Supplementary data for the article:

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Supplementary Material for

Bioavailability of potentially toxic elements in soil–grapevine (leaf, skin, pulp and seed) system and environmental and health risk assessment

Table S1: Procedures for major and trace element single extractions and pseudo-total digestion from the soil samples:

Extractant	Type	Procedure	References
		soil samples	
Distilled water	water-soluble soil pore water	2 g of each soil sample was measured and 20 mL of distilled water was added. The extraction was performed for 2 h on a rotary shaker	Ure, 1996; Quevauviller, 1998; Pueyo et al., 2004
Distilled water	water-soluble soil pore water	2 g of each soil sample was measured and 20 mL of distilled water was added. The extraction was performed for 16 h on a rotary shaker	Milićević et al., 2017a
0.01 mol L^{-1} $CaCl_2$	exchangeable	2 g of each soil sample was measured and 20 mL of extractant was added. The extraction was performed for 3 h on a rotary shaker	Ure, 1996; Quevauviller, 1998; Pueyo et al., 2004
0.1 mol L^{-1} NH_4NO_3	exchangeable	4 g of each soil sample was measured and 10 mL of extractant was added. The extraction was performed for 2 h on a rotary shaker	Ure, 1996; Quevauviller, 1998; Pueyo et al., 2004
0.05 mol L^{-1} Na_2EDTA	organically bound	2 g of each soil sample was measured and 20 mL of extractant was added. The extraction was performed for 1 h on a rotary shaker	Ure, 1996; Quevauviller, 1998; Pueyo et al., 2004
0.11 mol L^{-1} CH_3COOH	carbonate	1 g of each soil sample was measured and 40 mL of extractant was added. The extraction was performed for 16 h on a rotary shaker	Ure, 1996; Quevauviller, 1998; Pueyo et al., 2004
Aqua regia (HNO_3:HCl)	pseudo-total	0.5 g of each soil sample was digested using 9 mL 35% HCl and 3 mL 65% HNO_3	US EPA 3050b Method
		grapevine samples	
HNO_3:H_2O_2	total	0.5 g of each leaf and 2 g of each grape sample (seed, pulp, skin and berry) was digested using 1 mL 30% H_2O_2 and 7 mL 65% HNO_3	US EPA 3050 Method
		wine samples	
HNO_3:H_2O_2	total	500 µL of each wine sample was digested with 1 mL 30% H_2O_2 and 7 mL 65% HNO_3	US EPA 3050 Method

Table S2: Spearman's correlation coefficients between the element concentrations within different soil layers – topsoil and subsoil

Spearman's R between elements in soil (0-30 cm)

	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Pb	Sb	Sr	V	Zn
Al	1.00																					
As	-0.55	1.00																				
B	0.09	-0.02	1.00																			
Ba	0.36	-0.30	-0.63	1.00																		
Be	0.39	-0.02	-0.63	0.84	1.00																	
Ca	-0.22	0.47	0.26	-0.58	-0.37	1.00																
Cd	0.24	0.13	-0.53	0.65	0.84	-0.21	1.00															
Co	0.18	-0.30	0.29	0.25	0.09	-0.29	0.19	1.00														
Cr	0.16	0.04	0.55	-0.52	-0.36	0.57	-0.12	0.17	1.00													
Cu	0.04	-0.09	0.21	-0.24	-0.32	0.19	-0.01	0.16	0.30	1.00												
Fe	0.66	-0.18	-0.17	0.35	0.58	-0.13	0.74	0.15	0.23	0.15	1.00											
K	0.40	0.20	0.66	-0.40	-0.16	0.33	-0.07	0.01	0.63	0.05	0.32	1.00										
Li	0.42	0.24	0.10	0.05	0.31	0.40	0.29	-0.33	0.36	-0.24	0.47	0.61	1.00									
Mg	0.36	-0.01	0.59	-0.60	-0.44	0.58	-0.27	0.01	0.82	0.39	0.21	0.71	0.34	1.00								
Mn	-0.27	-0.23	-0.25	0.46	0.07	-0.33	0.07	0.47	-0.41	0.17	-0.21	-0.61	-0.53	-0.53	1.00							
Na	-0.03	-0.08	-0.32	0.39	0.30	-0.18	0.32	0.13	-0.07	-0.15	0.02	-0.26	-0.09	-0.25	0.08	1.00						
Ni	0.11	0.07	0.53	-0.46	-0.34	0.63	-0.09	0.23	0.94	0.34	0.18	0.61	0.36	0.79	-0.28	-0.11	1.00					
Pb	-0.39	0.32	0.02	-0.01	-0.16	-0.10	-0.28	0.12	-0.39	0.04	-0.59	-0.27	-0.53	-0.33	0.31	-0.09	-0.35	1.00				
Sb	0.22	0.20	0.54	-0.57	-0.29	0.52	-0.15	-0.07	0.67	0.15	0.24	0.77	0.48	0.78	-0.58	-0.43	0.69	-0.28	1.00			
Sr	-0.56	0.27	0.54	0.21	0.18	0.06	0.32	-0.20	-0.28	0.05	-0.14	-0.55	-0.23	-0.46	0.41	0.32	-0.23	0.00	-0.49	1.00		
V	0.85	-0.72	-0.13	0.54	0.46	-0.44	0.31	0.31	-0.02	0.01	0.55	-0.02	0.13	0.09	-0.02	0.23	-0.11	-0.38	-0.14	-0.33	1.00	
Zn	0.20	0.25	0.09	0.13	0.18	0.02	0.34	0.16	0.18	0.16	0.22	0.35	0.14	0.15	-0.17	0.28	0.18	0.25	0.22	-0.05	0.05	1.00

