

Evaluation of Trace Elements in Soils of Iraq using Multivariate Statistical Analysis and Pollution Indices

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Table 1S. Enrichment Factor (EF) values for the TEs in the soils of the study area with Min, Max, Mean and standard deviation (S.D.) values.

Station	EF Ti	EF V	EF Cr	EF Mn	EF Co	FE Ni	EF Cu	EF Zn	EF Ga	EF Ge	EF As	EF Se	EF Br	EF Rb	EF Sr	EF Y	EF Mo	EF Ag	EF Cd	EF Sn	EF Sb	EF I	EF Ba	EF Ba	EF W	EF Hg	EF TI	EF Pb	EF Bi	EF Th	EF U
1	0.32	0.20	4.30	1.19	7.11	4.90	0.81	0.76	0.69	0.53	0.78	1.49	0.25	0.90	0.64	1.21	18.64	25.87	7.60	1.64	7.96	10.08	0.37	0.37	2.99	25.78	3.45	0.51	2.73	0.76	0.71
2	0.39	0.41	4.71	1.17	6.33	3.27	0.70	0.90	0.86	0.68	0.89	2.86	0.26	0.84	1.17	1.34	22.86	31.99	10.38	1.55	9.09	11.30	0.42	0.42	3.41	35.92	4.26	0.62	7.14	0.87	1.16
3	0.39	0.41	3.40	1.17	6.33	3.27	0.70	0.90	0.86	0.68	0.89	2.86	0.26	0.84	1.17	1.34	22.86	31.99	10.38	1.55	9.09	11.30	0.42	0.42	3.41	35.92	4.26	0.62	71.38	0.87	1.16
4	0.35	0.15	5.73	1.26	7.06	3.99	0.78	0.68	0.75	0.67	1.00	1.31	1.03	0.62	4.74	0.95	27.94	31.03	11.48	3.11	10.75	10.39	0.71	0.71	4.41	35.68	5.00	0.63	3.66	0.60	1.06
5	0.32	0.14	5.83	1.32	2.89	4.08	0.86	0.77	0.73	0.75	0.84	0.91	0.52	0.78	1.54	1.10	27.34	34.71	11.49	3.49	8.98	13.14	0.65	0.65	3.83	32.94	4.41	0.51	4.77	0.89	1.04
6	0.31	0.24	4.18	1.16	4.16	4.01	0.61	0.71	0.55	0.88	0.78	1.63	0.73	0.58	1.83	0.64	20.27	29.41	7.58	2.39	13.67	8.42	0.38	0.38	3.42	28.44	3.66	0.42	3.60	0.58	0.88
7	0.53	0.29	10.26	1.14	6.42	3.23	0.63	0.90	0.37	7.83	5.35	29.65	5.35	0.63	3.40	1.04	29.65	39.13	12.73	4.91	14.41	55.39	0.43	0.43	5.37	39.13	4.96	0.37	4.97	0.53	1.13
8	0.35	0.21	5.83	1.20	10.67	3.64	0.81	0.74	0.75	0.75	0.55	2.04	0.41	0.81	1.66	1.39	0.34	32.96	11.66	3.39	20.37	16.80	0.52	0.52	3.75	65.47	4.38	0.55	5.93	0.78	0.86
9	0.34	0.19	3.67	1.27	9.28	3.54	0.82	0.91	0.69	0.79	0.93	2.41	0.76	0.87	2.48	1.27	51.01	38.28	10.59	1.48	12.17	11.84	0.56	0.56	7.66	36.30	5.08	0.57	3.28	0.88	0.99
10	0.32	0.23	4.60	1.07	4.25	3.93	1.01	1.25	0.72	0.63	0.61	1.85	0.37	0.80	1.51	1.10	34.49	34.05	10.14	3.18	9.57	12.97	0.54	0.54	5.42	38.72	3.98	0.74	2.80	0.88	0.81
11	0.34	0.37	6.40	1.25	6.82	3.85	0.99	0.01	0.65	0.71	0.36	3.46	0.03	0.80	1.61	1.15	20.31	33.59	11.64	3.37	9.40	9.07	0.52	0.52	3.70	53.67	4.47	0.70	8.22	0.42	0.88
