

## Summary of experimental runs

Composition	Runs	Beamline	$\lambda$ (Å)	Medium	P scale	P (GPa)	T (K)	# of heating spots	Analysis
Ca#10Fe#10	CF40	13-IDD	0.4133	NaCl	Au	39-42	1807-2526	4	Stab.
Ca-pyrolite	CP57	13-IDD	0.4133	Ne	Au	51-63	2343-2592	3	Stab., EOS
	CP64	13-IDD	0.4133	Ar	Au	64	2284	1	Stab., EOS, Chem.
	CP65	13-IDD	0.4133	NaCl	Au	61-68	2123-2909	3	Stab., EOS
	CP77	13-IDD	0.4133	NaCl	Au	71-83	1869-3022	6	Stab., EOS
	CP100	13-IDD	0.4133	NaCl	Au	90-107	1932-2861	6	Stab., EOS
	Komatiitic	K33	13-IDD	0.3344	Ne	Au	33	2200	3
K62		13-IDD	0.3344	Ne	Au	62	2350		EOS, Chem.
		16-IDB	0.4066						
K100		13-IDD	0.3344	Ne	Au	100	2300		EOS, Chem.
		16-IDB	0.4066						
K59B		13-IDD	0.3344		Brg, CaPv	52-65	1961-2710	12	Stab.
K73B		13-IDD	0.3344		Brg, CaPv	67-79	2128-2638	12	Stab.
Ca#30Fe#13	CF58M	13-BMC	0.4340	Ar	Au	58 (at 300K)	2400		M.S.
		3-IDB							
	CF59M	13-BMC	0.4340	Ar	Au	59 (at 300K)	2150		M.S.
		3-IDB							

The CF58M and CF59M samples were synthesized at ASU.  $\lambda$ : X-ray wavelength; P: pressure; T: temperature; Brg: bridgmanite; CaPv: CaSiO<sub>3</sub> perovskite; Stab.: examination of stability; EOS: equation of state; Chem.: chemical analysis; M.S.: Mössbauer spectroscopy

