Table S1: Geo-accumulation indices (relative to the upper continental crust's elemental compositions: Rudnick and Gao[54]) and the associated classification for the determining elements in the analyzed sediment samples (Punarbhaba river, Bangladesh).

Sample ID	Sc	Ti	V	Fe	La	Ce	Sm	Eu	Yb	Lu	Hf	Ta	Th	U
	[μg/g]	[%]	[μg/g]	[%]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]
This work														
P-1.1	-0.79	-0.37	-1.28	-0.72	0.23	1.58	0.29	-0.18	-0.09	0.16	0.057	0.25	0.84	0.78
P-1.2	-1.28	-1.25	-1.57	-1.12	1.36	0.58	0.84	0.03	-0.13	0.13	-0.31	-0.85	1.52	0.42
P-1.3	-1.78	-0.31	-2.23	-1.45	-1.03	-0.75	-1.37	1.09	-0.64	-0.68	0.53	-0.89	-0.81	-1.47
P-2.1	-0.52	-0.66	-0.81	-0.43	0.28	0.07	0.19	-0.36	-0.96	0.61	-0.22	0.32	0.66	0.83
P-2.2	-0.27	0.03	-0.48	-0.24	0.29	-0.02	0.04	-0.17	0.34	0.46	-0.41	0.29	0.65	0.98
P-2.3	-0.27	-0.22	-0.62	-0.19	0.30	0.01	0.06	0.55	0.25	0.71	-0.32	0.19	0.59	1.05
P-3.1	-2.46	-0.66	-2.48	-2.16	-0.38	-0.68	-0.81	0.63	-0.56	-0.08	-1.78	-2.22	-0.54	-0.72
P-3.2	-2.18	-1.13	-2.66	-2.13	-0.64	-0.89	-0.85	0.79	-0.44	-0.15	-1.79	-1.32	-0.49	-0.36
P-3.3	-1.85	-0.34	-1.94	-1.83	-1.08	-1.01	-1.44	-0.37	-1.02	-0.73	-0.93	-1.05	-0.91	-1.12
P-4.1	-2.09	-0.13	-2.79	-2.03	-1.11	-0.86	-1.55	0.60	-1.27	-0.29	-1.95	-2.03	-0.86	-1.31
P-4.2	-1.99	-0.25	-2.79	-1.87	-1.11	-0.89	-1.33	-0.72	-0.79	-0.78	-1.89	-0.81	-1.39	-1.03
P-4.3	-2.06	-1.03	-2.43	-1.89	-1.45	-1.04	-1.75	0.93	-1.04	-0.54	-1.59	-1.22	-1.61	-1.39
P-5.1	-0.81	-1.25	-1.16	-0.68	-0.05	0.39	0.02	-0.22	-0.47	0.27	-0.06	-0.09	-2.76	0.23
P-5.2	-0.85	-0.75	-1.35	-0.58	0.06	0.65	0.10	1.06	0.34	0.53	0.33	-0.21	0.66	0.59
P-5.3	-0.61	-0.97	-0.99	-0.53	-0.15	0.21	0.07	-0.31	0.11	0.48	-0.22	0.07	0.42	0.42
P-6.1	-2.02	-0.88	-3.01	-1.83	-1.91	-1.10	-1.76	0.53	-1	-0.73	-1.45	0.27	-1.11	-1.31
P-6.2	-1.99	-1.66	-2.86	-1.79	-1.78	-0.98	-1.97	0.79	-0.50	-0.54	-1.45	1.53	-1.56	-2.47
P-6.3	-1.67	-1.75	-2.38	-1.44	-2.04	-1.17	-1.95	-0.31	-0.04	-0.11	-0.06	-0.99	-1.34	-1.35
P-7.1	-1.99	-0.51	-2.18	-1.79	-1.16	-0.37	-1.16	-0.18	-1.14	-0.84	-1.31	1.37	-0.89	-0.58
P-7.2	-2.13	-1.66	-2.94	-2.16	-1.17	-0.37	-1.48	-0.64	-1	-0.78	-1.89	0.77	-0.70	0.11
P-7.3	-1.95	-1.44	-2.59	-2.04	-1.88	-1.07	-1.67	0.64	-0.75	-0.49	-1.55	-1.95	-1.41	-1.28
P-8.1	-1.04	-1.51	-1.54	-1.03	0.85	0.15	-0.07	-0.15	0.29	0.42	0.77	-0.19	1.37	0.89
P-8.2	-1.09	-1.37	-1.46	-1.06	0.38	-0.37	0.35	0.09	-0.39	0.13	0.03	-0.21	1.02	0.13
P-8.3	-1.02	-0.66	-1.21	-1.02	-0.05	-0.75	0.10	-0.29	-0.04	0.05	0.10	-0.91	0.71	0.71
P-9.1	-4.15	-1.51	-2.38	-1.41	-3.50	-1.39	-0.16	-0.36	-0.11	0.16	0.19	-0.75	-3.25	0.55
P-9.2	-2.02	-0.83	-2.38	-1.87	-1.35	-0.41	-2.25	-0.15	-0.57	-0.58	-1.62	-0.31	-1.97	-1.31
P-9.3	-2.23	-1.37	-2.33	-1.62	-1.02	0.25	-0.99	0.16	-1.51	-1.29	-1.43	-0.24	-0.74	-1.15
P-10.1	-1.80	-0.62	-2.38	-1.56	-1.07	-0.04	-0.89	0.39	-0.38	-0.18	-1.13	-1.40	-0.76	-1.08
P-10.2	-2.12	-0.79	-1.38	-1.29	-0.96	0.08	-0.74	-0.79	-0.24	0.13	-1.19	-0.51	-0.29	-0.05
P-10.3	-1.98	-1.25	-2.94	-1.89	-2.22	-0.37	-2.21	-0.93	-1.12	-0.63	-1.59	-0.39	-1.89	0.20
Mean (n=30)	**-1.63**	**-0.90**	**-1.99**	**-1.39**	**-0.78**	**-0.35**	**-0.81**	**0.07**	**-0.49**	**-0.17**	**-0.81**	**-0.45**	**-0.56**	**-0.34**
Min.	-4.15	-1.75	-3.01	-2.16	-3.50	-1.39	-2.25	-0.93	-1.51	-1.29	-1.95	-2.22	-3.25	-2.47
Max.	-0.27	0.03	-0.48	-0.19	1.36	1.58	0.84	1.08	0.34	0.71	0.77	1.53	1.52	1.05

I_{geo} value	Class	Quality of sediment
$I_{geo} \leq 0$	0	Practically unpolluted
$0 < I_{geo} < 1$	1	Unpolluted to moderately polluted
$1 < I_{geo} < 2$	2	Moderately polluted
$2 < I_{geo} < 3$	3	Moderately to heavily polluted
$3 < I_{geo} < 4$	4	Heavily polluted
$4 < I_{geo} < 5$	5	Heavily to extremely polluted
$I_{geo} > 5$	6	Extremely polluted

Table S2: Enrichment factor (relative to the upper continental crust's elemental compositions: Rudnick and Gao[54]) and the associated classification for the determined elements in the analyzed sediment samples (Punarbhaba river, Bangladesh).

