

Supplementary Information for:

Critical Zone weathering controls on the hydrogeochemistry and spatial variability of groundwater arsenic and fluoride in the Lake Victoria Basin, Northwest Tanzania

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Table S1. Summary statistics of trace elements in shallow wells (SW) samples ($\mu\text{g/L}$).

SW	Minimum	Maximum	Mean	s.d.
Al	11.57	1,252.54	161.12	386.31
B	4.17	138.32	20.32	41.61
Ba	26.14	478.11	150.01	137.28
Cu	0.89	268.17	29.96	83.74
Fe	2.56	1,992.53	317.69	627.48
Li	0.42	21.38	7.31	7.24
Mn	1.06	1,303.16	190.1	404.39
Ni	0.29	525.86	53.86	165.85
Zn	5.61	3,742.09	391.89	1,177.24

Table S2. Summary statistics of trace elements in boreholes (BH) samples ($\mu\text{g/L}$).

BH	Minimum	Maximum	Mean	s.d.
Al	13.35	2,047.63	315.56	288.72
B	1.94	17.22	8.45	1.89
Ba	18.12	164.28	71.59	21.16
Cu	0.75	13.02	4.56	1.86
Fe	9.88	6,312.78	1,005.89	885.63
Li	0.97	15.35	5.27	2.26
Mn	2.01	761.46	170.82	103.23
Ni	0.28	6.86	1.95	0.87
Zn	5.77	90.09	21.77	11.45

Table S3. Correlation matrix of trace elements in shallow wells (SW).

	Li	B	Ba	Al	Mn	Ni	Cu	Fe	Zn
Li	1.00								
B	-0.29	1.00							
Ba	0.10	0.26	1.00						
Al	-0.31	0.99	0.21	1.00					
Mn	-0.15	0.97	0.14	0.96	1.00				
Ni	-0.28	0.99	0.23	0.99	0.97	1.00			
Cu	-0.25	0.99	0.24	0.99	0.97	1.00	1.00		
Fe	-0.07	0.93	0.11	0.93	0.99	0.94	0.94	1.00	
Zn	-0.27	0.99	0.24	0.99	0.97	1.00	1.00	0.94	1.00

Table S4. Correlation matrix of trace elements in boreholes (BH).

	Fe	Li	B	Ba	Al	Mn	Ni	Cu	Zn
Fe	1.00								
Li	0.72	1.00							
B	0.76	0.84	1.00						
Ba	-0.44	0.11	-0.04	1.00					
Al	0.99	0.74	0.76	-0.42	1.00				
Mn	0.95	0.68	0.86	-0.45	0.95	1.00			
Ni	0.94	0.59	0.58	-0.48	0.94	0.84	1.00		
Cu	0.73	0.70	0.62	0.13	0.75	0.63	0.72	1.00	
Zn	-0.14	-0.18	-0.18	0.47	-0.12	-0.21	-0.02	0.49	1.00

Table S5. Summary of Levene's test results for homogeneity of variance in concentrations of physiochemical parameters.

Parameter	DF	Group	F-value	Pr(>F)
T (°C)	17	70	0.6383	0.8495
pH	17	70	1.1817	0.302
EC (µS/cm)			2.0571	0.01868*
Eh (mV)			1.1707	0.3108
TDS (mg/L)			1.4886	0.1247

Table S6. Summary of Levene's test results for homogeneity of variance in major ions concentrations.

Parameter	DF	Group	F-value	Pr(>F)
HCO ₃ ⁻ (mg/L)	17	70	0.6351	0.8523
Cl ⁻ (mg/L)			1.5392	0.1064
SO ₄ ²⁻ (mg/L)			0.6576	0.8324
Na ⁺ (mg/L)			1.3863	0.1701
Mg ²⁺ (mg/L)			0.8891	0.5885
K ⁺ (mg/L)			1.1946	0.2919
Ca ²⁺ (mg/L)			1.6984	0.06363

Table S7. Summary of Levene's test results for homogeneity of variance in F⁻, As(T) and As(III) concentrations.

Parameter	DF	Group	F-value	Pr(>F)
F ⁻ (mg/L)	17	70	1.832	0.04066*
As(T) (µg/L)			1.3534	0.1874
As(III) (µg/L)			0.409	0.979

Table S8. Summary statistics of the mean variation between water quality parameters in drinking water sources from SW and BH within the Gold mining areas of Geita district in Northwestern Tanzania.