**Run table for Ca-rich bridgmanite stability at high  $P-T$ .**

Run No.	Data No.	Composition	Medium	Heating duration	$V$ (Au) ( $\text{\AA}^3$ )	$P$ (GPa)	$\sigma(P)$ (GPa)	$T$ (K)	$\sigma(T)$ (K)	Phase assemblage
CF40	24	Ca10/Fe10	NaCl	01:34	59.88(0)	42.2	3	2201	144	Brg+CaPv
	42	Ca10/Fe10	NaCl	00:53	59.77(8)	40.2	2.8	1807	119	Brg+CaPv
	54	Ca10/Fe10	NaCl	01:14	59.77(2)	41.2	2.9	1955	123	Brg+CaPv
	72	Ca10/Fe10	NaCl	03:14	60.85(2)	39.3	2.8	2526	123	Ca-rich Brg
CP57	12	Ca-pyrolite	Ne	01:44	58.27(3)	55.3	3.9	2769	266	Ca-rich Brg+Fp+CaPv
	23	Ca-pyrolite	Ne	04:53	57.80(4)	56.3	3.9	2487	146	Ca-rich Brg+Fp
	30	Ca-pyrolite	Ne	03:30	56.67(3)	63.3	4.4	2343	155	Ca-rich Brg+Fp
	42	Ca-pyrolite	Ne	03:41	57.83(2)	55.4	3.9	2377	124	Ca-rich Brg
	45	Ca-pyrolite	Ne	02:14	58.66(2)	51.6	3.6	2592	129	Ca-rich Brg+Fp
CP64	6	Ca-pyrolite	Ar	03:32	56.46(7)	64.5	4.5	2284	254	Ca-rich Brg
CP65	18	Ca-pyrolite	NaCl	03:47	56.73(5)	61.5	4.3	2123	103	Brg+CaPv
	35	Ca-pyrolite	NaCl	02:03	56.54(10)	67.9	4.8	2909	181	Ca-rich Brg+Fp+CaPv
	43	Ca-pyrolite	NaCl	04:02	56.38(3)	66	4.6	2424	117	Ca-rich Brg+Fp
CP77	25	Ca-pyrolite	NaCl	01:22	55.60(2)	70.9	5	2219	213	Brg+CaPv
	30	Ca-pyrolite	NaCl	00:20	55.36(1)	70.7	4.9	1869	123	Brg+CaPv
	36	Ca-pyrolite	NaCl	03:32	54.51(10)	83	5.8	2630	313	Ca-rich Brg
	44	Ca-pyrolite	NaCl	02:34	55.24(3)	76.8	5.4	2668	219	Ca-rich Brg
	52	Ca-pyrolite	NaCl	02:10	55.45(8)	77.1	5.4	3022	202	Ca-rich Brg+Fp
	63	Ca-pyrolite	NaCl	08:24	54.50(7)	83.4	5.8	2675	220	Ca-rich Brg
CP100	30	Ca-pyrolite	NaCl	05:49	52.19(15)	107.3	7.5	2691	213	Ca-rich Brg+Fp
	37	Ca-pyrolite	NaCl	05:43	52.68(8)	99.4	7	2306	129	Ca-rich Brg+Fp
	53	Ca-pyrolite	NaCl	03:38	53.33(2)	90.1	6.3	1932	146	Brg+Fp+CaPv
	62	Ca-pyrolite	NaCl	02:21	53.12(6)	93.6	6.6	2130	224	Brg+CaPv
	67	Ca-pyrolite	NaCl	03:38	53.00(3)	99.4	7	2861	207	Ca-rich Brg+CaPv
