

Supplementary Material

The composition of subduction zone fluids and the origin of the trace element enrichment in arc magmas

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Contributions to Mineralogy and Petrology

Important note: Trace element compositions and bulk fluid/eclogite partition coefficients for run products at 4 GPa and 800 °C were already reported in Rustioni et al. (2019). These data are not repeated here and the reader is requested to consult the aforementioned publication for these experiments.

Table S-1. Summary of experiments

Experiment	Pressure (GPa)	Temperature (°C)	NaCl in fluid (wt. %)	Doped Fluid	Solid Starting Material	Duration (h)	Capsule material
PC09	4	800	0	-	MORB1-2D1	84	Au
PC22	4	800	0	-	MORB1-2D1	120	Pt
PC37	4	800	0	-	MORB2-2D2	68	Pt
PC38	4	800	0	-	MORB2-2D2	128	Pt
PC24*	4	800	0	SOL1	MORB1	144	Pt
PC14	4	800	1	-	MORB1-2D1	69	Au
PC23	4	800	5	-	MORB2-DD1	163	Pt
PC10	4	800	5	-	MORB1-2D1	68	Au
PC27	4	800	10	-	MORB1-2D1	93	Pt
PC18*	4	800	10	SOL2	MORB1	52	Pt
PC36	4	800	15	-	MORB2-2D2	103	Pt
PC39	4	800	15	-	MORB2-2D2	126	Pt
PC15	4	800	15	-	MORB1-2D1	63	Au
PC41	4	700	0	-	MORB2-2D2	123	Pt
PC45	4	700	5	-	MORB2-2D2	185	Pt
PC42	4	700	10	-	MORB2-2D2	126	Pt
PC40	4	700	15	-	MORB2-2D2	127	Pt
PC47	5	800	0	-	MORB2-2D2	148	Pt
PC49	5	800	5	-	MORB2-2D2	125	Pt
PC52	5	800	10	-	MORB2-2D2	79	Pt
PC53	5	800	15	-	MORB2-2D2	126	Pt
MA08	6	800	0	-	MORB2-2D2	121	Pt
MA07	6	800	10	-	MORB2-2D2	76	Pt
MA10	6	800	15	-	MORB2-2D2	76	Pt

* denotes reversed experiments. Where no doped fluid was used, the fluid added was a solution of NaCl in water only

Table S-2. Starting materials

		MORB1	MORB1-2D1	MORB2-2D2	MORB2-DD1	SOL1	SOL2
Major elements (wt. %)	SiO ₂	54.04 (18)	53.79 (19)	55.62 (17)	55.78 (15)		
	Al ₂ O ₃	17.38 (6)	17.04 (6)	17.26 (12)	17.54 (11)		
	MgO	5.56 (3)	5.73 (3)	5.41 (3)	5.27 (2)		
	CaO	9.52 (2)	9.75 (2)	8.88 (8)	8.66 (8)		
	FeO	8.30 (12)	8.14 (13)	6.93 (5)	7.04 (6)		
	Na ₂ O	3.90 (2)	3.83 (3)	3.77 (9)	3.83 (8)		
Trace elements (ppm)	Li		236 (2)	1029 (16)	1076 (15)		100
	Be		192 (1)	1000 (11)	1040 (10)	202	100
	B		45 (1)	495 (16)	266 (15)	159	74
	Rb		61 (1)	777 (16)	728 (16)		99
	Cs		6.2 (1)	1077 (16)	1079 (15)	198	95
	Sr		254 (2)	1068 (7)	877 (8)	178	98
	Ba		456 (2)	1092 (4)	1145 (5)	180	98
	Ti	7718 (18)	7718 (18)	7153 (114)	7153 (114)		
	Nb		138 (1)	77.4 (6)	30.7 (2)	103	17
	Ta		75 (1)	82.0 (9)	15.2 (2)	104	8
	Zr		119 (1)	37.8 (3)	33.1 (2)	188	96
	Hf		121 (1)	38.9 (4)	24.5 (2)	186	98
	La		208 (2)	211 (2)	41.8 (4)	142	99
	Ce		818 (5)	519 (3)	562 (4)	146	99
	Nd		222 (1)	221 (2)	44.0 (2)	154	99
	Sm		215 (2)	224 (1)	42.3 (3)	164	99
	Eu		217 (2)	223 (2)	45.9 (5)	166	99
	Gd		239 (2)	248 (1)	47.2 (4)	168	98
	Dy		245 (2)	243 (3)	48.7 (5)	175	98
	Er		240 (2)	310 (4)	47.4 (4)	177	98
	Yb		241 (2)	296 (3)	47.6 (4)	174	98
	Lu		248 (3)	243 (3)	49.5 (6)	177	98
	Y		250 (3)	36.7 (3)	50.5 (7)	161	98
	Sc			261 (5)			
	Pb		92.5 (4)	530 (5)	21.1 (9)	189	97
	Th		198 (3)	106 (1)	39.4 (7)	117	26
	U		275 (2)	134 (1)	54.9 (4)	195	97

Numbers in parentheses are one standard deviation in the last digits. Total iron is given as FeO.

Table S-3. Fluid bulk composition

Experiment	Pressure (GPa)	Temperature (°C)	Cl	SiO ₂	Al ₂ O ₃	Na ₂ O	CaO	FeO	MgO	Total solutes
PC09	4	800	0	12.0 (3)	1.02 (4)	1.13 (5)	0.61 (2)	0.25 (2)	0.141 (5)	15.1 (4)
PC22	4	800	0	5.46 (7)	0.36 (1)	0.48 (1)	0.30 (1)	0.07 (1)	0.068 (1)	6.7 (1)
PC37	4	800	0	24.6 (2)	1.82 (1)	2.28 (4)	1.13 (4)	0.5 (3)	0.224 (3)	30.6 (7)
PC38	4	800	0	24.5 (5)	1.68 (2)	2.14 (4)	0.75 (2)	0.93 (7)	0.202 (4)	30.2 (6)
PC24	4	800	0	7.0 (5)	0.45 (3)	0.65 (4)	0.52 (3)	0.77 (8)	0.142 (5)	9.5 (7)
PC14	4	800	0.48 (3)	19 (1)	2.11 (4)	2.00 (5)	1.5 (1)	1.0 (5)	0.4 (1)	27 (2)
PC23	4	800	2.3 (2)	27 (2)	1.52 (9)	3.6 (2)	2.7 (2)	1.3 (1)	0.83 (9)	38 (3)
PC10	4	800	3.7 (3)	41 (2)	1.9 (1)	3.86 (7)	2.8 (6)	2.8 (1)	1.2 (1)	57 (3)
PC27	4	800	4.9 (5)	13.3 (5)	1.61 (3)	3.87 (6)	7.5 (6)	0.74 (3)	0.537 (6)	33 (2)
PC18	4	800	4.2 (3)	27.4 (3)	0.65 (9)	3.93 (6)	6.9 (2)	1.26 (5)	0.23 (1)	44 (1)
PC36	4	800	6.5 (2)	34.9 (9)	0.93 (3)	5.66 (6)	2.7 (4)	1.24 (8)	0.43 (1)	51 (2)
PC39	4	800	6.8 (5)	27 (3)	1.0 (1)	5.74 (8)	2.6 (8)	2.6 (3)	0.76 (8)	45 (5)
PC15	4	800	6.9 (8)	13.1 (2)	1.4 (1)	9.1 (4)	9.2 (7)	2.9 (2)	1.62 (9)	43 (3)
PC41	4	700	0	5.91 (7)	0.170 (2)	0.37 (1)	0.09 (1)	0.22 (9)	0.061 (3)	6.8 (2)
PC45	4	700	2.81 (1)	7.26 (1)	0.30 (1)	2.33 (4)	0.42 (6)	1.16 (5)	0.153 (2)	13.8 (2)
PC42	4	700	5.2 (5)	14 (1)	0.28 (2)	4.19 (4)	1.14 (7)	0.83 (9)	0.23 (1)	25 (2)
PC40	4	700	7.74 (4)	14.1 (3)	0.22 (2)	5.5 (1)	1.97 (4)	1.4 (2)	0.26 (1)	29.5 (8)
PC47	5	800	0	25.9 (4)	1.82 (7)	2.81 (5)	1.18 (6)	0.44 (1)	0.57 (2)	32.7 (6)
PC49	5	800	2.73 (1)	9.3 (3)	0.31 (1)	2.06 (3)	0.95 (7)	0.23 (7)	0.17 (1)	15.1 (5)
PC52	5	800	4.8 (4)	12 (1)	0.37 (3)	3.0 (3)	1.9 (2)	0.20 (2)	0.30 (3)	21 (2)
PC53	5	800	8.11 (3)	8.2 (3)	0.37 (1)	4.89 (9)	3.02 (6)	1.1 (2)	0.47 (1)	24.4 (7)
MA08	6	800	0	39 (2)	5.4 (5)	3.3 (1)	1.7 (2)	1.8 (2)	0.78 (8)	52 (3)
MA07	6	800	4.87 (8)	20 (2)	1.28 (7)	3.36 (8)	2.8 (2)	0.44 (2)	0.57 (4)	33 (2)
MA10	6	800	7.86 (5)	12.0 (7)	0.60 (2)	3.74 (7)	4.1 (2)	0.54 (1)	0.58 (2)	28 (1)

All compositions are given in weight %. Number in parentheses are one standard deviation in the last digit. The difference of “total solutes” to 100 % is assumed to be water.