Sample ID	Sc	Ti	V	Fe	La	Ce	Sm	Eu	Yb	Lu	Hf	Ta	Th	U
	[μg/g]	[%]	[μg/g]	[%]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]	[μg/g]
This work														
P-1.1	0.951	1.27	0.68	1	1.93	4.92	2.01	1.45	1.54	1.84	1.70	1.95	2.95	2.83
P-1.2	0.89	0.91	0.73	1	5.56	3.24	3.87	2.21	1.99	2.38	1.75	1.21	6.21	2.89
P-1.3	0.79	2.21	0.58	1	1.34	1.62	1.06	5.82	1.75	1.71	3.96	1.48	1.56	0.99

P-2.1	0.94	0.85	0.77	1	1.64	1.41	1.54	1.05	0.69	2.06	1.16	1.68	2.13	2.39
P-2.2	0.98	1.20	0.85	1	1.44	1.16	1.22	1.05	1.49	1.63	0.89	1.45	1.86	2.33
P-2.3	0.95	0.98	0.75	1	1.41	1.15	1.19	1.67	1.35	1.87	0.91	1.31	1.73	2.36
P-3.1	0.81	2.81	0.80	1	3.42	2.78	2.54	6.89	3.01	4.23	1.29	0.96	3.05	2.71
P-3.2	0.97	2.00	0.69	1	2.81	2.37	2.44	7.64	3.23	3.96	1.26	1.76	3.12	3.42
P-3.3	0.99	2.81	0.93	1	1.69	1.77	1.31	2.76	1.76	2.15	1.87	1.72	1.89	1.64
P-4.1	0.95	3.73	0.59	1	1.89	2.25	1.39	6.21	1.69	3.34	1.058	0.99	2.25	1.64
P-4.2	0.91	3.08	0.53	1	1.69	1.97	1.46	2.22	2.11	2.12	0.99	2.08	1.38	1.79
P-4.3	0.89	1.83	0.69	1	1.36	1.81	1.11	7.09	1.81	2.56	1.23	1.59	1.22	1.42
P-5.1	0.91	0.67	0.72	1	1.55	2.10	1.62	1.38	1.16	1.93	1.54	1.51	0.24	1.88
P-5.2	0.83	0.89	0.59	1	1.56	2.34	1.61	3.11	1.89	2.16	1.88	1.29	2.36	2.26
P-5.3	0.95	0.74	0.72	1	1.31	1.67	1.52	1.17	1.56	2.02	1.24	1.52	1.94	1.93
P-6.1	0.88	1.94	0.44	1	0.95	1.66	1.05	5.13	1.78	2.15	1.30	4.30	1.65	1.43
P-6.2	0.87	1.099	0.48	1	1.01	1.77	0.89	6.01	2.46	2.39	1.27	10.03	1.18	0.63
P-6.3	0.86	0.81	0.52	1	0.66	1.21	0.70	2.20	2.64	2.52	2.62	1.37	1.08	1.07
P-7.1	0.88	2.44	0.77	1	1.56	2.69	1.56	3.06	1.58	1.95	1.40	9.02	1.87	2.32
P-7.2	1.028	1.41	0.58	1	1.97	3.44	1.59	2.85	2.23	2.59	1.20	7.59	2.74	4.82
P-7.3	1.07	1.51	0.68	1	1.11	1.96	1.29	6.39	2.45	2.92	1.40	1.07	1.54	1.69
P-8.1	0.10	0.72	0.70	1	3.69	2.28	1.95	1.84	2.51	2.73	3.49	1.79	5.31	3.81
P-8.2	0.98	0.80	0.76	1	2.71	1.61	2.65	2.22	1.59	2.29	2.13	1.81	4.22	2.28
P-8.3	0.10	1.28	0.88	1	1.96	1.20	2.18	1.65	1.97	2.09	2.18	1.08	3.31	3.32
P-9.1	0.15	0.93	0.51	1	0.23	1.01	2.36	2.07	2.45	2.96	3.04	1.57	0.28	3.88
P-9.2	0.91	2.08	0.71	1	1.45	2.78	0.78	3.33	2.49	2.47	1.20	2.99	0.94	1.48
P-9.3	0.66	1.19	0.61	1	1.52	3.65	1.55	3.45	1.08	1.26	1.15	2.59	1.85	1.39
P-10.1	0.84	1.91	0.57	1	1.39	2.86	1.58	3.86	2.26	2.59	1.34	1.11	1.74	1.39
P-10.2	0.56	1.41	0.94	1	1.25	2.58	1.46	1.42	2.07	2.68	1.07	1.72	1.99	2.36
P-10.3	0.94	1.56	0.48	1	0.79	2.86	0.79	1.95	1.70	2.39	1.22	2.82	0.99	4.26
Mean(n=30)	**0.88**	**1.57**	**0.67**	**1**	**1.76**	**2.20**	**1.61**	**3.30**	**1.94**	**2.39**	**1.63**	**2.45**	**2.15**	**2.29**
Min.	0.15	0.67	0.44	1	0.23	1.01	0.70	1.05	0.69	1.26	0.89	0.96	0.24	0.63
Max.	1.07	3.73	0.94	1	5.56	4.92	3.87	7.64	3.23	4.22	3.96	10.03	6.21	4.82

EF value	Remarks
EF < 1	no enrichment
EF < 3	minor enrichment
EF 3 - 5	moderate enrichment
EF 5 - 10	moderately severe enrichment
EF 10 - 25	severe enrichment
EF 25 - 50	very severe enrichment
EF > 50	extremely severe enrichment

Table S3: Calculated results of element-specific contamination factor (CF).

Sample ID	Sc [µg/g]	Ti [%]	V [µg/g]	Fe [%]	La [µg/g]	Ce [µg/g]	Sm [µg/g]	Eu [µg/g]	Yb [µg/g]	Lu [µg/g]	Hf [µg/g]	Ta [µg/g]	Th [µg/g]	U [µg/g]
This work														
P-1.1	0.87	1.16	0.62	0.91	1.76	4.48	1.83	1.32	1.405	1.68	1.55	1.78	2.69	2.58
P-1.2	0.62	0.63	0.51	0.69	3.85	2.24	2.68	1.53	1.375	1.65	1.21	0.83	4.29	2
P-1.3	0.44	1.21	0.32	0.55	0.73	0.89	0.58	3.19	0.96	0.94	2.17	0.81	0.86	0.54
P-2.1	1.05	0.95	0.86	1.11	1.83	1.57	1.711	1.17	0.77	2.29	1.29	1.87	2.37	2.67
P-2.2	1.24	1.53	1.07	1.27	1.83	1.48	1.54	1.33	1.89	2.06	1.13	1.83	2.36	2.96
P-2.3	1.25	1.29	0.98	1.31	1.85	1.51	1.56	2.2	1.78	2.45	1.19	1.72	2.27	3.10
P-3.1	0.27	0.95	0.27	0.34	1.15	0.94	0.86	2.32	1.02	1.42	0.44	0.32	1.03	0.91
P-3.2	0.33	0.681	0.24	0.34	0.96	0.81	0.83	2.61	1.11	1.35	0.43	0.6	1.07	1.17
P-3.3	0.42	1.18	0.39	0.42	0.71	0.75	0.55	1.16	0.74	0.90	0.79	0.72	0.79	0.69
P-4.1	0.35	1.37	0.22	0.37	0.69	0.83	0.51	2.28	0.62	1.23	0.39	0.37	0.82	0.60