	73	Ca-pyrolite	NaCl	03:22	52.27(2)	107.9	7.6	2916	136	Ca-rich Brg
K33	7	komatiitic	Ne	04:30	61.66(2)	34.5	2.4	2356	140	Brg+CaPv
	13	komatiitic	Ne	05:00	61.91(5)	33.6	2.3	2382	100	Brg+CaPv
	15	komatiitic	Ne	05:00	61.65(2)	32.3	2.3	2012	112	Brg+CaPv
K48	51	komatiitic	Ne	05:00	58.56(5)	48.4	3.4	2000	200	Brg+CaPv

X-ray energies were 37keV for K33 and 30keV for the other runs. Pressure was calculated using the Vinet equation of state of Au (ref.43). Pressure uncertainties ( $\sigma(P)$ ) were assumed to be 7% of the estimated pressures.

**Run table for runs K59B and K73B (the komatiitic composition) at high  $P-T$ .**

Run No.	Data No.	$V$ (Brg) ( $\text{\AA}^3$ )	$P$ (GPa)	$\sigma(P)$ (GPa)	$T$ (K)	$\sigma(T)$ (K)	Phase assemblage	
K59B	12	140.84(4)	65.1	6.5	2000	129	Brg+CaPv	
	42	146.19(8)	58.9	5.9	2700	118	Ca-rich Brg+CaPv	
	50	145.99(5)	58.7	5.9	2500	123	Ca-rich Brg	
	224	143.94(6)	65.4	6.5	2400	111	Ca-rich Brg	
	238	143.33(6)	68.2	6.8	2500	102	Ca-rich Brg	
	245	143.84(4)	65.5	6.5	2340	105	Ca-rich Brg	
	251	145.12(4)	61.4	6.1	2440	121	Ca-rich Brg	
	256	143.77(4)	66.6	6.7	2500	100	Ca-rich Brg	
	261	143.29(6)	68.6	6.9	2540	114	Ca-rich Brg	
	266	145.12(5)	61.6	6.2	2480	116	Ca-rich Brg	
	271	145.72(6)	59.5	6	2480	102	Ca-rich Brg	
	276	146.86(6)	55	5.5	2330	127	Ca-rich Brg	
	K73B	8	141.22(4)	76.2	7.6	2470	105	Ca-rich Brg
		20	140.63(6)	79.2	7.9	2570	100	Ca-rich Brg
27		140.33(5)	78.9	7.9	2320	102	Ca-rich Brg	
32		137.33(4)	79.1	7.9	2027	106	Brg+CaPv	
37		140.71(6)	77.2	7.7	2280	100	Ca-rich Brg+(CaPv) <sup>a</sup>	
42		141.22(6)	75.7	7.6	2380	113	Ca-rich Brg	
47		142.41(4)	71.6	7.2	2470	152	Ca-rich Brg	
52		142.12(6)	71.6	7.2	2280	111	Ca-rich Brg	
57		140.92(7)	76.8	7.7	2360	102	Ca-rich Brg	
62		139.95(6)	81.2	8.1	2435	102	Ca-rich Brg	
67		141.95(6)	72.7	7.3	2370	146	Ca-rich Brg	
72		139.55(16)	82.2	8.2	2320	125	Ca-rich Brg+(CaPv) <sup>a</sup>	

