

COMMUNICATION

Supplementary information: Ultrafast LIBS elemental imaging: a new tool for pedogenesis studies in highly polluted anthropogenic soils

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Clément Noel,^a Hermine Huot,^b César Alvarez-Llamas,^a Marc Offroy,^c Françoise Watteau,^d Ludovic Duponchel,^{e,*} Vincent Motto-Ros^{a,*}

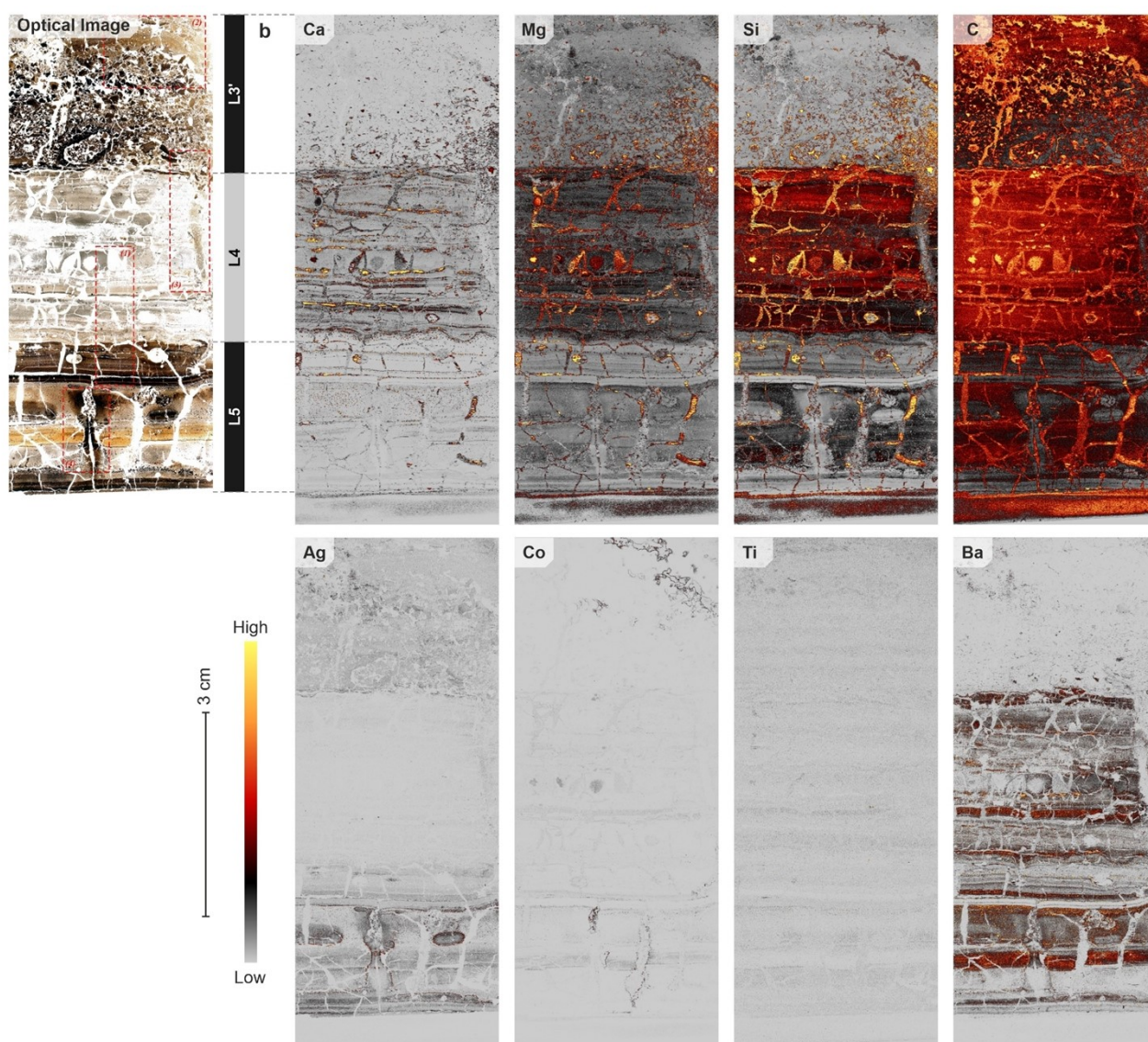


Fig S1. Optical image of the thin soil section and elemental LIBS images for Ca, Mg, Si, C, Ag, Co, Ti and Ba.

