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CORRECTION

Correction to: Assessment of tailings stability and soil contamination of Kef Ettout (NW Tunisia) abandoned mine

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The original version of this paper was published with error. Tables and figures were renumbered during the publication process but captions retained as it was presented from original manuscript. Given in this article are the correct figures, tables and captions.

The online version of the original article can be found at https://doi.org/10.1007/s12517-018-4204-0

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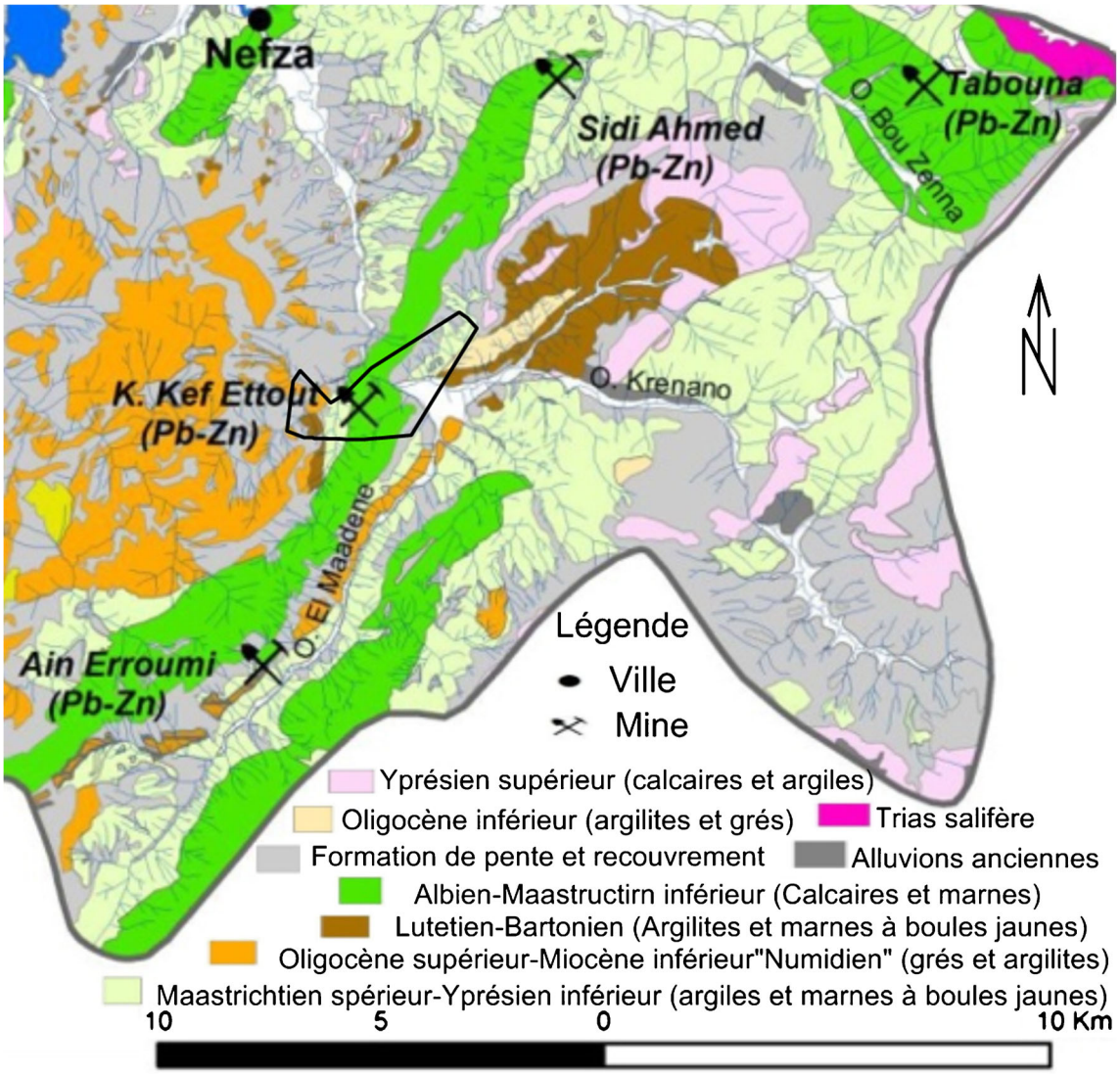