P-4.2	0.38	1.26	0.22	0.41	0.69	0.81	0.59	0.91	0.87	0.87	0.41	0.86	0.57	0.74
P-4.3	0.36	0.74	0.28	0.40	0.55	0.73	0.45	2.86	0.73	1.03	0.49	0.64	0.49	0.57
P-5.1	0.86	0.63	0.67	0.94	1.45	1.97	1.52	1.29	1.09	1.81	1.44	1.41	0.22	1.76
P-5.2	0.84	0.89	0.59	1.00	1.56	2.35	1.61	3.12	1.9	2.16	1.88	1.3	2.36	2.27
P-5.3	0.98	0.76	0.75	1.04	1.35	1.73	1.57	1.21	1.62	2.09	1.29	1.58	2.01	2.00
P-6.1	0.37	0.82	0.19	0.42	0.4	0.69	0.44	2.16	0.75	0.90	0.55	1.81	0.70	0.60
P-6.2	0.38	0.47	0.21	0.43	0.44	0.76	0.38	2.59	1.06	1.03	0.55	4.32	0.51	0.27
P-6.3	0.47	0.43	0.29	0.55	0.36	0.67	0.39	1.21	1.46	1.39	1.44	0.76	0.59	0.59
P-7.1	0.38	1.05	0.33	0.43	0.67	1.16	0.67	1.32	0.68	0.84	0.61	3.89	0.81	1
P-7.2	0.34	0.47	0.19	0.34	0.66	1.16	0.54	0.96	0.75	0.87	0.40	2.56	0.92	1.62
P-7.3	0.39	0.55	0.25	0.36	0.41	0.71	0.47	2.33	0.89	1.06	0.51	0.39	0.56	0.62
P-8.1	0.73	0.53	0.52	0.73	2.71	1.67	1.43	1.35	1.84	2	2.55	1.31	3.89	2.79
P-8.2	0.70	0.58	0.55	0.72	1.95	1.16	1.91	1.6	1.14	1.65	1.53	1.3	3.04	1.64
P-8.3	0.74	0.95	0.65	0.74	1.45	0.89	1.61	1.22	1.46	1.55	1.61	0.8	2.45	2.46
P-9.1	0.08	0.53	0.29	0.57	0.13	0.57	1.34	1.17	1.39	1.68	1.72	0.89	0.16	2.19
P-9.2	0.37	0.84	0.29	0.41	0.59	1.13	0.31	1.35	1.01	1	0.49	1.21	0.38	0.60
P-9.3	0.32	0.58	0.30	0.49	0.74	1.78	0.75	1.68	0.53	0.61	0.56	1.27	0.9	0.68
P-10.1	0.43	0.97	0.29	0.51	0.71	1.46	0.81	1.97	1.16	1.32	0.68	0.57	0.89	0.71
P-10.2	0.35	0.87	0.58	0.61	0.77	1.59	0.89	0.87	1.27	1.65	0.66	1.06	1.23	1.45
P-10.3	0.38	0.63	0.19	0.41	0.32	1.16	0.32	0.79	0.69	0.97	0.49	1.14	0.40	1.73
Mean(n=30)	**0.56**	**0.85**	**0.44**	**0.63**	**1.11**	**1.32**	**1.02**	**1.70**	**1.13**	**1.42**	**1.02**	**1.33**	**1.39**	**1.45**
Min.	0.08	0.45	0.19	0.34	0.13	0.57	0.31	0.79	0.53	0.61	0.39	0.32	0.16	0.27
Max.	1.25	1.53	1.07	1.31	3.85	4.48	2.68	3.19	1.9	2.45	2.55	4.32	4.29	3.10

CF<1	Low Contamination
1≤ CF <3	Moderate Contamination
3≤CF<6	Considerable Contamination
CF≥6	Very High Contamination

Table S4: Calculated results of site-specific environmental indices (C_d, mC_d ,and PLI).

Sample ID	Degree of Contamination (C_d)	Modified degree of Contamination (mC_d)	Pollution Load Index (PLI)
	$C_d = \sum CF$	$mC_d = \frac{1}{n}\sum_{i=1}^{n} CF_i$	PLI= $(CF1*CF2*....CFn)^{(1/n)}$
This work			
P-1.1	24.62	1.76	1.56
P-1.2	24.10	1.72	1.38
P-1.3	14.18	1.01	0.84
P-1	**20.97**	**1.49**	**1.26**
P-2.1	21.49	1.53	1.43
P-2.2	23.53	1.68	1.61
P-2.3	24.47	1.75	1.66
P-2	**23.16**	**1.65**	**1.57**
P-3.1	12.22	0.87	0.72
P-3.2	12.54	0.89	0.74
P-3.3	10.22	0.73	0.69
P-3	**11.66**	**0.83**	**0.72**
P-4.1	10.64	0.76	0.62
P-4.2	9.58	0.68	0.63
P-4.3	10.33	0.74	0.61
P-4	**10.18**	**0.73**	**0.62**

P-5.1	17.05	1.22	1.08
P-5.2	23.84	1.70	1.54
P-5.3	19.99	1.43	1.36
P-5	**20.29**	**1.45**	**1.33**
P-6.1	10.80	0.77	0.64
P-6.2	13.39	0.96	0.64
P-6.3	10.61	0.76	0.65
P-6	**11.6**	**0.83**	**0.64**
P-7.1	13.84	0.99	0.79
P-7.2	11.79	0.84	0.68
P-7.3	9.52	0.68	0.57
P-7	**11.72**	**0.84**	**0.68**
P-8.1	24.03	1.72	1.44
P-8.2	19.46	1.39	1.24
P-8.3	18.57	1.31	1.21
P-8	**20.69**	**1.47**	**1.29**
P-9.1	12.71	0.91	0.61
P-9.2	9.98	0.71	0.63
P-9.3	11.18	0.79	0.69
P-9	**11.29**	**0.80**	**0.64**
P-10.1	12.48	0.89	0.79
P-10.2	13.83	0.99	0.91
P-10.3	9.64	0.69	0.58
P-10	**11.98**	**0.86**	**0.76**
Mean	**15.35**	**1.096**	**0.95**

Classification	**Degree**
$C_d < 8$	Low contamination
$8 \le C_d < 16$	Moderate contamination
$16 \le C_d < 32$	Considerable contamination
$C_d \ge 32$	Very High contamination

$mC_d < 1.5$	Nil to very low contamination
$1.5 \le mC_d < 2$	Low contamination
$2 \le mC_d < 4$	Moderate contamination
$4 \le mC_d < 8$	Considerable contamination
$8 \le mC_d < 16$	Very High contamination
$16 \le mC_d < 32$	Extremely High contamination
$mC_d > 32$	Ultra-High contamination

PLI=0	Perfection
PLI<1	Baseline Level
PLI>1	Contaminated Level

Table S5 : Principal component analysis (PCA) for elements in the sediments of the Punarbhaba river.

Chemical Components	Principle Components				
	PC 1	PC 2	PC 3	PC 4	PC 5
Sc	**.800**	.385	.078	.281	.174
Ti	.172	.054	.108	**.894**	-.070
V	**.844**	.343	-.016	.292	.084
Fe	**.840**	.376	.100	.202	.149
La	.513	**.704**	.002	-.051	-.203
Ce	.110	**.925**	.029	**.086**	.181
Sm	**.605**	**.677**	-.027	-.073	-.182
Eu	-.181	-.110	**.893**	.123	-.041
Yb	**.721**	.292	.374	-.217	-.072
Lu	**.829**	.339	.176	-.010	-.083
∑LREE	.294	**.951**	.020	.039	.047
∑HREE	**.505**	.183	**.821**	-.079	-.086
∑REE	.300	**.948**	.034	.038	.045
Hf	**.629**	.290	.226	-.343	-.158
Ta	.094	.029	-.087	-.077	**.933**
Th	**.563**	**.656**	.025	-.090	-.183
U	**.796**	.436	-.138	.004	-.018
^{226}Ra	**.908**	.130	-.042	.254	.127
^{232}Th	**.838**	.257	.024	-.011	.081
^{40}K	**.711**	-.008	-.238	.509	-.146
Eigenvalues	10.959	2.192	1.880	1.235	1.107
% of Variance	54.797	10.959	9.402	6.177	5.535
Cumulative %	54.797	65.755	75.158	81.335	86.870

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table S6: Correlation matrix for the analysed parameters in the sediment samples Punarbhaba river, Bangladesh.

