Environmental Fate of Trace Elements in Depositional Sediments after Flashflood events: The Case of Mandra town in Greece

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Supplementary Material

Mineral magnetic measurements, ratios and definitions

Mass-specific magnetic properties and ratios measured and calculated from the Bartington meter.

(a) Mass-specific low-frequency susceptibility (χ) 10^{-6} m^3 kg^{-1}; χ is a ferrimagnetic concentration parameter, which is sensitive to diamagnetic and paramagnetic signals when ferrimagnetic concentrations are low.

Analytical quality control

The overall recovery rates based on the analysis of CRMs ranged for As from 86 to 98%, for Cd 91 to 92%, for Co 71 to 105%, for Cu 80 to 102% and for Fe 73 to 99%. Additionally, the recovery rates for Ni ranged from 78 to 108% and for Mn were found between 74 to 103%. Moreover, both Pb and Zn fluctuated between 58 to 99% and 78 to 98%, respectively. However, significant discrepancies were found for Cr, which exhibited recoveries between 40 and 108% of the corresponding values obtained by the aqua regia digestion.

Analytical precision of the BCR protocol was evaluated by analyzing selected soil samples in duplicate and was found to be lower than 15% for all the extraction steps. Accuracy of the method was validated against the standard reference material (BCR-701) which provides Cd, Cr, Cu, Ni, Pb and Zn certified values for each step of the experiment. Close agreement with certified values was achieved for Cd and Ni; mean recovery rates were 97% for Cd and 99% for Ni. Regarding Cr, some underestimation of the certified value for step 2 (reducible phase) was evitable, but this may be due to the fact that a portion of Cr certified as being in the reducible phase is not released until step 3. Moreover, accepted recovery rates were found to be 105% for Cu, and 92% for Pb. However, significant discrepancies were found for Zn and Cr, which exhibited recoveries of 77% and 112%, respectively.

Percent recovery = F1 + F2 + F3 + R/ (F1cert + F2cert + F3cert + Rcert) x 100

where: F1, F2, F3 and R (residual fraction) are the measured concentrations for each step of the extraction procedure and F1cert, F2cert, F3cert and Rcert correspond to the certified values of the reference material.

(**a**)

(**b**)

(**c**)

(**d**)

Figure S1. Photographs of accumulated debris of heterogenous materials after the flash flood event **(a)**, and sampling locations representing: surface soil sampling upstream of the inundated area (sample SR01) **(b)**; sampling of flood sediment deposited on a paved surface (sample FL10) **(c)**; and sampling of flood sediment deposited on an open-space area (sample FL06) **(d).**