Fig. 1 Geological map of the of Wadi El Maadene catchment area and and location of study area (Rouvier, 1987; Batik, 1980)

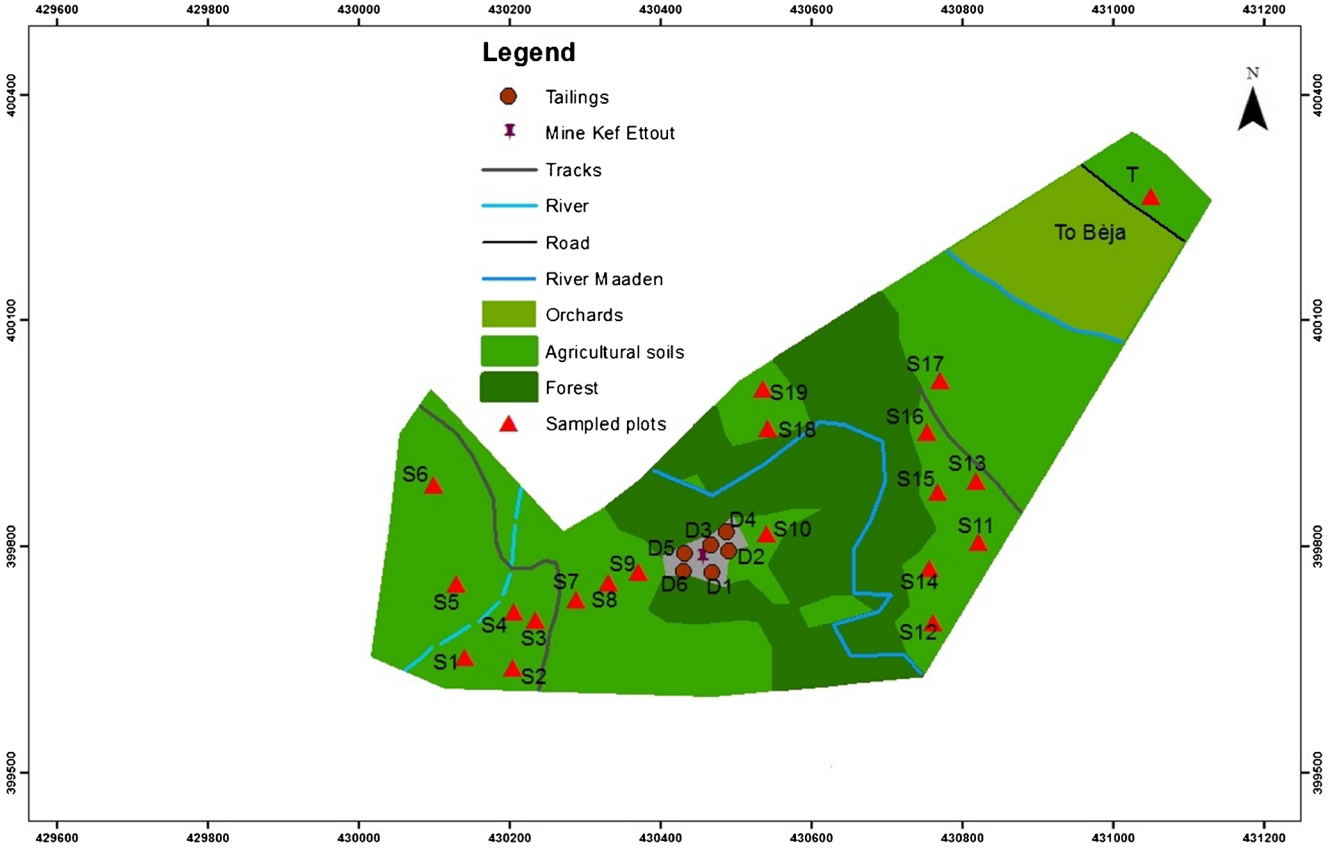

Fig. 2 Location of tailings and soils plots in the study area

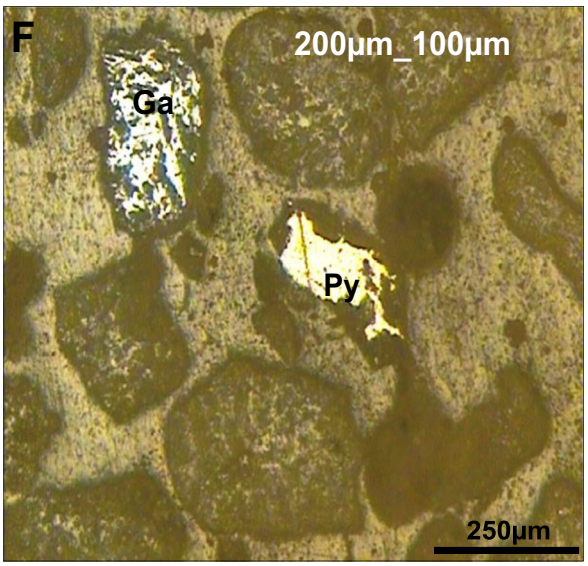

Photo 1 The progressed alteration from the external border towards the center of pyrite and galena

