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Supplement of

Characteristics of trace metals in traffic-derived particles in Hsuehshan Tunnel, Taiwan: size distribution, fingerprinting metal ratio, and emission factor

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This Supporting Information material contains two tables and three figures. Table S1 lists the recoveries and precisions of each PM metal analyzed by ICP-MS, and Table S2 shows correlation matrix of metals in submicron PM. Three figures contained in Supporting Information include (1) average size distributions of Al, Ca, Mg and K as well as La and Ce (Figure S1), (2) size distributions of traffic-related elements in all sets of samples (Figure S2), and (3) size distributions of some crustal and REEs in all sets of samples (Figure S3) collected at both the inlet and outlet sites of Hsuehshan Tunnel.

Table S1

Recoveries and precisions of trace metals analyzed by ICP-MS compared to certified or reference values of NIST SRM-1648.

Elements[a]	Certified value (μg/g)	Measured value (μg/g, N = 5)	Accuracy (%, N = 5)	Precision (%, N = 5)
Al	34200	35345 ± 894	103	3
Fe	39100	38603 ± 534	99	1
Na	4250	4353 ± 457	102	1
Mg*	8000	8377 ± 474	105	6
K	10500	9982 ± 119	95	1
Ba*	737	734 ± 26	100	4
Ti*	4000	3962 ± 113	99	3
Mn	786	787 ± 37	100	5
Co*	18	18± 0.4	98	2
Ni	82	82 ± 2	100	3
Cu	609	577 ± 11	95	2
Zn	4760	4411 ± 114	93	3
Cd	75	73 ± 3	98	4
Sb*	45	49 ± 0.5	109	1
Pb	6550	6621 ± 293	101	4
V	127	126 ± 2	99	2
Cr	403	389 ± 5	96	1
As	115	126 ± 2	110	1
Se	27	27 ± 1.4	100	5
Cs*	3	3 ± 0.1	105	3
Ce*	55	54 ± 2.6	98	5
U	5.5	5.5 ± 0.3	100	6

[a.] * Reference value reported by NIST.

Table S2

Correlation matrix of selected elements in submicron particles observed in Hsuehshan Tunnel. Correlation coefficients higher than 0.8 are marked in bold.