Spearman's R between elements in soil (30-60 cm)

	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Pb	Sb	Sr	V	Zn
Al	1.00																					
As	0.31	1.00																				
B	0.30	0.05	1.00																			
Ba	0.40	0.37	-0.13	1.00																		
Be	0.35	0.46	-0.33	0.80	1.00																	
Ca	-0.08	-0.14	-0.02	0.53	-0.40	1.00																
Cd	0.25	0.64	-0.02	0.12	0.17	0.09	1.00															
Co	0.22	0.48	0.06	0.41	0.32	-0.63	0.48	1.00														
Cr	0.44	0.04	0.47	-0.11	0.00	0.41	0.19	-0.09	1.00													
Cu	0.32	0.36	0.30	0.01	-0.01	-0.03	0.51	0.20	0.13	1.00												
Fe	0.66	0.67	0.02	0.34	0.49	0.01	0.76	0.47	0.39	0.39	1.00											
K	0.66	0.10	0.62	-0.19	-0.21	0.39	0.17	-0.20	0.74	0.38	0.35	1.00										
Li	0.76	0.38	0.00	0.73	0.79	-0.27	0.10	0.26	0.32	0.10	0.60	0.24	1.00									
Mg	0.68	-0.07	0.55	-0.15	-0.17	0.32	0.11	-0.09	0.78	0.30	0.35	0.88	0.32	1.00								
Mn	-0.28	0.22	0.01	0.49	0.12	-0.53	0.06	0.42	-0.34	-0.03	-0.12	-0.47	-0.04	-0.53	1.00							
Na	0.44	0.05	0.40	-0.16	-0.24	0.44	0.09	-0.21	0.63	0.35	0.21	0.80	0.16	0.78	-0.25	1.00						
Ni	0.23	-0.13	0.34	-0.22	-0.07	0.44	0.20	-0.07	0.90	0.03	0.24	0.56	0.12	0.66	-0.40	0.46	1.00					
Pb	-0.20	0.26	-0.11	0.57	0.41	-0.62	-0.24	0.25	0.43	-0.07	-0.26	-0.51	0.19	-0.49	0.66	-0.30	-0.50	1.00				
Sb	0.49	0.23	0.42	-0.18	-0.04	0.47	0.44	-0.06	0.87	0.36	0.58	0.76	0.28	0.76	-0.40	0.62	0.75	-0.60	1.00			
Sr	-0.62	-0.11	0.45	-0.10	-0.07	0.33	-0.18	-0.41	-0.33	-0.17	-0.34	-0.35	-0.39	-0.47	0.18	-0.10	-0.28	0.08	-0.28	1.00		
V	0.63	0.20	-0.02	0.83	0.76	-0.46	-0.05	0.34	0.19	0.03	0.40	0.07	0.88	0.22	0.12	0.07	0.05	0.36	0.02	-0.36	1.00	
Zn	0.37	0.70	-0.17	0.46	0.66	-0.24	0.51	0.30	0.04	0.48	0.59	0.04	0.52	0.04	-0.07	0.00	-0.07	0.26	0.19	-0.11	0.41	1.00

p<0.01
p<0.05

Table S3: Spearman's correlation coefficients between the elements in the soil and the grapevine parts (leaf, skin, pulp and seed);