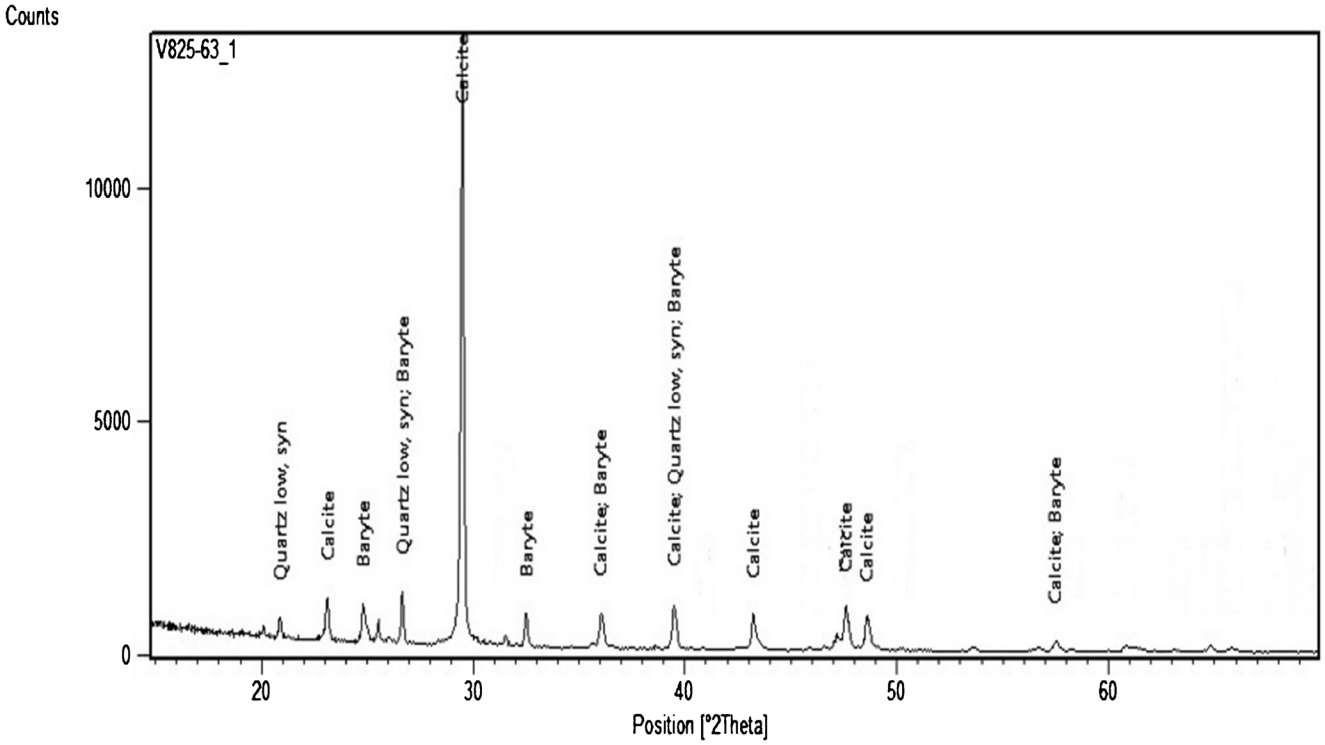

Fig. 3 RDX Diffractogramm of tailings sediments showing the presence of calcite, barite, quartz and essentially carbonates of the gangue and neoformed calcite