Table S-4. Trace elements in the fluid

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81 (1)	5.2 (5)	7.74 (4)	0	2.73 (1)	4.8 (4)	8.11 (3)	0	4.87 (8)	7.86 (5)
Li	188 (5)	735 (16)	852 (53)	816 (9)	1300 (36)	892 (25)	794 (74)	836 (22)	1497 (72)	1173 (50)	1365 (16)
Be	58 (1)	56 (1)	97 (8)	99 (1)	316 (8)	195 (8)	266 (24)	215 (9)	776 (82)	682 (63)	316 (16)
B	922 (18)	1822 (5)	4723 (447)	1630 (26)	1338 (15)	874 (35)	826 (77)	1077 (34)	1247 (118)	1792 (183)	1870 (92)
Rb	1475 (20)	2852 (26)	4452 (344)	2362 (12)	1588 (57)	1433 (49)	1175 (108)	1154 (33)	1226 (52)	2853 (265)	2831 (96)
Cs	2516 (4)	4420 (153)	6013 (473)	3329 (42)	2047 (5)	1853 (89)	3409 (290)	3837 (129)	1924 (40)	4609 (442)	4981 (192)
Sr	83 (8)	1244 (47)	2203 (114)	1993 (30)	519 (20)	581 (32)	980 (97)	1799 (40)	528 (50)	2557 (112)	3577 (70)
Ba	979 (23)	2534 (94)	3304 (143)	2871 (51)	1153 (46)	1369 (54)	2886 (442)	3102 (664)	767 (69)	2940 (206)	3781 (105)
Ti	25.5 (8)	44 (3)	78 (9)	79 (17)	550 (11)	93 (4)	109 (10)	118 (5)	1396 (154)	627 (44)	273 (14)
Nb	1.94 (5)	1.89 (2)	2.7 (3)	2.6 (1)	12.1 (3)	6.5 (2)	6.2 (5)	4.7 (2)	28 (3)	18 (2)	8.5 (5)
Ta	0.58 (5)	0.7 (1)	1.6 (2)	2.0 (2)	1.77 (7)	1.12 (7)	1.5 (1)	1.37 (7)	12 (1)	3.8 (4)	1.35 (4)
La	0.23 (2)	0.5 (1)	1.4 (2)	4.0 (2)	0.45 (2)	5.1 (3)	7.2 (7)	26 (3)	19 (3)	23 (1)	46 (2)
Ce	0.84 (6)	4 (1)	6 (1)	18 (2)	2.9 (1)	19.9 (8)	25 (2)	64 (5)	84 (11)	124 (12)	153 (7)
Nd	0.26 (2)	0.46 (7)	1.5 (4)	3.7 (3)	0.55 (3)	3.5 (2)	6.4 (6)	17 (1)	20 (3)	21 (1)	34 (2)
Sm	0.26 (3)	0.47 (6)	1.1 (1)	3.4 (3)	0.64 (5)	3.0 (2)	6.1 (5)	14.4 (8)	21 (3)	21 (2)	29 (1)
Eu	0.45 (4)	1.1 (1)	1.7 (1)	7.0 (5)	1.25 (4)	5.3 (2)	14 (1)	37 (2)	38 (4)	39 (3)	59 (3)
Gd	0.24 (2)	0.44 (5)	1.2 (2)	3.3 (2)	0.80 (5)	2.4 (1)	5.2 (4)	11.5 (6)	18 (2)	16.0 (8)	18.3 (9)
Dy	0.37 (4)	0.44 (7)	1.4 (1)	2.7 (4)	1.06 (6)	1.24 (7)	2.4 (2)	5.3 (2)	15 (2)	7.8 (5)	5.0 (3)
Er	0.56 (7)	0.7 (1)	2.7 (3)	4.6 (6)	1.2 (2)	0.74 (7)	1.2 (1)	2.9 (1)	17 (3)	4.9 (7)	2.1 (1)
Yb	0.9 (1)	1.6 (2)	7.9 (9)	10 (1)	1.2 (2)	0.50 (7)	0.9 (1)	1.8 (2)	17 (3)	3.7 (7)	1.3 (1)
Lu	0.54 (8)	0.82 (5)	5.6 (5)	7.3 (9)	0.8 (1)	0.33 (4)	0.6 (1)	1.27 (9)	12 (2)	2.6 (7)	0.9 (1)
Y	13 (2)	13.8 (4)	43 (4)	30 (4)	4.0 (7)	11 (4)	11 (2)	35 (7)	94 (51)	11 (5)	2.3 (2)
Sc	0.58 (6)	0.97 (5)	2.7 (2)	3.8 (5)	4.1 (2)	0.78 (7)	1.1 (1)	1.8 (1)	12 (1)	5.1 (6)	2.0 (1)
Pb	96 (4)	361 (9)	408 (93)	1118 (35)	534 (12)	377 (19)	435 (44)	343 (19)	386 (14)	367 (39)	1358 (266)
Th	0.37 (2)	0.12 (3)	0.23 (4)	0.6 (1)	0.26 (2)	4.2 (2)	4.3 (4)	2.5 (1)	15 (2)	5.4 (4)	2.7 (1)
U	20 (4)	3.5 (4)	7.7 (9)	20 (3)	17.4 (9)	42 (3)	43 (5)	61 (4)	124 (8)	137 (19)	64 (4)

All compositions are given in ppm by weight, except for Cl (wt.%). Numbers in parentheses are one standard deviation in the last digits.

