GSA Data Repository 2015239

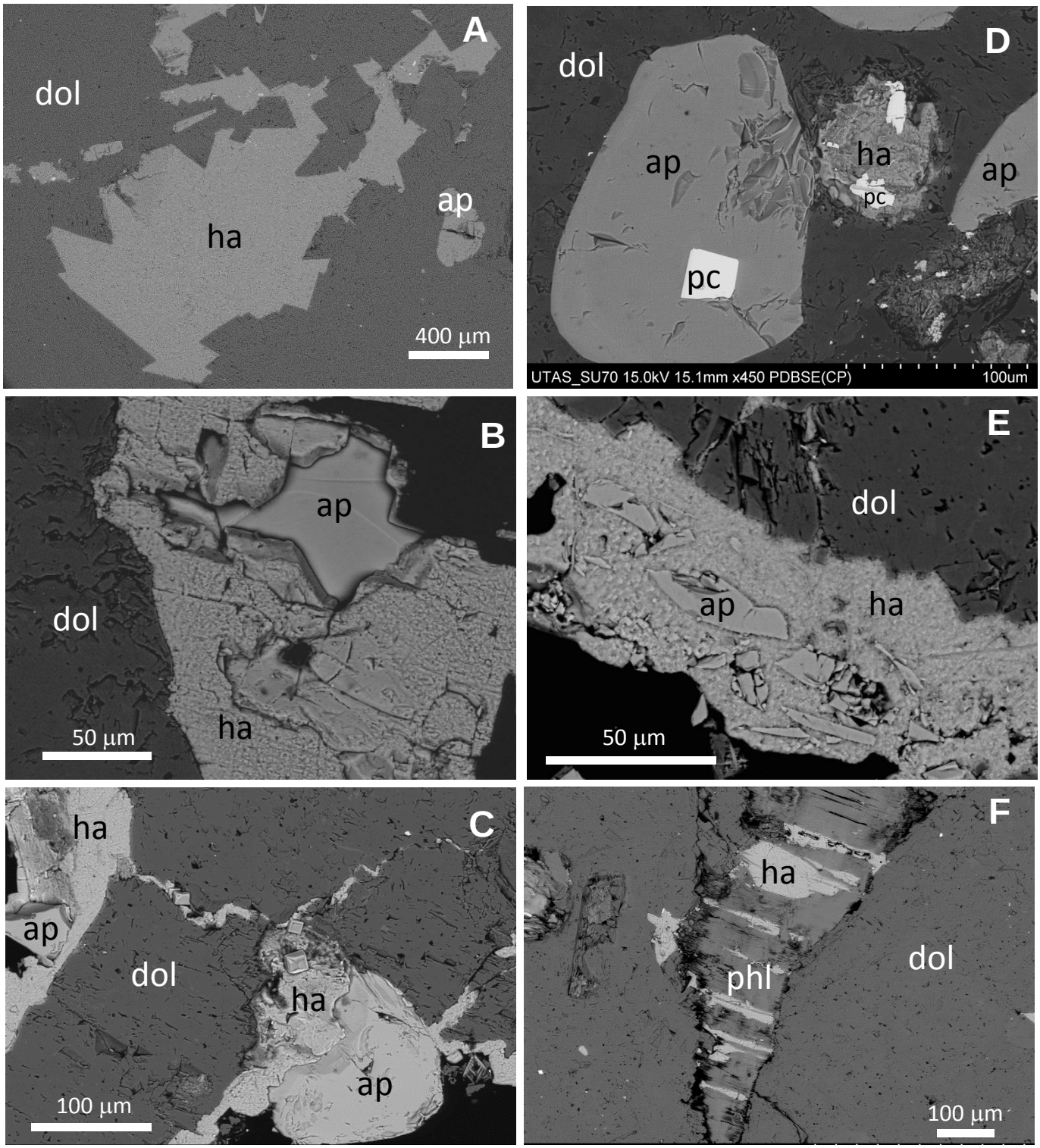


Figure DR1. Occurrence of halite (ha) in carbonatite of the St.-Honoré syenite-carbonatite complex in association with dolomite (dol), apatite (ap), pyrochlore (pc) and phlogopite (phl). Back-scattered electron images.