	Al	Fe	Mg	K	Ca	Sr	Ba	Ti	Mn	Ni	Cu	Zn	Mo	Cd	Sn	Sb	Pb	V	Cr	Rb	Cs	Ga	La	Ce	Pr	Nd
Al	1.00																									
Fe	0.20	1.00																								
Mg	0.23	0.77	1.00																							
K	0.17	0.69	0.59	1.00																						
Ca	0.39	0.71	**0.82**	0.39	1.00																					
Sr	0.41	0.54	0.58	0.31	0.75	1.00																				
Ba	0.20	**0.91**	0.79	0.53	0.70	0.63	1.00																			
Ti	0.09	0.76	0.56	0.43	0.51	0.35	0.74	1.00																		
Mn	0.08	0.63	0.32	0.61	0.36	0.14	0.27	0.38	1.00																	
Ni	0.43	-0.06	0.09	0.06	0.15	0.34	-0.02	0.04	-0.13	1.00																
Cu	0.06	**0.90**	0.74	0.51	0.62	0.53	**0.97**	0.78	0.29	-0.07	1.00															
Zn	-0.02	0.58	0.26	0.58	0.27	0.08	0.23	0.41	**0.98**	-0.15	0.26	1.00														
Mo	0.04	**0.88**	0.73	0.51	0.66	0.63	**0.94**	0.71	0.29	-0.06	**0.96**	0.27	1.00													
Cd	0.05	0.77	0.44	0.70	0.43	0.30	0.49	0.60	**0.91**	0.00	0.52	**0.93**	0.51	1.00												
Sn	0.06	**0.87**	0.72	0.52	0.67	0.63	**0.94**	0.78	0.27	-0.05	**0.96**	0.24	**0.95**	0.52	1.00											
Sb	0.07	**0.87**	0.69	0.57	0.55	0.51	**0.92**	0.72	0.29	-0.03	**0.94**	0.25	**0.88**	0.53	**0.93**	1.00										
Pb	0.23	0.68	0.44	0.68	0.50	0.30	0.38	0.40	**0.84**	-0.02	0.35	0.77	0.35	**0.82**	0.40	0.45	1.00									
V	-0.04	-0.12	-0.16	0.01	-0.25	0.01	-0.04	-0.04	-0.24	0.50	-0.02	-0.18	-0.03	0.00	0.01	0.05	-0.18	1.00								
Cr	-0.10	0.16	-0.03	0.18	-0.02	-0.06	0.11	0.44	0.16	-0.10	0.15	0.33	0.09	0.36	0.15	0.11	0.16	0.11	1.00							
Rb	0.31	0.64	0.65	0.72	0.57	0.32	0.43	0.38	0.65	0.09	0.37	0.56	0.36	0.65	0.40	0.47	**0.89**	-0.15	0.07	1.00						
Cs	0.21	0.32	0.64	0.31	0.43	0.26	0.28	0.17	0.15	0.24	0.23	0.11	0.19	0.23	0.21	0.32	0.42	0.05	-0.02	0.73	1.00					
Ga	0.13	**0.92**	**0.82**	0.56	0.74	0.64	**0.98**	0.75	0.33	-0.01	**0.95**	0.29	**0.92**	0.54	**0.93**	**0.91**	0.43	-0.02	0.13	0.48	0.32	1.00				
La	0.39	0.78	0.68	0.43	**0.80**	0.71	**0.80**	0.56	0.30	0.06	0.74	0.22	0.79	0.41	0.76	0.67	0.45	-0.10	0.02	0.46	0.23	**0.80**	1.00			
Ce	0.11	0.73	0.65	0.39	0.71	0.72	**0.86**	0.57	0.08	-0.04	**0.84**	0.02	**0.90**	0.27	**0.89**	0.79	0.29	-0.11	0.01	0.32	0.15	**0.84**	**0.84**	1.00		
Pr	0.26	0.49	0.42	0.38	0.38	0.28	0.50	0.35	0.11	0.03	0.53	0.07	0.58	0.18	0.45	0.47	0.17	-0.16	-0.04	0.24	0.09	0.46	0.64	0.55	1.00	
Nd	0.16	0.76	0.67	0.41	0.74	0.73	**0.88**	0.59	0.10	-0.01	**0.85**	0.04	**0.90**	0.29	**0.89**	**0.80**	0.31	-0.11	0.01	0.34	0.16	**0.86**	**0.87**	**1.00**	0.57	1.00

