

Supplementary Materials: Quantification and Characterization of Metals in Ultrafine Road Dust Particles

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Table S1. QA/QC for ICP measurements of certified reference materials; mean concentrations and standard deviation (sd) obtained using ICP-MS unless indicated otherwise. Percent recoveries are calculated based on certified values unless indicated otherwise. All concentrations are in mg kg⁻¹.

	NIST 1648 (n=12 ^d)				NIST 2557 (n=15 ^d)			NIST 2584 (n=9 ^d)			NIST 2711 (n=15 ^d)			BCR-723 (n=15 ^d)		
	LOD ^c	mean	sd	% recovery	mean	sd	% recovery	mean	sd	% recovery	mean	sd	% recovery	mean	sd	% recovery
Aluminum ^a	7.32	32784	1219	96	183228	24382	92 ^b	22212	1520	96	62268	5050	95	35304	3562	94 ^b
Antimony	0.86	32.5	3.88	72 ^b	3.25	2.42	NA	11.2	2.02	80 ^b	15.1	3.54	78	21.8	3.93	77 ^b
Arsenic	0.07	83.6	6.02	73	12.5	1.83	NA	16.1	1.66	92	90.5	11.0	86	11.5	1.47	NA
Barium	0.27	730	56.9	99 ^b	2756	377	95 ^b	1396	110	107 ^b	706	67.6	97	446	52.2	97 ^b
Beryllium	0.01	1.87	0.19	NA	0.61	0.05	NA	0.74	0.04	106 ^b	2.20	0.17	NA	1.26	0.12	NA
Cadmium	0.01	61.3	5.42	82	1.34	0.18	3 ^b	7.74	1.11	77	34.3	3.37	82	1.80	0.26	72 ^b
Chromium	1.64	78.4	8.53	19	425	132	NA	131	44.0	97	37.7	7.70	80	190	31.8	43 ^b
Cobalt	0.09	16.1	2.24	90 ^b	35.9	5.07	NA	13.6	0.90	136 ^b	11.4	1.09	114 ^b	35.5	3.41	119 ^b
Copper ^a	0.85	598	29.3	98	128	16.0	NA	324	92.0	101 ^b	138	41.2	121	289	66.0	NA
Iron ^a	14.0	37105	1559	95	13334	2035	89 ^b	14029	881	86	27460	2646	95	31407	3322	95 ^b
Lanthanum	0.01	29.1	1.73	69 ^b	687	89.3	98 ^b	13.3	2.86	70	29.5	4.32	74 ^b	14.0	2.03	NA
Lead	0.05	6188	349	94	13134	1314	94	9349	696	96	1127	107	97	827	85.0	95 ^b
Magnesium ^a	3.04	5615	3402	70 ^b	59568	16835	99 ^b	14158	1106	89	7972	4263	76	30847	3542	NA
Manganese ^a	0.19	783	60.3	100	709	85.6	NA	334	24.8	90 ^b	630	75.9	99	1274	228	100 ^b
Molybdenum	0.43	11.9	1.03	NA	18.8	12.6	NA	6.50	5.57	118 ^b	1.16	0.42	73 ^b	37.7	5.29	94 ^b
Nickel	0.22	58.9	2.55	72	4107	368	82 ^b	97.7	48.5	109 ^b	20.9	4.64	102	171	20.1	100 ^b
Rubidium	0.03	33.5	1.49	64 ^b	7.28	0.98	NA	29.9	2.48	91 ^b	106	9.13	96 ^b	65.3	5.70	87 ^b
Silicon ^a	48.6	131547	26633	NA	172773	21076	96 ^b	75757	13187	71 ^b	277787	79015	91	124420	32328	NA
Strontium	0.60	172	6.16	NA	71.3	6.66	NA	159	12.4	99 ^b	247	17.7	101	241	24.2	95 ^b
Sulfur ^a	54.2	46676	2916	93 ^b	1479	202	NA	15771	1133	NA	419	102	100	30361	13084	NA
Thallium	0.01	2.21	0.05	NA	0.03	0.01	NA	0.30	0.02	NA	2.37	0.19	96	0.34	0.03	NA
Titanium ^a	1.57	2532	183	63 ^b	2455	268	NA	1319	262	31	1823	277	60	1466	282	57 ^b
Uranium	0.01	5	0.31	94	1.17	0.12	NA	1.27	0.16	79 ^b	2.13	0.35	82 ^b	1.49	0.17	NA
Vanadium	0.05	102	9.36	80	61.4	5.08	NA	32.7	2.64	96 ^b	76.8	7.16	94	72.9	7.79	97 ^b
Zinc ^a	3.46	4434	313	93	1202	149	120 ^b	2338	192	91	346	45.1	99	1669	309	101 ^b

