



Expanding Your Toolbox with Semi-quantitative ICP-MS Analysis

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Common Elements That Are Used for Source Investigation

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	*	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	**	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu		
**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr		

What about other elements?

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
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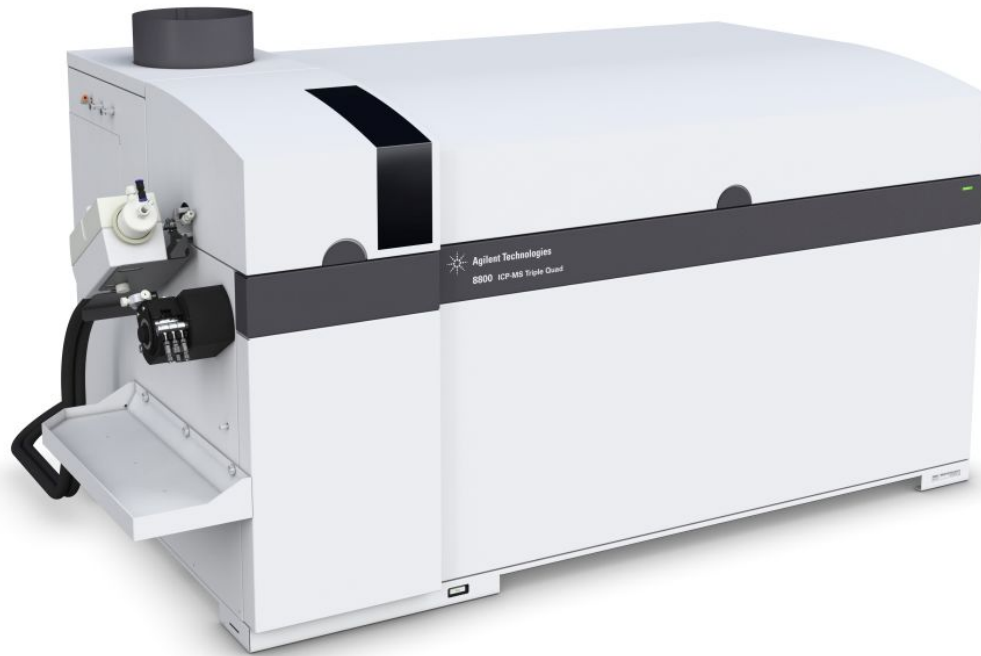
BROOKS APPLIED LABS

All the Data All the Time

- Semi-quantitative ICP-MS provides rapid trace element profiling
- Concentration results are not the most accurate, but that is acceptable
- Complementary analytical tool for quantitative measurements
- All data is rapidly acquired with a single scan



Inductively Coupled Plasma – Mass Spectrophotometry (ICP-MS)



AQUEOUS SAMPLE
INTRODUCTION



DESOLVATION



IONIZATION

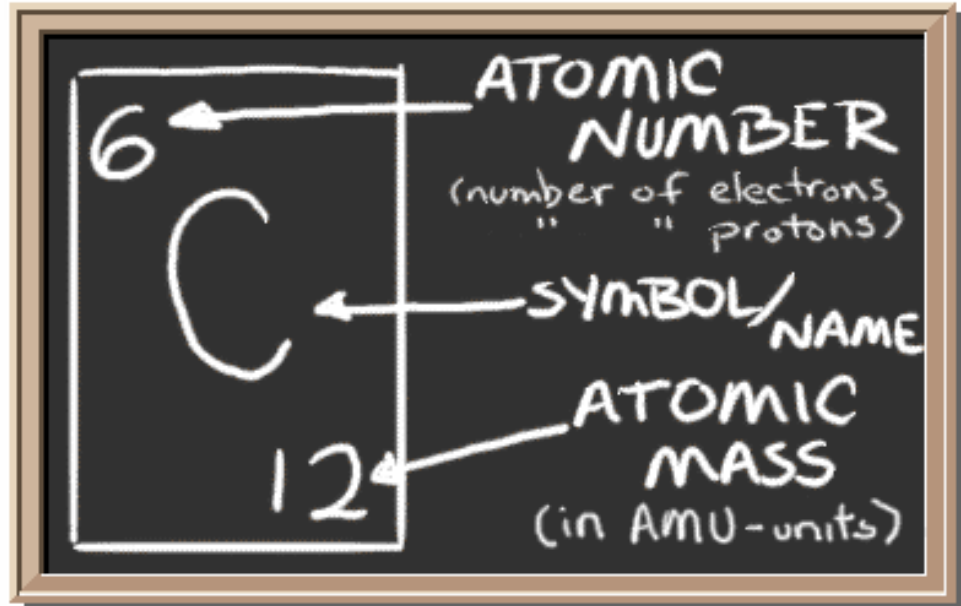
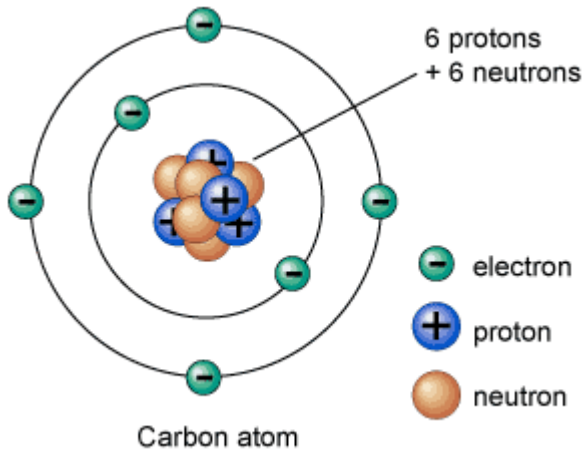