topsoil layer (0–30 cm)–grapevine parts												
soil–leaf	R	*p*	*soil–skin*	R	*p*	*soil–pulp*	R	*p*	*soil–seed*	R	*p*	
Ba 2h H_2O–Ba leaf	0.70	*<0.01*	Ba 2h H_2O–Ba skin	0.73	*<0.01*	Ba 2h H_2O–Ba pulp	0.80	*<0.01*	Ba 2h H_2O–Ba seed	0.82	*<0.01*	
Ba 16h H_2O–Ba leaf	0.60	*<0.01*	Ba 16h H_2O–Ba skin	0.86	*<0.01*	Ba 16h H_2O–Ba pulp	0.77	*<0.01*	Ba 16h H_2O–Ba seed	0.89	*<0.01*	
Ba $CaCl_2$–Ba leaf	0.60	*<0.01*	Ba $CaCl_2$–Ba skin	0.90	*<0.01*	Ba $CaCl_2$–Ba pulp	0.91	*<0.01*	Ba $CaCl_2$–Ba seed	0.95	*<0.01*	
Ba NH_4NO_3–Ba leaf	0.68	*<0.01*	Ba NH_4NO_3–Ba skin	0.66	*<0.01*	Ba NH_4NO_3–Ba pulp	0.66	*<0.01*	Ba NH_4NO_3–Ba seed	0.75	*<0.01*	
Ba Na_2EDTA–Ba leaf	0.57	*<0.01*	Ba Na_2EDTA–Ba skin	0.53	*<0.01*	Ba Na_2EDTA–Ba pulp	0.51	*<0.01*	Ba Na_2EDTA–Ba seed	0.54	*<0.01*	
Ba CH_3COOH–Ba leaf	0.75	*<0.01*	Ba CH_3COOH–Ba skin	0.53	*<0.01*	Sr 2h H_2O–Sr pulp	0.57	*<0.01*	Cr 2h H_2O–Ni seed	0.52	*<0.01*	
Ni $CaCl_2$–Ni leaf	0.53	*<0.01*	Sr $CaCl_2$–Sr skin	0.82	*<0.01*	Sr 16h H_2O–Srpulp	0.65	*<0.01*	Cu 2h H_2O–Ni seed	0.56	*<0.01*	
Cu Na_2EDTA–Cu leaf	0.56	*<0.01*	Sr 2h H_2O–Sr skin	0.50	*<0.01*	Ba CH_3COOH–Ba pulp	0.43	*<0.05*	Ni 2h H_2O–Ni seed	0.55	*<0.01*	
Mn $CaCl_2$–Mn leaf	0.42	*<0.05*	Fe 16h H_2O–Fe skin	0.56	*<0.01*	Sr $CaCl_2$–Sr pulp	0.40	*<0.05*	Ba CH_3COOH–Ba seed	0.49	*<0.05*	
Mn NH_4NO_3–Mn leaf	0.47	*<0.05*	V 16h H_2O–V skin	0.44	*<0.01*	Sr Na_2EDTA–Sr pulp	0.40	*<0.05*				
Ni NH_4NO_3–Ni leaf	0.45	*<0.05*	Cu Na_2EDTA–Cu skin	0.40	*<0.05*							
Be NH_4NO_3–Be leaf	0.50	*<0.05*	Zn Na_2EDTA–Zn skin	0.44	*<0.05*							
V Na_2EDTA– V leaf	0.41	*<0.05*	Ni $CaCl_2$–Ni skin	0.40	*<0.05*							
			Sr NH_4NO_3–Sr skin	0.46	*<0.05*							
			Mn NH_4NO_3–Mn skin	0.41	*<0.05*							

subsoil layer (30–60 cm)–grapevine parts												
soil–leaf	R	*p*	*soil–skin*	R	*p*	*soil–pulp*	R	*p*	*soil–seed*	R	*p*	
Ba 2h H_2O–Ba leaf	0.58	*<0.01*	Ba 2h H_2O–Ba skin	0.66	*<0.01*	Ba 2h H_2O–Ba pulp	0.82	*<0.01*	Ba 2h H_2O–Ba seed	0.76	*<0.01*	
Ba 16h H_2O–Ba leaf	0.61	*<0.01*	Ba 16h H_2O–Ba skin	0.82	*<0.01*	Ba 16h H_2O–Ba pulp	0.80	*<0.01*	Ba 16h H_2O–Ba seed	0.81	*<0.01*	
Ba $CaCl_2$–Ba leaf	0.58	*<0.01*	Ba $CaCl_2$–Ba skin	0.91	*<0.01*	Ba $CaCl_2$–Ba pulp	0.91	*<0.01*	Ba $CaCl_2$–Ba seed	0.96	*<0.01*	
Ba NH_4NO_3–Ba leaf	0.57	*<0.01*	Ba NH_4NO_3–Ba skin	0.77	*<0.01*	Ba NH_4NO_3–Ba pulp	0.70	*<0.01*	Ba NH_4NO_3–Ba seed	0.77	*<0.01*	
Ba Na_2EDTA–Ba leaf	0.70	*<0.01*	Ba Na_2EDTA–Ba skin	0.73	*<0.01*	Ba Na_2EDTA–Ba pulp	0.65	*<0.01*	Ba Na_2EDTA–Ba seed	0.68	*<0.01*	
Ba CH_3COOH–Ba leaf	0.62	*<0.01*	Ba CH_3COOH–Ba skin	0.60	*<0.01*	Ba CH_3COOH–Ba pulp	0.51	*<0.01*	Ba CH_3COOH–Ba seed	0.52	*<0.01*	
Sr 16h H_2O–Sr leaf	0.52	*<0.01*	Sr $CaCl_2$–Sr skin	0.78	*<0.01*	Sr 2h H2O–Sr pulp	0.52	*<0.01*	Ni CaCl2–Ni seed	0.62	*<0.01*	
Ni $CaCl_2$–Ni leaf	0.50	*<0.05*	Sr NH_4NO_3–Sr skin	0.61	*<0.01*	Sr 16h H2O–Sr pulp	0.51	*<0.01*	Ni NH_4NO_3–Ni seed	0.60	*<0.01*	
Ni NH_4NO_3–Ni leaf	0.43	*<0.05*	Al Na_2EDTA–Al skin	0.51	*<0.01*	Sr CaCl2–Sr pulp	0.64	*<0.01*	Sr CaCl2–Sr seed	0.41	*<0.05*	
V $CaCl_2$–V leaf	0.44	*<0.05*	Ni $CaCl_2$–Ni skin	0.50	*<0.05*	Sr NH4NO3–Sr pulp	0.58	*<0.01*	Ni 2h H2O–Ni seed	0.4	*<0.05*	
			Ni NH_4NO_3–Ni skin	0.44	*<0.05*	Sr Na2EDTA–Sr pulp	0.56	*<0.01*	Ni 16h H2O–Ni seed	0.41	*<0.05*	
						Al 16h H_2O–Al pulp	0.42	*<0.05*				
						Cu 16h H_2O–Cu pulp	0.44	*<0.05*				
						V 16h H_2O–V pulp	0.40	*<0.05*				
						V Na_2EDTA–V pulp	0.44	*<0.05*				