Table S-5. Mineral compositions

Experiment	Garnet								Omphacite							
	SiO ₂	TiO ₂	Al ₂ O ₃	MgO	CaO	FeO	Na ₂ O	Total	SiO ₂	TiO ₂	Al ₂ O ₃	MgO	CaO	FeO	Na ₂ O	Total
PC09	39.2 (1)	0.71 (3)	21.6 (1)	7.3 (1)	10.4 (3)	21.2 (3)	0.068 (5)	100.5	54.5 (4)	0.4 (1)	11.2 (4)	8.6 (3)	13.6 (3)	5.4 (8)	5.9 (2)	99.6
PC22	45.5 (2)	0.76 (5)	19.9 (5)	7.2 (5)	7.4 (6)	19.2 (2)	0.10 (1)	100.1	57.1 (3)	0.242 (4)	12.8 (6)	6.80 (6)	11.13 (1)	6.07 (6)	5.9 (1)	100.0
PC37	46.3 (4)	0.71 (7)	19.2 (4)	8.1 (4)	8.3 (3)	17.4 (2)	0.32 (4)	100.3	61.4 (7)	0.45 (4)	14.6 (7)	7.3 (1)	11.8 (4)	4.5 (4)	6.9 (2)	106.9
PC38	46 (1)	0.66 (2)	19.0 (8)	7.5 (2)	9.7 (7)	17.4 (4)	0.15 (4)	100.4	59.7 (5)	0.45 (9)	12 (2)	11 (3)	11 (2)	5.7 (6)	5.7 (9)	105.5
PC24	46.4 (2)	0.75 (2)	17.1 (2)	5.4 (3)	9.2 (2)	20.39 (7)	0.8 (5)	100.0	56.9 (1)	0.17 (1)	14.2 (8)	6.9 (4)	12.25 (3)	3.3 (4)	6.2 (1)	99.9
PC14	47.9 (2)	1.0 (1)	23.6 (4)	6.5 (3)	6 (4)	20.9 (4)	0.089 (8)	106.0	55.6 (2)	0.37 (4)	13.7 (7)	7.5 (2)	11.77 (2)	5.3 (6)	5.76 (2)	100.0
PC23	44.5 (4)	0.83 (5)	22 (1)	5.3 (1)	9.4 (4)	18.3 (8)	0.11 (1)	100.4	57 (1)	0.35 (1)	13.1 (6)	6.9 (1)	11.5 (5)	4.8 (3)	6.5 (5)	100.2
PC10	40.7 (4)	0.92 (5)	22.5 (2)	6.8 (1)	10.6 (3)	18.5 (2)	0.062 (1)	100.1	55.2 (4)	0.26 (2)	14.4 (2)	7.5 (2)	13.0 (3)	3.9 (1)	5.71 (8)	100.0
PC18	46 (1)	0.48 (5)	18 (1)	6.3 (2)	8.5 (4)	20.1 (5)	0.9 (5)	100.3	55.0 (8)	0.23 (2)	12.8 (4)	7.1 (4)	14.2 (5)	4.3 (2)	6.4 (1)	100.0
PC27	46.6 (5)	0.86 (5)	18.6 (3)	5.8 (3)	9.0 (3)	18.2 (7)	1.0 (3)	100.1	56.7 (4)	0.63 (9)	14.2 (2)	6.04 (1)	10.4 (1)	5.1 (4)	6.9 (1)	100.0
PC36	46 (1)	0.7 (2)	20.3 (4)	8 (1)	6.7 (8)	18.7 (6)	0.12 (3)	100.5	57.9 (4)	0.44 (3)	13.4 (3)	7.2 (3)	11.4 (4)	2.9 (5)	6.7 (1)	99.9
PC39	45.8 (4)	0.34 (4)	19.9 (3)	9.8 (5)	5.4 (3)	18.5 (4)	0.20 (3)	99.9	59.2 (3)	0.46 (2)	13.8 (4)	6.3 (1)	10.2 (3)	2.24 (7)	7.76 (4)	100.0
PC15	47.7 (6)	0.71 (4)	18.4 (6)	5.81 (5)	8.3 (6)	17.4 (4)	1.8 (2)	100.1	58.1 (7)	0.61 (9)	15.7 (2)	5.3 (2)	8.0 (4)	4.8 (3)	7.5 (4)	100.0
PC41	44.3 (5)	0.60 (5)	19.9 (2)	6.22 (8)	6.1 (2)	22.7 (3)	0.10 (1)	99.9	57 (1)	0.80 (5)	15.0 (8)	5.6 (2)	10.2 (5)	5.7 (2)	5.9 (5)	100.2
PC45	44.8 (5)	0.54 (3)	18.3 (2)	4.9 (1)	8.0 (2)	23.4 (3)	0.10 (1)	100.0	58.4 (6)	0.52 (8)	12.0 (3)	6.88 (7)	10.4 (3)	6.2 (3)	5.6 (1)	100.0
PC42	47 (2)	0.56 (4)	18.2 (2)	4.6 (2)	7.5 (6)	22.8 (3)	0.3 (1)	101.0	56.7 (8)	0.70 (3)	12.7 (3)	6.20 (7)	11.3 (3)	6.6 (2)	5.8 (1)	100.0
PC40	46.0 (2)	0.27 (5)	19.2 (2)	8.2 (5)	5.3 (3)	20.8 (4)	0.23 (5)	100.0	55.9 (2)	0.60 (5)	12.80 (8)	5.9 (1)	11.0 (2)	6.4 (2)	7.32 (8)	99.9
PC47	45.9 (5)	0.51 (3)	18.9 (3)	8.5 (5)	7.4 (4)	18.6 (7)	0.10 (1)	99.9	57.7 (3)	0.33 (1)	13.6 (2)	7.3 (1)	11.2 (2)	3.7 (3)	6.2 (2)	100.0
PC49	48 (1)	0.56 (4)	19.3 (3)	7.9 (3)	6.9 (6)	19.7 (5)	0.19 (6)	102.6	60.3 (2)	0.25 (2)	15.3 (2)	6.0 (2)	8.8 (2)	1.5 (2)	7.9 (1)	100.1
PC52	46.9 (3)	0.8 (1)	18.19 (4)	7.1 (1)	6.9 (2)	19.8 (4)	0.31 (3)	100.0	57.9 (5)	0.42 (8)	15.6 (3)	5.6 (1)	8.4 (4)	5.9 (4)	6.2 (2)	100.0
PC53	47.3 (3)	0.52 (3)	18.0 (3)	7.5 (6)	7.2 (7)	17.9 (1)	1.0 (1)	99.4	58.7 (1)	0.42 (6)	15.3 (1)	5.6 (8)	8.5 (1)	3.9 (3)	7.6 (2)	100.0
MA08	54 (2)	0.19 (7)	17.2 (6)	11.0 (3)	4.1 (6)	16.2 (2)	0.11 (1)	102.8	51.3 (9)	1.76 (9)	16.7 (6)	10.3 (8)	12 (1)	4.8 (8)	3.2 (2)	100.1
MA07	46.7 (6)	1.2 (2)	20.0 (6)	6.9 (2)	9.0 (4)	15.5 (3)	0.8 (1)	100.1	57 (1)	0.5 (1)	14.8 (2)	6.2 (2)	11.1 (5)	3 (1)	8.0 (7)	100.6
MA10	46.6 (5)	0.7 (2)	19.1 (3)	9 (1)	7 (1)	17.3 (5)	0.5 (1)	100.2	57.5 (1)	0.5 (1)	15 (1)	6.8 (6)	10.8 (8)	2.6 (4)	7.0 (2)	100.2

All compositions are given in weight %. Number in parentheses are one standard deviation in the last digit.

Table S-6. Garnet trace element composition

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81 (1)	5.2 (5)	7.74 (4)	0	2.73 (1)	4.8 (4)	8.11 (3)	0	4.87 (8)	7.86 (5)
Li	114 (9)	96 (7)	126 (14)	87 (6)	159 (11)	125 (21)	149 (22)	152 (17)	147 (51)	222 (27)	116 (927)
Be	< 33	35 (6)	110 (20)	44 (2)	66 (4)	92 (22)	63.1 (6)	93 (17)	167 (38)	118 (12)	44 (6)
B	< 82	46 (7)	< 96	23.7 (9)	98 (6)	107 (30)	36.1 (3)	53 (8)	157 (62)	78 (10)	49 (6)
Rb	10 (3)	10 (5)	8 (2)	1.52 (9)	4.1 (9)	15 (4)	8 (4)	8 (2)	19 (8)	11 (3)	33 (22)
Cs	7 (2)	10 (6)	16 (8)	0.67 (4)	3 (1)	14 (3)	4 (2)	6 (3)	18 (3)	7 (2)	54 (37)
Sr	17 (3)	19 (4)	54 (18)	3.7 (7)	4.0 (8)	8 (2)	23 (6)	24 (3)	22 (11)	44 (12)	66 (22)
Ba	7.7 (5)	18 (7)	25 (8)	6 (2)	12.5 (8)	33 (7)	10.3 (1)	9.7 (5)	43 (9)	25 (8)	11 (2)
Ti	3570 (286)	3243 (162)	3371 (202)	1618 (307)	3065 (184)	3353 (268)	4605 (645)	3106 (186)	1148 (402)	7111 (1209)	4083 (1102)
Nb	16 (2)	7 (1)	19 (7)	2.0 (9)	6 (1)	6.2 (8)	25 (8)	9 (2)	25 (18)	43 (17)	30 (11)
Ta	14 (2)	6 (1)	17 (9)	1.7 (5)	5 (1)	7 (1)	19 (6)	6.0 (9)	31 (23)	39 (17)	25 (10)
La	5 (2)	1.6 (3)	9 (4)	1.2 (5)	1.4 (2)	1.5 (2)	3.5 (3)	7 (2)	10 (6)	2.2 (3)	15 (9)
Ce	22 (10)	16 (4)	37 (7)	8 (1)	5.4 (9)	13 (2)	21 (1)	32 (4)	12 (6)	22 (4)	53 (30)
Nd	14 (3)	4.4 (5)	12 (2)	4 (1)	22 (3)	27 (4)	37 (3)	47 (4)	35 (14)	24 (5)	38 (13)
Sm	101 (5)	20 (2)	24 (5)	36 (15)	129 (9)	143 (13)	164 (7)	162 (15)	37 (14)	103 (11)	137 (42)
Eu	216 (9)	54 (5)	47 (6)	79 (26)	232 (23)	235 (17)	305 (12)	291 (24)	30 (14)	195 (15)	214 (56)
Gd	332 (11)	89 (10)	92 (12)	145 (44)	300 (30)	296 (18)	395 (14)	381 (20)	63 (33)	254 (25)	259 (74)
Dy	726 (46)	242 (14)	370 (17)	492 (41)	468 (39)	477 (25)	552 (16)	508 (51)	105 (68)	304 (43)	355 (94)
Er	967 (125)	481 (22)	1074 (80)	1284 (82)	603 (55)	666 (53)	801 (29)	703 (88)	168 (120)	305 (63)	435 (110)
Yb	852 (142)	622 (56)	1498 (155)	2030 (271)	613 (62)	663 (60)	769 (42)	644 (79)	194 (128)	253 (66)	413 (106)
Lu	636 (123)	540 (58)	1361 (163)	1919 (279)	491 (46)	540 (56)	627 (26)	502 (70)	152 (107)	184 (54)	316 (87)
Y	173 (16)	131 (20)	215 (12)	284 (41)	124 (38)	86 (4)	131 (31)	88 (10)	51 (22)	174 (35)	101 (31)
Sc	434 (48)	310 (10)	523 (55)	678 (54)	508 (44)	464 (44)	564 (30)	417 (44)	208 (135)	208 (49)	299 (82)
Pb	9 (2)	8 (2)	16 (3)	2.4 (1)	6 (3)	18 (5)	11 (3)	10 (1)	17 (9)	12 (5)	17 (6)
Th	4 (3)	0.7 (2)	2.6 (7)	2 (1)	2.5 (2)	4.1 (4)	2.5 (2)	7 (1)	8 (4)	2.9 (4)	7 (3)
U	33 (3)	3.4 (4)	7 (2)	6 (2)	53 (7)	57 (6)	52 (5)	68 (10)	15 (9)	21 (3)	61 (18)

All compositions are given in ppm by weight, except for Cl (wt.%). Numbers in parentheses are one standard deviation in the last digits.

