Table S1. Chemical compositions of oxide, carbonate and silicate (?) inclusions in the studied lower-mantle diamonds from Rio Sorriso

Sample	1.2.1a	1.2.1c	1.2.1d	1.2.2a	1.2.3b	1.2.3c1	1.2.3c2	1.2.4b	1.2.4d	2.2.1	2.2.3a	2.2.4	2.7.2a	2.8.2	2.8.3	3.1.3b1	3.1.3b2	3.1.3b3
Mineral	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer	fPer
Association				fPer+ $CaSiO_3$+ $CaTiO_3$				fPer+Mgs	fPer+Mgs		fPer+ $CaSiO_3$					fPer+Brd	fPer+Brd	fPer+Brd
SiO_2	0.08	bdl.	0.02	0.05	0.01	0.06	bdl	0.06	0.22	bdl	0.06	0.04	0.01	0.20	0.07	0.02	0.04	0.01
TiO_2	bdl	0.02	0.01	0.02	bdl	bdl	0.03	0.04	0.01	bdl	0.01	0.00	bdl	0.07	0.06	0.01	bdl	0.01
Al_2O_3	0.02	0.08	0.04	0.04	0.05	0.06	bdl	0.06	0.01	0.11	0.04	0.12	0.09	0.06	0.11	0.15	0.03	0.07
Cr_2O_3	0.15	0.16	0.16	0.15	0.17	0.14	0.14	0.20	0.18	0.54	0.53	0.54	0.56	0.19	0.19	0.75	0.34	1.03
FeO	34.03	57.54	57.80	59.06	59.37	59.47	59.66	46.67	51.96	35.25	35.88	34.36	30.25	39.21	39.82	33.74	25.41	25.88
NiO	1.05	0.18	0.19	0.22	0.23	0.21	0.21	0.33	0.20	1.15	1.18	1.20	1.22	0.11	0.22	1.11	1.26	1.27
MnO	0.30	0.35	0.35	0.37	0.43	0.42	0.32	0.22	0.15	0.27	0.29	0.29	0.43	0.89	0.65	0.49	0.27	0.27
MgO	63.65	42.00	42.39	38.44	40.07	39.06	39.11	51.57	45.34	61.23	60.52	63.05	66.17	55.84	52.63	62.29	72.50	69.47
CaO	bdl	0.02	bdl	bdl	0.01	bdl	0.02	bdl	0.03	bdl	bdl	bdl	0.01	0.66	1.64	0.00	0.00	0.00
Na_2O	0.02	Bdl	0.17	0.09	0.34	0.23	0.12	0.08	0.25	0.17	0.21	0.10	0.29	0.21	0.51	0.61	0.21	0.67
K_2O	bdl	bdl	bdl	bdl	0.03	bdl	bdl	0.00	0.05	0.01	0.01	0.00	0.00	0.02	0.01	0.00	0.01	bdl
Total	99.30	100.35	101.13	98.44	100.71	99.65	99.61	99.23	98.40	98.73	98.73	99.70	99.03	97.46	95.91	99.18	100.07	98.68
fe#	0.231	0.434	0.433	0.463	0.454	0.460	0.461	0.337	0.391	0.244	0.249	0.234	0.204	0.282	0.298	0.233	0.164	0.173
mg#	0.769	0.566	0.567	0.537	0.546	0.540	0.539	0.663	0.609	0.756	0.751	0.766	0.796	0.718	0.702	0.767	0.836	0.827