Table S4: The contamination factor (CF) calculated for the potentially toxic elements measured in the vineyard soil samples

	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Fe	Mn	Na	Ni	Pb	Sb	Sr	V	Zn
sample									CF (0-30 cm)									
1	0.99	0.95	2.12	0.79	1.05	13.94	1.63	1.60	1.09	1.04	1.19	0.99	1.75	0.89	0.49	0.45	0.62	0.97
2	0.95	0.90	2.05	0.79	1.01	13.31	1.55	1.37	1.19	1.00	1.25	0.92	1.57	0.79	0.53	0.43	0.60	0.96
3	0.94	0.88	2.05	0.80	1.01	13.50	1.70	1.43	0.78	1.00	1.38	0.88	1.72	0.75	0.54	0.40	0.61	0.88
4	1.00	0.89	1.84	0.80	1.07	13.79	1.58	1.48	0.76	1.03	1.09	0.95	1.74	0.61	0.57	0.41	0.63	0.92
5	1.06	0.88	1.77	0.81	1.11	14.27	1.44	1.30	1.61	1.07	0.97	0.90	1.39	0.54	0.59	0.41	0.65	0.95
6	1.06	0.86	1.71	0.83	1.12	13.82	1.29	1.08	0.75	1.04	0.90	0.92	1.06	0.55	0.57	0.42	0.64	0.94
7	1.13	0.91	1.77	0.83	1.26	14.45	1.50	1.33	0.80	1.09	0.87	0.98	1.57	0.53	0.56	0.40	0.68	0.95
8	1.06	0.87	1.98	0.83	1.16	14.12	1.54	1.81	0.83	1.06	0.97	0.91	2.68	0.56	0.67	0.41	0.63	0.97
9	1.12	0.89	2.12	0.84	1.15	15.47	1.99	2.33	0.85	1.17	1.00	1.05	3.41	0.46	0.70	0.41	0.68	1.06
10	0.91	1.14	1.91	0.72	0.97	13.25	1.42	1.66	0.83	0.98	0.90	1.00	1.86	0.81	0.60	0.57	0.57	1.07
11	0.98	0.93	2.07	0.77	1.06	13.84	1.64	1.53	0.81	1.02	1.05	1.00	1.77	0.67	0.60	0.46	0.62	1.03
12	0.95	0.91	2.32	0.81	1.01	14.06	2.04	1.42	1.04	1.00	1.50	1.03	1.82	0.98	0.55	0.43	0.60	1.19
13	1.02	0.83	2.35	0.82	1.08	13.51	1.68	1.35	0.74	1.02	1.08	1.00	1.40	0.55	0.54	0.42	0.64	0.89
14	1.10	0.87	2.03	0.86	1.11	14.46	1.56	1.52	0.81	1.10	1.06	1.02	1.61	0.50	0.54	0.45	0.65	1.15
15	1.07	0.67	2.57	0.67	0.91	13.48	1.63	2.54	0.93	1.06	0.86	0.91	2.90	0.51	0.80	0.32	0.64	1.03
16	1.15	0.78	2.66	0.71	0.90	12.63	1.59	1.74	0.93	1.03	0.91	0.86	1.95	0.66	0.71	0.31	0.65	0.97
17	1.17	0.56	2.97	0.77	0.91	12.51	1.74	1.66	0.91	1.02	1.28	0.89	2.17	0.63	0.60	0.32	0.65	0.92
18	1.02	0.78	2.60	0.66	0.89	12.74	1.52	1.94	0.84	1.03	0.81	1.06	2.13	0.52	0.61	0.27	0.64	0.94
19	0.99	1.03	2.45	0.73	1.01	13.24	1.43	1.57	0.81	0.98	0.90	0.91	1.81	0.72	0.69	0.38	0.59	0.96
20	1.02	0.97	3.04	0.73	1.04	13.75	1.56	1.74	0.81	1.03	0.83	0.90	2.04	0.65	0.64	0.39	0.61	1.11
21	1.02	0.98	2.14	0.74	1.09	14.49	1.63	2.01	0.87	1.08	0.89	0.91	2.33	0.53	0.67	0.41	0.61	0.95
22	0.87	0.93	2.12	0.65	0.90	13.12	1.44	1.88	0.85	0.99	0.97	0.93	2.28	0.49	0.57	0.89	0.54	0.84
23	1.00	1.01	2.36	0.73	1.00	13.06	1.49	1.51	0.81	1.00	0.96	0.90	1.76	0.73	0.67	0.38	0.59	0.97
24	1.02	0.98	2.46	0.70	1.02	13.67	1.57	1.68	0.83	1.06	0.85	0.90	1.99	0.63	0.75	0.35	0.59	1.02
25	1.05	0.97	2.26	0.73	1.06	14.23	1.62	1.69	0.88	1.10	0.94	0.91	2.12	0.58	0.72	0.37	0.60	1.04