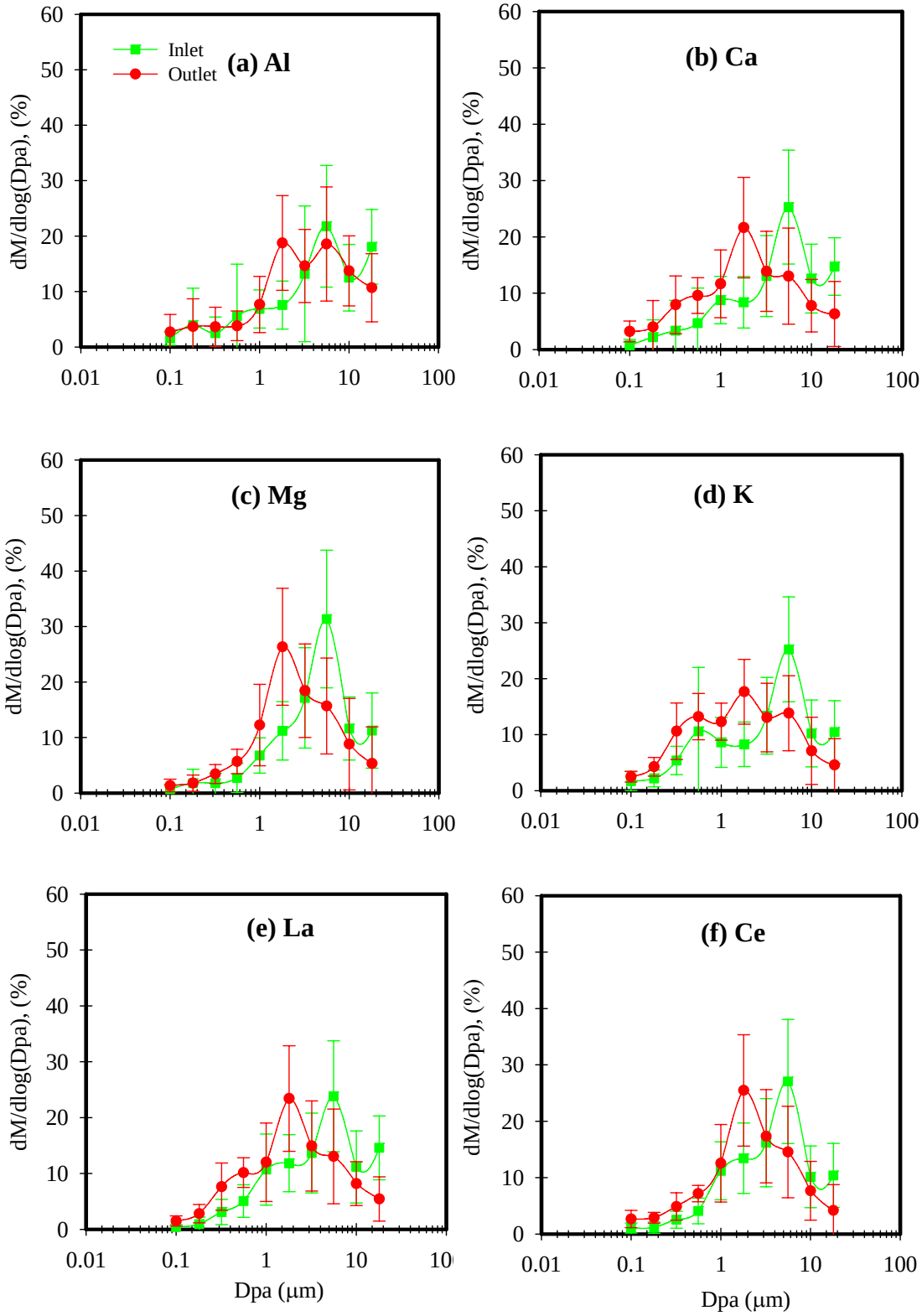


Figure S1. Average size distributions of Al, Ca, Mg, K as well as La and Ce observed at the inlet and outlet sites inside Hsuehshan Tunnel.