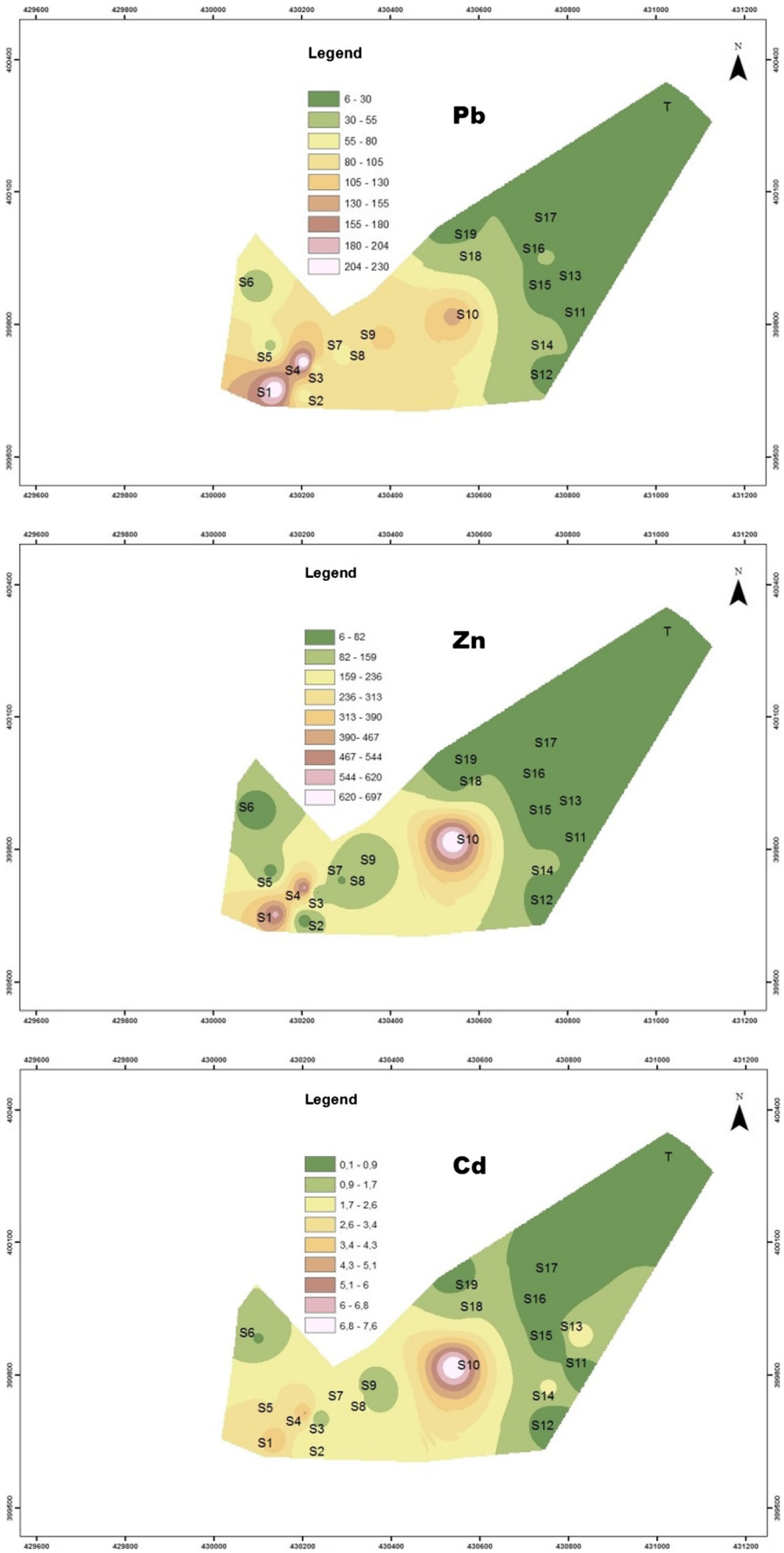

Fig. 4 Spatial distribution of Pb, Zn and Cd in study area

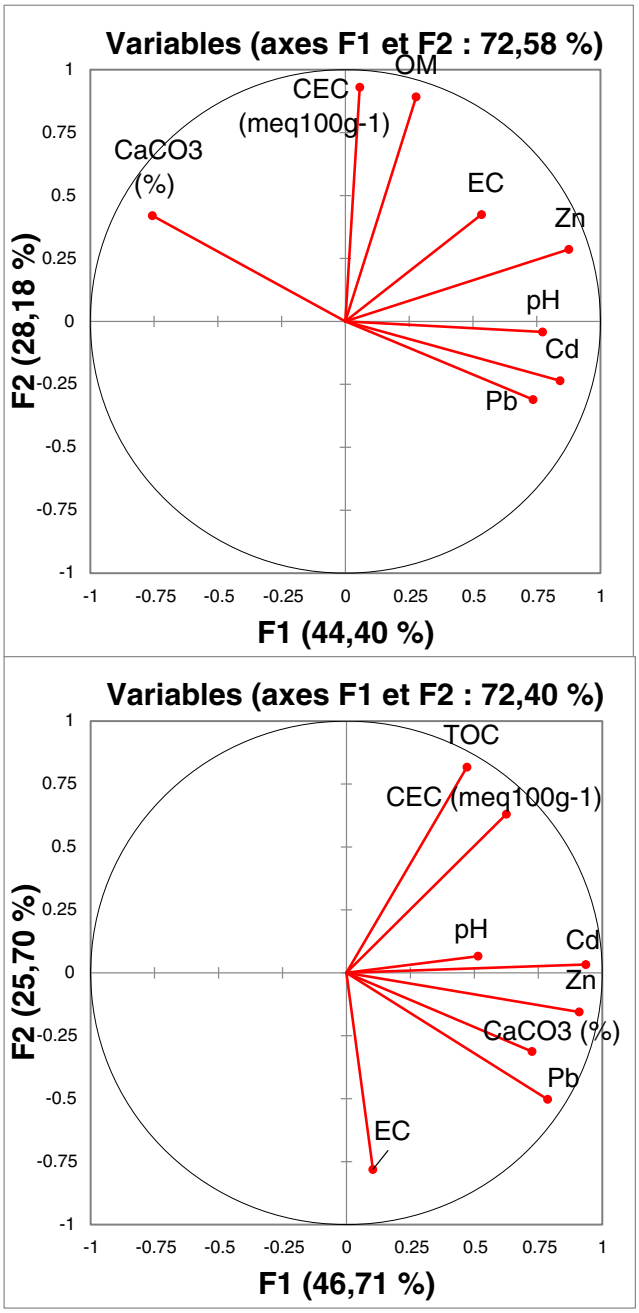

Fig. 5 Correlation circle on F1 and F2 of the tailings and agricultural soils

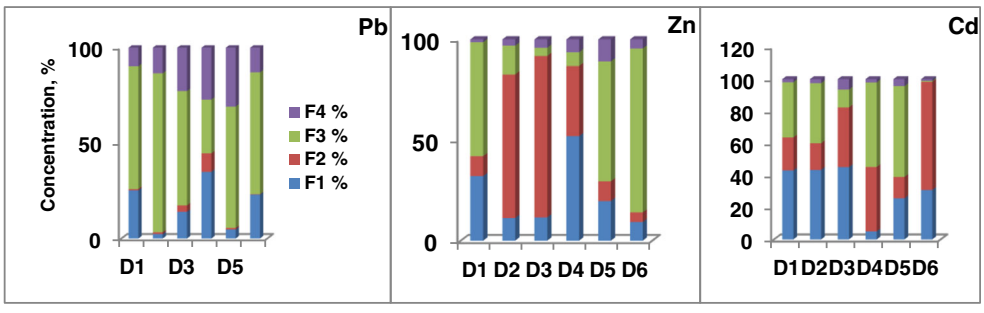

Fig. 6 Mean percentages of lead, zinc and cadmium bended to the four fractions of tailings sediments. Dn: Tailing number; F1: Exchangeable and carbonate bound Fraction); F2: Fe and Mn oxide bound Fraction; F3: Organically and sulfur bound Fraction; F4: Residual Fraction

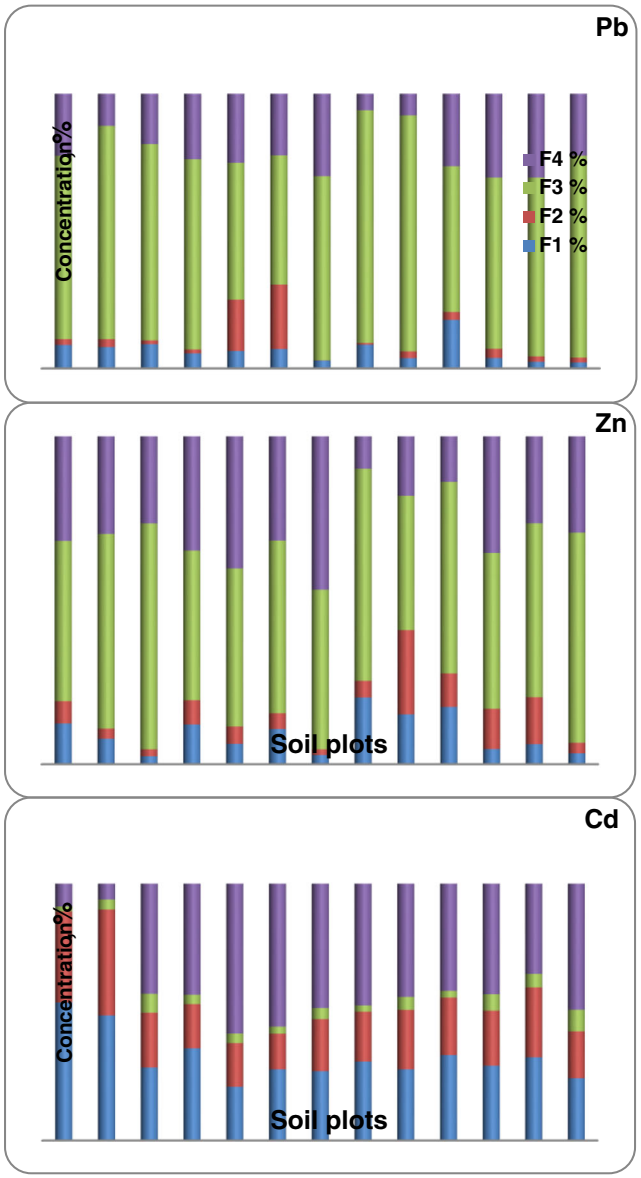

Fig. 7 Mean percentages of lead, zinc and cadmium bended to the four fractions of soil sediments. F1: Exchangeable and carbonate bound Fraction); F2: Fe and Mn oxide bound Fraction; F3: Organically and sulfur bound Fraction; F4: Residual Fraction

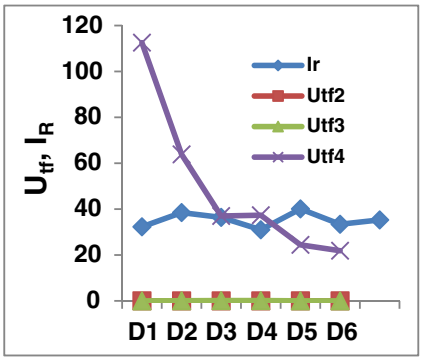

Fig. 8 Distribution indexes of exchangeable (U_{tf1}), Fe-Mn oxides (U_{tf2}) organic matter (U_{tf3}) and residual (U_{tf4}) fractions and binding intensity (I_R) of analyzed metals of tailings sediments. Dn: tailings number