^a Measured concentrations obtained by ICP-OES

^b % recovery calculated based on the indicative values. NA: no certified or indicative value available

^c LOD = Limits of detection calculated as 3 times the standard deviation of 21 procedural blanks for ICP-MS and 27 for ICP-OES

^d Max number of replicates with the following exceptions: (i) Cu n=6 for all CRMs; (ii) Si n=9 for NIST 2557, NIST 2711 and BCR; n=6 for NIST 1648 and n=3 for NIST 2584; (iii) Ti and Zn n=13 for NIST 2557, NIST 2711 and BCR; n=7 for NIST 2584 and n=10 for NIST 164

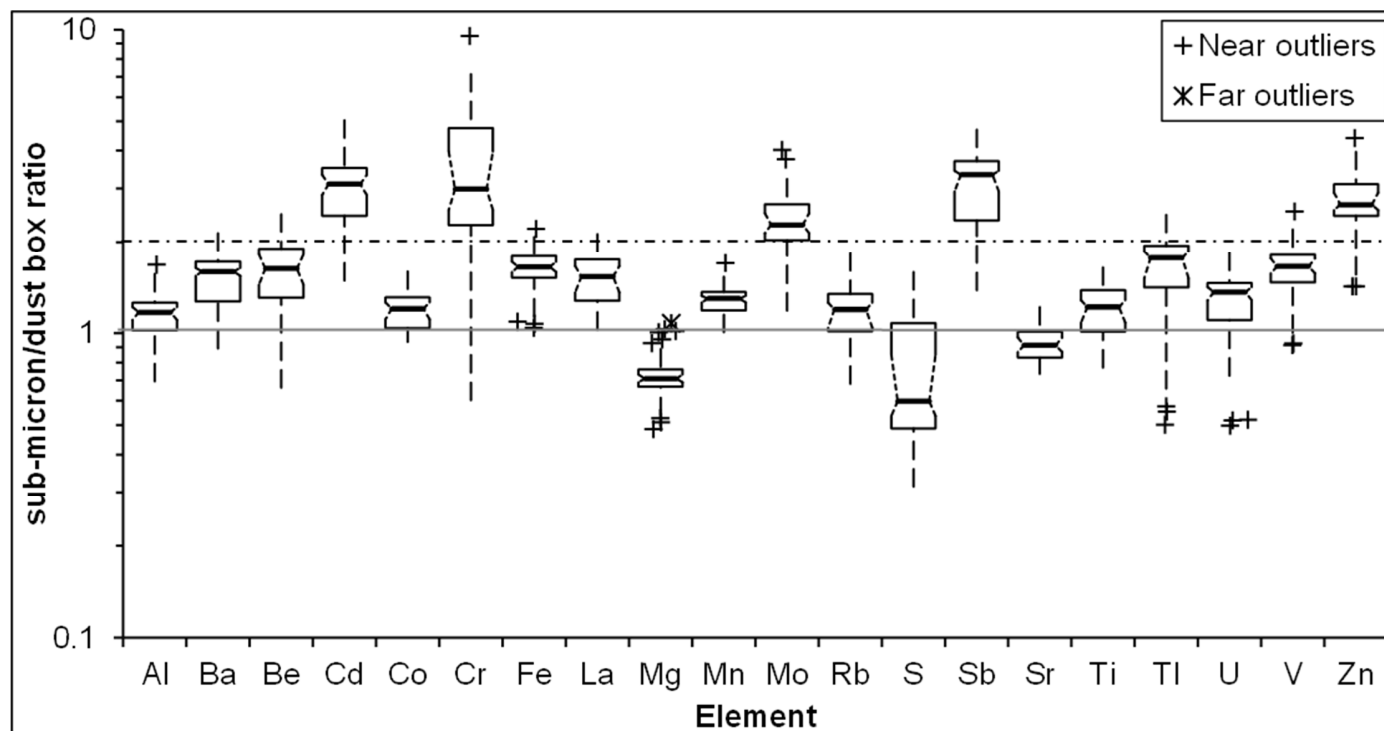


Figure S1. Ratios of element concentrations in the aerosolized sub-micron fractions compared to the dust box considering all six road dust samples (sub-micron/dust box ratio); each box plot shows the median within the 25th and 75th percentile box, dispersion extending 1.5*IQR from each quartile, as well as near (> 1.5 IQR) and far (> 3 IQR) outliers. The 95% confidence interval for the median is plotted as a notch on the box. Plain and dotted lines at sub/dust box ratio = 1 or 2 respectively are visual guidelines. Cu, Sn, Pb, Ni, Bi and As were not included in the analysis due to potential cross-contamination from the bronze beads. Ag, Bi, Zr, B, Ce, Se and Si were not included because > 50% of the values in the sub-micron and nano fractions were < LOD.