12	0.33	0.21	4.30	1.30	5.22	4.51	0.78	0.76	0.75	0.47	0.75	1.06	0.38	0.76	1.76	1.05	23.68	31.48	9.53	3.24	8.88	4.75	0.47	0.47	3.72	42.52	4.28	0.47	6.42	0.51	0.99
13	0.35	0.26	3.44	1.09	4.35	3.98	0.83	0.85	0.49	0.42	0.50	0.69	0.48	0.58	1.20	0.78	11.57	20.52	6.21	2.91	5.61	10.07	0.37	0.37	3.17	18.19	2.67	0.69	4.33	0.44	0.67
14	0.31	0.07	3.65	1.21	6.88	4.45	0.87	0.75	0.79	0.64	0.79	1.94	1.12	0.62	20.42	0.93	24.84	31.53	9.79	1.78	8.54	4.88	0.36	0.36	3.42	36.59	4.27	0.53	4.47	0.38	0.80
15	0.35	0.26	3.44	1.09	4.35	3.98	0.83	0.85	0.49	0.42	0.50	0.69	0.48	0.58	1.20	0.78	11.57	20.52	6.21	2.91	5.61	10.07	0.37	0.37	3.17	18.19	2.67	0.69	4.33	0.44	0.67
16	0.31	0.24	4.18	1.16	4.16	4.01	0.61	0.71	0.55	0.88	0.78	1.63	0.73	0.58	1.83	0.64	20.27	29.41	7.58	2.39	13.67	8.42	0.38	0.38	3.42	28.44	3.66	0.42	3.60	0.58	0.88
17	0.31	0.12	4.69	1.13	4.27	3.97	0.80	0.76	0.73	0.68	0.62	1.64	0.79	0.78	1.64	1.11	36.14	33.36	9.70	2.89	11.33	13.81	0.41	0.41	3.45	65.82	4.16	0.54	6.02	0.48	0.81
18	0.34	0.15	4.30	1.21	5.82	4.14	0.61	0.71	0.64	0.75	0.61	1.94	0.66	0.76	1.86	1.15	20.34	36.07	11.96	3.67	21.95	13.32	0.59	0.59	3.95	48.71	4.69	0.47	4.57	0.66	0.85
19	0.37	0.16	6.78	1.37	5.92	4.07	0.67	0.75	0.01	0.77	0.61	2.01	0.46	0.77	1.80	1.11	26.07	37.33	12.10	3.66	9.55	11.54	0.60	0.60	4.02	34.66	4.63	0.42	4.46	0.76	1.07
20	0.32	0.19	3.84	1.19	5.77	3.70	0.83	0.95	0.60	0.51	0.38	1.91	0.37	0.78	1.72	1.18	47.48	32.28	11.15	1.34	22.55	6.30	0.46	0.46	3.51	38.64	4.29	0.69	5.77	0.74	0.87
21	0.31	0.13	4.17	1.10	4.38	4.23	0.83	0.72	0.72	0.79	0.81	2.41	0.71	0.74	1.59	1.08	21.66	33.93	9.47	2.96	18.57	18.24	0.55	0.55	3.32	30.25	4.06	0.46	6.93	0.57	0.82
22	0.33	0.15	3.74	1.19	4.98	4.17	0.81	0.77	0.60	8.13	0.66	3.24	2.09	0.72	3.41	1.03	26.80	31.28	11.65	5.37	9.56	11.95	0.73	0.73	4.37	42.12	4.88	0.06	169.4 4	0.33	0.81
23	0.02	0.13	1.95	0.32	9.68	0.65	0.43	1.70	0.10	0.68	1.56	20.37	1.83	0.24	0.22	0.52	35.36	520.3 3	98.99	5.14	106.0 1	51.95	0.79	0.79	5.27	33.82	4.06	0.28	4.83	0.35	1.47
24	0.33	0.31	3.95	1.28	6.49	4.08	0.91	0.83	0.65	0.84	0.73	2.11	0.33	0.80	1.70	1.05	31.21	29.98	10.86	0.74	12.88	12.29	0.52	0.52	3.55	30.49	4.27	0.47	4.20	0.68	0.87