Table S-7. Omphacite trace element composition

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81 (1)	5.2 (5)	7.74 (4)	0	2.73 (1)	4.8 (4)	8.11 (3)	0	4.87 (8)	7.86 (5)
Li	1286 (77)	1251 (39)	1221 (55)	1280 (58)	1381 (46)	1315 (41)	914 (30)	871 (23)	646 (42)	1565 (326)	863 (24)
Be	747 (55)	471 (41)	895 (44)	845 (34)	763 (13)	493 (17)	533 (14)	490 (50)	724 (39)	763 (71)	733 (50)
B	212 (40)	205 (32)	223 (30)	309 (17)	167 (21)	40 (5)	198 (14)	117 (12)	130 (28)	95 (16)	85 (16)
Rb	62 (4)	209 (78)	261 (54)	132 (17)	43 (12)	8 (3)	119 (13)	28 (2)	280 (42)	60 (31)	65 (30)
Cs	60 (3)	210 (31)	839 (317)	343 (44)	66 (18)	4 (1)	60 (7)	24 (3)	304 (65)	33 (17)	82 (39)
Sr	661 (132)	237 (30)	926 (125)	450 (95)	183 (76)	88 (28)	411 (117)	139 (12)	660 (62)	672 (294)	220 (72)
Ba	182 (22)	183 (39)	269 (162)	21 (2)	75 (11)	51 (11)	250 (132)	51 (14)	481 (47)	264 (128)	35 (14)
Ti	4824 (338)	2549 (535)	4174 (209)	3582 (287)	2002 (60)	1517 (91)	2498 (475)	2532 (354)	10575 (952)	3102 (806)	2948 (766)
Nb	38 (6)	19 (5)	19 (1)	18 (4)	4.1 (5)	2.1 (3)	15 (7)	15 (6)	32 (4)	16 (9)	18 (10)
Ta	37 (8)	14 (5)	13 (1)	1 (3)	2.9 (5)	1.6 (1)	12 (6)	12 (6)	33 (3)	14 (8)	15 (8)
La	57 (13)	3.2 (31)	66 (11)	16 (2)	37 (18)	11 (8)	94 (18)	29 (5)	37 (5)	10 (4)	3 (1)
Ce	282 (55)	37 (22)	470 (75)	146 (11)	117 (46)	34 (24)	269 (52)	88 (13)	115 (11)	48 (18)	15 (3)
Nd	62 (14)	2.3 (20)	58 (11)	16 (4)	41 (18)	16 (9)	111 (20)	47 (7)	63 (5)	22 (6)	16 (1)
Sm	63 (14)	4 (3)	58 (10)	20 (5)	43 (14)	21 (7)	108 (18)	52 (6)	106 (6)	38 (6)	37 (2)
Eu	71 (14)	7 (5)	76 (13)	28 (5)	48 (13)	24 (6)	121 (10)	689 (9)	147 (9)	46 (10)	48 (3)
Gd	69 (14)	6 (4)	59 (10)	30 (5)	48 (11)	27 (4)	113 (7)	72 (9)	167 (8)	53 (10)	50 (6)
Dy	68 (14)	9 (7)	64 (8)	43 (8)	52 (11)	20 (4)	134 (10)	76 (14)	168 (14)	53 (14)	40 (10)
Er	75 (17)	13 (10)	82 (9)	63 (12)	68 (16)	16 (5)	171 (18)	81 (22)	191 (19)	53 (17)	43 (18)
Yb	72 (18)	15 (11)	86 (7)	68 (14)	62 (19)	14 (6)	173 (17)	87 (24)	182 (19)	44 (18)	35 (16)
Lu	57 (15)	12 (9)	72 (6)	55 (11)	50 (14)	9 (6)	142 (15)	65 (18)	148 (15)	32 (14)	25 (12)
Y	25 (8)	25 (7)	35 (9)	15 (3)	43 (12)	13 (3)	31 (3)	23 (5)	28 (2)	32 (7)	11 (1)
Sc	110 (10)	92 (7)	107 (6)	113 (15)	91 (11)	40 (6)	161 (14)	100 (15)	198 (10)	85 (9)	114 (10)
Pb	243 (46)	60 (6)	157 (38)	145 (21)	56 (22)	17 (7)	184 (40)	30.4 (3)	106 (16)	108 (66)	26 (7)
Th	14 (2)	1.0 (7)	12 (3)	3.1 (6)	19 (9)	4 (2)	19 (4)	5.3 (7)	8 (1)	2.1 (5)	3 (2)
U	37 (4)	2.3 (22)	48 (4)	15 (2)	30 (11)	6 (2)	31 (3)	18 (1)	27 (5)	11 (4)	13 (5)

All compositions are given in ppm by weight, except for Cl (wt.%). Numbers in parentheses are one standard deviation in the last digits.

Table S-8. Rutile trace element composition

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81 (1)	5.2 (5)	7.74 (4)	0	2.73 (1)	4.8 (4)	8.11 (3)	0	4.87 (8)	7.86 (5)
Li	< 111	< 64	< 525	< 2342	< 107	< 120	< 85	< 95	< 869	< 643	< 499
Be	< 146	< 82	< 151	< 259	< 112	< 152	< 187	< 240	< 1570	< 1134	< 730
B	< 252	< 84	< 938	< 1326	< 254	< 145	< 133	< 171	< 1343	< 1003	< 1512
Rb	< 94	< 48	< 1177	< 783	< 14	< 106	< 82	< 55	< 1180	< 847	< 207
Cs	< 326	< 54	< 2132	< 1569	< 15	< 360	< 165	< 96	< 597	< 465	< 530
Sr	< 98	< 94	< 2637	< 236	< 15	< 55	< 48	< 30	< 927	< 686	< 855
Ba	< 243	< 199	< 283	< 178	< 23	< 44	< 47	< 55	< 1501	< 1034	< 599
Nb	6391 (1300)	5828 (79)	6392 (371)	5706 (34)	6578 (556)	7079 (305)	7922 (287)	7339 (164)	6039 (173)	< 6260	7658 (230)
Ta	5863 (1365)	5287 (347)	6008 (563)	5164 (115)	6982 (681)	6987 (354)	7713 (192)	7254 (158)	5963 (177)	< 6267	7429 (677)
La	< 14	< 18	< 795	< 36	< 5	< 15	< 169	< 5	< 45	< 37	< 55
Ce	< 70	< 64	< 2403	< 81	< 17	< 44	< 444	< 8	< 268	< 215	< 174
Nd	< 32	< 19	< 801	< 27	< 13	< 27	< 182	< 23	< 63	< 55	< 49
Sm	< 17	< 20	< 751	< 53	< 16	< 34	< 121	< 34	< 66	< 56	< 47
Eu	< 19	< 11	< 736	< 133	< 10	< 20	< 61	< 10	< 43	< 32	< 65
Gd	< 28	< 22	< 634	< 151	< 25	< 34	< 77	< 38	< 54	< 47	< 63
Dy	< 20	< 15	< 624	< 267	< 28	< 19	< 35	< 23	< 32	< 30	< 39
Er	< 46	< 22	< 499	< 187	< 42	< 22	< 45	< 26	< 36	< 34	< 28
Yb	< 56	< 13	< 501	< 166	< 50	< 23	< 32	< 33	< 31	< 29	< 35
Lu	< 36	< 6	< 340	< 132	< 37	< 6	< 20	< 9	< 9	< 9	< 15
Y	< 6	< 3	< 78	< 53	< 14	< 4	< 9	< 10	< 12	< 12	< 9
Sc	< 65	< 29	< 245	< 180	< 72	< 85	< 65	< 60	< 117	< 109	< 98
Pb	< 99	< 56	< 766	< 263	< 16	< 36	< 53	< 55	< 488	< 358	< 385
Th	< 7	< 4	< 394	< 9	< 4	< 8	< 170	< 5	< 16	< 14	< 9
U	< 100	< 10	< 463	< 20	< 19	< 51	< 146	< 31	< 70	< 58	< 107

All compositions are given in ppm by weight, except for Cl (wt.%). Numbers in parentheses are one standard deviation in the last digits.