Parameter	Kruskal-Wallis chi-squared	df	p-value	Remarks
Temperature	0.05267	1	0.8185	Not significant
pH	3.0627	1	0.0801	Not significant
EC ($\mu\text{S/cm}$)	6.429	1	0.0112	Significant
Eh (mV)	0.10422	1	0.7468	Not significant
TDS (mg/L)	7.4809	1	0.0062	Significant
HCO_3^- (mg/L)	3.275	1	0.0703	Not significant
Cl^- (mg/L)	2.1845	1	0.1394	Not significant
SO_4^{2-} (mg/L)	0.53985	1	0.4625	Not significant
NO_3^- (mg/L)	0.09883	1	0.7532	Not significant
Na^+ (mg/L)	0.97096	1	0.3244	Not significant
Mg^{2+} (mg/L)	10.926	1	0.0009	Significant
K^+ (mg/L)	4.7668	1	0.0290	Significant
Ca^{2+} (mg/L)	0.40585	1	0.5241	Not significant
F^- (mg/L)	6.3517	1	0.0117	Significant
As(T) ($\mu\text{g/L}$)	0.4365	1	0.5088	Not significant
As(III) ($\mu\text{g/L}$)	0.4365	1	0.5088	Not significant

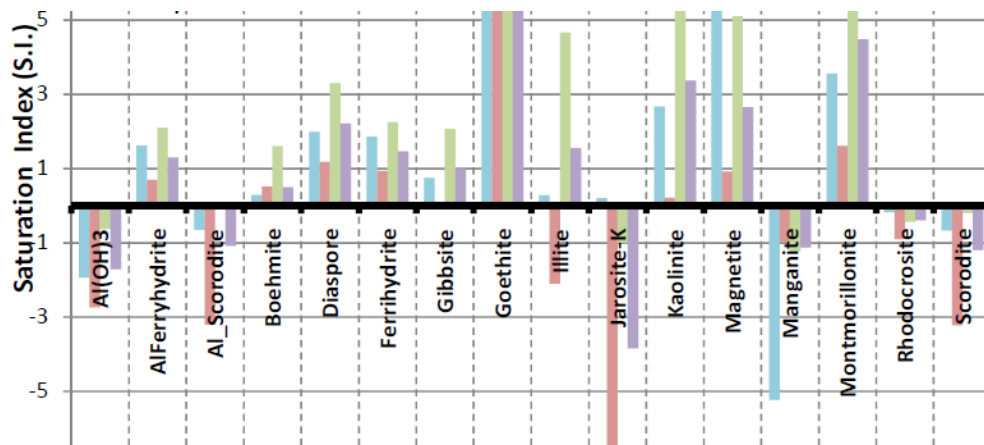


Figure S1. Saturation indices for selected As minerals phases controlling the water chemistry.

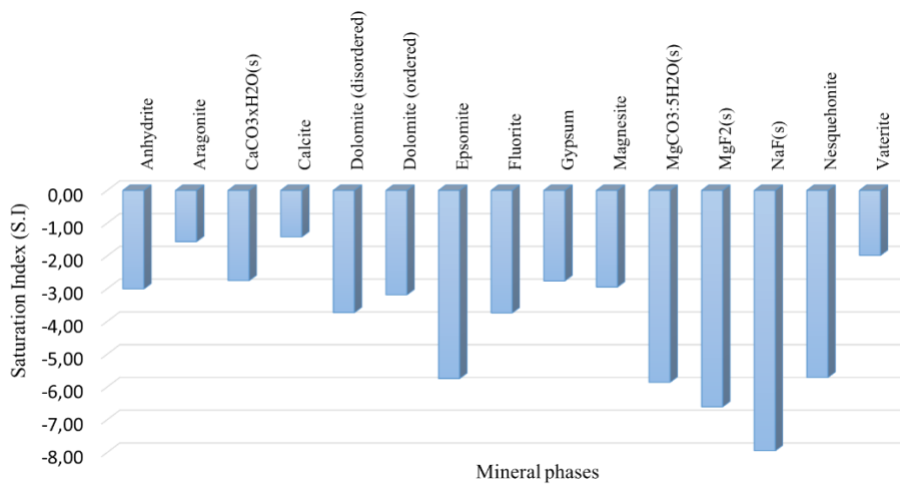


Figure S2. Saturation indices for selected minerals phases, all minerals are under saturated, this is reflected on the low concentrations of fluoride in the water samples.