25	0.31	0.16	3.93	1.26	5.73	4.25	0.90	0.84	0.70	0.74	0.61	2.02	1.71	0.77	2.71	1.01	24.24	34.95	10.84	3.52	7.96	15.98	5.07	5.07	3.89	45.15	4.74	0.50	4.23	0.75	1.09
Min	0.02	0.07	1.95	0.32	2.89	0.65	0.43	0.01	0.01	0.42	0.36	0.69	0.03	0.24	0.22	0.52	0.34	20.52	6.21	0.74	5.61	4.75	0.36	0.36	2.99	18.19	2.67	0.06	2.73	0.33	0.67
Max	0.53	0.41	10.26	1.37	10.67	4.90	1.01	1.70	0.86	8.13	5.35	29.65	5.35	0.90	20.42	1.39	51.01	520.3 3	98.99	5.37	106.0 1	55.39	5.07	5.07	7.66	65.82	5.08	0.74	169.4 4	0.89	1.47
Mean	0.33	0.22	4.61	1.16	5.97	3.84	0.78	0.82	0.62	1.27	0.92	3.76	0.88	0.72	2.59	1.04	25.48	51.44	13.67	2.90	15.53	14.57	0.69	0.69	3.99	37.66	4.21	0.52	14.08	0.63	0.93
S.D.	0.08	0.09	1.59	0.19	1.86	0.77	0.13	0.27	0.21	2.03	0.95	6.57	1.06	0.14	3.83	0.22	10.60	97.79	17.87	1.19	19.42	12.22	0.92	0.92	1.02	11.70	0.62	0.15	35.02	0.18	0.18
Sezgin et al. (2019)							3.55	3.65											2.21							2.23		2.08			

Table 2S. Contamination Factor (CF) values for the TEs in the soils of the study area with Min, Max, Mean and standard deviation (S.D.) values.

Station	CF (Ti)	CF (V)	CF (Cr)	CF Mn	CF (Co)	CF (Ni)	CF (Cu)	CF (Zn)	CF (Ga)	CF (Ge)	CF (As)	CF (Se)	CF (Br)	CF (Rb)	CF (Sr)	CF (Y)	CF (Mo)	CF (Ag)	CF (Cd)	CF (Sn)	CF (Sb)	CF (I)	CF (Ba)	CF (W)	CF (Hg)	CF (Tl)	CF (Pb)	CF (Bi)	CF (Th)	CF (U)
1	0.387	0.241	5.244	1.445	8.673	5.979	0.992	0.929	0.836	0.650	0.952	1.818	0.300	1.094	0.786	1.478	22.727	31.538	9.268	2.000	9.701	12.286	0.450	3.647	31.429	4.200	0.622	3.333	0.924	0.867
2	0.406	0.426	4.874	1.209	6.549	3.376	0.722	0.926	0.888	0.700	0.922	2.955	0.270	0.866	1.211	1.387	23.636	33.077	10.732	1.600	9.403	11.679	0.440	3.529	37.143	4.400	0.637	7.381	0.902	1.200
3	0.360	0.155	5.966	1.316	7.345	4.152	0.815	0.703	0.776	0.700	1.040	1.364	1.070	0.643	4.938	0.991	29.091	32.308	10.732	1.600	9.403	11.679	0.440	3.529	37.143	5.200	0.656	3.810	0.620	1.100
4	0.323	0.140	5.815	1.316	2.885	4.066	0.853	0.771	0.730	0.750	0.835	0.909	0.520	0.779	1.537	1.096	27.273	34.615	11.951	3.240	11.194	10.821	0.740	4.588	32.857	4.400	0.511	4.762	0.891	1.033
5	0.386	0.298	5.244	1.457	5.221	5.038	0.766	0.894	0.691	1.100	0.981	2.045	0.920	0.729	2.298	0.800	25.455	36.923	11.463	3.480	8.955	13.107	0.650	3.824	35.714	4.600	0.530	4.524	0.728	1.100