26	0.88	0.93	2.38	0.63	0.89	13.57	1.44	1.74	0.90	1.06	1.04	0.86	2.21	0.46	0.73	0.92	0.53	0.89
									CF (30-60 cm)									
1	0.84	1.20	0.93	1.03	1.00	0.56	1.24	1.70	0.33	0.92	1.52	1.49	2.34	2.08	1.74	1.02	1.40	0.83
2	0.86	1.21	0.86	1.08	1.03	0.58	1.07	1.68	0.50	0.90	1.37	1.48	2.10	1.82	1.59	1.07	1.42	1.01
3	0.88	1.24	0.98	1.13	1.03	0.58	1.38	1.75	0.32	0.94	1.93	1.59	2.48	1.84	1.72	1.06	1.45	0.93
4	0.94	1.21	0.81	1.06	1.09	0.58	1.28	1.97	0.31	0.99	1.47	1.31	2.75	1.35	1.97	0.85	1.45	0.93
5	1.04	1.26	0.86	1.26	1.21	0.59	1.25	1.72	0.80	1.04	1.53	1.68	2.06	1.63	1.90	1.07	1.59	0.99
6	0.98	1.17	0.78	1.12	1.14	0.54	1.22	1.32	0.29	0.98	1.19	1.50	1.46	1.30	1.59	1.04	1.49	0.92
7	1.12	1.32	0.79	1.22	1.40	0.60	1.22	1.75	0.33	1.09	1.14	1.65	2.33	1.32	1.76	1.02	1.67	0.96
8	1.05	1.18	0.84	1.19	1.30	0.59	1.10	2.38	0.32	1.04	1.07	1.66	4.02	1.10	2.27	1.02	1.54	0.94
9	1.05	1.21	0.84	1.09	1.23	0.64	1.41	3.30	0.35	1.18	0.95	1.74	5.87	0.91	2.60	0.94	1.61	1.11
10	0.93	1.28	0.84	1.05	1.06	0.58	1.12	1.92	0.35	0.97	1.12	2.00	2.50	3.15	1.94	1.41	1.42	1.47
11	0.97	1.19	0.84	1.08	1.12	0.57	1.11	1.77	0.75	0.99	1.09	1.73	2.34	1.26	2.23	1.12	1.48	0.99
12	0.93	1.26	1.04	1.19	1.12	0.61	1.47	1.81	0.36	1.00	1.99	1.68	2.63	1.64	1.85	1.01	1.50	0.92
13	0.83	1.18	1.17	1.06	1.02	0.53	1.21	1.46	0.32	0.91	1.74	1.46	1.92	1.74	1.50	1.00	1.43	0.87
14	1.00	1.27	0.90	1.16	1.14	0.58	1.36	1.81	0.36	1.07	1.82	1.68	2.22	1.64	1.82	1.03	1.55	0.97
15	0.94	0.73	1.21	0.92	0.79	0.46	0.97	2.34	0.31	0.88	0.97	1.93	2.96	0.66	2.16	1.50	1.42	0.72
16	1.17	1.12	1.19	1.09	0.96	0.51	1.18	2.30	0.35	0.97	1.25	1.82	2.66	1.63	2.19	0.83	1.61	0.90
17	1.13	0.77	1.28	1.14	0.94	0.52	1.24	2.35	0.36	0.97	1.34	1.95	2.92	1.41	2.09	0.84	1.60	0.90
18	1.02	1.05	1.06	0.95	0.92	0.53	1.04	2.63	0.35	0.97	0.95	2.19	3.09	1.17	2.19	0.77	1.53	0.91
19	1.05	1.47	1.23	1.54	1.15	0.60	1.19	3.15	0.33	1.12	1.75	1.75	2.68	1.62	2.80	1.02	1.55	0.97
20	1.06	1.31	2.20	0.99	1.17	0.57	1.20	2.68	0.39	1.06	0.87	1.71	2.93	1.27	2.38	0.90	1.50	0.98
21	0.12	0.10	0.25	0.47	0.08	0.20	0.82	0.44	0.24	0.23	1.03	0.87	0.64	0.79	0.64	3.11	0.01	0.63
22	0.83	1.20	0.93	0.89	0.87	0.54	1.03	2.65	0.33	0.95	1.26	1.85	3.28	1.07	2.43	3.13	1.28	0.76
23	1.14	1.43	1.16	0.96	0.78	1.08	1.22	1.96	0.41	1.08	1.19	2.14	2.32	0.65	2.59	0.94	1.12	0.95
24	1.00	1.21	1.41	0.75	0.74	1.09	1.32	2.20	0.37	1.07	0.88	1.50	3.16	0.40	2.35	0.71	0.98	0.96
25	1.00	1.22	0.97	0.86	0.69	1.04	1.21	2.01	0.45	1.03	1.19	1.94	2.67	0.68	2.28	0.97	0.97	0.91
26	0.88	1.09	0.96	0.73	0.52	1.01	1.18	2.58	0.36	1.01	1.29	1.86	3.19	0.44	2.29	1.75	0.86	0.82

