated for each phase for successful runs 1 and 2. Two dashes indicate that phase was not used in the analysis. Compositions listed in the Observed column represent those used as independent variables and correspond to those listed in table S3.

	Observed	Estimated Trachyte	
	Trachyte	1	2
SiO <sub>2</sub>	65.65	65.64	65.64
TiO <sub>2</sub>	0.44	0.43	0.43
Al <sub>2</sub> O <sub>3</sub>	15.91	15.85	15.84
FeO*	4.99	4.99	5.00
MnO	0.17	0.17	0.17
MgO	0.17	0.20	0.06
CaO	1.35	1.36	1.36
Na <sub>2</sub> O	5.57	5.66	5.67
K <sub>2</sub> O	5.73	5.87	5.88
P <sub>2</sub> O <sub>5</sub>	0.02	0.02	0.01
Wt. fraction comendite		0.21	0.21
Feldspar	An <sub>0</sub> Ab <sub>66</sub> Or <sub>34</sub>	0.22	0.21
Feldspar	An <sub>10</sub> Ab <sub>51</sub> Or <sub>39</sub>	0.48	0.49
Pyroxene	Wo <sub>43</sub> En <sub>03</sub> Fe <sub>54</sub>	0.02	0.05
Pyroxene	Wo <sub>44</sub> En <sub>20</sub> Fe <sub>36</sub>	0.02	--
Olivine	Fa <sub>98</sub>	0.04	0.03
Quartz		--	--
Ilmenite		0.01	0.01
Apatite		<0.01	<0.01

**table S5. H<sub>2</sub>O contents in comenditic MI and modeled saturation pressures.**  
 Saturation pressures calculated using the model of (19) at 720°C.

Sample	H <sub>2</sub> O wt%	Saturation P (bar)
PKTU-1	2.73	445
PKTU-2	1.77	200
PKTU-3	2.95	513
PKTU-4a	2.42	357
PKTU-4b	2.02	256
PKTU-5	2.73	445
PKTU-7	1.65	176
PKTU-8	2.70	436
PKTU-9	2.28	320
PKTU-10	2.18	295
P-26-1	2.94	510
P-26-PX-1a	4.36	1046
P-26-PX-1b	2.62	413
P-62-1	3.00	529
P-62-2a	1.85	218
P-62-2b	2.39	349
P-62-3	1.50	148
P-62-6	3.30	629
P-62-7a	1.39	128
P-62-7b	1.88	224
P-62-7c	2.32	331
P-62-8	2.82	472
P-62-9	3.31	633
P-62-10	1.71	188
P-62-12a	1.77	200
P-62-12b	2.33	333
P-62-14	1.82	211
P-62-15	2.90	497
P-62-16	4.23	990
P-62-18	1.71	188
P-62-PX-3	1.58	163
CBS-2a	2.26	315
CBS-PX-1a	2.51	382
CBS-PX-1c	1.21	99
CBS-PX-1d	2.58	767