6	0.404	0.225	7.866	0.873	4.920	2.476	0.481	0.687	0.283	6.000	4.100	22.727	4.100	0.485	2.604	0.800	22.727	30.000	9.512	3.000	17.164	10.571	0.480	4.294	30.000	3.800	0.281	3.810	0.402	0.867
7	0.347	0.210	5.849	1.207	10.708	3.652	0.815	0.739	0.757	0.750	0.556	2.045	0.410	0.810	1.669	1.396	0.336	33.077	9.756	3.760	11.045	42.464	0.330	4.118	65.714	4.400	0.556	5.952	0.783	0.867
8	0.324	0.182	3.462	1.201	8.761	3.345	0.776	0.857	0.651	0.750	0.878	2.273	0.720	0.821	2.342	1.200	48.182	36.154	11.707	3.400	20.448	16.857	0.530	3.765	34.286	4.800	0.541	3.095	0.826	0.933
9	0.354	0.253	5.092	1.189	4.699	4.348	1.118	1.380	0.796	0.700	0.673	2.045	0.410	0.881	1.671	1.217	38.182	37.692	10.000	1.400	11.493	11.179	0.530	7.235	42.857	4.400	0.822	3.095	0.978	0.900
10	0.334	0.364	6.303	1.232	6.717	3.790	0.974	0.011	0.638	0.700	0.351	3.409	0.030	0.791	1.583	1.135	20.000	33.077	11.220	3.520	10.597	14.357	0.600	6.000	52.857	4.400	0.693	8.095	0.413	0.867
11	0.354	0.227	4.622	1.395	5.611	4.848	0.838	0.821	0.803	0.500	0.805	1.136	0.410	0.815	1.889	1.126	25.455	33.846	11.463	3.320	9.254	8.929	0.510	3.647	45.714	4.600	0.500	6.905	0.543	1.067
12	0.583	0.429	5.681	1.793	7.168	6.566	1.365	1.409	0.809	0.700	0.820	1.136	0.790	0.949	1.975	1.287	19.091	33.846	10.244	3.480	9.552	5.107	0.510	4.000	30.000	4.400	1.137	7.143	0.728	1.100
13	0.359	0.078	4.269	1.422	8.053	5.217	1.018	0.876	0.928	0.750	0.922	2.273	1.310	0.728	23.914	1.091	29.091	36.923	10.244	4.800	9.254	16.607	0.600	5.235	42.857	5.000	0.622	5.238	0.446	0.933
14	0.583	0.429	5.681	1.793	7.168	6.566	1.365	1.409	0.809	0.700	0.820	1.136	0.790	0.949	1.975	1.287	19.091	33.846	11.463	2.080	10.000	5.714	0.430	4.000	30.000	4.400	1.137	7.143	0.728	1.100
15	0.386	0.298	5.244	1.457	5.221	5.038	0.766	0.894	0.691	1.100	0.981	2.045	0.920	0.729	2.298	0.800	25.455	36.923	10.244	4.800	9.254	16.607	0.480	5.235	35.714	4.600	0.530	4.524	0.728	1.100
16	0.347	0.133	5.193	1.250	4.726	4.390	0.884	0.841	0.809	0.750	0.688	1.818	0.870	0.866	1.818	1.230	40.000	36.923	9.512	3.000	17.164	10.571	0.450	4.294	72.857	4.600	0.593	6.667	0.533	0.900
17	0.315	0.140	4.034	1.135	5.460	3.886	0.568	0.661	0.599	0.700	0.571	1.818	0.620	0.715	1.750	1.083	19.091	33.846	10.732	3.200	12.537	15.286	0.560	3.824	45.714	4.400	0.441	4.286	0.620	0.800