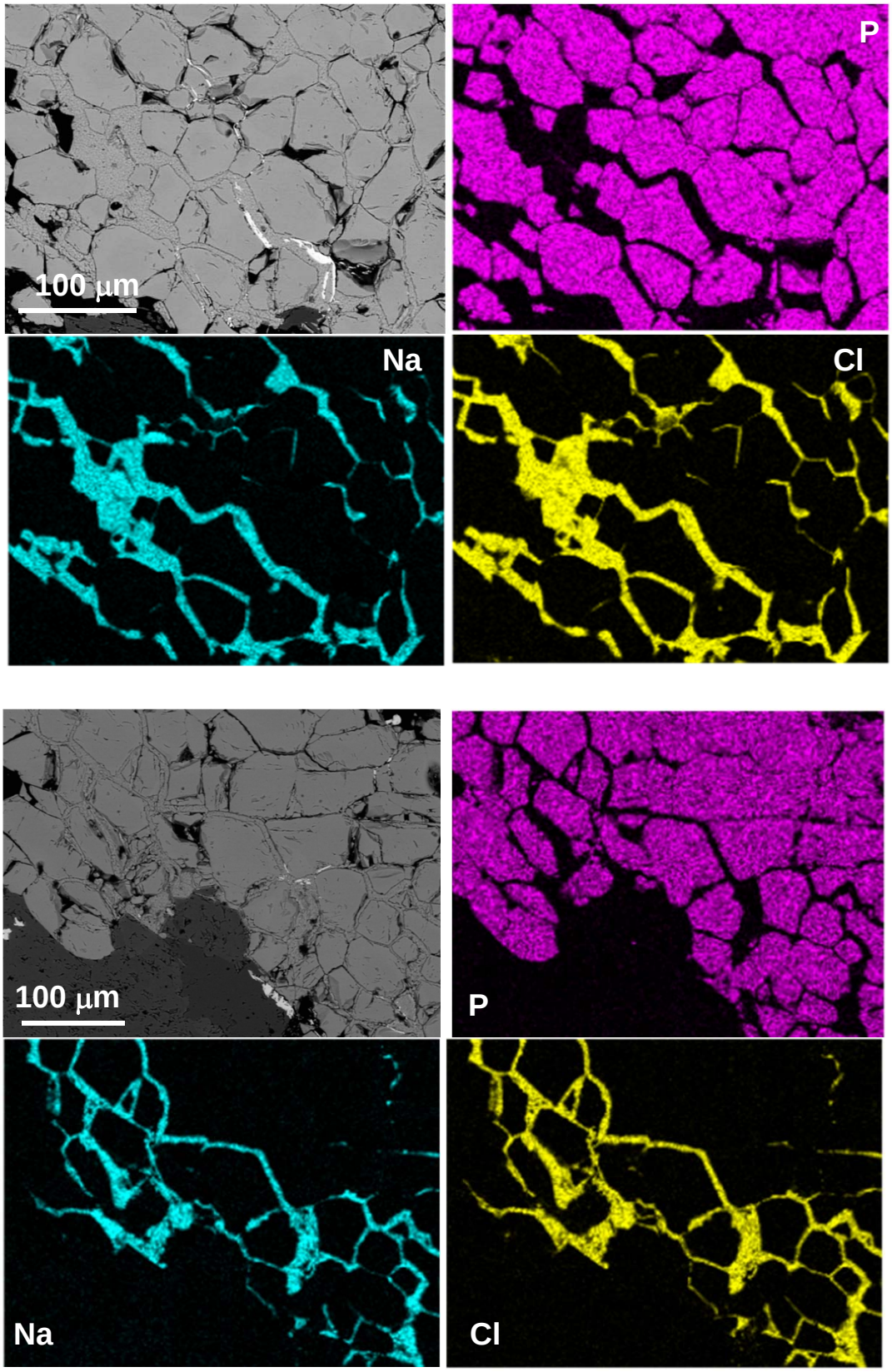


Fig. DR2. Backscattered images and X-ray element maps showing halite and synchysite cementing “sugary” apatite segregation in dolomite