Table S5: The biological absorption coefficient (BAC) of the elements in different grapevine parts from the soil (0–30 cm and 30–60 cm)

	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Pb	Sb	Sr	V	Zn
BAC seed/soil (0-30)																						
Med.	1.08E-05	1.28E-04	0.14	0.085	/	4.76	2.44E-04	1.46E-04	1.14E-04	0.14	3.57E-04	2.03	/	0.73	0.0059	0.06	5.90E-04	3.68E-05	4.16E-04	0.065	7.96E-06	0.080
Min	1.30E-06	2.47E-05	0.08	0.029	/	0.53	4.53E-05	3.61E-06	5.55E-05	0.09	7.70E-05	1.70	/	0.09	0.0004	0.02	3.47E-05	2.29E-05	1.76E-05	0.014	5.76E-07	0.004
Max	1.08E-04	4.51E-04	0.18	0.213	/	7.65	2.54E-03	6.87E-04	1.76E-03	0.31	4.82E-04	3.40	/	1.12	0.0186	0.58	5.68E-03	0.093341	5.69E-03	0.174	3.19E-04	0.136
BAC seed/soil (30-60)																						
Med.	1.12E-05	1.34E-04	0.14	0.074	/	4.47	7.74E-04	1.49E-04	0.000156	0.16	3.32E-04	2.49	/	0.80	0.0062	0.05	4.79E-04	3.92E-05	3.07E-04	0.064	9.36E-06	0.085
Min	1.41E-06	2.06E-05	0.06	0.016	/	0.28	8.23E-05	3.89E-06	5.17E-05	0.07	7.95E-05	1.55	/	0.08	0.0005	0.01	3.69E-05	9.71E-06	1.02E-05	0.009	3.94E-07	0.004
Max	1.11E-04	1.04E-03	0.56	0.189	/	8.12	7.78E-03	7.46E-04	0.001514	0.36	1.55E-03	13.62	/	1.30	0.0180	0.69	4.89E-03	0.062008	4.40E-03	0.169	5.60E-04	0.149
BAC pulp/soil (0-30)																						
Med.	1.33E-05	3.2E-05	0.07	0.005	/	0.24	3.74E-05	2.58E-06	3.99E-05	0.02	6.59E-05	1.00	/	0.08	0.0003	0.04	1.16E-04	3.28E-04	2.76E-04	0.007	2.7E-05	0.038
Min	3.58E-06	6.6E-06	0.03	0.002	/	0.06	1.13E-05	1.87E-06	2.73E-05	0.01	2.52E-05	0.65	/	0.05	0.0001	0.00	1.97E-05	1.00E-05	8.7E-06	0.002	3.8E-07	0.019
Max	9.53E-05	1.64E-04	0.11	0.012	/	0.50	1.14E-03	0.002072	0.021699	0.59	2.96E-04	1.66	/	0.10	0.0021	0.08	8.40E-04	0.042541	1.16E-03	0.019	7.1E-05	0.077
BAC pulp/soil (30-60)																						
Med.	1.59E-05	2.9E-05	0.06	0.005	/	0.24	1.19E-04	2.53E-06	3.81E-05	0.02	6.12E-05	1.20	/	0.08	0.0002	0.04	9.38E-05	0.000277	1.79E-04	0.006	1.86E-05	0.038
Min	3.81E-06	6.12E-06	0.03	0.001	/	0.02	3.47E-05	1.94E-06	2.17E-05	0.01	2.31E-05	0.67	/	0.05	0.0001	0.00	1.84E-05	7.04E-06	6.01E-06	0.001	2.59E-07	0.018
Max	1.06E-04	8.55E-04	0.43	0.011	/	0.48	7.26E-03	3.17E-03	0.018399	0.66	2.87E-04	6.52	/	0.10	0.0020	0.10	7.38E-04	0.073705	0.000787	0.022	4.29E-03	0.106
BAC skin/soil (0-30)																						
Med.	7.56E-06	1.61E-05	0.16	0.014	/	0.41	9.22E-05	4.09E-05	4.07E-05	0.03	1.22E-04	2.23	/	0.12	0.0008	0.02	2.82E-04	1.53E-05	2.82E-04	0.018	1.7E-05	0.024
Min	3.43E-06	1.43E-06	0.01	0.008	/	0.06	1.01E-05	1.02E-06	2.37E-05	0.02	9.32E-05	1.26	/	0.09	0.0003	0.00	1.9E-05	9.22E-06	4.44E-06	0.009	3.53E-07	0.014
Max	1.46E-04	2.43E-04	0.23	0.033	/	0.67	0.075081	0.017389	0.000682	0.12	2.24E-04	2.93	/	0.16	0.0028	0.03	1.21E-03	0.050936	0.006911	0.046	1.33E-04	0.045
BAC skin/soil (30-60)																						
Med.	8.59E-06	1.50E-05	0.17	0.013	/	0.42	2.28E-04	4.31E-05	4.23E-05	0.03	1.24E-04	2.49	/	0.11	0.0008	0.01	2.57E-04	1.27E-05	1.87E-04	0.017	1.12E-05	0.024
Min	3.62E-06	1.27E-06	0.01	0.005	/	0.03	3.38E-05	1.16E-06	2.11E-05	0.02	8.86E-05	1.35	/	0.08	0.0003	0.00	1.52E-05	6.18E-06	2.82E-06	0.003	2.34E-07	0.013
Max	1.59E-04	2.02E-04	0.74	0.028	/	0.74	0.238686	0.01558	6.22E-04	0.13	5.79E-04	13.22	/	0.18	0.0021	0.03	1.02E-03	0.027414	0.004229	0.039	1.38E-03	0.056
BAC leaf/soil (0-30)																						
Med.	0.0007	0.006	0.46	0.068	1.27E-03	3.48	0.0005	0.0028	0.0015	0.10	0.0026	0.57	0.006	0.32	0.05	0.07	0.0095	0.0110	3.43E-03	0.971	0.0015	0.189
Min	0.0003	0.002	0.31	0.034	1.13E-04	0.45	0.0001	0.0012	0.0004	0.06	0.0013	0.37	0.002	0.16	0.02	0.01	0.0002	0.0008	9.46E-05	0.380	0.0006	0.116
Max	0.0014	0.024	1.12	0.131	9.31E-03	5.88	0.0028	0.0090	0.0230	0.14	0.0056	0.86	0.009	0.54	0.17	0.15	0.0562	0.1355	0.14816	1.499	0.0035	0.332
BAC leaf/soil (30-60)																						
Med.	0.0009	0.005	0.48	0.059	1.43E-03	3.96	0.0016	0.0030	0.0015	0.11	0.003	0.65	0.006	0.32	0.05	0.07	0.0080	0.0083	2.73E-03	0.884	0.0011	0.198
Min	0.0003	0.002	0.26	0.022	9.50E-05	0.29	0.0003	0.0016	0.0002	0.06	0.001	0.34	0.002	0.16	0.02	0.01	0.0001	0.0004	5.98E-05	0.151	0.0004	0.107
Max	0.0061	0.086	1.68	0.117	9.79E-03	6.63	0.0108	0.0095	0.0201	0.16	0.022	3.40	0.023	0.50	0.22	0.15	0.0471	0.3514	0.102233	1.326	0.0833	0.330