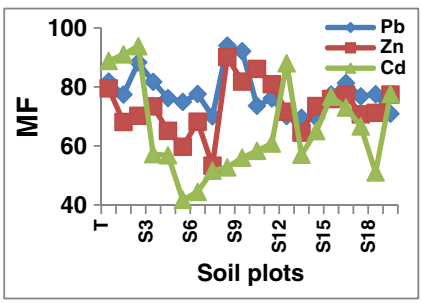

Fig. 9 Mobility factors (MF) of different metals percentages in control (T) and agricultural soils

Table 1 Sequential extraction procedures BCR (the European Community Bureau of Reference)

Extraction methods	Chemical composition	References	
Sequential extraction	F1 (Exchangeable and carbonate bound Fraction):	0.11 $molL^{-1}$ of AcOH	Davidson et al., 1994; Ure et al., 1993; Davidson et al., 1998; Rauret et al., 2000
	F2 (Fe and Mn oxide bound Fraction)	NH_2OH-HCl (0.1 $molL^{-1}$, pH 2)	
	F3 (Organically and sulfur bound Fraction.)	H_2O_2 (8.8 $molL^{-1}$, pH 3.2) and $AcONH_4$ (1 $molL^{-1}$, pH 2)	
	F4 (Residual Fraction)	Digestion (HCl–HNO_3) + HF (150 °C-2 h)	

Table 2 Mean values of physicochemical proprieties of the tailings plots

	pH	EC ($mScm^{-1}$)	$CaCO_3$ (%)	OM (%)	CEC (meq1 00 g^{-1})	Sand (%)	Clay (%)	Silt (%)	Texture
D1	7.8	500	74	0.7	8	53	6	41	Sandy-loam
D2	8	580	78	1.4	13	70	8	22	Sandy-loam
D3	7.5	570	59	0.5	9	51	3	46	Sandy-loam
D4	7.1	560	59	1.3	12	32	18	50	Loamy-sand
D5	7.7	570	62	1.0	8	53	8	39	Sandy-loam
D6	8.2	550	58	1.2	12	24	16	60	Sandy-loam

D: tailings; TOC: Total organic carbon; EC: Electric conductivity; CEC: Cationexchange capacity; OM: Organic matter

Table 3 Physicochemical proprieties of initial wastes of ore valorization unity (WOVU)

	pH	EC ($mScm^{-1}$)	$CaCO_3$ (%)	TOC (gkg^{-1})	CEC (meq1 00 g^{-1})	Sand (%)	Clay (%)	Silt (%)
Min	6.5	621.2	42.3	2.1	15.9	28.9	21.6	44.9
Max	6.9	703.2	51.6	4.2	21.3	32.6	24.2	55.6
Mean	6.8	661.9	47.0	2.9	17.9	30.8	19.1	50.1
SD	0,2	38.7	5.1	0.9	3.1	2.1	1.4	6.3
N	69	69	69	69	69			

N: Samples number, Max: Maximum; Min: Minimum; SD:Standard deviation; TOC: Total organic carbon