	Sc	Ti	V	Fe	La	Ce	Sm	Eu	Yb	Lu	∑LREE	∑HREE	∑REE	Hf	Ta	Th	U	^{226}Ra	^{232}Th	^{40}K
Sc	1																			
Ti	.358	1																		
V	.930**	.383*	1																	
Fe	.945**	.317	.958**	1																
La	.634**	.076	.614**	.589**	1															
Ce	.503**	.138	.462*	.523**	.543**	1														
Sm	.666**	.060	.721**	.729**	.870**	.599**	1													
Eu	-.092	.082	-.195	-.114	-.083	-.142	-.158	1												
Yb	.625**	.082	.648**	.701**	.532**	.366*	.607**	-.002	1											
Lu	.795**	.147	.840**	.875**	.627**	.419*	.758**	-.061	.787**	1										
∑LREE	.622**	.130	.587**	.623**	.795**	.941**	.792**	-.139	.484**	.563**	1									
∑HREE	.487**	.126	.447*	.537**	.405*	.226	.430*	.591**	.801**	.646**	.329	1								
∑REE	.627**	.131	.592**	.628**	.797**	.940**	.795**	-.128	.495**	.571**	1.000**	.344	1							
Hf	.479**	-.040	.482**	.572**	.503**	.343	.590**	.011	.657**	.589**	.456*	.543**	.463*	1						
Ta	.165	-.090	.107	.144	-.027	.126	-.025	-.099	-.028	-.038	.079	-.085	.077	-.065	1					
Th	.628**	.080	.606**	.585**	.928**	.532**	.833**	-.085	.596**	.630**	.759**	.449*	.762**	.563**	.005	1				
U	.759**	.150	.807**	.818**	.652**	.518**	.778**	-.320	.684**	.827**	.645**	.396*	.648**	.580**	.087	.693**	1			
^{226}Ra	.879**	.337	.884**	.862**	.561**	.253	.570**	-.139	.549**	.732**	.412*	.397*	.417*	.481**	.174	.586**	.744**	1		
^{232}Th	.774**	.177	.731**	.749**	.642**	.345	.602**	-.139	.642**	.693**	.509**	.457*	.514**	.651**	.153	.688**	.680**	.875**	1	
^{40}K	.613**	.511**	.698**	.601**	.402*	.061	.469**	-.177	.258	.515**	.212	.142	.213	.249	-.013	.427*	.634**	.761**	.560**	1

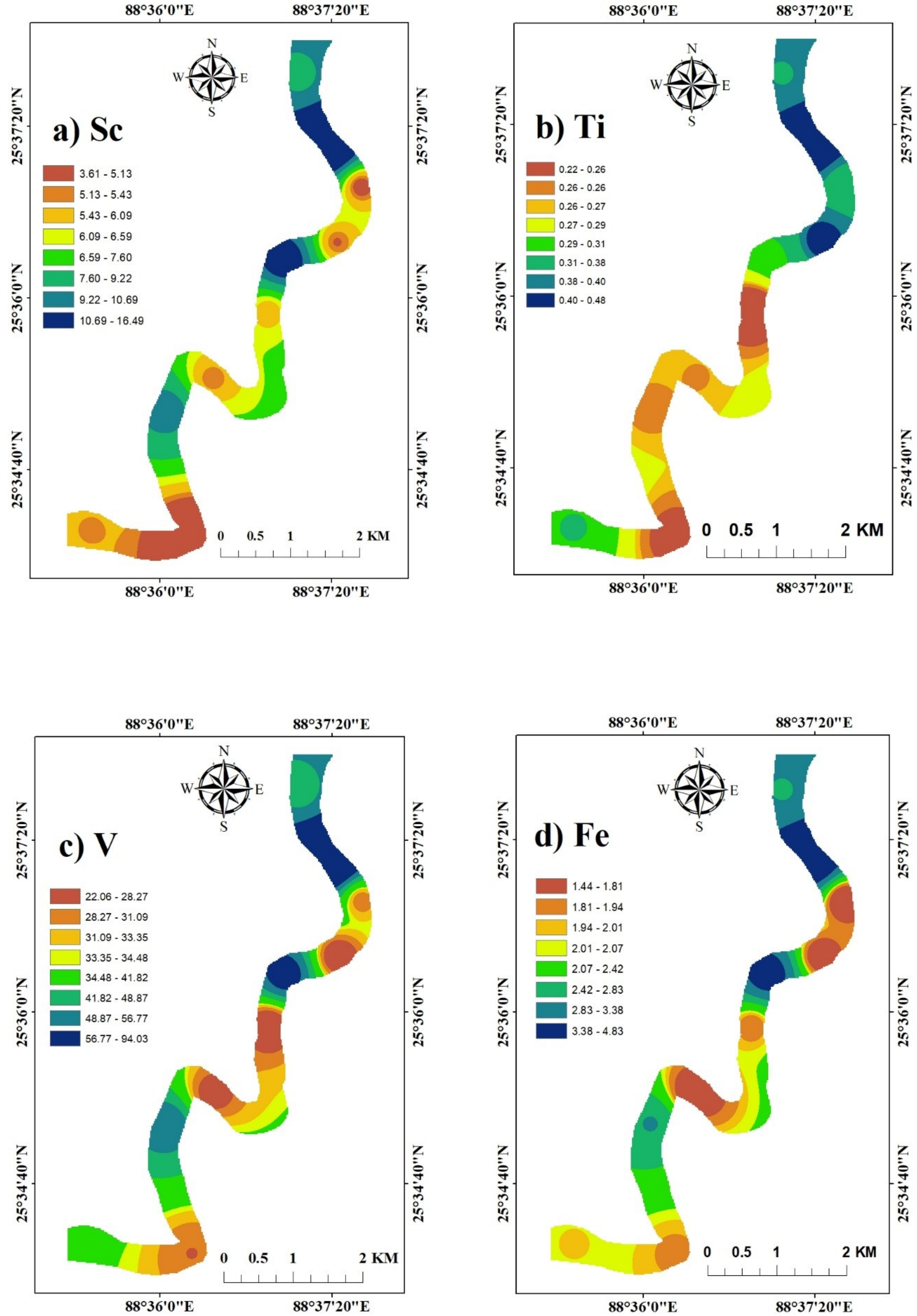
**. Correlation is significant at the 0.01 level (2-tailed).