MASS FILTERING

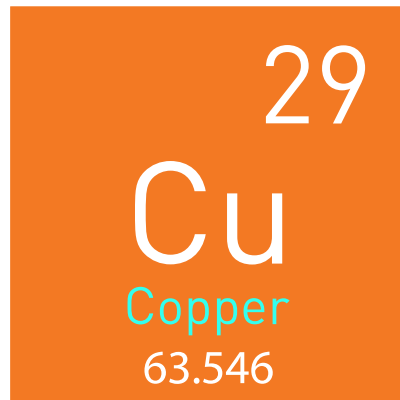


DETECTION

BROOKS APPLIED LABS



Stormwater Runoff is a problem!



Where are the heavy metals coming from?



Source Identification and Data Interpretation



Image: <https://www.13moons.com>



Image: <https://www.syfy.com/syfywire/pocket-spectrometer-star-trek-tricorder-you-always-wanted>

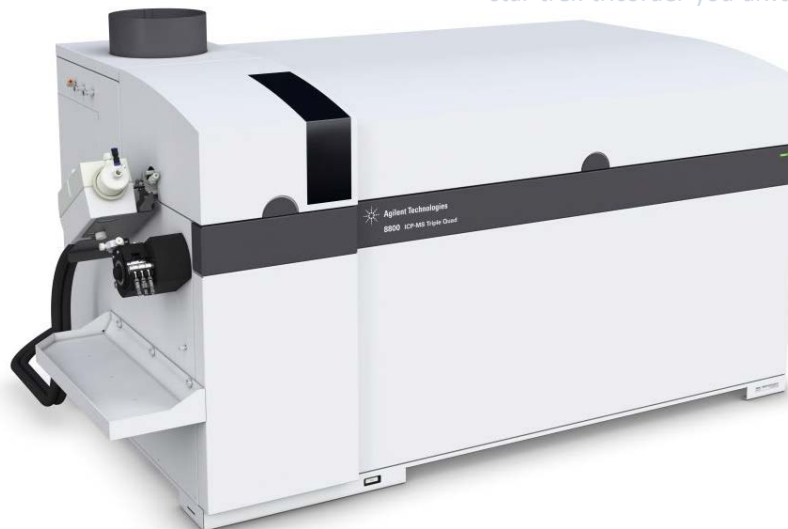




Image: <https://pxhere.com/fr/photo/480533>



Image: <https://wilsonandmiller.com/products/patriots-10lb-sledgehammer-with-carbon-steel-head-hickory-handle>