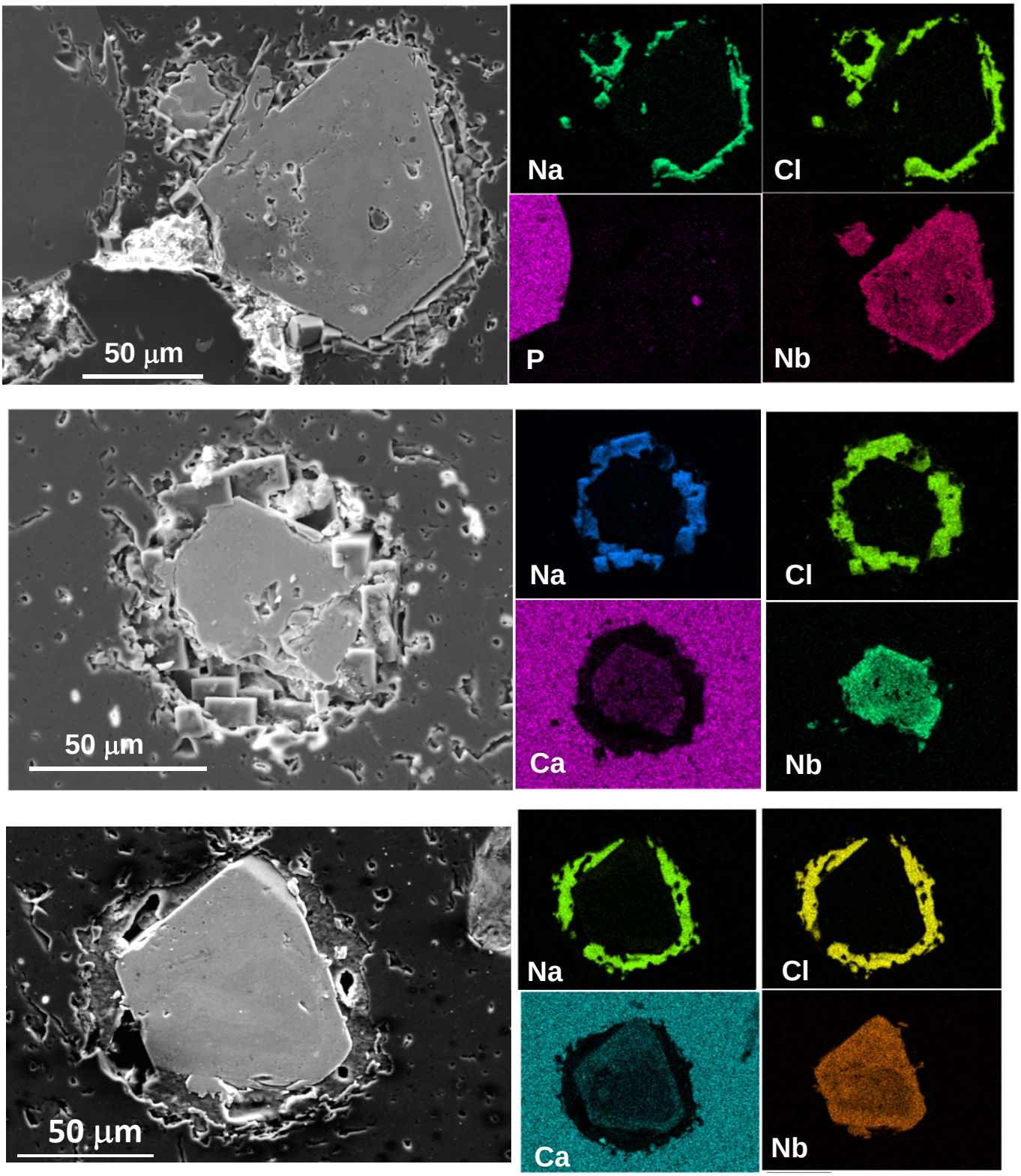


Fig. DR3. Backscattered images and X-ray element maps showing pyrochlore crystals surrounded by halite “pools” in dolomite