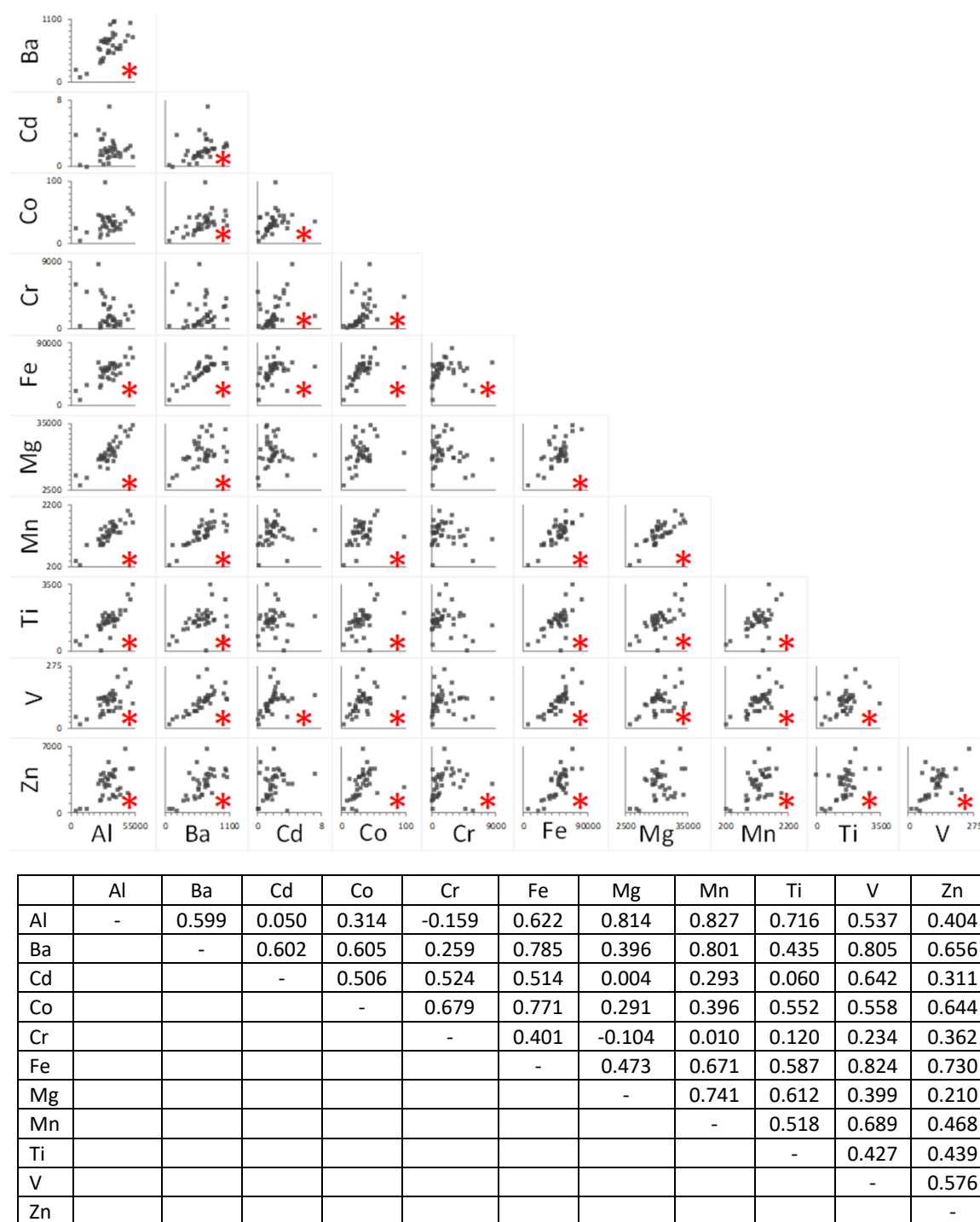


Figure S2. Scatterplot matrix showing the correlation between concentrations of various key elements in the nano-scale dust fractions (n=35); “*” indicate significant Spearman’s correlations at a 5% significance level (2-sided Fisher’s test); correlation coefficients reported in the accompanying table.