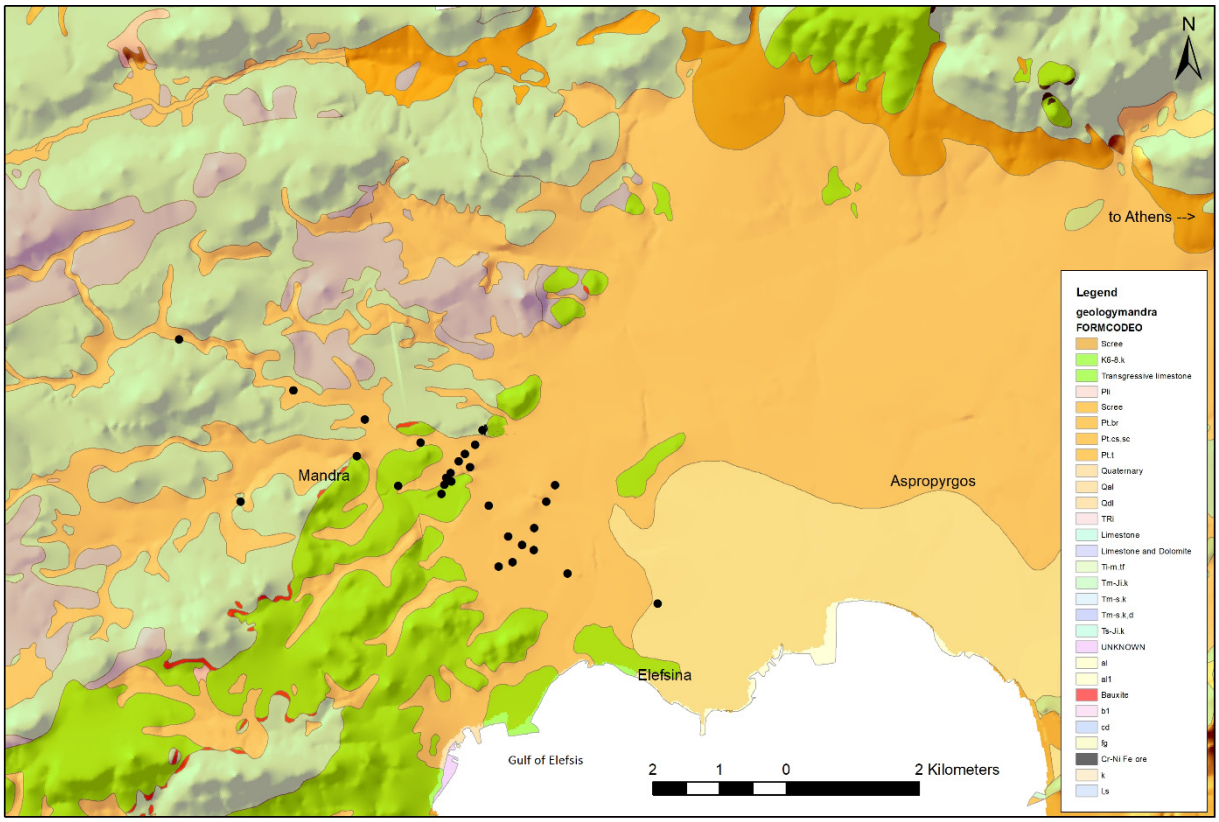

Figure S2. Simplified lithological map of the study area, showing bauxite occurrences and the sampling points of the present study. The map was composed in ArcPro GIS based on the Geological Map of Greece 1:50000 published by IGME.

Table S1. Results of SEM-EDS microanalysis of metal-enriched grain surfaces found in samples FL06 and FL08 collected at Traverse 2.

FL06			
Element	**Spect. Type**	**Element %**	**Atomic%**
Al K	ED	1.11	1.74
Si K	ED	1.35	2.03
Fe K	ED	0.48	0.37
Cu K	ED	45.20	30.15
Zn K	ED	33.48	21.71
O		16.61	44.01
Total		98.23	100.00
Fl08			
Element	**Spect. Type**	**Element %**	**Atomic%**
Al	ED	0.58	1.85
Si	ED	0.98	1.38
Ca	ED	0.42	0.42
Mn	ED	1.20	0.87
Fe	ED	51.17	36.28
Cu	ED	0.49	0.31
O		24.20	59.90
Total		79.04	100.00

Table S2. Comparison of trace element concentrations in samples of the two traverses.

Variable	Traverse	N	Mean	St. Dev.	Min	Median	Max
Cd (mg/kg)	T1	7	0.73	0.12	0.5	0.7	0.9
	T2	7	0.84	0.16	0.6	0.9	1.1
Cu (mg/kg)	T1	8	27	6.24	26	26	38
	T2	7	132	207	51	51	599
Pb (mg/kg)	T1	8	41	16.2	35	35	72
	T2	7	79	29.1	71	71	122
Zn (mg/kg)	T1	8	105	36.3	90	90	164
	T2	7	366	298	193	193	945
As (mg/kg)	T1	8	11	2.56	11	11	14
	T2	7	12	2.37	13	13	15
Co (mg/kg)	T1	8	18	4.54	19	19	24
	T2	7	19	4.74	20	20	24
Cr (mg/kg)	T1	8	92	17.7	89	89	125
	T2	7	114	34.3	103	103	183
Fe (% wt.)	T1	8	2.6	0.64	2.6	2.6	3.6
	T2	7	3.1	0.70	2.9	2.9	3.9
Mn (mg/kg)	T1	8	697	160	730	730	919
	T2	7	794	215	783	783	1080
Ni (mg/kg)	T1	8	137	34.6	137	137	193
	T2	7	138	33.2	135	135	183