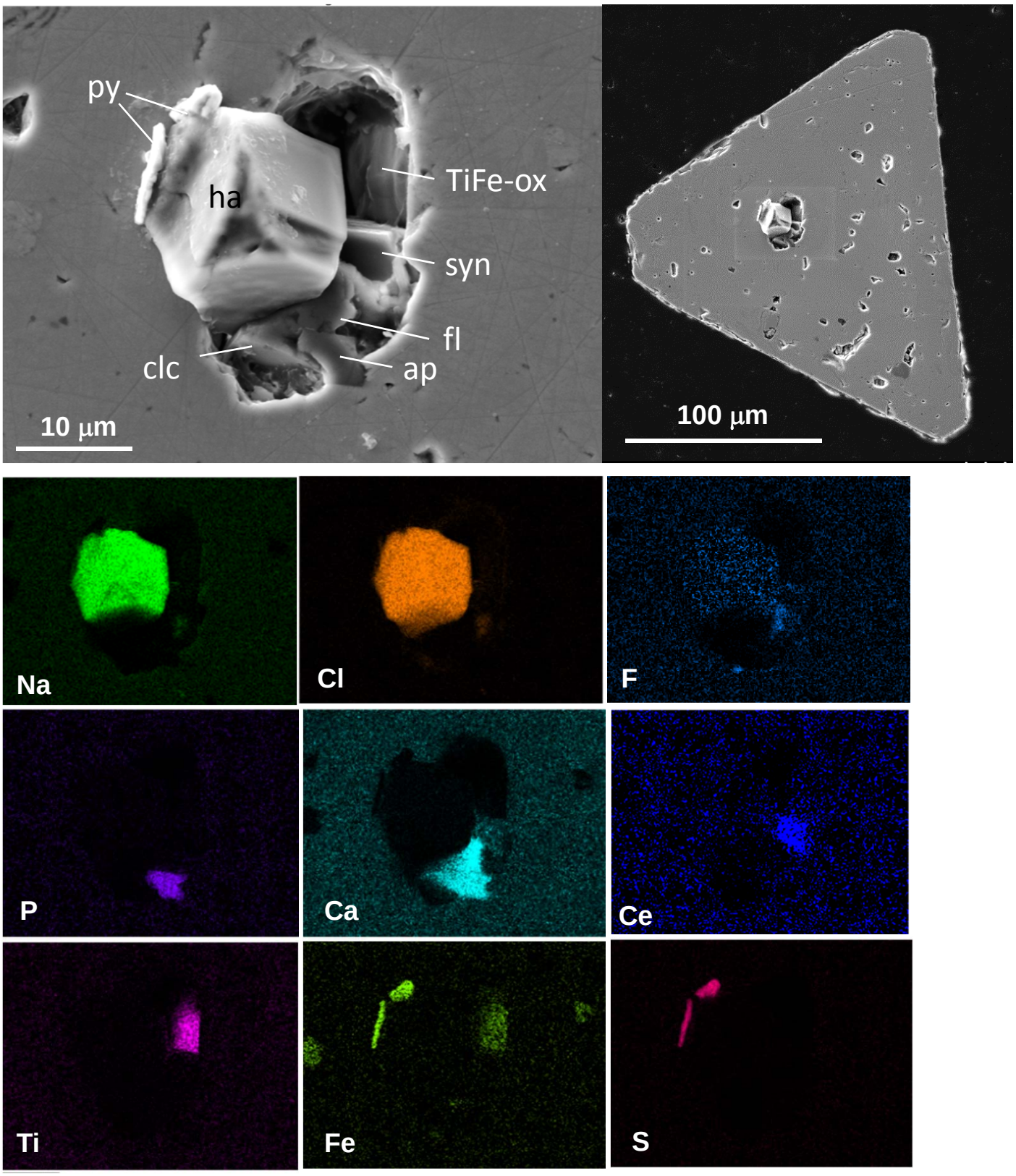


Fig. DR4. Backscattered electron image and X-ray element maps showing daughter phases in pyrochlore-hosted melt inclusion, represented by halite (Na, Cl; ha), apatite (P, Ca; ap), calcite (Ca; clc), fluorite (F, Ca; fl), synchysite (Ce, Ca; syn), Ti-Fe oxide (Ti, Fe; TiFe-ox) and pyrite (Fe, S; py)