Inlet site

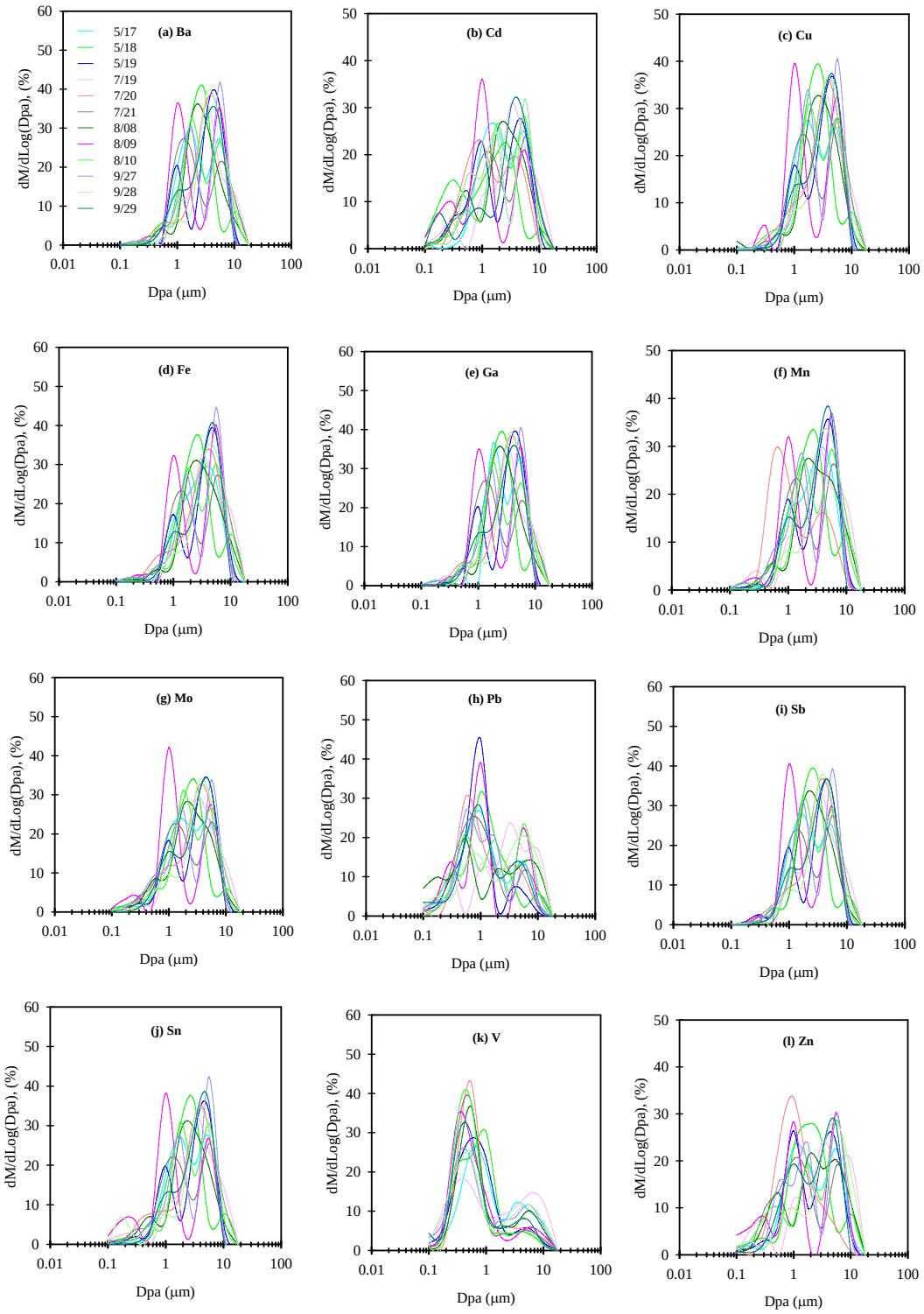


Figure S2. Size distributions of traffic-derived elements in all sets of size-resolved samples collected at both the inlet and outlet sites in Hsuehshan Tunnel.