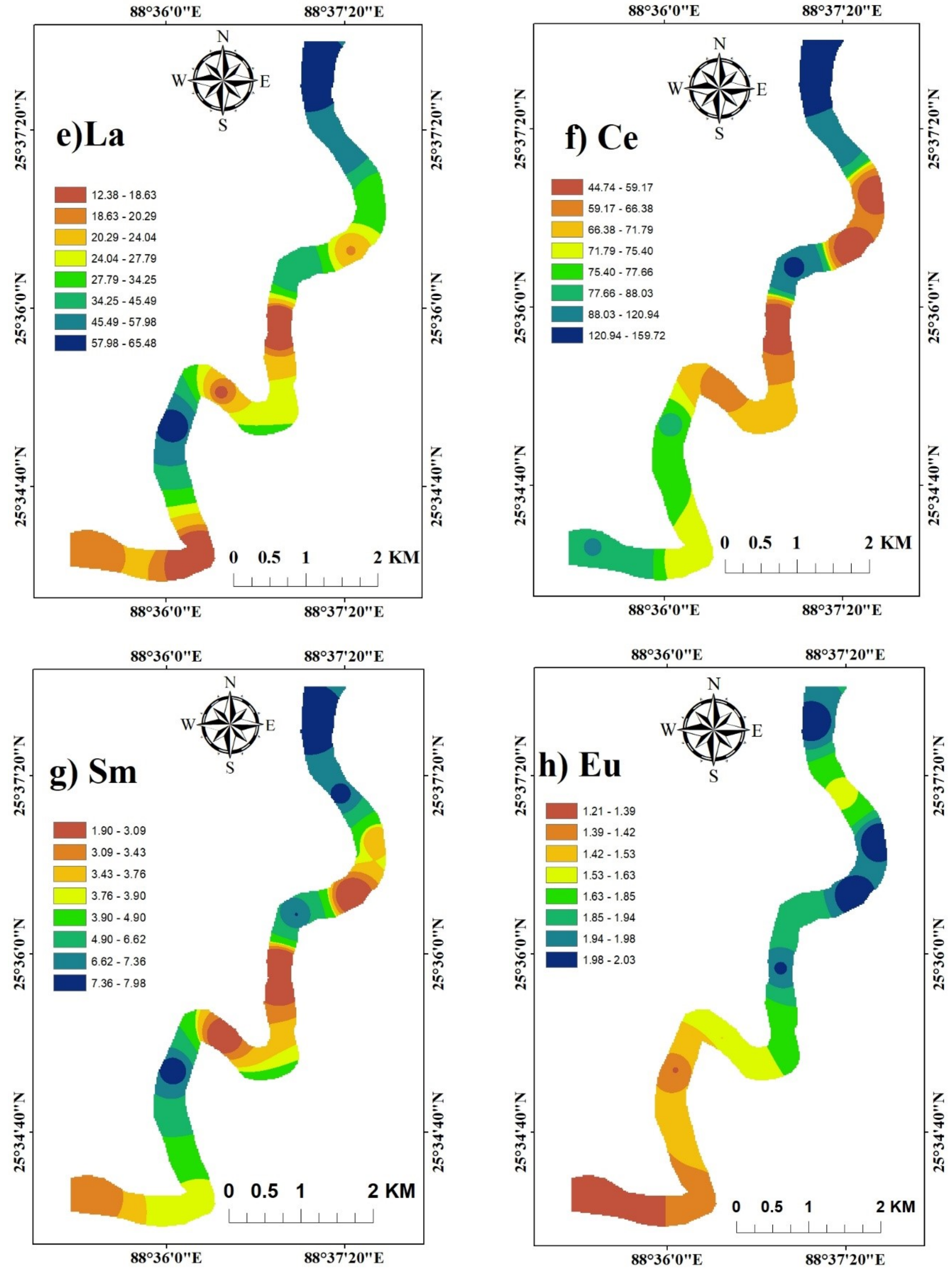
*. Correlation is significant at the 0.05 level (2-tailed).

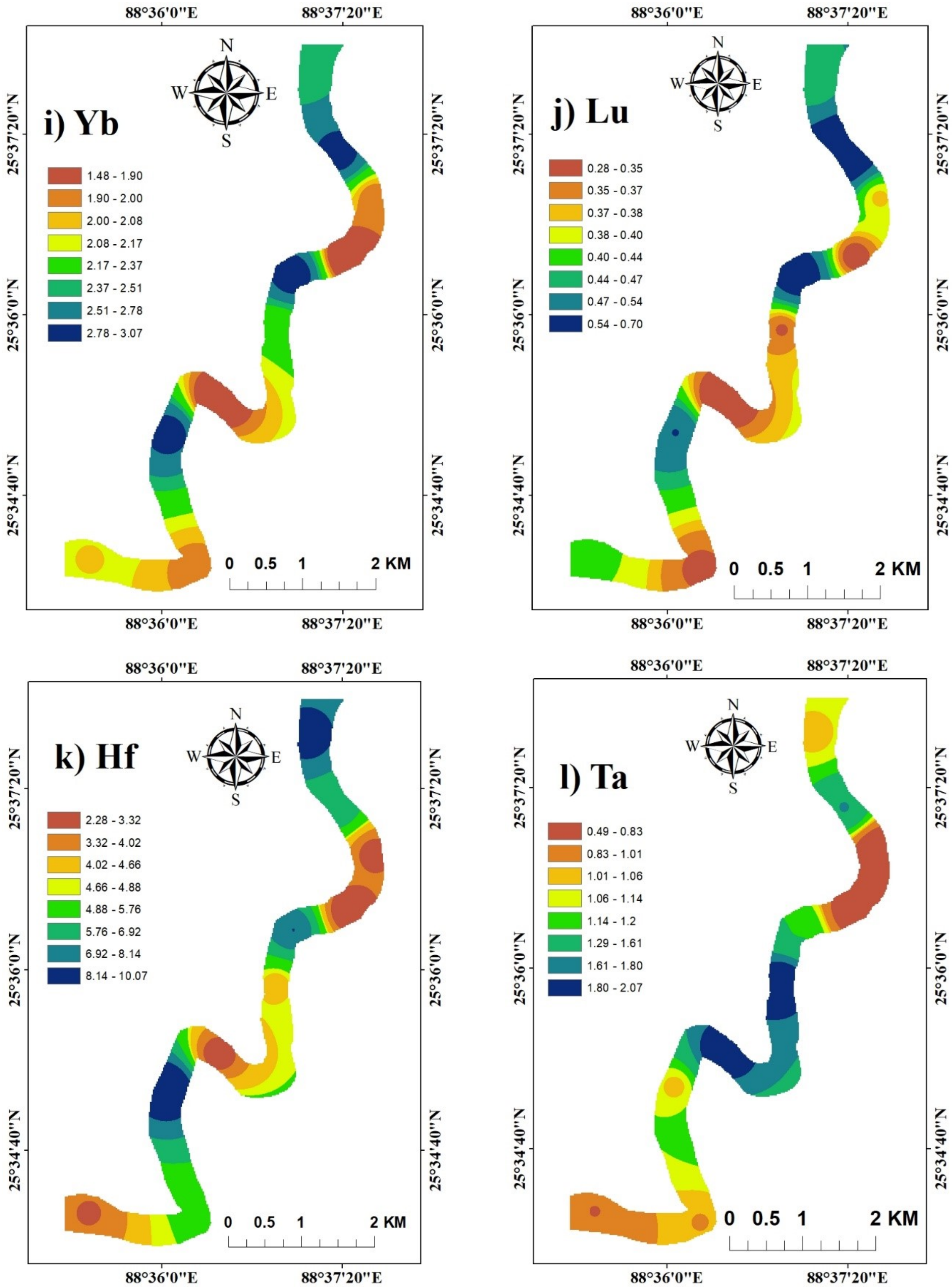
Table S7: Source apportioning contributions of metal(oid)s in Punarbhaba River sediment by the positive matrix factorization (PMF) model.