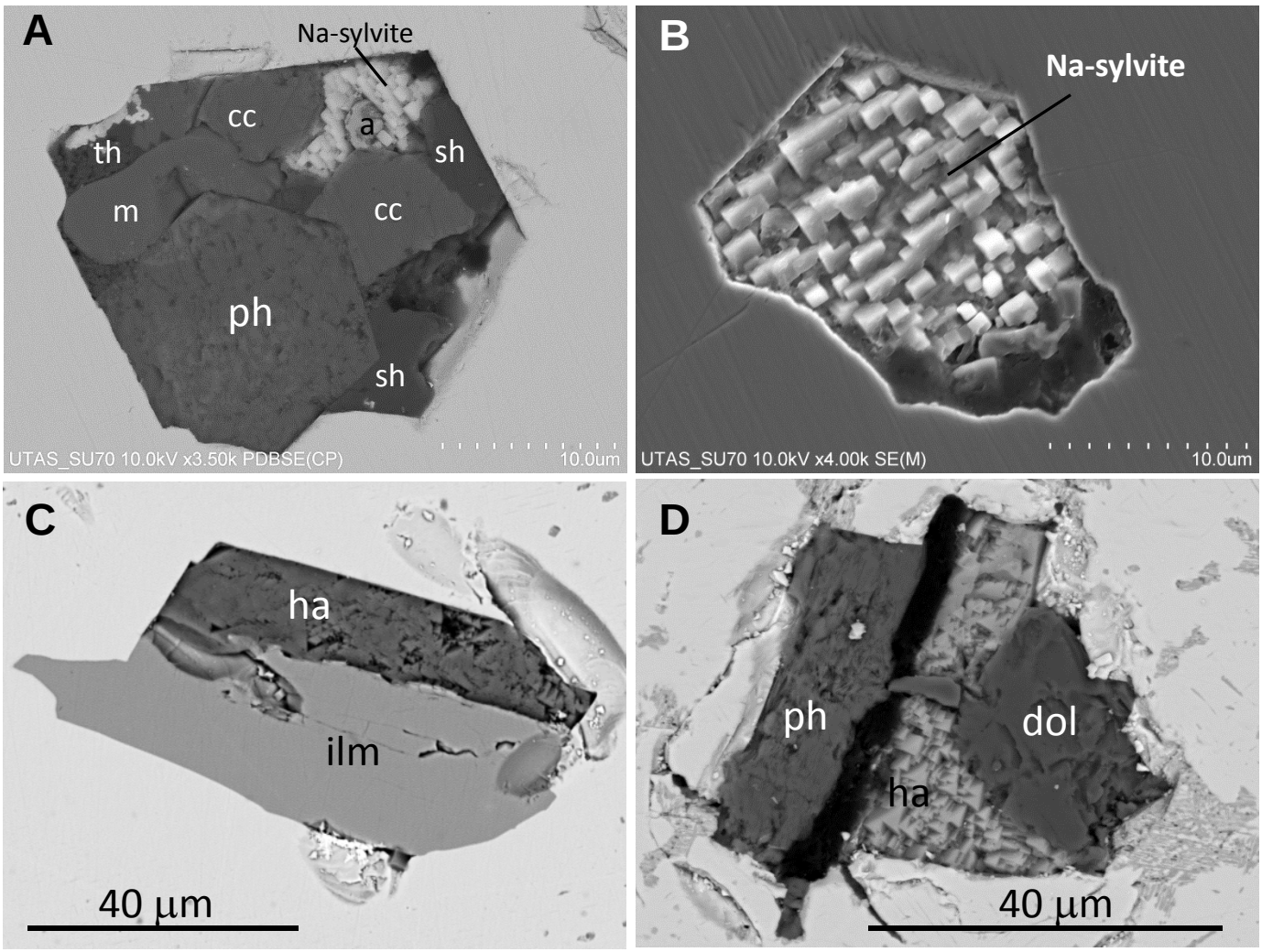


Fig. DR5. Back-scattered electron images showing chlorides (Na-sylvite and halite (ha)) in melt inclusions entrapped in magmatic magnetite from Oka, Quebec, Canada (A, B) and Phalabora, South Africa (C, D) intrusive carbonatites. Associated daughter minerals are calcite (cc), shortite (sh), phlogopite (ph), monticellite (m), thenardite (th), andradite (a), ilmenite (ilm) and dolomite (dol).

Table DR1. Major (wt%) and trace (ppm) element composition of halite-bearing dolomitic carbonatite from the St.-Honoré syenite-carbonatite complex

SiO_2	1.06	Li	1.94	Sr	276	La	208	Hf	0.75
TiO_2	0.04	Be	1.44	Y	96.3	Ce	469	Ta	2.01
Al_2O_3	0.36	Sc	1.37	Zr	329	Pr	58.4	W	0.15
FeO	5.61	Ti	321	Nb	123	Nd	227	Tl	0.21
MnO	1.74	V	29.3	Mo	16.5	Sm	38.5	Pb	5.16
MgO	15.79	Cr	4.47	Ag	0.56	Eu	11.18	Bi	0.06
CaO	26.92	Mn	13829	Cd	0.02	Gd	27.5	Th	2.51
Na_2O	2.47	Co	7.65	Sn	0.98	Tb	3.86	U	2.16
K_2O	0.14	Ni	5.3	Sb	0.49	Dy	19.7		
P_2O_5	0.85	Cu	57.3	Te	0.06	Ho	3.48		
SO_3	0.82	Zn	14.6	Cs	0.15	Er	8.94		
CO_2	41	Ga	5.64	Ba	52.7	Tm	1.2		
Cl*	2.83	As	18.3			Yb	6.98		
total	99.63	Rb	3.66			Lu	0.97		

Cl* calculated based on assumption that all Na is in NaCl.

Major elements were analysed in lithium borate disks by XRF using an Axios Advanced 4.0kW X-ray fluorescence spectrometer by Panalytical (School of Earth Sciences, University of Tasmania). Trace elements were analysed by solution ICP-MS using a PicoTrace high pressure digestion system and an Agilent 7700 ICP-MS with a 3rd Generation Octopole Reaction System (School of Earth Sciences, University of Tasmania). Sulfur and Carbon were analysed by a Thermo Finnigan EA 1112 Series Flash Elemental Analyser (Central Science Laboratory, University of Tasmania).