Outlet site

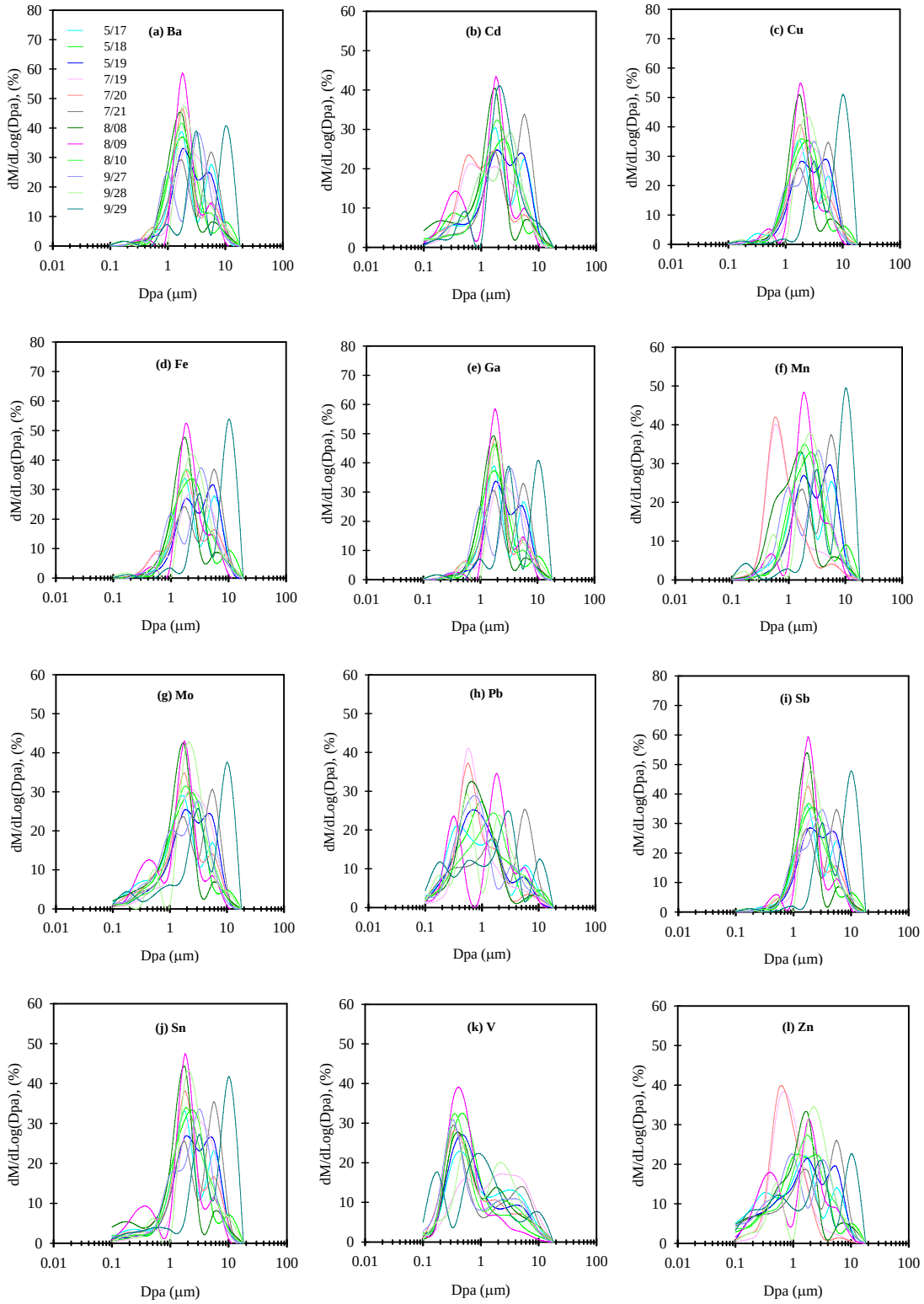
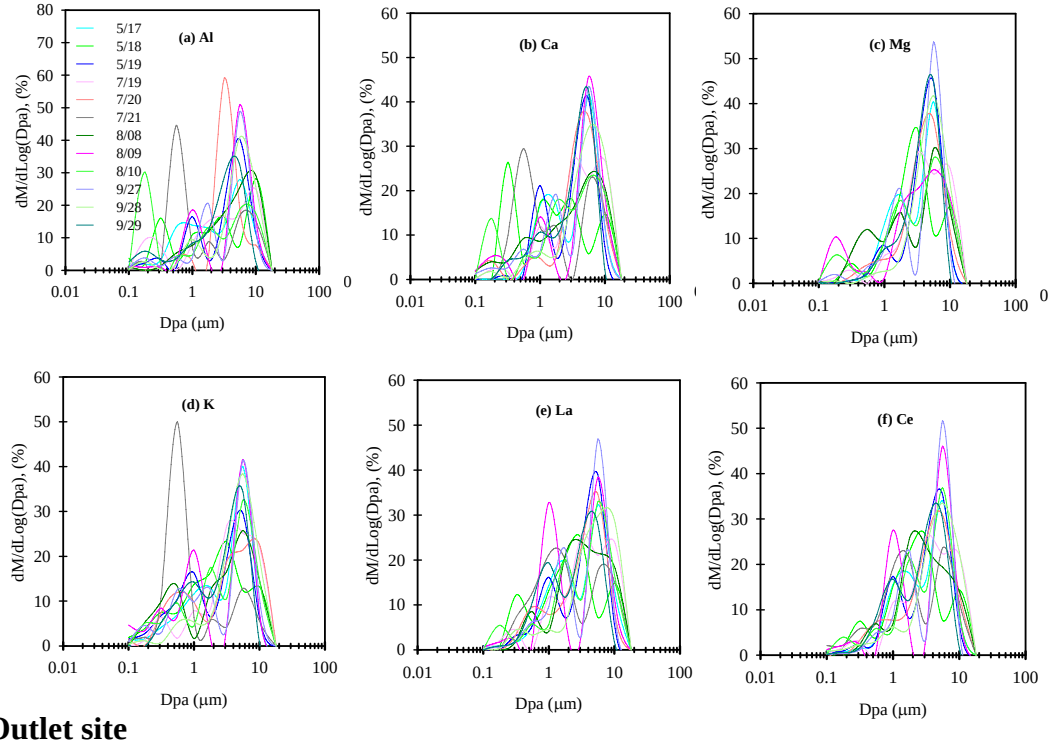