Real World Semi-Quant Results

Lab ID	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Unit	µg/L	µg/L	µg/L	µg/L	µg/L
Li	76.1	1770	30.4	73.5	20.2
Be	ND	7.05	6.66	7.75	7.96
B	56200	148000	117000	76800	2720
Na	25100	1060000	60100	34900	462000
Mg	778000	1940000	748000	415000	1190000
Al	38.3	103	ND	ND	ND
P	ND	ND	ND	ND	ND
S	92700	2130000	262000	244000	184000
K	7980	71800	8120	6820	84300
Ca	1230000	468000	2880000	2320000	3250000
Ti	ND	ND	ND	ND	ND
V	ND	ND	ND	ND	ND
Cr	ND	ND	ND	ND	ND
Mn	4570	26100	2960	3020	14.5
Fe	33.6	ND	1850	223	ND
Co	11.9	8.61	19.9	9.25	9.66
Ni	18.7	13.2	21.5	35.9	14.7
Cu	2.10	8.07	24.2	7.91	11.6
Zn	42.3	10.5	23.7	8.80	14.7
Ga	10.3	2.35	9.73	14.8	1.56
As	ND	ND	ND	ND	ND
Se	ND	ND	ND	ND	ND
Br	23300	13900	19500	13200	115000
Rb	148	920	162	172	133
Sr	8000	8580	11900	16900	2310
Y	ND	ND	ND	ND	ND
Zr	ND	ND	ND	ND	ND
Nb	ND	ND	ND	ND	ND
Mo	8.31	572	10.4	27.8	0.415
Ru	ND	ND	ND	ND	ND
Pd	ND	ND	3.43	3.87	ND
Ag	ND	0.673	0.743	0.600	0.806
Cd	1.27	1.18	0.837	1.01	0.853

Lab ID	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Unit	µg/L	µg/L	µg/L	µg/L	µg/L
Sn	ND	ND	ND	ND	ND
Sb	1.05	0.383	0.553	0.074	0.041
Te	ND	ND	ND	0.492	ND
Cs	0.185	2.57	1.38	0.912	2.78
Ba	219	51.0	236	349	39.2
La	0.490	0.339	ND	ND	ND
Ce	0.414	8.60	8.04	8.15	9.19
Pr	0.059	0.053	ND	ND	ND
Nd	0.214	0.163	ND	ND	ND
Sm	ND	ND	ND	ND	ND
Eu	ND	ND	ND	ND	ND
Gd	ND	ND	ND	ND	ND
Tb	ND	ND	ND	ND	ND
Dy	ND	ND	ND	ND	ND
Ho	ND	ND	ND	ND	ND
Er	ND	ND	ND	ND	ND
Tm	ND	ND	ND	ND	ND
Yb	ND	ND	ND	ND	ND
Lu	ND	ND	ND	ND	ND
Hf	ND	ND	ND	ND	ND
Ta	ND	ND	ND	ND	ND
W	0.084	117	0.144	ND	ND
Re	1.15	19.2	2.14	3.99	1.06
Ir	ND	ND	ND	ND	ND
Pt	0.178	0.256	0.186	ND	ND
Au	ND	ND	ND	ND	ND
Hg	0.038	1.38	0.265	0.141	0.017
Tl	1.32	0.714	0.907	0.755	1.09
Pb	ND	0.891	1.03	0.845	3.17
Bi	0.063	0.799	0.766	0.837	1.02
Th	ND	0.041	ND	ND	ND
U	0.231	223	12.2	22.0	0.836

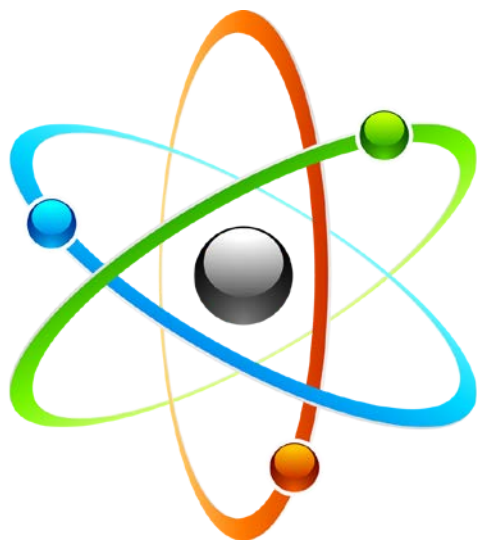
Conclusion



Semi-quantitative ICP-MS Analysis

- Increased data capture
- Focus on viable elements to support your data quality objectives
- Increase the capability for forensic source identification
- Cutting-edge and cost-effective approach
- Increase the probability of project success

Meaningful Metals Data



Thank you!

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