Table DR2. Detailed Rb-Sr and Sm-Nd isotope results for St.-Honoré dolomite, phlogopite, apatite and halite

	weight, mg	Rb ppm	Sr ppm	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Sm ppm	Nd ppm	$^{147}Sm/^{144}Nd$	$^{143}Nd/^{144}Nd$	εNd (now)	age t, Ga	Sr(t)	εNd(i)
sample Honoré-1, sub-sample 1													
DOL1	15.6	0.12	152.0	0.00227	0.704326	9.60	57.88	0.1002	0.512467	-3.34	0.571	0.70431	3.8
DOL3	65	*0.11*	*183.2*	0.00168	0.704027	41.7	261.4	0.0963	0.512463	-3.3	0.571	0.70401	4.0
PHL1	11.0	57.52	180.2	0.9235	0.711201	3.89	23.98	0.0980	0.512458	-3.51	0.571	0.70382	3.8
PHL1 L	0.9	12.56	644.8	0.0564	0.704335								
sample Honoré-1, sub-sample 2													
DOL2	20	*0.13*	*503*	0.00076	0.703367	61.7	392.4	0.0950	0.512454	-3.4	0.571	0.70336	3.9
HAL1	118	0.01	2.82	0.00940	0.704509						0.571	0.70443	
HAL3,4	88	*0.03*	*4.55*	0.01606	0.704495						0.571	0.70437	
HAL5	100	*0.03*	*19.82*	0.00469	0.704255						0.571	0.70422	
sample Honoré-2													
DOL 4	25	*1.33*	*272*	0.01410	0.703710	21.7	109.0	0.1201	0.512513	-2.3	0.571	0.70360	3.2
HAL6	70	*0.03*	*5.02*	0.01522	0.704484						0.571	0.70436	
sample Honoré-3													
AP1	30.3	*0.13*	*6090*	0.00006	0.702872	188.6	1214.3	0.0938	0.512434	-3.8	0.571	0.70287	3.6

Abbreviations: DOL=dolomite, PHL=phlogopite (PHL1 L= 2M HCl leach), HAL=halite, AP=apatite

Rb, Sr, Sm and Nd by isotope dilution MC-ICPMS, except for Rb and Sr given in italics (by quadrupole ICPMS on a 10% split of the solutions)

$^{87}Sr/^{86}Sr$ normalized to $^{88}Sr/^{86}Sr$=8.37521 and reported relative to SRM987=0.710230

$^{143}Nd/^{144}Nd$ normalized to $^{146}Nd/^{145}Nd$=2.0719425 (equivalent to $^{146}Nd/^{144}Nd$ = 0.7219) and reported relative to LaJolla=0.511860

typical internal precisions (2se) ±0.000020 for $^{87}Sr/^{86}Sr$, ±0.000012 for $^{143}Nd/^{144}Nd$; external precision (2 std dev) ±0.000040 (Sr), ±0.000020 (Nd)

modern CHUR is $^{147}Sm/^{144}Nd$ 0.1960, $^{143}Nd/^{144}Nd$ 0.512632 (Bouvier et al., 2008), decay constants: ^{87}Rb 1.395E-11/year; ^{147}Sm 6.54E-12/year