Table S-9. Fluid/garnet partition coefficients

Experiment	PC09	PC22	PC37	PC38	PC24	PC14	PC23	PC10	PC18	PC27	PC36	PC39	PC15
Cl (wt. %)	0	0	0	0	0	0.48	2.25	3.76	4.23	4.91	6.50	6.81	6.93
Li	> 2.6	2.3 (3)	7.7 (7)	9.1 (9)	> 0.52	> 1.5	8 (3)	> 11	> 0.8	3.7 (9)	13 (2)	11 (2)	4 (1)
Be	> 0.64	> 0.3	6 (2)	8 (1)	> 0.2	> 0.4	4 (1)	> 2	> 0.9	4 (1)	8 (2)	11 (2)	> 2
B	> 10.6	> 0.4	11 (1)	8 (1)	> 1	> 0.5	37 (4)	> 36	> 5	50 (4)	48 (8)	43 (8)	> 2
Rb	> 45	37 (6)	114 (80)	425 (63)	> 32	> 27	819 (259)	> 254	> 81	105 (43)	1569 (450)	1666 (303)	> 68
Cs	> 12	> 40	129 (96)	604 (94)	> 159	> 6	1524 (482)	> 67	> 144	641 (287)	1975 (879)	4592 (1082)	> 55
Sr	68 (4)	> 51	29 (6)	34 (9)	11 (3)	60 (20)	72 (5)	>191 (132)	127 (8)	48 (10)	107 (69)	135 (52)	142 (65)
Ba	> 26	> 46	69 (37)	100 (35)	> 41	> 28	312 (95)	> 165	> 114	99 (64)	305 (176)	161 (40)	> 125
Ti	0.031 (3)	0.016 (1)	0.086 (0)	0.082 (4)	0.029 (2)	0.046 (8)	0.09 (1)	0.08 (1)	0.14 (2)	0.053 (6)	0.12 (4)	0.18 (4)	0.052 (7)
Nb	0.40 (7)	0.16 (2)	1.8 (5)	1.6 (5)	0.28 (5)	0.4 (2)	0.7 (3)	0.9 (2)	1.1 (2)	0.29 (5)	0.8 (5)	2 (1)	1.6 (5)
Ta	0.07 (2)	0.031 (5)	0.4 (1)	0.3 (1)	0.04 (2)	0.09 (4)	0.20 (4)	0.10 (4)	> 0.3	0.063 (9)	0.09 (6)	0.4 (2)	0.4 (2)
La	> 0.23	0.27 (3)	0.09 (2)	0.07 (3)	1.5 (3)	0.13 (7)	1.4 (4)	5.5 (9)	> 8	0.4 (1)	4 (2)	4 (2)	3 (2)
Ce	0.20 (2)	0.21 (3)	0.07 (2)	0.09 (3)	1.3 (5)	0.20 (18)	0.8 (2)	6 (3)	12 (6)	0.35 (9)	3 (1)	5 (2)	1.6 (7)
Nd	> 0.043	0.065 (7)	0.07 (2)	0.05 (1)	0.8 (2)	0.07 (3)	0.4 (1)	> 0.9	> 1	0.33 (7)	0.7 (3)	1 (4)	1.2 (4)
Sm	0.025 (8)	0.021 (5)	0.024 (5)	0.022 (4)	0.17 (5)	0.05 (2)	0.10 (3)	0.2 (1)	0.61 (2)	0.09 (1)	0.14 (5)	0.18 (5)	0.18 (3)
Eu	0.023 (8)	0.015 (3)	0.022 (3)	0.021 (3)	0.10 (3)	0.05 (3)	0.11 (2)	0.18 (2)	0.30 (3)	0.10 (1)	0.18 (7)	0.3 (1)	0.40 (7)
Gd	0.014 (5)	0.006 (1)	0.009 (2)	0.0067 (9)	0.05 (1)	0.018 (8)	0.05 (1)	0.045 (7)	0.16 (2)	0.022 (3)	0.06 (2)	0.04 (1)	0.07 (1)
Dy	0.008 (2)	0.0028 (5)	0.0042 (8)	0.0031 (4)	0.016 (6)	0.007 (2)	0.017 (1)	0.015 (1)	0.068 (7)	0.0055 (8)	0.021 (6)	0.009 (2)	0.021 (4)
Er	0.005 (1)	0.0013 (3)	0.0024 (4)	0.0016 (2)	0.010 (4)	0.0031 (9)	0.008 (2)	0.008 (1)	0.08 (1)	0.0025 (5)	0.010 (3)	0.004 (1)	0.013 (3)
Yb	0.003 (1)	0.0009 (2)	0.0021 (4)	0.0016 (4)	0.014 (7)	0.0024 (9)	0.009 (2)	0.0068 (8)	0.13 (3)	0.0029 (6)	0.006 (3)	0.003 (1)	0.015 (3)
Lu	0.003 (1)	0.0007 (2)	0.0016 (3)	0.0014 (3)	0.013 (5)	0.002 (1)	0.008 (2)	0.006 (1)	0.18 (3)	0.0025 (7)	0.005 (2)	0.0030 (9)	0.014 (4)
Y	0.031 (7)	0.009 (2)	0.14 (5)	0.07 (3)	0.042 (8)	0.04 (1)	0.04 (1)	0.06 (1)	0.23 (8)	0.16 (4)	0.17 (7)	0.07 (2)	0.14 (4)
Sc			0.0067 (9)	0.0064 (6)						0.007 (1)	0.016 (4)	0.011 (3)	
Pb	> 31	> 10	26 (6)	31 (3)	7.5 (7)	> 6	11 (1)	> 149	> 51	60 (15)	296 (72)	205 (64)	> 36
Th	> 0.15	0.10 (1)	0.08 (2)	0.033 (8)	1.1 (5)	0.19 (12)	1.1 (2)	> 0.6	1.1 (1)	0.13 (3)	0.7 (1)	0.7 (2)	1.0 (4)
U	2 (1)	0.6 (1)	0.9 (3)	1.5 (2)	1.2 (1)	2 (1)	4 (1)	9 (1)	17 (2)	1.1 (2)	6 (2)	8 (2)	2.5 (6)

Numbers in parentheses are one standard deviation in the last digits; minimum values of D are reported when only maximum concentrations of trace elements were available for garnet.

Table S-9. Fluid/garnet partition coefficients

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81	5.20	7.74	0	2.73	4.8	8.11	0	4.87	7.86
Li	1.7 (2)	7.6 (7)	7 (1)	9.4 (8)	8.2 (8)	7 (1)	5 (1)	5.5 (8)	10 (4)	5.3 (9)	12 (3)
Be	> 1.7	1.6 (3)	0.9 (2)	2.3 (1)	4.8 (4)	2.1 (6)	4.2 (4)	2.3 (5)	5 (2)	6 (1)	7 (1)
B	> 11	40 (6)	> 49	69 (4)	13.7 (9)	8 (3)	23 (2)	20 (3)	8 (4)	23 (5)	38 (6)
Rb	155 (55)	281 (140)	535 (155)	1553 (98)	385 (96)	99 (30)	142 (80)	152 (37)	63 (30)	252 (87)	85 (59)
Cs	364 (112)	426 (249)	380 (214)	4984 (350)	619 (211)	136 (40)	766 (480)	605 (273)	105 (22)	662 (207)	93 (68)
Sr	5 (1)	67 (17)	41 (16)	536 (102)	128 (29)	70 (24)	43 (15)	76 (11)	24 (14)	58 (19)	54 (19)
Ba	128 (12)	144 (60)	134 (47)	480 (140)	93 (10)	42 (11)	281 (44)	318 (83)	18 (5)	116 (44)	351 (69)
Ti	0.0071 (8)	0.014 (2)	0.023 (4)	0.05 (2)	0.18 (2)	0.028 (3)	0.024 (5)	0.038 (4)	1.2 (6)	0.09 (2)	0.07 (2)
Nb	0.12 (2)	0.26 (5)	0.14 (6)	1.3 (6)	1.9 (4)	1.1 (2)	0.2 (1)	0.5 (2)	1.1 (9)	0.4 (2)	0.3 (1)
Ta	0.04 (1)	0.11 (4)	0.09 (6)	1.2 (4)	0.32 (9)	0.17 (4)	0.08 (3)	0.23 (5)	0.4 (3)	0.10 (5)	0.05 (2)
La	0.05 (3)	0.3 (1)	0.16 (9)	3 (1)	0.33 (5)	3.5 (6)	2.1 (4)	3 (1)	2 (1)	10 (2)	3 (2)
Ce	0.04 (2)	0.3 (1)	0.17 (6)	2.3 (6)	0.5 (1)	1.5 (3)	1.2 (2)	2.0 (4)	7 (5)	6 (1)	3 (2)
Nd	0.018 (5)	0.11 (3)	0.13 (6)	0.9 (4)	0.025 (5)	0.13 (2)	0.17 (3)	0.35 (5)	0.6 (3)	0.9 (2)	0.9 (4)
Sm	0.0025 (4)	0.02 (1)	0.05 (1)	0.09 (4)	0.0050 (7)	0.021 (3)	0.037 (5)	0.09 (1)	0.6 (3)	0.21 (4)	0.21 (7)
Eu	0.0021 (3)	0.019 (3)	0.036 (7)	0.09 (4)	0.0054 (7)	0.023 (3)	0.046 (6)	0.13 (2)	1.2 (7)	0.20 (3)	0.27 (8)
Gd	0.00073 (8)	0.005 (1)	0.013 (4)	0.023 (9)	0.0027 (4)	0.0079 (9)	0.013 (2)	0.030 (3)	0.3 (2)	0.06 (1)	0.07 (2)
Dy	0.00051 (9)	0.0018 (4)	0.0038 (5)	0.006 (1)	0.0023 (3)	0.0026 (3)	0.0044 (5)	0.010 (1)	0.14 (11)	0.026 (5)	0.014 (4)
Er	0.0006 (1)	0.0014 (3)	0.0025 (4)	0.0036 (7)	0.0019 (4)	0.0011 (2)	0.0015 (2)	0.0041 (7)	0.10 (9)	0.016 (6)	0.005 (2)
Yb	0.0011 (3)	0.0025 (6)	0.005 (1)	0.005 (1)	0.0019 (5)	0.0007 (2)	0.0011 (3)	0.0027 (6)	0.09 (7)	0.015 (7)	0.003 (1)
Lu	0.0008 (3)	0.0015 (3)	0.0041 (9)	0.004 (1)	0.0017 (5)	0.0006 (1)	0.0010 (2)	0.0025 (5)	0.08 (8)	0.014 (8)	0.003 (1)
Y	0.08 (2)	0.11 (2)	0.20 (3)	0.11 (3)	0.03 (2)	0.13 (5)	0.08 (4)	0.4 (1)	1.82 (178)	0.06 (4)	0.022 (9)
Sc	0.0013 (3)	0.0031 (3)	0.0052 (9)	0.006 (1)	0.008 (1)	0.0017 (3)	0.0020 (4)	0.0043 (7)	0.06 (4)	0.024 (9)	0.007 (2)
Pb	11 (3)	44 (12)	26 (11)	463 (43)	86 (41)	21 (7)	38 (14)	35 (6)	23 (13)	31 (16)	78 (40)
Th	0.09 (6)	0.16 (8)	0.09 (4)	0.3 (2)	0.10 (2)	1.0 (1)	1.8 (3)	0.36 (9)	2 (1)	1.9 (4)	0.4 (2)
U	0.6 (2)	1.0 (3)	1.1 (4)	3 (2)	0.33 (6)	0.7 (1)	0.8 (2)	0.9 (2)	8 (6)	6 (2)	1.0 (4)