Figure S2 *(continued)*

Inlet site



Outlet site

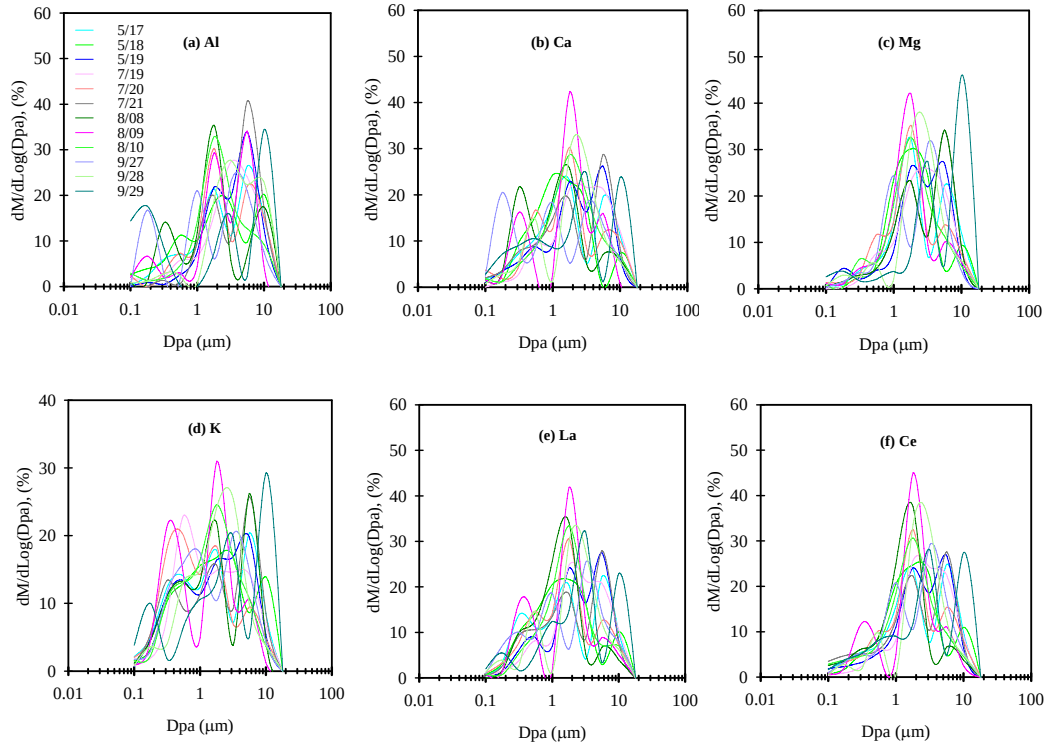


Figure S 3. Size distributions of major crustal elements (Al, Ca, Mg and K) and rare earth elements (La and Ce) of all size-resolved samples collected in Hsuehshan Tunnel.