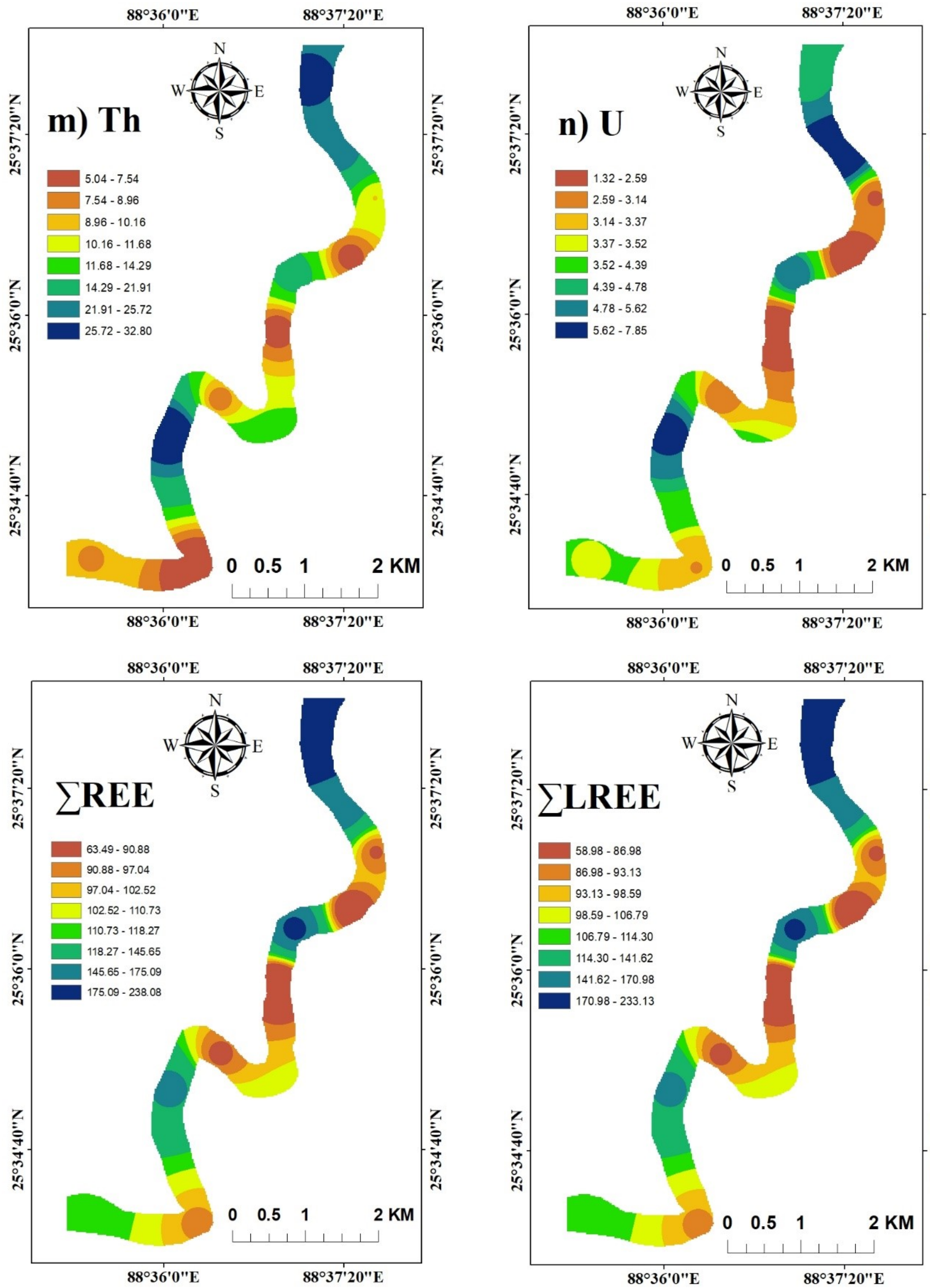
	Profile Contribution (μg/g)				
Element	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
Sc	1.70	4.53	0.86	0.96	0.07
Ti	0.06	0.08	0.05	0.15	0.00
V	6.76	26.13	3.80	7.50	0.00
Fe	0.61	1.26	0.31	0.32	0.03
La	0.00	12.87	2.72	2.60	16.15
Ce	4.48	19.75	42.70	9.13	7.06
Sm	0.33	1.85	0.71	0.71	1.44
Eu	1.08	0.00	0.24	0.25	0.19
Yb	0.95	0.65	0.28	0.18	0.24
Lu	0.13	0.16	0.05	0.09	0.04
∑LREE	4.74	34.60	46.17	12.43	24.53
∑HREE	2.09	0.74	0.59	0.47	0.50
∑REE	6.83	35.34	46.78	12.89	25.04
Hf	2.98	1.47	0.77	0.11	0.80
Ta	0.35	0.29	0.24	0.46	0.00
Th	0.97	6.67	1.61	0.00	5.97
U	0.70	1.95	0.53	0.96	0.30
^{226}Ra	11.85	39.79	0.00	16.92	0.72
^{232}Th	21.73	39.96	4.41	14.54	6.81
^{40}K	156.40	223.25	90.36	390.82	56.97

	Profile Contribution (%)				
Element	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
Sc	20.9	55.8	10.6	11.8	0.9
Ti	18.2	23.3	14.9	43.0	0.6
V	15.3	59.1	8.6	17.0	0.0
Fe	23.9	49.9	12.1	12.8	1.3
La	0.0	37.5	7.9	7.6	47.0
Ce	5.4	23.8	51.4	11.0	8.5
Sm	6.6	36.7	14.2	14.0	28.5
Eu	61.4	0.0	13.7	13.9	11.0
Yb	41.4	28.2	12.3	7.8	10.2
Lu	28.3	34.4	10.4	18.9	8.0
∑LREE	3.9	28.3	37.7	10.1	20.0
∑HREE	47.5	16.9	13.5	10.6	11.5
∑REE	5.4	27.9	36.9	10.2	19.7
Hf	48.7	24.0	12.6	1.7	13.0
Ta	26.1	21.5	17.7	34.6	0.0
Th	6.3	43.8	10.6	0.0	39.3
U	15.7	43.9	12.0	21.7	6.8
^{226}Ra	17.1	57.4	0.0	24.4	1.0
^{232}Th	24.8	45.7	5.0	16.6	7.8
^{40}K	17.0	24.3	9.8	42.6	6.2


a) Sc
3.61 - 5.13
5.13 - 5.43
5.43 - 6.09
6.09 - 6.59
6.59 - 7.60
7.60 - 9.22
9.22 - 10.69
10.69 - 16.49
b) Ti
0.22 - 0.26
0.26 - 0.26
0.26 - 0.27
0.27 - 0.29
0.29 - 0.31
0.31 - 0.38
0.38 - 0.40
0.40 - 0.48
c) V
22.06 - 28.27
28.27 - 31.09
31.09 - 33.35
33.35 - 34.48
34.48 - 41.82
41.82 - 48.87
48.87 - 56.77
56.77 - 94.03
d) Fe
1.44 - 1.81
1.81 - 1.94
1.94 - 2.01
2.01 - 2.07
2.07 - 2.42
2.42 - 2.83
2.83 - 3.38
3.38 - 4.83
88°36'0"E
88°37'20"E
25°37'20"N
25°36'0"N
25°34'40"N
N
S
E
W
0 0.5 1 2 KM


e)La
12.38 - 18.63
18.63 - 20.29
20.29 - 24.04
24.04 - 27.79
27.79 - 34.25
34.25 - 45.49
45.49 - 57.98
57.98 - 65.48
f) Ce
44.74 - 59.17
59.17 - 66.38
66.38 - 71.79
71.79 - 75.40
75.40 - 77.66
77.66 - 88.03
88.03 - 120.94
120.94 - 159.72
g) Sm
1.90 - 3.09
3.09 - 3.43
3.43 - 3.76
3.76 - 3.90
3.90 - 4.90
4.90 - 6.62
6.62 - 7.36
7.36 - 7.98
h) Eu
1.21 - 1.39
1.39 - 1.42
1.42 - 1.53
1.53 - 1.63
1.63 - 1.85
1.85 - 1.94
1.94 - 1.98
1.98 - 2.03
88°36'0"E
88°37'20"E
25°37'20"N
25°36'0"N
25°34'40"N
N
S
E
W
0 0.5 1 2 KM