Numbers in parentheses are one standard deviation in the last digits; minimum values of D are reported when only maximum concentrations of trace elements were available for garnet.

Table S-10. Fluid/omphacite partition coefficients

Experiment	PC09	PC22	PC37	PC38	PC24	PC14	PC23	PC10	PC18	PC27	PC36	PC39	PC15
Cl (wt. %)	0	0	0	0	0	0.48	2.25	3.76	4.23	4.91	6.50	6.81	6.93
Li	0.51 (12)	0.156 (7)	0.76 (4)	0.8 (1)	0.24 (2)	0.8 (1)	0.7 (2)	1.2 (3)	0.45 (3)	0.68 (2)	0.95 (5)	0.93 (5)	2.3 (4)
Be	0.25 (2)	0.112 (4)	0.62 (3)	0.5 (1)	0.17 (4)	0.50 (3)	0.43 (5)	1.1 (2)	0.7 (2)	0.83 (8)	0.57 (6)	0.43 (6)	1.7 (6)
B	7 (2)	0.66 (6)	3.0 (5)	2.6 (6)	0.9 (3)	1.8 (13)	3 (1)	23 (9)	5 (1)	16 (2)	36 (4)	21 (6)	5.2 (9)
Rb	30 (3)	1.11 (5)	12 (4)	15 (5)	2.5 (9)	74 (21)	6 (2)	153 (86)	9 (2)	11.3 (9)	117 (47)	228 (51)	14 (4)
Cs	8 (2)	0.991 (2)	12 (4)	14 (4)	2.4 (8)	> 25	8 (2)	129 (17)	14 (5)	43 (11)	94 (35)	246 (58)	51 (17)
Sr	3.8 (2)	0.52 (3)	3.2 (4)	1.9 (5)	0.7 (3)	6 (3)	1.4 (4)	9 (2)	7 (3)	7.4 (4)	7 (2)	9 (2)	23 (7)
Ba	2.4 (5)	0.60 (12)	5.8 (9)	5 (1)	1.5 (4)	9 (5)	1.6 (7)	102 (20)	13 (5)	18 (4)	21 (8)	14 (3)	127 (38)
Ti	> 2	0.051 (2)	0.13 (1)	0.12 (3)	0.13 (1)	0.13 (2)	0.20 (2)	0.28 (4)	0.29 (4)	0.07 (1)	0.18 (2)	0.13 (2)	0.06 (1)
Nb	> 4	0.46 (3)	1.1 (5)	1.2 (4)	1.4 (2)	0.3 (2)	1.6 (3)	7 (3)	0.84 (7)	0.3 (1)	12 (5)	8 (2)	0.4 (1)
Ta	> 0.4	0.14 (2)	0.2 (1)	0.27 (9)	0.2 (1)	0.08 (5)	0.4 (1)	1.1 (9)	0.6 (2)	0.07 (2)	1.0 (3)	1.8 (5)	0.16 (4)
La	0.03 (2)	0.0017 (1)	0.011 (3)	0.008 (4)	0.10 (8)	0.005 (4)	0.017 (6)	0.16 (6)	0.4 (2)	0.20 (2)	8 (2)	11 (6)	0.7 (2)
Ce	0.04 (2)	0.0025 (3)	0.017 (4)	0.011 (5)	0.07 (6)	0.008 (7)	0.03 (1)	0.17 (8)	0.4 (1)	0.21 (3)	6 (1)	9 (2)	0.5 (1)
Nd	0.018 (4)	0.0021 (1)	0.012 (4)	0.009 (5)	0.09 (8)	0.006 (5)	0.019 (6)	0.16 (7)	0.4 (2)	0.22 (3)	1.2 (5)	1.0 (4)	0.5 (1)
Sm	0.032 (9)	0.00274 (8)	0.020 (6)	0.013 (5)	0.08 (7)	0.006 (5)	0.021 (5)	0.15 (8)	0.40 (2)	0.18 (2)	0.5 (1)	0.5 (1)	0.4 (1)
Eu	0.079 (12)	0.00507 (6)	0.031 (8)	0.024 (9)	0.10 (7)	0.012 (10)	0.036 (9)	0.3 (1)	0.69 (4)	0.29 (4)	0.9 (2)	1.2 (3)	1.6 (3)
Gd	0.11 (2)	0.00383 (9)	0.019 (5)	0.015 (6)	0.08 (6)	0.008 (6)	0.024 (6)	0.14 (5)	0.44 (7)	0.09 (1)	0.28 (7)	0.19 (4)	0.4 (1)
Dy	0.08 (5)	0.0059 (5)	0.024 (7)	0.021 (7)	0.09 (5)	0.008 (7)	0.031 (7)	0.22 (4)	0.40 (6)	0.034 (8)	0.18 (5)	0.14 (1)	0.21 (7)
Er	0.06 (4)	0.006 (1)	0.020 (7)	0.019 (8)	0.14 (4)	0.007 (5)	0.027 (8)	0.26 (4)	0.8 (1)	0.017 (4)	0.14 (4)	0.17 (3)	0.14 (5)
Yb	0.06 (4)	0.0066 (9)	0.022 (8)	0.02 (1)	0.18 (6)	0.008 (6)	0.033 (9)	0.3 (1)	0.8 (1)	0.019 (5)	0.16 (6)	0.32 (7)	0.15 (4)
Lu	0.05 (4)	0.006 (1)	0.018 (7)	0.019 (9)	0.20 (5)	0.009 (7)	0.03 (1)	0.26 (6)	1.1 (3)	0.017 (5)	0.15 (6)	0.37 (8)	0.18 (8)
Y	0.21 (15)	0.031 (6)	0.2 (1)	0.5 (3)	0.22 (8)	0.07 (5)	0.07 (3)	0.8 (2)	2.5 (8)	0.8 (3)	0.6 (2)	0.7 (1)	1.5 (7)
Sc			0.027 (4)	0.026 (6)						0.022 (2)	0.038 (4)	0.045 (6)	
Pb	6 (3)	0.52 (5)	4.8 (6)	4 (1)	0.7 (3)	3 (1)	3.4 (8)	50 (9)	5 (2)	22 (4)	105 (26)	39 (11)	67 (17)
Th	0.04 (2)	0.00074 (2)	0.009 (3)	0.0067 (3)	0.12 (10)	0.003 (2)	0.011 (5)	0.03 (2)	0.19 (4)	0.048 (8)	2.0 (3)	1.0 (2)	0.21 (3)
U	1.0 (5)	0.028 (2)	0.3 (1)	0.2 (1)	0.3 (2)	0.10 (7)	0.24 (7)	1.3 (7)	6.1 (8)	1.0 (2)	28 (5)	31 (7)	2.3 (5)

Numbers in parentheses are one standard deviation in the last digits; > minimum values of D are reported when only maximum concentrations of trace elements were available for omphacite.