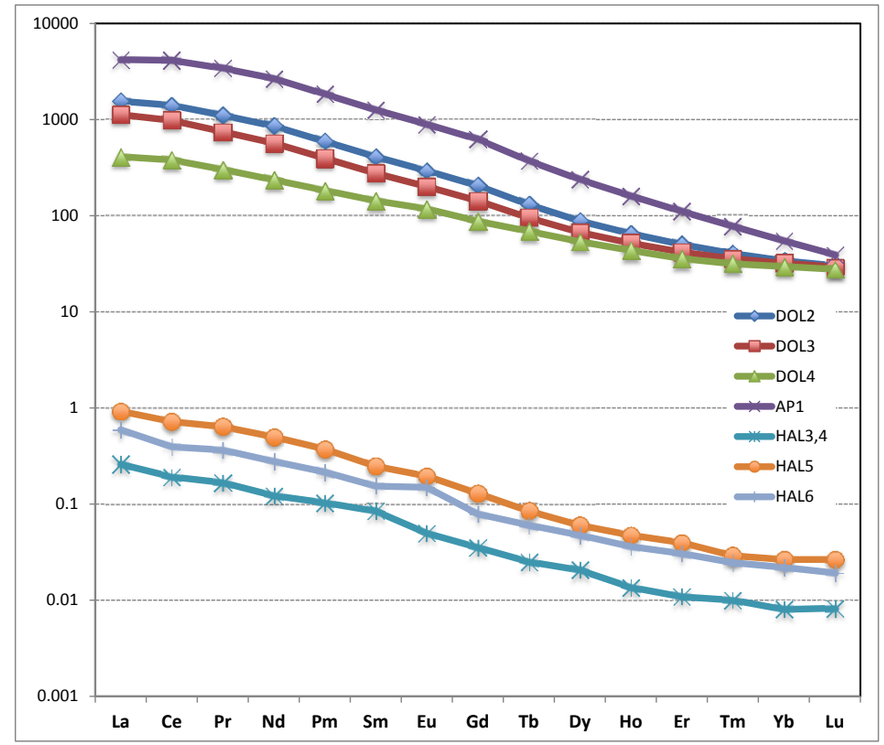
USGS basalt standard BCR-2 analyzed by isotope dilution in this batch yields: Sm=6.45 ppm; Nd=28.15 ppm; $^{147}Sm/^{144}Nd$=0.1384; $^{143}Nd/^{144}Nd$=0.512628, 0.512625, 0.512632, 0.512644; $^{87}Sr/^{86}Sr$=0.705014, 0.704951, 0.704948, 0.704958

Table DR3. Trace element compositions for St.-Honoré apatite, dolomite and halite

								rock standards……					
	AP1	**DOL2**	**DOL3**	**DOL4**	**HAL3,4**	**HAL5**	**HAL6**	**W2-J**	**W2-J**	**W2-I**	**W2-I**	**BCR2-O**	**BR-3**
Li	0.19	0.29	0.28	0.87	0.01	0.02	0.02	9.13	9.19	9.18	9.13	9.27	14.21
Be	0.35	0.81	1.35	8.70	0.00	0.01	0.01	0.62	0.62	0.62	0.61	2.13	1.82
Ca	385,254	238,900	219,607	290,211	111	391	408	77,526	78,110	77,837	77,295	50,580	97,910
Sc	0.3	1.4	0.5	2.3					36		36	33	23
Ti	30.7	1.5	0.7	56.6	0.39	0.57	0.42	6,355	6,383	6,355	6,328	13,472	15,873
V	33.2	8.5	2.6	37.2					263		260	407	230
Cr	0.3	0.3	3.9	0.2					93		92	15	373
Co	0.5	1.3	0.3	0.4					45		44	38	59
Ni	2.9	1.8	3.1	1.9					70		70	12	264
Cu	0.6	1.3	0.8	0.4					102		104	14	65
Zn	14.6	9.7	7.1	10.7					77		77	129	155
Ga	3.0	1.1	1.0	1.5					17		17	22	17
As	5.6	1.1	0.3	0.4					1		1	0	2
Rb	0.13	0.13	0.11	1.33	0.03	0.03	0.03	19.8	20	19.8	20	46	47
Sr	6,069	502	185	273	4.56	19.88	5.02	194.8	195	194.9	194	336	1,361
Y	203	93	76	60	0.020	0.071	0.055	20.1	20	20.2	20	33	27
Zr	10.26	3.02	0.07	0.53					88		88	184	268
Nb	437.53	2.23	0.12	0.84	0.006	0.042	0.102	7.3	7.30	7.3	7.25	12.36	113.9
Mo	0.04	0.05	0.04	0.02	0.005	0.025	0.048	0.4	0.43	0.4	0.41	240.9	2.03
Cd	0.13	0.02	0.01	0.01					0.08		0.08	0.21	0.16
Sn	0.29	0.05	0.03	0.22	0.020	0.036	0.035	2.0	1.93	1.9	1.97	2.44	2.18
Sb	0.06	0.10	0.01	0.03					0.70		0.71	0.24	0.13
Cs	0.01	0.01	0.00	0.08	0.001	0.004	0.001	0.9	0.89	0.9	0.88	1.13	0.79
Ba	39.2	41.1	42.8	13.1	0.738	1.064	1.052	170	170	169	169	675	1,068
La	997	368.3	266.5	97.5	0.061	0.219	0.141	10.54	10.56	10.50	10.48	24.89	82.30
Ce	2,530	861.7	599.7	232.6	0.117	0.441	0.241	23.26	23.26	23.18	23.17	53.11	153.08
Pr	324	105.2	71.1	28.8	0.016	0.061	0.035	3.03	3.02	3.02	3.03	6.88	17.51
Nd	1,249	399.5	265.5	110.1	0.057	0.233	0.130	12.93	12.90	12.89	12.92	28.54	66.48
Sm	192.9	62.81	42.24	21.87	0.013	0.038	0.023	3.27	3.26	3.26	3.27	6.57	12.12
Eu	51.88	17.02	11.64	6.85	0.003	0.011	0.009	1.09	1.10	1.09	1.09	1.94	3.65
Gd	128.0	42.19	29.36	18.01	0.007	0.026	0.016	3.70	3.70	3.71	3.72	6.70	9.87
Tb	13.92	4.88	3.56	2.57	0.001	0.003	0.002	0.62	0.62	0.62	0.61	1.05	1.27
Dy	60.39	22.39	17.04	13.66	0.005	0.015	0.012	3.80	3.79	3.81	3.82	6.32	6.36
Ho	9.12	3.68	2.93	2.46	0.001	0.003	0.002	0.80	0.80	0.80	0.81	1.32	1.10
Er	18.33	8.31	6.92	5.92	0.002	0.007	0.005	2.22	2.22	2.22	2.23	3.65	2.55
Tm	1.98	1.03	0.91	0.81	0.000	0.001	0.001	0.33	0.33	0.33	0.33	0.53	0.32
Yb	9.32	5.78	5.46	5.04	0.001	0.005	0.004	2.05	2.05	2.06	2.07	3.40	1.81
Lu	1.00	0.77	0.75	0.70	0.000	0.001	0.000	0.30	0.30	0.30	0.30	0.50	0.24
Hf	0.12	0.07	0.01	0.01	0.000	0.001	0.000	2.35	2.34	2.36	2.37	4.81	5.64
Ta	1.75	0.02	0.00	0.01	0.000	0.000	0.001	0.45	0.45	0.45	0.46	0.77	5.71