Table S1. Total concentrations in major and main trace elements analyzed in the bulk soil samples collected in three layers along the profile of the soil developing on a former settling pond of steel industry. The concentrations of C, N and S were determined by dry combustion. Major elements were analyzed using ICP-OES and trace elements using ICP-MS after lithium metaborate attack and acid digestion of the resulting glass¹ by the Service d'Analyse des Roches et des Minéraux (CNRS, Vandoeuvre-lès-Nancy) as present-ed in Huot et al.²

Element	Unit	L3' (42-55 cm)	L4 (65-68 cm)	L5 (68-82 cm)
Major elements				
C	%	3.46	9.5	1.89
N	%	0.02	0.18	0.05
Al	%	5.6	5.4	4.1
Ca	%	8.1	18.9	7.0
Fe	%	2.2	1.6	1.3
K	%	0.4	1.3	0.7
Mg	%	1.1	1.3	1.3
Mn	%	26.7	2.1	34.1
Na	%	<LD	0.1	<LD
P	%	0.2	0.1	0.2
Si	%	5.7	12.3	6.2
S	%	0.12	0.4	0.06
Ti	%	0.03	0.08	0.01
Main trace elements				
As	mg kg ⁻¹	736	81.5	1131.5
Ba	mg kg ⁻¹	3754.8	3995.7	2550.2
Cd	mg kg ⁻¹	89.6	325.5	133.8
Co	mg kg ⁻¹	12.4	10.4	12.3
Cr	mg kg ⁻¹	24	77.6	<LD
Cu	mg kg ⁻¹	165.2	246.2	147
Ni	mg kg ⁻¹	23.3	214.7	21.3
Pb	mg kg ⁻¹	7003.5	21214.5	3002.7
Sb	mg kg ⁻¹	187.7	81.7	150.5
Sn	mg kg ⁻¹	1142.5	7033.6	566.4
Sr	mg kg ⁻¹	728.8	1115.6	811.1
Zn	mg kg ⁻¹	13918.5	28545.6	8148.8

References

- (1) Carignan, J.; Hild, P.; Meville, G.; Morel, J.; Yeghicheyan, D. Routine Analyses of Trace Elements in Geological Samples Using Flow Injection and Low Pressure On-Line Liquid Chromatography Coupled to ICP-MS: A Study of Geochemical Reference Materials BR, DR-N, UB-N, AN-G and GH. *Geostandards Newsletter* **2001**, 25 (2–3), 187–198. <https://doi.org/10.1111/j.1751-908X.2001.tb00595.x>.
- (2) Huot, H.; Simonnot, M.-O.; Marion, P.; Yvon, J.; De Donato, P.; Morel, J.-L. Characteristics and Potential Pedogenetic Processes of a Technosol Developing on Iron Industry Deposits. *J Soils Sediments* **2013**, 13 (3), 555–568. <https://doi.org/10.1007/s11368-012-0513-1>.

Table S2. Operating parameters of the spectrometers and detectors.

Spectrometer	A	B
<i>Model</i>	Shamrock 303 (Andor Tech.)	Shamrock 500 (Andor Tech.)
<i>Grating</i>	1200 L/mm	600 L/mm
<i>Wavelength Range (nm)</i>	190-235	278-358
<i>Spectral Resolution (nm)</i>	0.15	0.15
<i>Gain</i>	1500	1000
<i>Delay (μs)</i>	0.8	1
<i>Gate Width (μs)</i>	5	5
<i>Accumulation</i>	1	1

Table S3. Selected lines for elemental intensity extraction and image generation shown in figure 3 and supplementary Figure S1.

Element	Specie	Spectrometer	Position (nm)
C	I	A	193.09
Zn	I	A	213.86
Cd	I	A	228.80
Ba	II	A	233.52
Pb	I	B	283.30
Sn	I	B	283.99
Mg	I	B	285.21
Si	I	B	288.16
Fe	I	B	302.06
Al	I	B	309.27
Ca	II	B	317.93
Cu	I	B	327.39
Ti	II	B	337.28
Ag	I	B	338.29
Co	I	B	345.35
Mn	I	B	354.80