Heating duration for each data point was 5second. No pressure medium was used in the runs listed here. X-ray energy was 37keV. Static pressure was calculated using the equation of state (EOS) parameters of Brg and Ca-rich Brg for the komatiitic composition in this study. Thermal pressure was calculated using the EOS parameters of MgSiO<sub>3</sub> Brg (ref.45). Pressure uncertainties ( $\sigma(P)$ ) were assumed to be 10% of the estimated pressures.

<sup>a</sup>The intensity of X-ray diffraction peaks is low.

**Run table for Ca-pyrolite at 300K.**

Run No.	Data No.	Medium	$V$ (Au) ( $\text{\AA}^3$ )	$P$ (GPa)	$V$ (Brg) ( $\text{\AA}^3$ )	$a$ ( $\text{\AA}$ )	$b$ ( $\text{\AA}$ )	$c$ ( $\text{\AA}$ )	Octahedral tilting ( $^\circ$ )	Phase assemblage
CP57	2	Ne	56.74(3)	50.0(3)	143.03(6)	4.571(1)	4.749(1)	6.589(3)	19.2(2)	Ca-rich Brg
	16 <sup>a</sup>	Ne	57.08(4)	47.5(3)	142.71(10)	4.574(1)	4.742(2)	6.579(7)	18.5(3)	Ca-rich Brg+CaPv
	26	Ne	57.44(3)	45.0(2)	144.39(13)	4.591(1)	4.759(1)	6.609(6)	18.6(3)	Ca-rich Brg
	33	Ne	56.37(3)	52.8(3)	143.88(6)	4.580(1)	4.757(1)	6.604(3)	19.2(2)	Ca-rich Brg+Fp
	43	Ne	56.82(4)	49.4(3)	143.49(8)	4.578(1)	4.754(2)	6.594(3)	19.0(2)	Ca-rich Brg
	49	Ne	57.11(11)	47.3(8)	144.12(6)	4.587(1)	4.758(2)	6.604(3)	18.7(2)	Ca-rich Brg+Fp
	82	Ne	57.05(9)	47.7(7)	143.77(7)	4.580(1)	4.751(2)	6.607(3)	19.1(2)	Ca-rich Brg
	94	Ne	56.96(3)	48.3(2)	143.19(14)	4.570(2)	4.749(2)	6.597(7)	19.5(4)	Ca-rich Brg
	97	Ne	57.03(2)	47.9(1)	143.99(6)	4.582(1)	4.757(2)	6.606(3)	19.2(2)	Ca-rich Brg
CP64	120	Ar	56.40(6)	52.5(4)	142.73(5)	4.566(1)	4.740(1)	6.594(2)	19.4(2)	Ca-rich Brg
	121	Ar	56.88(4)	48.9(3)	143.16(6)	4.569(2)	4.750(1)	6.596(2)	19.5(2)	Ca-rich Brg
	123	Ar	56.31(8)	53.2(6)	142.56(6)	4.563(2)	4.740(1)	6.592(2)	19.6(2)	Ca-rich Brg
	289	Ar	67.83(11)	0.1(3)	166.79(18)	4.823(2)	4.980(1)	6.945(7)	18.0(4)	Ca-rich Brg+Fp
CP65	36	NaCl	55.73(1)	57.8(1)	141.60(12)	4.548(1)	4.730(1)	6.583(6)	20.1(3)	Ca-rich Brg+Fp+CaPv
	44	NaCl	55.73(4)	57.9(2)	141.49(6)	4.553(1)	4.732(1)	6.567(3)	19.4(2)	Ca-rich Brg
CP77	27	NaCl	54.86(11)	65.2(10)	136.40(6)	4.473(1)	4.695(1)	6.495(3)	21.9(2)	Brg+CaPv
	31	NaCl	54.73(1)	66.5(1)	135.81(5)	4.461(1)	4.693(1)	6.486(3)	22.4(2)	Brg+CaPv
	39	NaCl	53.87(4)	74.6(4)	137.67(5)	4.504(2)	4.696(1)	6.509(2)	20.2(2)	Ca-rich Brg
	46	NaCl	54.62(5)	67.5(5)	138.81(5)	4.513(1)	4.707(1)	6.536(2)	20.6(2)	Ca-rich Brg
	55	NaCl	54.50(5)	68.5(4)	137.86(4)	4.504(1)	4.692(1)	6.524(2)	20.4(2)	Ca-rich Brg+Fp
CP100	107	NaCl	67.75(2)	0.2(0)	163.75(7)	4.779(2)	4.949(1)	6.924(2)	19.5(2)	Brg+Fp
	33	NaCl	51.91(2)	95.8(2)	131.34(4)	4.407(1)	4.634(1)	6.430(2)	22.8(1)	Ca-rich Brg+Fp
	39	NaCl	52.16(1)	92.8(1)	132.21(6)	4.420(2)	4.641(1)	6.445(2)	22.5(2)	Ca-rich Brg+Fp
	55	NaCl	52.98(1)	83.7(1)	130.92(35)	4.402(6)	4.634(10)	6.418(7)	22.9(8)	Brg+Fp+CaPv
	64	NaCl	52.82(3)	85.4(3)	131.07(8)	4.390(2)	4.645(2)	6.428(6)	24.1(3)	Brg+CaPv
	70 <sup>a</sup>	NaCl	52.21(1)	92.3(2)	132.33(1)	4.422(1)	4.646(1)	6.441(2)	22.4(1)	Ca-rich Brg+CaPv
	77	NaCl	52.04(8)	94.2(9)	131.61(8)	4.420(1)	4.638(1)	6.421(4)	21.9(2)	Ca-rich Brg

X-ray energy was 30keV. Pressure was calculated using the Vinet equation of state (EOS) of Au (ref. <sup>42</sup>).