W	0.12	0.03	0.02	0.02	0.004	0.002	0.004	0.24	0.24	0.24	0.24	0.42	0.94
Tl	0.00	0.00	0.00	0.00	0.008	0.010	0.025	0.09	0.09	0.09	0.09	0.25	0.05
Pb*	2.87	1.87	0.57	0.73	0.162	0.793	0.088	7.43	7.43	7.62	7.61	9.86	4.59
Th	51.11	1.37	0.68	2.85	0.001	0.003	0.013	2.08	2.12	2.13	2.18	5.89	10.57
U	5.59	0.16	0.04	0.10	0.000	0.001	0.004	0.50	0.50	0.51	0.51	1.70	2.55

results acquired by solution-mode quadrupole ICP-MS of weighed splits of solutions used for Sr-Nd isotope work
*Pb based on sum of counts for masses 206, 207 and 208 for unknowns and standards (primary, secondary)

sample/chondrite	chondrite	DOL2	DOL3	DOL4	AP1	HAL3,4	HAL5	HAL6
La	0.237	1554	1125	411	4208	0.26	0.92	0.59
Ce	0.612	1408	980	380	4135	0.19	0.72	0.39
Pr	0.095	1107	748	303	3414	0.17	0.64	0.37
Nd	0.467	855	569	236	2675	0.12	0.50	0.28
Pm		593	396	184	1836	0.10	0.37	0.22
Sm	0.153	411	276	143	1261	0.08	0.25	0.15
Eu	0.058	293	201	118	894	0.05	0.20	0.15
Gd	0.2055	205	143	87.6	623	0.04	0.13	0.08
Tb	0.0374	130	95.2	68.8	372	0.03	0.08	0.06
Dy	0.254	88.1	67.1	53.8	238	0.02	0.06	0.05
Ho	0.0566	65.0	51.8	43.5	161	0.01	0.05	0.04
Er	0.1655	50.2	41.8	35.8	111	0.01	0.04	0.03
Tm	0.0255	40.4	35.7	31.6	77.7	0.01	0.03	0.02
Yb	0.17	34.0	32.1	29.6	54.8	0.01	0.03	0.02
Lu	0.0254	30.2	29.4	27.7	39.3	0.01	0.03	0.02
(La/Sm)cn		3.8	4.1	2.9	3.3	3.1	3.7	3.9
(Gd/Yb)cn		6.0	4.4	3.0	11.4	4.4	4.9	3.6
Eu*		1.01	1.01	1.05	1.01	0.91	1.10	1.36

chondrite REE reference values from McDonough, WF & Sun, SS (1995) The composition of the Earth. Chemical Geology 120, 223-253
normalised concentration for Pm (promethium) interpolated from Sm and Nd