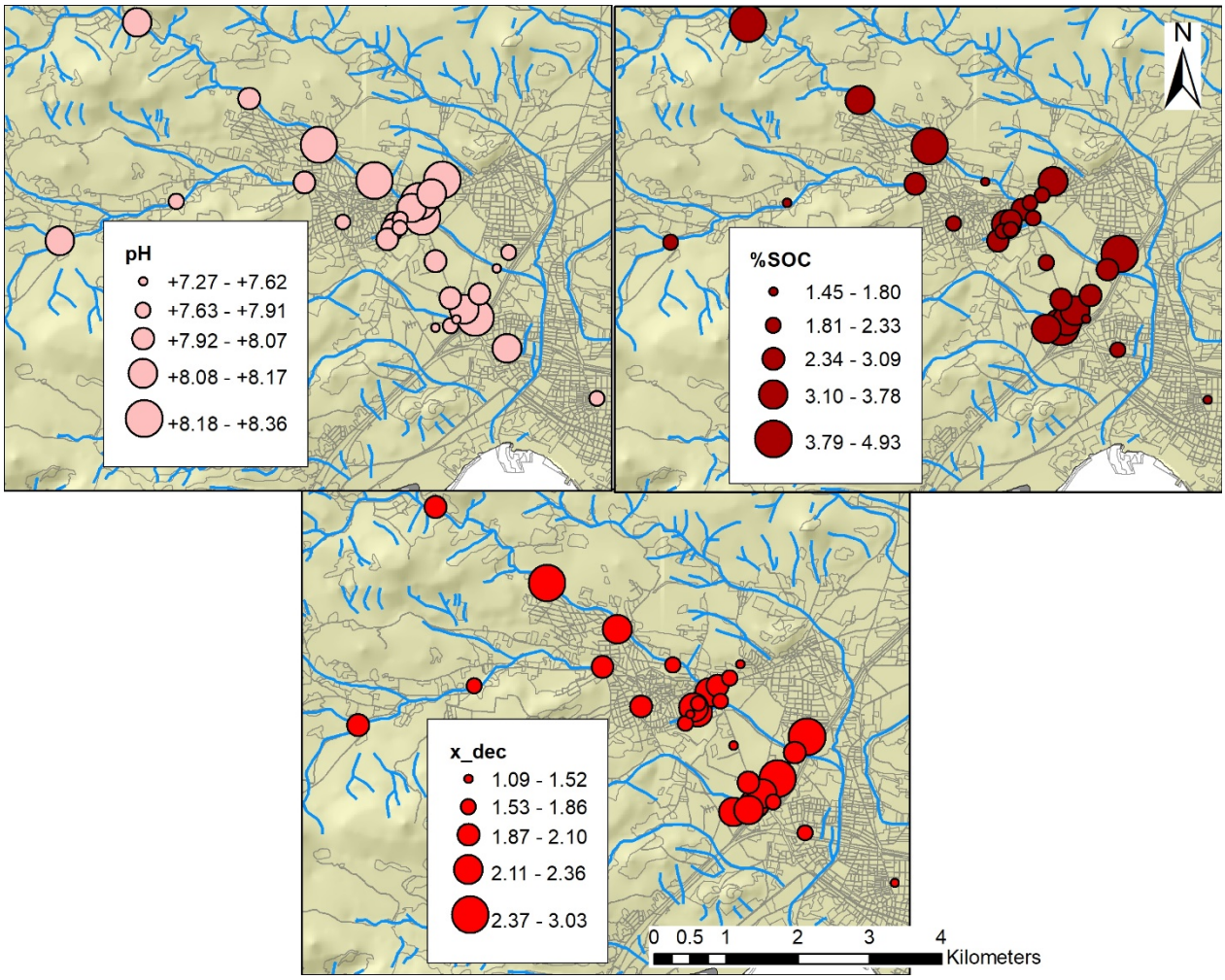

Figure S3. Spatial distribution of physicochemical parameters (pH, % TOC and χ) measured in the collected samples.

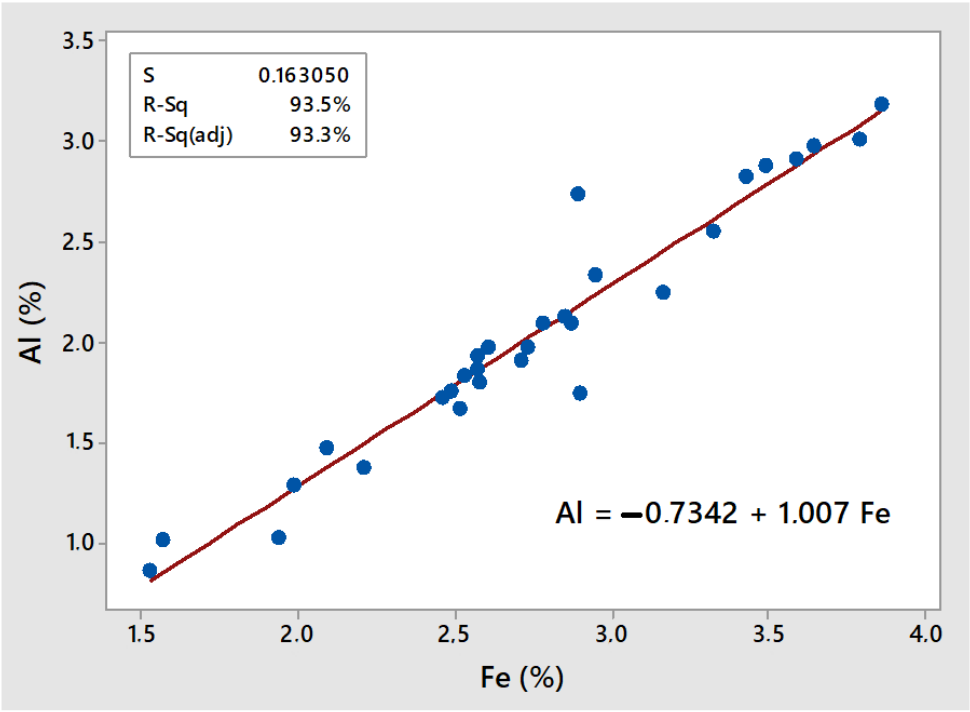

Figure S4. Correlation between Al and Fe in collected samples indicating the influence of local bauxite deposits on the chemistry of flood-deposited material.