Table S-10. Fluid/omphacite partition coefficients

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81	5.20	7.74	0	2.73	4.8	8.11	0	4.87	7.86
Li	0.15 (1)	0.59 (3)	0.70 (7)	0.64 (4)	0.94 (6)	0.68 (4)	0.9 (1)	0.96 (5)	2.3 (3)	0.7 (2)	1.58 (6)
Be	0.077 (8)	0.12 (1)	0.11 (1)	0.117 (6)	0.41 (2)	0.40 (3)	0.50 (6)	0.44 (6)	1.1 (2)	0.9 (2)	0.43 (5)
B	4.3 (9)	9 (1)	21 (5)	5.3 (4)	8 (1)	22 (4)	4.2 (7)	9 (1)	10 (3)	19 (5)	22 (5)
Rb	24 (2)	14 (5)	17 (5)	18 (2)	37 (12)	187 (68)	10 (2)	41 (4)	4.4 (8)	47 (29)	44 (22)
Cs	42 (2)	21 (4)	7 (3)	10 (1)	31 (9)	501 (219)	57 (11)	162 (24)	6 (1)	139 (82)	61 (31)
Sr	0.13 (4)	5.2 (9)	2.4 (4)	4 (1)	3 (1)	7 (2)	2.4 (9)	13 (1)	0.8 (2)	4 (2)	16 (6)
Ba	5.4 (8)	14 (3)	12 (8)	138 (13)	15 (3)	27 (7)	12 (8)	61 (30)	1.6 (3)	11 (6)	107 (46)
Ti	0.0053 (5)	0.017 (5)	0.019 (3)	0.022 (7)	0.27 (2)	0.061 (6)	0.04 (1)	0.047 (8)	0.13 (2)	0.20 (7)	0.09 (3)
Nb	0.051 (9)	0.10 (3)	0.14 (2)	0.15 (4)	3.0 (4)	3.1 (5)	0.4 (2)	0.3 (1)	0.9 (2)	1.1 (8)	0.5 (3)
Ta	0.015 (5)	0.05 (2)	0.12 (2)	0.15 (5)	0.6 (2)	0.7 (1)	0.12 (8)	0.11 (6)	0.36 (8)	0.3 (2)	0.09 (5)
La	0.004 (1)	0.16 (15)	0.021 (7)	0.25 (4)	0.012 (6)	0.5 (4)	0.08 (2)	0.9 (2)	0.5 (1)	2 (1)	14 (5)
Ce	0.0030 (8)	0.11 (10)	0.013 (5)	0.12 (2)	0.02 (1)	0.6 (4)	0.09 (3)	0.7 (2)	0.7 (2)	3 (1)	10 (2)
Nd	0.004 (1)	0.20 (19)	0.03 (1)	0.23 (8)	0.013 (7)	0.2 (1)	0.06 (2)	0.35 (8)	0.32 (7)	1.0 (3)	2.2 (2)
Sm	0.004 (1)	0.11 (10)	0.019 (5)	0.17 (6)	0.015 (6)	0.15 (6)	0.06 (1)	0.28 (5)	0.20 (4)	0.6 (1)	0.78 (7)
Eu	0.006 (2)	0.145 (103)	0.022 (5)	0.25 (6)	0.026 (8)	0.22 (6)	0.12 (2)	0.5 (1)	0.26 (4)	0.9 (2)	1.2 (1)
Gd	0.003 (1)	0.07 (5)	0.021 (7)	0.11 (3)	0.017 (5)	0.09 (2)	0.046 (7)	0.16 (3)	0.11 (2)	0.30 (7)	0.37 (6)
Dy	0.005 (2)	0.050 (45)	0.022 (5)	0.06 (2)	0.021 (6)	0.06 (2)	0.018 (3)	0.07 (2)	0.09 (2)	0.15 (5)	0.12 (4)
Er	0.007 (3)	0.052 (49)	0.032 (7)	0.07 (2)	0.017 (6)	0.05 (2)	0.007 (2)	0.04 (1)	0.09 (2)	0.09 (4)	0.05 (2)
Yb	0.013 (5)	0.10 (9)	0.09 (2)	0.14 (5)	0.019 (8)	0.04 (2)	0.005 (1)	0.020 (7)	0.09 (3)	0.08 (5)	0.04 (2)
Lu	0.009 (4)	0.07 (6)	0.08 (1)	0.13 (4)	0.017 (8)	0.04 (3)	0.004 (1)	0.019 (7)	0.08 (2)	0.08 (6)	0.03 (2)
Y	0.5 (3)	0.6 (2)	1.2 (4)	1.9 (6)	0.09 (4)	0.8 (5)	0.4 (1)	1.5 (6)	3 (2)	0.3 (2)	0.22 (4)
Sc	0.005 (1)	0.011 (1)	0.025 (3)	0.034 (9)	0.045 (7)	0.019 (4)	0.007 (1)	0.018 (4)	0.06 (1)	0.06 (1)	0.018 (2)
Pb	0.39 (9)	6.0 (8)	3 (1)	8 (1)	10 (4)	22 (10)	2.4 (7)	11.3 (7)	3.6 (7)	3 (2)	52 (25)
Th	0.026 (6)	0.122 (117)	0.019 (7)	0.19 (7)	0.013 (7)	1.0 (6)	0.23 (7)	0.47 (8)	1.7 (5)	2.5 (7)	0.9 (5)
U	0.5 (2)	1.5 (14)	0.16 (3)	1.3 (4)	0.6 (2)	7 (2)	1.4 (3)	3.4 (5)	5 (1)	13 (6)	5 (1)

Numbers in parentheses are one standard deviation in the last digits; > minimum values of D are reported when only maximum concentrations of trace elements were available for omphacite.

Table S-11. Fluid/rutile partition coefficients

Experiment	PC09	PC22	PC37	PC38	PC24	PC14	PC23	PC10	PC18	PC27	PC36	PC39
Cl (wt. %)	0	0	0	0	0	0.48	2.25	3.76	4.23	4.91	6.50	6.81
Ti	0.00029 (1)	0.000130 (3)	0.000637 (5)	0.000566 (9)	0.00025 (1)	0.018 (1)	0.00076 (7)	0.00077 (7)	0.00071 (7)	0.00050 (5)	0.00084 (8)	0.00063 (6)
Nb	0.0011 (1)	0.000374 (3)	0.0024 (1)	0.00194 (7)	0.00063 (7)	0.072 (7)	0.0017 (1)	0.0036 (3)	0.0021 (2)	0.00112 (9)	0.0032 (3)	0.0016 (1)
Ta	0.00014 (2)	0.000062 (2)	0.00042 (3)	0.00031 (2)	0.00014 (3)	0.014 (2)	0.00026 (3)	0.00040 (5)	0.0010 (1)	0.00021 (3)	0.00038 (5)	0.00026 (3)
Experiment	PC15	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	6.93	0	2.81	5.20	7.74	0	2.73	4.8	8.11	0	4.87	7.86
Ti	0.00039 (4)	0.000045 (2)	0.000076 (7)	0.00014 (1)	0.00016 (2)	0.00095 (3)	0.00016 (1)	0.00019 (2)	0.00020 (2)	0.0024 (3)	0.0011 (1)	0.00048 (4)
Nb	0.0013 (1)	0.00030 (7)	0.00032 (3)	0.00042 (3)	0.00046 (4)	0.0018 (2)	0.00092 (7)	0.00079 (6)	0.00064 (5)	0.0046 (6)	0.0029 (2)	0.00111 (9)
Ta	0.00043 (6)	0.00010 (3)	0.00013 (2)	0.00026 (3)	0.00039 (5)	0.00025 (3)	0.00016 (2)	0.00019 (2)	0.00019 (2)	0.0020 (3)	0.00060 (8)	0.00018 (2)