Table S6: The ratio factor (RF) between the parts of grapevine exposed to air (the grapevine leaves and grape skin) vs. those parts which are not directly exposed to air pollution (the grape pulp and seed)

	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Pb	Sb	Sr	V	Zn
RF leaf/seed																						
Med.	67	33.50	3.17	0.72	/	0.77	2.79	40.41	5.92	0.69	6.34	0.29	/	0.41	7.53	0.94	18.58	71.79	4.47	10.71	151.27	2.29
Min	4.85	11.67	2.27	0.49	/	0.49	0.07	8.57	0.21	0.23	3.53	0.12	/	0.27	4.95	0.10	0.38	0.12	0.13	5.36	1.98	1.21
Max	418	712.85	11.29	1.31	/	1.22	53.28	1324.71	259.01	0.99	39.21	0.39	/	3.41	104.60	3.23	243.03	755.72	498.49	46.73	3925.09	43.22
RF leaf/pulp																						
Med.	51.61	212.84	7.82	11.84	/	15.57	8.73	993.56	35.81	5.59	32.61	0.61	/	3.84	208.96	1.65	64.27	130.89	17.44	133.48	112.51	4.58
Min	5.12	30.24	3.89	7.55	/	9.02	0.50	0.59	0.02	0.21	12.11	0.24	/	2.21	61.33	0.51	0.86	0.08	0.48	28.57	11.93	3.07
Max	290.48	1011.05	22.25	20.81	/	25.93	193.23	4207.55	461.43	13.78	115.33	1.09	/	6.11	448.86	95.21	1387.17	2428.12	17023.13	280.81	4705.41	11.11
RF skin/seed																						
Med.	0.76	0.16	1.16	0.17	/	0.09	0.25	0.45	0.41	0.19	0.36	1.06	/	0.14	0.11	0.21	0.57	0.44	0.61	0.23	0.98	0.26
Min	0.05	0.02	0.00	0.11	/	0.06	0.01	0.01	0.02	0.08	0.26	0.38	/	0.11	0.07	0.00	0.03	0.00	0.02	0.10	0.01	0.15
Max	112.55	8.27	1.54	0.32	/	0.15	400.86	103.03	6.40	0.87	1.57	1.25	/	1.12	1.85	0.98	17.44	1570.95	195.19	1.07	55.73	3.92
RF skin/pulp																						
Med.	0.77	0.83	2.57	2.72	/	1.75	1.21	5.21	1.07	1.83	2.07	2.23	/	1.55	3.18	0.35	4.42	0.85	1.18	2.73	0.72	0.71
Min	0.07	0.08	0.00	1.41	/	0.87	0.08	0.01	0.00	0.04	0.35	0.78	/	1.06	0.45	0.01	0.02	0.00	0.12	0.50	0.22	0.31
Max	28.03	17.47	3.81	5.15	/	3.52	2160	6521	15.38	5.75	4.11	3.17	/	2.00	5.26	3.42	45.04	3006	90.59	7.32	325.92	1.05