i) Yb
1.48 - 1.90
1.90 - 2.00
2.00 - 2.08
2.08 - 2.17
2.17 - 2.37
2.37 - 2.51
2.51 - 2.78
2.78 - 3.07
j) Lu
0.28 - 0.35
0.35 - 0.37
0.37 - 0.38
0.38 - 0.40
0.40 - 0.44
0.44 - 0.47
0.47 - 0.54
0.54 - 0.70
k) Hf
2.28 - 3.32
3.32 - 4.02
4.02 - 4.66
4.66 - 4.88
4.88 - 5.76
5.76 - 6.92
6.92 - 8.14
8.14 - 10.07
l) Ta
0.49 - 0.83
0.83 - 1.01
1.01 - 1.06
1.06 - 1.14
1.14 - 1.2
1.29 - 1.61
1.61 - 1.80
1.80 - 2.07
N
S
E
W
0 0.5 1 2 KM
88°36'0"E
88°37'20"E
25°37'20"N
25°36'0"N
25°34'40"N


m) Th
5.04 - 7.54
7.54 - 8.96
8.96 - 10.16
10.16 - 11.68
11.68 - 14.29
14.29 - 21.91
21.91 - 25.72
25.72 - 32.80
n) U
1.32 - 2.59
2.59 - 3.14
3.14 - 3.37
3.37 - 3.52
3.52 - 4.39
4.39 - 4.78
4.78 - 5.62
5.62 - 7.85
∑REE
63.49 - 90.88
90.88 - 97.04
97.04 - 102.52
102.52 - 110.73
110.73 - 118.27
118.27 - 145.65
145.65 - 175.09
175.09 - 238.08
∑LREE
58.98 - 86.98
86.98 - 93.13
93.13 - 98.59
98.59 - 106.79
106.79 - 114.30
114.30 - 141.62
141.62 - 170.98
170.98 - 233.13
88°36'0"E
88°37'20"E
25°37'20"N
25°36'0"N
25°34'40"N
N
S
E
W
0 0.5 1 2 KM

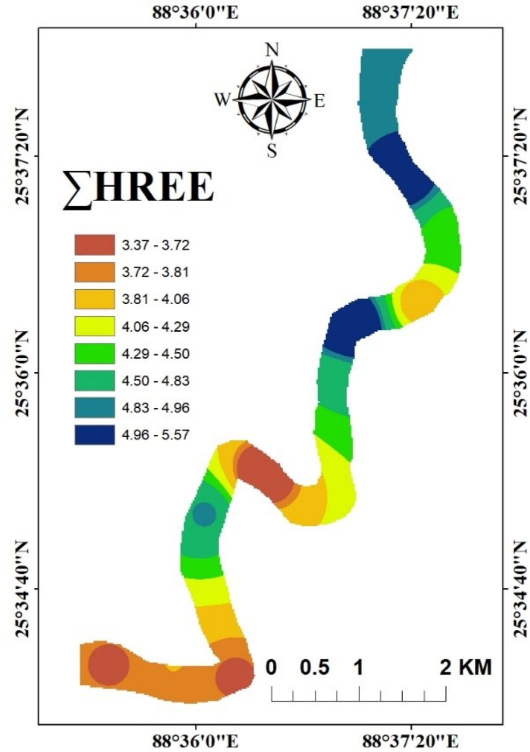


Fig. S1: Inverse distance weighting (IDW) map for the spatial distribution of elemental abundances in the Punarbhaba river basin, Bangladesh.

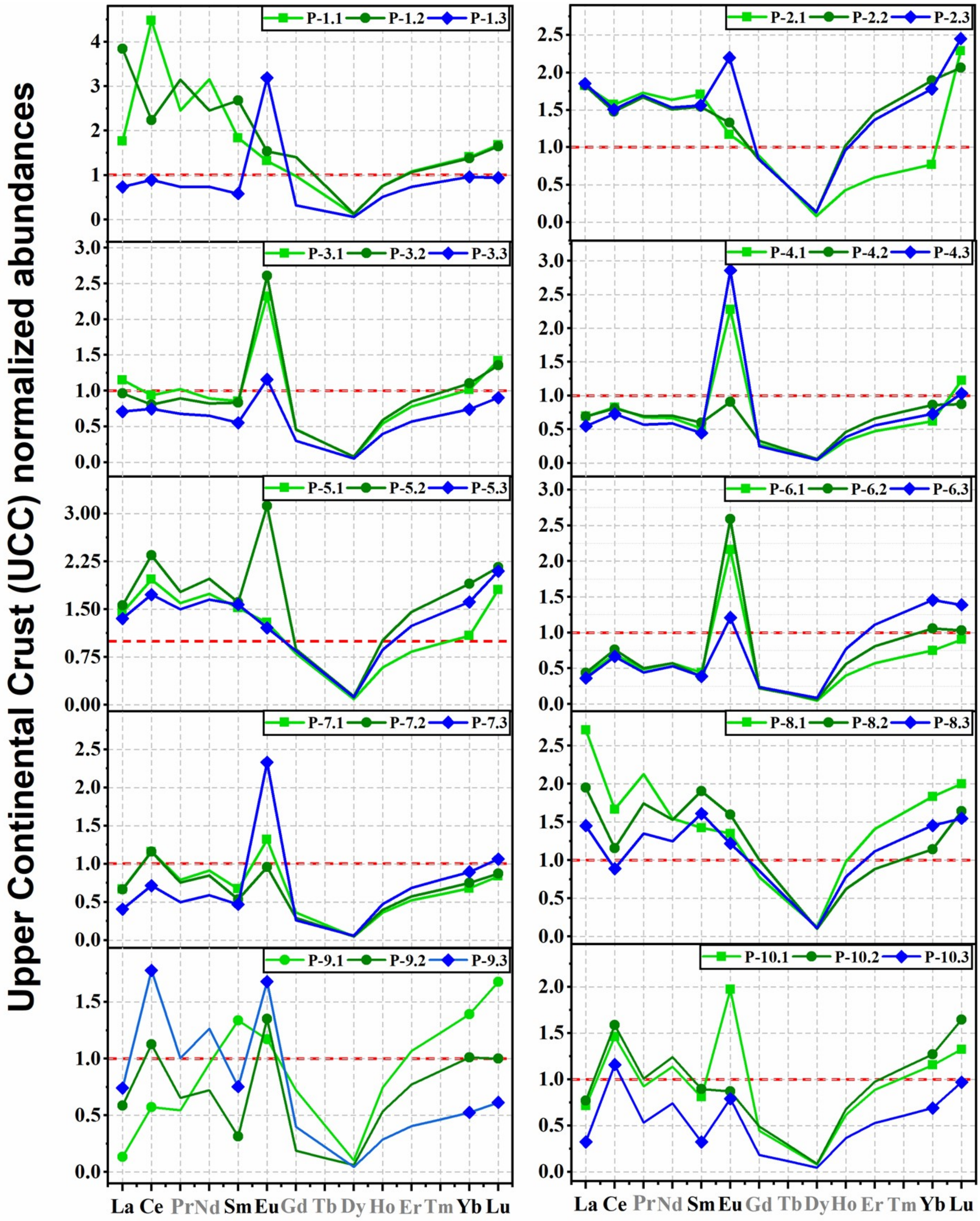


Fig. S2: Upper continental crust (UCC: Rudnick and Gao, 2014) normalized rare earth elements abundances in the sediments of Punarbhaba river basin.

