and allow us to better understand and quantify the effects of the Lost City hydrothermal system on the basement rocks of the southern part of the massif.

Changes in chemical composition during hydrothermal alteration are related to the mobility of elements (major, trace and REE) and depend on water–rock ratios, exposure times on the ocean floor (e.g.,

Table 1
Major and trace elements analyses of the serpentinized peridotites and olivine-rich troctolites recovered from Hole 1309D of the central dome of the Atlantis Massif

Leg	304	304	304	304	304	305	305	305	305	305	305
Site	1309B	1309D	1309D	1309D	1309D	1309D	1309D	1309D	1309D	1309D	1309D
Core	11R	27R	42R	58R	65R	232R	234R	237R	241R	248R	256R
Section	1	3	1	1	2	1	2	2	2	1	2
Interval	23–30 cm	6–9 cm	0–8 cm	50–57 cm	22–30 cm	20–31 cm	102–110 cm	7–17 cm	97–108 cm	114–120 cm	46–56 cm
Depth (mbsf)	57.23	155.14	224.3	300.9	335.72	1115.3	1127.22	1140.59	1160.74	1193.04	1231.9
Type of rock	Harzburgite	Harzburgite	Talc-rich harzburgite	Harzburgite	Cr-rich harzburgite	Olivine-rich troctolite	Olivine-rich troctolite	Olivine-rich troctolite	Olivine-rich troctolite	Olivine-rich troctolite	Olivine-rich troctolite
Alteration (%)	90	90	90	70	50	10	10	10	10	5	10
SiO_2	37.96	36.34	44.58	35.87	35.53	38.86	37.63	37.45	38.76	40.11	38.89
Al_2O_3	0.79	0.72	0.63	1.24	1.03	6.39	3.45	4.36	5.62	3.16	3.39
Fe_2O_3	8.16	9.35	8.93	9.77	11.53	10.81	11.89	11.08	11.62	10.25	12.34
MnO	0.076	0.100	0.089	0.109	0.067	0.155	0.167	0.162	0.161	0.179	0.179
MgO	39.77	39.65	34.6	39.94	39.51	32.56	39.35	36.25	36.44	43.41	38.27
CaO	0.27	0.60	0.88	0.09	0.14	4.15	2.23	3.49	3.32	2.02	3.08
Na_2O	0.12	0.05	0.11	0.07	0.07	0.42	0.26	0.20	0.43	0.28	0.25
K_2O	<0.01	0.02	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.02	<0.01	<0.01
TiO_2	0.005	0.021	0.04	0.058	0.038	0.06	0.04	0.057	0.043	0.041	0.057
P_2O_5	<0.01	0.01	0.02	0.01	<0.01	0.02	0.01	<0.01	0.01	0.01	<0.01
LOI	12.43	12.92	9.98	12.48	11.99	5.47	4.73	6.55	3.38	<0.01	3.25
Total	99.56	99.80	99.86	99.63	99.83	98.92	99.74	99.57	99.81	99.41	99.67
Trace elements											
Ce	0.24	0.07	0.27	0.18	0.07	0.27	0.17	0.17	0.18	0.15	0.18
Co	111	114	106	116	127	77	109	115	107	58	104
Cr	2190	1910	2110	1930	4420	1230	550	2210	1240	850	1720
Cs (d.l=<0.1 ppm)	<0.1	<d.l.	0.4	0.3	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Cu (d.l.=<10 ppm)	<10	20	<d.l.	40	50	40	280	50	50	20	50
Dy	0.02	0.08	0.31	0.23	0.08	0.22	0.12	0.24	0.11	0.11	0.23
Er	0.03	0.05	0.22	0.15	0.06	0.13	0.10	0.15	0.08	0.08	0.16
Eu	0.018	0.011	0.087	0.039	0.024	0.087	0.053	0.068	0.067	0.038	0.065
Ga (d.l.=<1 ppm)	<1	<d.l.	2	1	2	4	2	3	4	2	2
Gd	0.01	0.05	0.21	0.17	0.03	0.15	0.09	0.15	0.07	0.07	0.17
Ge (d.l=<0.5 ppm)	0.9	1.2	2.1	1.2	1.5	0.5	1.2	1.2	0.9	<d.l.	1.1
Hf (d.l=<0.1 ppm)	<0.1	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Ho	<0.01	0.02	0.07	0.05	0.02	0.05	0.03	0.05	0.03	0.02	0.05
La	0.07	<0.05	0.08	<d.l.	<d.l.	0.08	<d.l.	<d.l.	0.05	<d.l.	<d.l.
Lu (d.l=<0.05 ppm)	0.009	0.01	0.038	0.024	0.014	0.023	0.018	0.027	0.016	0.018	0.023
Nb	<0.2	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Nd	0.16	0.08	0.32	0.29	0.08	0.3	0.18	0.26	0.17	0.17	0.25
Ni	2430	1540	780	1560	1150	570	1400	1150	840	610	1120
Pb (d.l=<5 ppm)	<5	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	9	<d.l.	<d.l.	<d.l.
Pr	0.03	0.01	0.05	0.04	0.01	0.05	0.03	0.04	0.03	0.03	0.04
Rb (d.l=<1 ppm)	<1	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Sb (d.l=<0.2 ppm)	<0.2	3.2	4.1	2.4	2.5	<d.l.	1.6	2.3	0.7	<d.l.	0.9
Sc	8	8	13	9	7	10	8	12	8	8	12
Sm	0.04	0.03	0.14	0.12	0.03	0.11	0.07	0.11	0.06	0.06	0.1
Sr (d.l=<2 ppm)	<2	<d.l.	4	<d.l.	<d.l.	31	18	21	26	15	15
Ta (d.l=<0.01 ppm)	<0.01	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Tb	<0.01	<d.l.	0.04	0.04	0.01	0.03	0.02	0.03	0.02	0.01	0.03
Th (d.l=<0.05 ppm)	<0.05	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Tl (d.l=<0.05 ppm)	<0.05	<d.l.	0.11	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.
Tm	0.006	0.008	0.037	0.024	0.01	0.021	0.017	0.023	0.013	0.014	0.025
U (d.l=<0.01 ppm)	0.02	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	0.02	0.1	<d.l.	<d.l.	<d.l.
V	39	19	29	20	14	24	15	26	17	11	29
Y	<0.5	0.6	2.7	1.5	0.6	1.5	0.9	1.6	0.8	0.8	1.5
Yb	0.05	0.06	0.26	0.16	0.08	0.14	0.12	0.16	0.09	0.1	0.16
Zn	<30	40	40	50	50	40	40	60	50	<30	60
Zr (d.l=<4 ppm)	<4	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.	<d.l.