Table 4 Mean values of physicochemical proprieties of the soil plots

	pH	EC ($mScm^{-1}$)	$CaCO_3$ (%)	CEC (meq1 00 g^{-1})	TOC	Sand (%)	Clay (%)	Silt (%)	Texture
T	7	400	19	17	0.75	7	43	50	Silty-clay
S1	7.7	460	21	19	1.01	40	51	S1	Silty-clay
S2	7.5	500	17	17	1.27	19	65	S2	Silty
S3	7.7	530	24	17	1.28	20	55	S3	Silty
S4	7.2	520	22	18	0.45	17	73	S4	Silty
S5	7.4	530	18	21	1.67	45	43	S5	Silty-clay
S6	8	480	19	17	1.43	19	65	S6	Silty
S7	7.1	480	23	19	1.8	46	42	S7	clay-silty
S8	8.1	490	24	17	1.35	32	50	S8	Silty-clay
S9	7.9	420	22	19	1.93	41	42	S9	Silty-clay
S10	8	400	25	26	4.5	59	32	S10	Clay-loam
S11	7.5	450	16	17	1.81	30	55	S11	Silty-clay
S12	7.7	420	18	21	2.25	50	42	S12	Clay-loam
S13	7.4	410	16	24	2.51	55	35	S13	Clay-loam
S14	7.6	420	20	16	1.6	36	40	S14	Silty-clay
S15	7.3	440	16	16	1.51	34	38	S15	Silty-clay
S16	7.4	430	19	17	1.72	41	46	S16	Silty-clay
S17	7.2	420	16	16	1.51	34	39	S17	Silty-clay
S18	7.5	400	20	21	1.75	43	50	S18	Silty-clay
S19	7.3	420	15	19	2.03	35	52	S19	Silty-clay

TOC: total organic carbon; T: Control soil: S: soil plot

Table 5 Pb, Zn and Cd means concentrations, standard deviations, maximum and minimum concentrations in initial wastes of ore valorization unity (WOVU) in $mgkg^{-1}$

	Pb	Zn	Cd
Min	14,177.00	22,124.00	1649.00
Max	15,277.00	24,591.00	2213.00
Mean	14,505.00	23,177.00	1908.00
SD	751.00	1391.00	271.30

SD: standard deviations, Maximum: Max;Minimum: Min

Table 6 Mean concentrations and their standards Deviations of potentially toxic metals of tailings plots ($mgkg^{-1}$)

Plot tailings	Pb	SD	Zn	SD	Cd	SD
D1	3250.00	861.00	2165.00	787.00	18.00	1.7
D2	3281.00	120.00	4900.00	672.00	18.00	2.0
D3	8984.00	1265.00	5330.00	1072.00	69.00	4.6
D4	11,082.00	2268.00	15,000.00	2123.00	77.50	7.8
D5	3486.00	266.00	4900.00	316.00	12.50	1.3
D6	37,400.00	3435.00	9520.00	729.00	90.00	2.7

Dx: talings number; SD: Standard deviation

Table 7 Mean concentrations and their standard deviations of potentially toxic metals of soil plots ($mgkg^{-1}$)

	Pb	SD	Zn	SD	Cd	SD
T	10	4	7	3	0.1	0.0
S1	227	28	556	49	4.0	0.8
S2	70	14	44	4	2.0	0.9
S3	72	10	80	10	1.0	0.3
S4	230	29	551	32	4.4	1.1
S5	49	8	60	8	2.6	0.2
S6	44	6	41	8	0.9	0.3
S7	67	6	73	17	2.2	0.3
S8	82	7	151	10	1.8	0.3
S9	114	7	99	9	1.0	0.2
S10	138	8	698	17	7.7	0.4
S11	14	5	42	5	0.4	0.1
S12	24	5	45	8	0.3	0.1
S13	22	7	32	7	2.5	0.2
S14	44	6	98	9	2.0	0.3
S15	16	3	9	4	0.1	0.0
S16	33	4	23	7	0.2	0.1
S17	7	3	6	3	0.2	0.1
S18	53	8	62	8	1.6	0.3
S19	6	4	16	4	0.3	0.2

T: Control soil; SD: Standard deviation

Table 8 Comparison of potentially toxic metal contents with some background values ($mgkg^{-1}$)

	This study	Control soil	Reference values				
			1	2	3	4	5
Pb	6–230	6	50	9–50	25	10	35
Zn	6–698	7	100	10–100	62		90
Cd	0.1–7.77	0.1	3	0.05–0.45	_	0.3	0.35

1: Canadian Canadian Norms of the total contents of the ETM (mgkg-1) in soils (the Canadian Council of Ministers of the environment,1991) ; 2: Ordinary soils (Baize, 1997) ; 3: Worldwide data (Kabata-Pendias and Pendias, 1999); 4: WHO (cited by Parizanganeh et al., 2012); 5: Bowen (1979)