**Run table for the komatiitic composition at 300K.**

Run No.	Data No.	$V$ (Au) (Å <sup>3</sup> )	$P$ (GPa)	$V$ (Brg) (Å <sup>3</sup> )	$a$ (Å)	$b$ (Å)	$c$ (Å)	Octahedral tilting (°)	Phase assemblage
K33	1	59.33(2)	33.1(1)	149.66(4)	4.636(1)	4.816(1)	6.704(2)	19.7(2)	Brg+CaPv
	9	59.80(2)	30.4(1)	149.99(4)	4.638(1)	4.814(1)	6.718(2)	19.8(1)	Brg+CaPv
	17	59.72(3)	30.9(1)	150.20(4)	4.640(1)	4.818(1)	6.718(1)	19.8(1)	Brg+CaPv
	21	59.68(4)	31.1(2)	150.32(6)	4.642(2)	4.818(1)	6.721(3)	19.7(2)	Brg+CaPv
	22	66.24(3)	4.3(1)	163.76(6)	4.782(1)	4.945(2)	6.926(2)	19.2(2)	Brg+CaPv
	25	66.38(4)	3.9(1)	164.05(5)	4.783(1)	4.950(1)	6.928(2)	19.4(2)	Brg+CaPv
	26	66.57(2)	3.4(1)	164.19(5)	4.784(1)	4.953(1)	6.929(2)	19.4(2)	Brg+CaPv
	54	67.83(1)	0.1(0)	165.97(5)	4.803(1)	4.963(1)	6.963(2)	19.3(2)	Brg+CaPv
	55	67.85(2)	0.0(1)	166.05(5)	4.803(1)	4.965(1)	6.963(1)	19.3(1)	Brg+CaPv
K62	1	55.66(16)	58.4(12)	143.36(7)	4.583(1)	4.736(2)	6.604(3)	18.2(2)	Ca-rich Brg
	3	55.79(16)	57.3(12)	143.09(7)	4.581(2)	4.731(2)	6.602(2)	18.1(2)	Ca-rich Brg
	7	55.69(16)	58.1(12)	142.83(5)	4.576(1)	4.731(1)	6.597(2)	18.4(2)	Ca-rich Brg
	112	56.62(16)	50.9(11)	145.89(5)	4.614(1)	4.760(1)	6.643(2)	17.8(2)	Ca-rich Brg
	113	56.70(16)	50.3(11)	145.50(6)	4.609(1)	4.756(1)	6.638(2)	17.9(2)	Ca-rich Brg
	114	56.65(1)	50.6(0)	145.04(7)	4.601(2)	4.753(1)	6.633(3)	18.3(2)	Ca-rich Brg
	118	55.94(1)	56.1(1)	143.76(7)	4.584(2)	4.736(2)	6.621(3)	18.6(3)	Ca-rich Brg
	136	67.46(11)	1.0(3)	168.55(8)	4.848(2)	4.976(2)	6.986(2)	17.0(3)	Ca-rich Brg
	143	56.42(16)	52.4(12)	145.16(6)	4.602(1)	4.753(1)	6.636(3)	18.2(2)	Ca-rich Brg
243	67.53(3)	0.8(1)	168.46(6)	4.848(1)	4.974(1)	6.986(2)	16.9(2)	Ca-rich Brg	
K100	11	51.99(0)	93.8(0)	133.44(5)	4.461(1)	4.635(1)	6.453(2)	19.8(2)	Ca-rich Brg
	26	52.50(7)	89.0(8)	134.51(4)	4.469(1)	4.649(1)	6.473(2)	20.2(2)	Ca-rich Brg
	31	52.49(2)	89.1(3)	134.45(4)	4.470(1)	4.649(1)	6.470(2)	20.0(2)	Ca-rich Brg
	54	52.94(5)	84.1(5)	135.21(4)	4.478(1)	4.657(1)	6.484(2)	20.1(2)	Ca-rich Brg
	76	54.17(16)	71.6(14)	138.14(13)	4.527(2)	4.691(2)	6.505(6)	18.2(4)	Ca-rich Brg
	95	55.36(3)	60.9(3)	141.81(6)	4.559(1)	4.722(2)	6.588(2)	19.1(2)	Ca-rich Brg
	176	67.48(14)	0.9(4)	168.87(6)	4.850(1)	4.977(1)	6.997(2)	17.2(2)	Ca-rich Brg
	179	67.46(9)	1.0(2)	169.08(11)	4.850(2)	4.979(2)	7.002(4)	17.4(3)	Ca-rich Brg

X-ray energies were 37keV for K33 and 30keV for K100. Ne was used as a pressure medium. Pressure was calculated using the Vinet equation of state of Au (ref. <sup>42</sup>).