18	0.334	0.141	6.151	1.246	5.372	3.686	0.604	0.683	0.007	0.700	0.556	1.818	0.420	0.694	1.633	1.009	23.636	33.846	11.220	3.440	20.597	12.500	0.540	3.706	31.429	4.200	0.381	4.048	0.685	0.967
19	0.344	0.202	4.118	1.273	6.186	3.969	0.884	1.013	0.638	0.550	0.410	2.045	0.400	0.837	1.849	1.270	50.909	34.615	10.976	3.320	8.657	10.464	0.500	3.647	41.429	4.600	0.737	6.190	0.793	0.933
20	0.346	0.147	4.723	1.248	4.965	4.790	0.943	0.814	0.816	0.900	0.922	2.727	0.800	0.843	1.805	1.222	24.545	38.462	11.951	1.440	24.179	6.750	0.620	3.765	34.286	4.600	0.519	7.857	0.641	0.933
21	0.321	0.147	3.681	1.170	4.903	4.097	0.797	0.760	0.586	8.000	0.644	3.182	2.060	0.710	3.354	1.009	26.364	30.769	10.732	3.360	21.045	20.679	0.710	3.765	41.429	4.800	0.059	166.667	0.326	0.800
22	0.012	0.074	1.151	0.191	5.726	0.386	0.254	1.003	0.592	0.400	0.922	12.045	1.080	0.144	1.277	0.304	20.909	307.692	11.463	5.280	9.403	11.750	0.460	4.294	20.000	2.400	0.163	2.857	0.207	0.867
23	0.358	0.335	4.252	1.383	6.991	4.397	0.977	0.899	0.704	0.900	0.791	2.273	0.350	0.865	1.829	1.126	33.636	32.308	58.537	3.040	62.687	30.214	0.570	3.118	32.857	4.600	0.507	4.524	0.728	0.933
24	0.316	0.164	3.983	1.270	5.796	4.303	0.910	0.851	0.704	0.750	0.615	2.045	1.730	0.782	2.747	1.026	24.545	35.385	11.707	0.800	13.881	13.250	5.130	3.824	45.714	4.800	0.507	4.286	0.761	1.100
Min	0.012	0.074	1.151	0.191	2.885	0.386	0.254	0.011	0.007	0.400	0.351	0.909	0.030	0.144	0.786	0.304	0.336	30.000	9.268	0.800	8.657	5.107	0.330	3.118	20.000	2.400	0.059	2.857	0.207	0.800
Max	0.583	0.429	7.866	1.793	10.708	6.566	1.365	1.409	0.928	8.000	4.100	22.727	4.100	1.094	23.914	1.478	50.909	307.692	58.537	5.280	62.687	42.464	5.130	7.235	72.857	5.200	1.137	166.667	0.978	1.200
Mean	0.358	0.226	4.937	1.270	6.243	4.265	0.854	0.868	0.689	1.258	0.907	3.295	0.888	0.772	2.948	1.099	26.643	45.737	12.785	3.015	14.869	14.143	0.719	4.203	39.583	4.442	0.570	11.925	0.664	0.969
S.D.	0.102	0.107	1.279	0.300	1.678	1.275	0.244	0.281	0.196	1.799	0.705	4.659	0.829	0.178	4.539	0.247	10.274	55.840	9.778	1.130	11.203	7.921	0.944	0.911	11.586	0.517	0.243	33.000	0.198	0.113
Sezgin et al. (2019)							2.39	2.5											1.58							1.63		1.54		