Table S7: Non-carcinogenic and carcinogenic risk assessment for workers in the vineyard~~.~~ chronically exposed to the potentially toxic elements in the soil

	Non-carcinogenic risk – HI (Hazardous Index)				Carcinogenic risk – R			
sample	HQ(o)	HQ(i)	HQ(d)	HI	R(o)	R(i)	R(d)	R
1	0.28	0.007	0.005	0.29	3.36E-05	8.40E-07	1.02E-06	3.54E-05
2	0.26	0.007	0.005	0.27	2.94E-05	7.19E-07	9.68E-07	3.11E-05
3	0.27	0.008	0.005	0.28	3.02E-05	7.53E-07	9.47E-07	3.19E-05
4	0.27	0.007	0.005	0.28	3.12E-05	7.79E-07	9.57E-07	3.29E-05
5	0.26	0.006	0.005	0.28	2.82E-05	6.87E-07	9.41E-07	2.98E-05
6	0.25	0.006	0.005	0.26	2.46E-05	5.70E-07	9.28E-07	2.60E-05
7	0.27	0.006	0.005	0.29	2.90E-05	7.03E-07	9.81E-07	3.07E-05
8	0.28	0.007	0.005	0.29	3.63E-05	9.48E-07	9.39E-07	3.82E-05
9	0.32	0.007	0.005	0.33	4.47E-05	1.22E-06	9.58E-07	4.68E-05
10	0.27	0.006	0.006	0.28	3.62E-05	8.71E-07	1.23E-06	3.83E-05
11	0.27	0.007	0.005	0.28	3.22E-05	8.03E-07	9.96E-07	3.40E-05
12	0.28	0.008	0.005	0.30	3.03E-05	7.51E-07	9.78E-07	3.20E-05
13	0.27	0.007	0.004	0.28	2.85E-05	7.10E-07	8.87E-07	3.00E-05
14	0.28	0.007	0.005	0.29	3.16E-05	7.99E-07	9.37E-07	3.34E-05
15	0.29	0.006	0.004	0.30	4.62E-05	1.32E-06	7.23E-07	4.82E-05
16	0.28	0.006	0.004	0.29	3.44E-05	9.12E-07	8.38E-07	3.61E-05
17	0.28	0.008	0.003	0.29	3.13E-05	8.72E-07	6.03E-07	3.27E-05
18	0.27	0.006	0.004	0.28	3.75E-05	1.01E-06	8.40E-07	3.93E-05
19	0.27	0.006	0.005	0.28	3.37E-05	8.21E-07	1.11E-06	3.56E-05
20	0.28	0.006	0.005	0.29	3.60E-05	9.13E-07	1.04E-06	3.79E-05
21	0.29	0.006	0.005	0.30	4.03E-05	1.05E-06	1.05E-06	4.24E-05
22	0.26	0.006	0.005	0.28	3.78E-05	9.79E-07	1.00E-06	3.98E-05
23	0.27	0.006	0.005	0.28	3.26E-05	7.92E-07	1.09E-06	3.45E-05
24	0.28	0.006	0.005	0.29	3.51E-05	8.83E-07	1.05E-06	3.70E-05
25	0.29	0.006	0.005	0.30	3.52E-05	8.88E-07	1.04E-06	3.71E-05
26	0.27	0.006	0.005	0.28	3.56E-05	9.10E-07	1.00E-06	3.76E-05

Table S8: Non-carcinogenic assessment for consumers of grapevine (adults and children) and consumers of wine (adults) from the investigated vineyard and carcinogenic risk (R) assessment applying adjustable formula for children and adults.

consumers			
sample	HI male	HI children	R adjustable
1	0.23	0.10	1.03E-05
2	0.24	0.08	7.13E-06
3	0.43	0.10	9.27E-06
4	0.32	0.10	8.24E-06
5	0.22	0.08	7.99E-06
6	0.18	0.07	8.42E-06
7	0.18	0.06	6.69E-06
8	0.13	0.05	6.53E-06
9	0.20	0.08	6.93E-06
10	0.15	0.06	7.39E-06
11	0.24	0.10	8.55E-06
12	0.21	0.07	7.53E-06
13	0.17	0.06	5.90E-06
14	0.42	0.12	9.11E-06
15	0.20	0.06	1.37E-05
16	0.24	0.09	9.92E-06
17	0.64	0.11	6.44E-06
18	0.34	0.08	8.07E-06
19	0.34	0.09	6.44E-06
20	0.19	0.07	6.71E-06
21	0.16	0.06	8.05E-06
22	0.19	0.06	7.99E-06
white wine	0.22	/	7.05E-07
red wine	0.21	/	2.881E-06