Sample	3.1.3b4	3.1.3b5	3.6.3a	3.8.1d	3.9.3b	3.10.1a	3.10.1b	1.5.2a	3.1.3b	1.2.2b1	1.2.2b2	2.2.2a	2.2.3a	2.2.3c	1.2.4c	2.11.2a	4.18.1
Mineral	fPer	fPer	fPer	fPer	fPer	fPer	fPer	Brd	Brd	$CaSiO_3$	$CaSiTiO_3$	CaSiO3	CaSiO3	CaSiO3	Mgs	$CaMgSi_2O_6$	CaMgSi2O6
Association	fPer+Brd	fPer+Brd				fPer+ Merrillite			fPer+Brd	$CaSiO_3$+ $CaTiO_3$+ fPer	$CaSiTiO_3$ $CaSiO_3$+ fPer		$CaSiO_3$+ fPer	$CaSiO_3$+ fPer	Mgs+fPer		
SiO_2	0.02	0.01	0.07	bdl	0.04	0.01		55.99	56.32	49.98	12.92	47.92	51.58	50.64	0.04	53.77	52.71
TiO_2	0.01	0.00	0.08	bdl	0.01	0.01	0.04	0.20	0.12	bdl	40.28	bdl	0.04	0.02	0.00	0.06	bdl
Al_2O_3	0.11	0.09	0.04	bdl	0.03	0.12	0.14	2.25	1.26	bdl	1.83	0.59	0.09	0.06	0.01	0.59	0.32
Cr_2O_3	1.02	1.00	0.08	bdl	0.42	1.21	1.25	0.22	0.08	bdl	1.33	bdl	0.01	0.02	0.02	0.15	bdl
FeO	26.16	24.58	48.05	32.73	32.65	62.86	61.48	5.94	4.91	0.35	0.51	0.53	0.28	0.08	2.76	2.75	6.12
NiO	1.28	1.36	0.23	bdl	0.82	0.10	0.27	bdl	0.01	bdl	bdl	bdl	0.02	bdl	0.05	0.01	bdl
MnO	0.25	0.25	0.23	1.10	0.29	1.47	1.50	0.18	0.11	bdl	bdl	bdl	0.03	0.03	0.12	0.06	bdl
MgO	69.78	73.13	51.68	63.15	64.74	32.19	32.91	34.00	35.32	0.28	bdl	bdl	bdl	bdl	39.97	17.41	13.08
CaO	0.01	0.01	0.01	bdl	0.01	0.01	0.00	bdl	0.10	48.13	38.06	49.7	47.44	47.46	1.29	23.48	25.31
Na_2O	0.64	0.26	0.03	bdl	0.24	1.43	1.15	bdl	0.07	bdl	bdl	bdl	0.06	0.02	0.06	0.41	bdl
K_2O	bdl	0.01	0.01	bdl	bdl	bdl	bdl	bdl	0.02	bdl	bdl	bdl	0.02	0.00	0.01	0.01	bdl
Total	99.28	100.70	100.51	96.98	99.25	99.41	98.74	98.78	98.32	98.74	94.93	98.74	99.56	98.33	44.32*	98.68	97.55
fe#	0.174	0.159	0.343	0.225	0.220	0.523	0.512	0.089	0.072	-	-	-	-	-	-	0.081	0.208
mg#	0.826	0.841	0.657	0.775	0.780	0.477	0.488	0.911	0.928	-	-	-	-	-	-	0.919	0.792