Numbers in parentheses are one standard deviation in the last digits

Table S-12. Fluid/eclogite partition coefficients

Experiment	PC41	PC45	PC42	PC40	PC47	PC49	PC52	PC53	MA08	MA07	MA10
Cl (wt. %)	0	2.81 (1)	5.2 (5)	7.74 (4)	0	2.73 (1)	4.8 (4)	8.11 (3)	0	4.87 (8)	7.86 (5)
Li	0.23 (2)	0.93 (5)	1.09 (11)	1.02 (5)	1.46 (8)	1.06 (6)	1.3 (2)	1.43 (7)	3.4 (4)	1.1 (3)	2.4 (1)
Be	> 0.12	0.19 (2)	0.17 (2)	0.19 (1)	0.65 (3)	0.59 (4)	0.78 (8)	0.65 (8)	1.6 (2)	1.4 (2)	0.69 (8)
B	> 5.8	13 (2)	> 27.4	8.4 (6)	10 (1)	13 (3)	6 (1)	12 (1)	9 (3)	20 (4)	27 (5)
Rb	36 (3)	22 (8)	28 (8)	30 (4)	57 (17)	137 (32)	15 (3)	57 (5)	7 (1)	70 (38)	54 (23)
Cs	65 (4)	34 (6)	12 (5)	16 (2)	50 (13)	242 (59)	88 (18)	229 (32)	10 (2)	203 (105)	70 (30)
Sr	0.2 (1)	8 (1)	3.8 (7)	7 (2)	5 (2)	10 (4)	3 (1)	19 (2)	1.3 (2)	6 (3)	23 (7)
Ba	9 (1)	22 (5)	19 (12)	193 (17)	23 (4)	31 (6)	17 (11)	90 (40)	3 (1)	17 (9)	148 (53)
Ti	0.0016 (1)	0.0031 (2)	0.0053 (4)	0.0064 (6)	0.04 (1)	0.0067 (5)	0.032 (6)	0.0083 (6)	0.21 (3)	0.13 (3)	0.08 (2)
Nb	0.012 (2)	0.014 (1)	0.018 (1)	0.021 (2)	0.089 (9)	0.045 (3)	0.035 (3)	0.029 (2)	0.19 (2)	0.12 (1)	0.048 (4)
Ta	0.004 (1)	0.0057 (7)	0.012 (1)	0.018 (2)	0.012 (2)	0.008 (1)	0.009 (1)	0.009 (1)	0.08 (1)	0.025 (3)	0.008 (1)
La	0.006 (2)	0.20 (18)	0.033 (9)	0.40 (7)	0.02 (1)	0.7 (5)	0.12 (3)	1.3 (3)	0.7 (2)	3 (1)	6 (3)
Ce	0.005 (1)	0.14 (10)	0.021 (7)	0.20 (3)	0.04 (2)	0.8 (5)	0.14 (4)	1.0 (2)	1.1 (2)	3 (1)	5 (2)
Nd	0.006 (2)	0.15 (10)	0.04 (2)	0.3 (1)	0.017 (6)	0.17 (5)	0.07 (2)	0.35 (5)	0.39 (8)	0.9 (2)	1.4 (3)
Sm	0.0033 (6)	0.04 (1)	0.025 (6)	0.13 (4)	0.008 (1)	0.044 (6)	0.045 (6)	0.15 (2)	0.27 (5)	0.33 (5)	0.38 (9)
Eu	0.0035 (5)	0.041 (8)	0.026 (5)	0.15 (4)	0.010 (1)	0.049 (5)	0.070 (7)	0.23 (3)	0.38 (6)	0.37 (5)	0.5 (1)
Gd	0.0014 (1)	0.011 (2)	0.017 (4)	0.04 (1)	0.0054 (7)	0.017 (2)	0.023 (2)	0.059 (5)	0.14 (3)	0.12 (2)	0.14 (4)
Dy	0.0011 (2)	0.0043 (9)	0.0075 (8)	0.012 (3)	0.0048 (6)	0.0061 (6)	0.0080 (8)	0.021 (2)	0.11 (3)	0.051 (9)	0.030 (8)
Er	0.0013 (3)	0.0034 (6)	0.0056 (9)	0.008 (1)	0.0041 (8)	0.0027 (4)	0.0028 (3)	0.009 (1)	0.09 (3)	0.03 (1)	0.011 (3)
Yb	0.0024 (6)	0.006 (1)	0.012 (2)	0.011 (3)	0.0042 (9)	0.0018 (4)	0.0021 (4)	0.006 (1)	0.09 (4)	0.03 (1)	0.007 (2)
Lu	0.0019 (6)	0.0037 (6)	0.010 (2)	0.009 (2)	0.0036 (9)	0.0015 (3)	0.0018 (3)	0.005 (1)	0.08 (3)	0.03 (1)	0.006 (2)
Y	0.16 (4)	0.20 (3)	0.40 (6)	0.24 (6)	0.05 (2)	0.25 (9)	0.15 (5)	0.7 (2)	2.5 (15)	0.12 (7)	0.05 (2)
Sc	0.0024 (4)	0.0054 (4)	0.010 (1)	0.011 (2)	0.016 (2)	0.0037 (6)	0.0035 (5)	0.008 (1)	0.06 (2)	0.038 (9)	0.011 (2)
Pb	0.6 (1)	9 (1)	4 (2)	13 (2)	15 (6)	22 (6)	4 (1)	15 (1)	5 (1)	5 (4)	60 (22)
Th	0.036 (8)	0.13 (9)	0.027 (9)	0.21 (7)	0.02 (1)	1.0 (3)	0.33 (9)	0.42 (6)	1.8 (5)	2.2 (4)	0.6 (2)
U	0.6 (1)	1.3 (7)	0.24 (4)	1.8 (4)	0.4 (1)	1.6 (2)	1.1 (2)	1.6 (3)	6 (1)	9 (2)	2.0 (6)

Numbers in parentheses are one standard deviation in the last digits; minimum values of D are reported when only maximum concentrations of trace elements were available for garnet and/or omphacite.

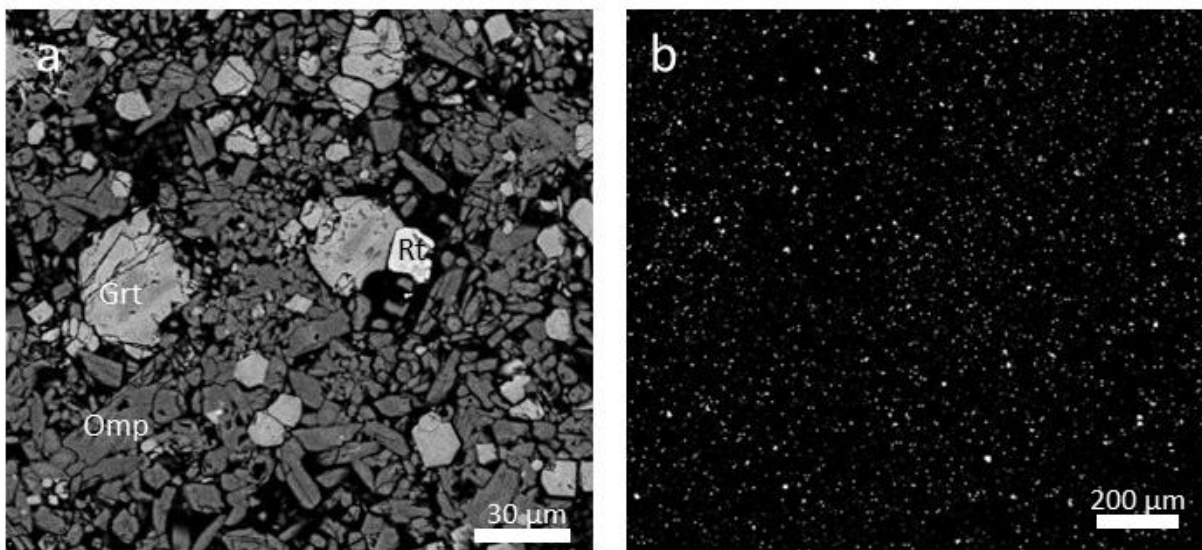


Figure S-1. Backscattered electron images of run products from high pressure experiments. (a) is taken from the silicate part of experiment PC47. The label “Omp” stands for omphacite, “Grt” for garnet, and “Rt” for rutile. Darker cores visible in some of the garnet crystals are remnants of the natural garnet seeds added to the starting material. (b) backscattered electron image of a typical diamond trap containing homogeneously distributed precipitates (bright spots).

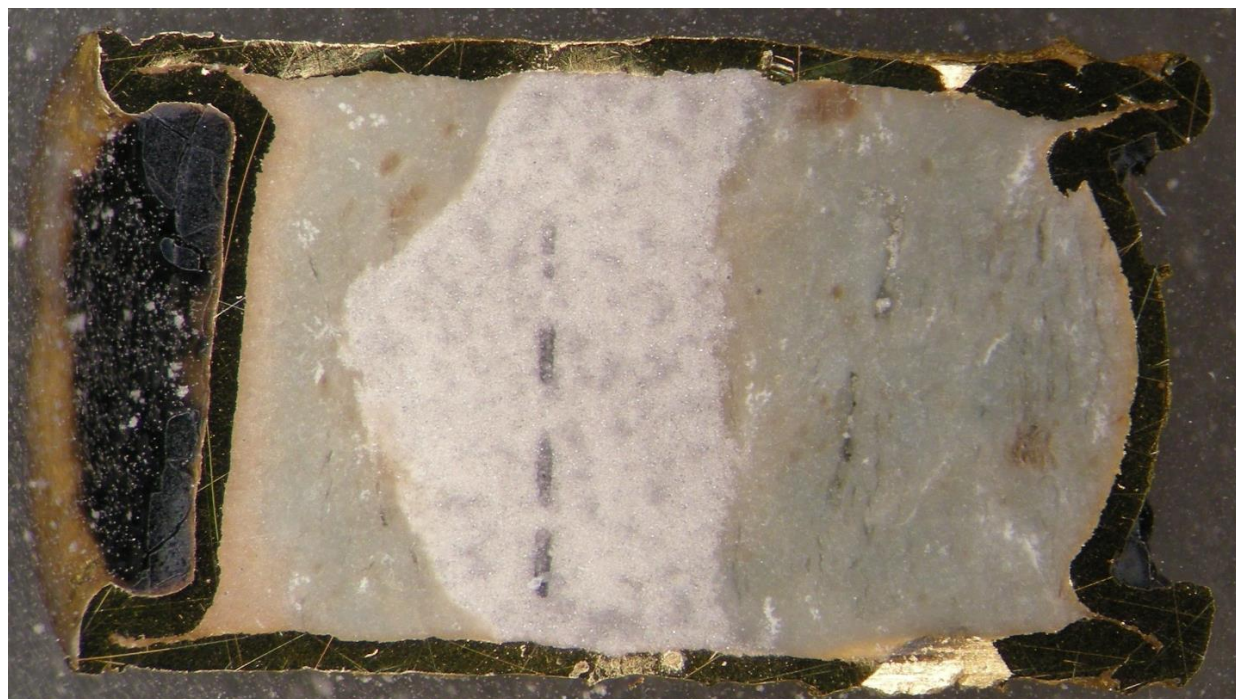


Figure S-2. Cross section of piston cylinder sample capsule PC14 mounted in epoxy and polished after high pressure and temperature experiment (image width is about 10 mm). Traces of Laser Ablation ICP-MS analysis are visible in the diamond trap layer.