**Run table for K59B and K73B (the komatiitic composition) at 300K.**

Run No.	Data No.	<i>P</i> (GPa)	<i>V</i> (Brg) (Å <sup>3</sup> )	<i>a</i> (Å)	<i>b</i> (Å)	<i>c</i> (Å)	Octahedral tilting (°)	Phase assemblage	
K59B	13	63(4)	139.00(6)	4.511(2)	4.714(1)	6.537(2)	20.9(2)	Brg+CaPv	
	43	58(4)	143.30(7)	4.575(2)	4.738(1)	6.610(3)	19.1(2)	Ca-rich Brg+CaPv	
	51	58(4)	143.29(5)	4.582(2)	4.734(1)	6.607(2)	18.3(2)	Ca-rich Brg	
	225	64(5)	141.30(4)	4.560(1)	4.713(1)	6.576(2)	18.4(2)	Ca-rich Brg	
	239	66(5)	140.72(5)	4.553(1)	4.707(1)	6.566(2)	18.5(2)	Ca-rich Brg	
	246	64(4)	141.38(4)	4.560(1)	4.715(1)	6.576(2)	18.5(2)	Ca-rich Brg	
	252	60(4)	142.54(4)	4.574(1)	4.726(1)	6.594(2)	18.3(2)	Ca-rich Brg	
	257	65(5)	141.12(4)	4.558(1)	4.712(1)	6.571(2)	18.4(2)	Ca-rich Brg	
	262	67(5)	140.62(6)	4.547(2)	4.708(1)	6.569(3)	19.1(3)	Ca-rich Brg	
	267	60(4)	142.55(4)	4.574(1)	4.726(1)	6.594(2)	18.3(2)	Ca-rich Brg	
	272	58(4)	143.23(5)	4.582(1)	4.733(1)	6.605(2)	18.2(2)	Ca-rich Brg	
	277	54(4)	144.47(4)	4.596(1)	4.745(1)	6.624(2)	18.1(2)	Ca-rich Brg	
	K73B	9	73(5)	138.83(4)	4.528(1)	4.689(1)	6.539(2)	18.9(2)	Ca-rich Brg
		21	76(5)	138.03(4)	4.521(1)	4.679(1)	6.524(2)	18.7(2)	Ca-rich Brg
28		76(5)	138.10(5)	4.521(1)	4.683(1)	6.523(2)	18.9(2)	Ca-rich Brg	
33		77(5)	135.33(4)	4.458(1)	4.686(1)	6.477(2)	22.2(1)	Brg+CaPv	
38		75(5)	138.40(6)	4.524(2)	4.688(1)	6.525(2)	18.9(3)	Ca-rich Brg	
43		73(5)	138.95(5)	4.531(2)	4.692(1)	6.536(3)	18.8(2)	Ca-rich Brg	
48		68(5)	140.12(5)	4.545(1)	4.701(1)	6.558(2)	18.6(2)	Ca-rich Brg	
53		69(5)	140.05(6)	4.543(2)	4.701(1)	6.557(2)	18.7(3)	Ca-rich Brg	
58		73(5)	138.73(6)	4.525(2)	4.692(1)	6.534(3)	19.2(2)	Ca-rich Brg	
63		77(5)	137.81(6)	4.514(1)	4.684(1)	6.517(3)	19.2(3)	Ca-rich Brg	
68		69(5)	140.00(5)	4.543(2)	4.702(1)	6.554(2)	18.8(2)	Ca-rich Brg	
73		78(5)	137.45(26)	4.506(13)	4.684(2)	6.512(5)	19.7(11)	Ca-rich Brg+CaPv	

No pressure medium was used in the runs listed here. X-ray energy was 37keV. Static pressure was calculated using the equation of state (EOS) parameters of Brg and Ca-rich Brg for the komatiitic composition in this study. For K59B\_13, K59B\_43, K73B\_33, and K73B\_73, the static pressures estimated using CaPv EOS (ref.64) are 62.3, 57.5, 75.3, and 75.2GPa, in a good agreement with the pressures estimated using Brg EOS, 63.4, 57.9, 76.7, and 78.2GPa. Pressure uncertainties are assumed to be 7%.