Note: bdl – below detection limit; * - CO_2 not analyzed

Table S2. Isotopic composition of carbon in diamonds from Rio Sorriso

Sample	δ^{13}C, ‰ VPDB											Primary mineral inclusion(s)
	1	2	3	4	5	6	7	8	9	Aver	Deviation	
1.2.1	-5.25	-5.96	-5.37							-5.53	0.38	High-Ni fPer
1.2.2	-6.91	-5.16	-5.22							-5.76	0.99	Low-Ni fPer + CaSiPrv +CaTiPrv
1.2.3	-8.50	-9.90	-6.65	-9.36	-10.48	-8.76				-8.94	1.34	Low-Ni fPer
1.3.1	-6.37	-8.03	-4.53	-6.39	-6.71					-6.41	1.25	
1.3.2	-6.79	-8.68	-7.66	-6.46	-5.83					-7.08	1.11	
1.4.2	-6.46	-8.45	-7.58							-7.50	1.00	
1.5.2	-4.98	-6.03	-6.40	-5.64	-5.28	-5.96				-5.72	0.52	Brd
2.2.1	-6.14	-5.19	-6.51	-5.23	-4.91					-5.60	0.69	High-Ni fPer
2.2.2	-5.13	-4.98	-5.21	-5.07						-5.10	0.10	
2.2.3	-5.11	-6.63	-5.69	-5.01						-5.61	0.74	High-Ni fPer + CaSiPrv
2.2.4	-5.19	-5.16	-5.18	-5.04	-5.43					-5.20	0.14	High-Ni fPer
2.3.1	-5.60	-5.66	-6.10	-5.68						-5.76	0.23	
2.6.1	-6.34	-6.68	-5.68	-5.81						-6.11	0.41	
2.6.2	-6.31	-5.65	-6.39	-7.34	-7.20					-6.58	0.70	
2.6.4	-7.61	-5.83	-5.58							-6.34	1.11	
2.6.5	-6.97	-5.72	-6.26	-7.34	-6.04					-6.47	0.67	
2.7.1	-5.68	-5.08	-4.69	-5.74						-5.30	0.50	
2.7.2	-5.26	-5.35	-7.17							-5.93	1.08	High-Ni fPer
2.8.3	-7.06	-5.95	-6.11							-6.37	0.60	Low-Ni fPer
2.10.3	-5.54	-5.79	-4.77	-5.56	-4.60					-5.25	0.53	
2.11.2	-4.82	-5.44								-5.13	0.44	Di?
3.1.2	-9.48	-5.23	-8.51	-7.61	-7.22	-7.90	-6.44	-8.23		-7.58	1.31	
3.2.2	-5.63	-7.00	-6.71	-5.98	-7.62	-6.23	-5.30	-7.48	-6.02	-6.44	0.81	High-Ni fPer
3.2.3	-5.38	-6.24	-5.28	-6.33						-5.81	0.55	
3.4.1	-5.76	-6.15	-4.89	-5.15						-5.49	0.57	
3.5.2	-4.83	-5.27	-6.07	-7.25	-5.47	-5.36	-4.60	-5.14		-5.50	0.83	High-Ni fPer + Brd
3.5.4	-7.45	-6.53	-8.08	-5.95	-5.45					-6.69	1.07	
3.5.5	-5.08	-5.68	-6.56	-5.23	-5.49					-5.61	0.58	
3.6.1	-5.17	-5.94	-5.56	-6.50						-5.79	0.57	
3.6.2	-5.18	-5.49	-6.02	-5.18	-5.26	-5.17	-5.47			-5.56	0.54	Tuite
3.6.3	-8.17	-6.94								-7.56	0.87	Low-Ni fPer
3.9.2	-5.83	-7.94	-8.21							-8.08	0.19	
3.9.3	-6.21	-6.30	-6.46	-5.99	-5.78					-6.15	0.27	High-Ni fPer

3.9.4	-5.34	-5.01	-4.89	-5.97	-4.94				-5.23	0.45	
3.10.1	-6.50	-6.81	-6.79						-6.70	0.17	Low-Ni fPer
3.10.2	-4.88	-5.68	-5.59	-5.67	-6.13				-5.59	0.45	High-Ni fPer + Tuite
4.3.2	-7.12	-5.81	-6.28	-6.94					-6.54	0.60	
4.6.1	-4.73	-5.35	-5.18	-5.50					-5.19	0.33	
4.11.1	-8.27	-9.43	-7.49	-9.12	-6.16				-8.09	1.32	
4.16.1	-7.28	-7.84	-5.92	-6.19	-6.67				-6.78	0.79	
4.18.3	-5.34	-5.39	-5.65	-5.67					-5.51	0.17	
6.2.1	-4.72	-6.10	-5.86	-6.80	-5.81				-5.86	0.75	
6.3.1	-12.00	-15.03	-13.61	-10.00	-9.58	-11.96	-9.45	-9.62	-11.41	2.10	
6.6.1	-4.85	-4.64	-5.20	-5.20	-5.34				-5.05	0.29	
6.7.1	-10.44	-7.85	-10.48	-6.86	-6.85				-8.50	1.84	
6.8.1	-8.91	-8.01	-8.09	-8.29					-8.33	0.41	