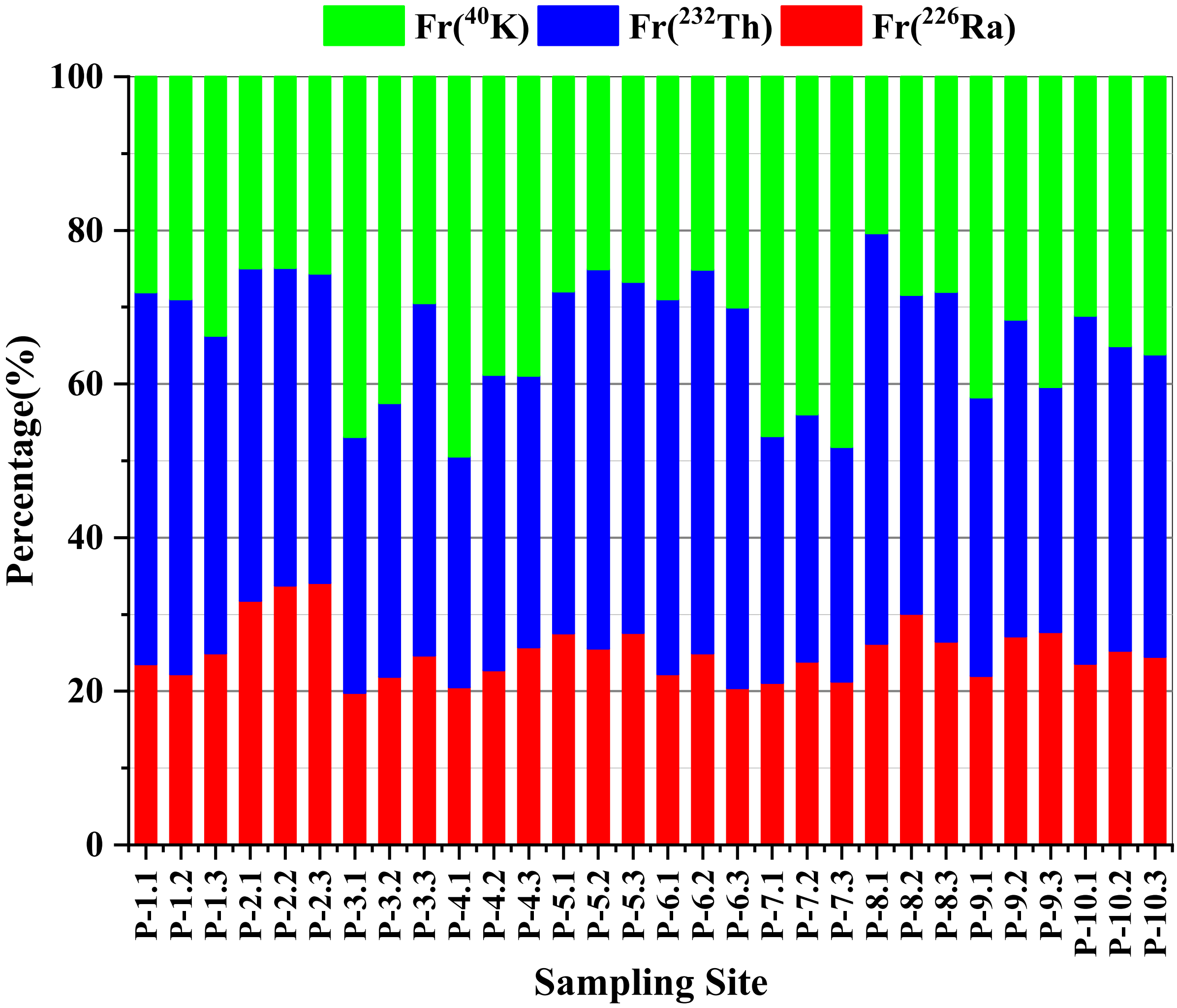


Fig. S3: Fractional contributions of ^{226}Ra, ^{232}Th and ^{40}K to the total absorbed dose rate (D) in all sites.

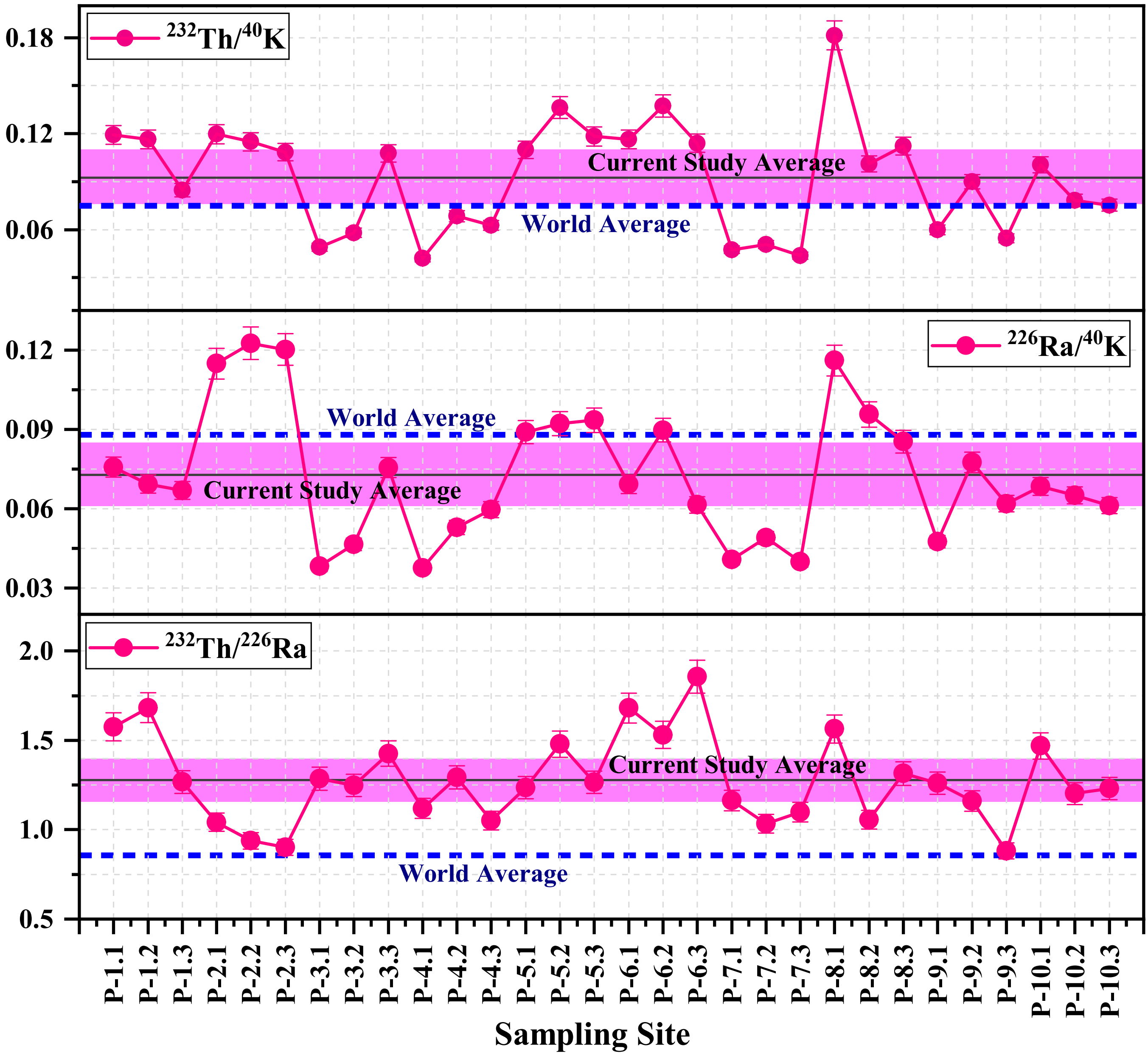


Fig. S4: Distributions of activity ratios ^{232}Th/^{40}K, ^{226}Ra/^{40}K, and ^{232}Th/ ^{226}Ra in all sampling sites of the Punarbhaba River basin, Bangladesh.

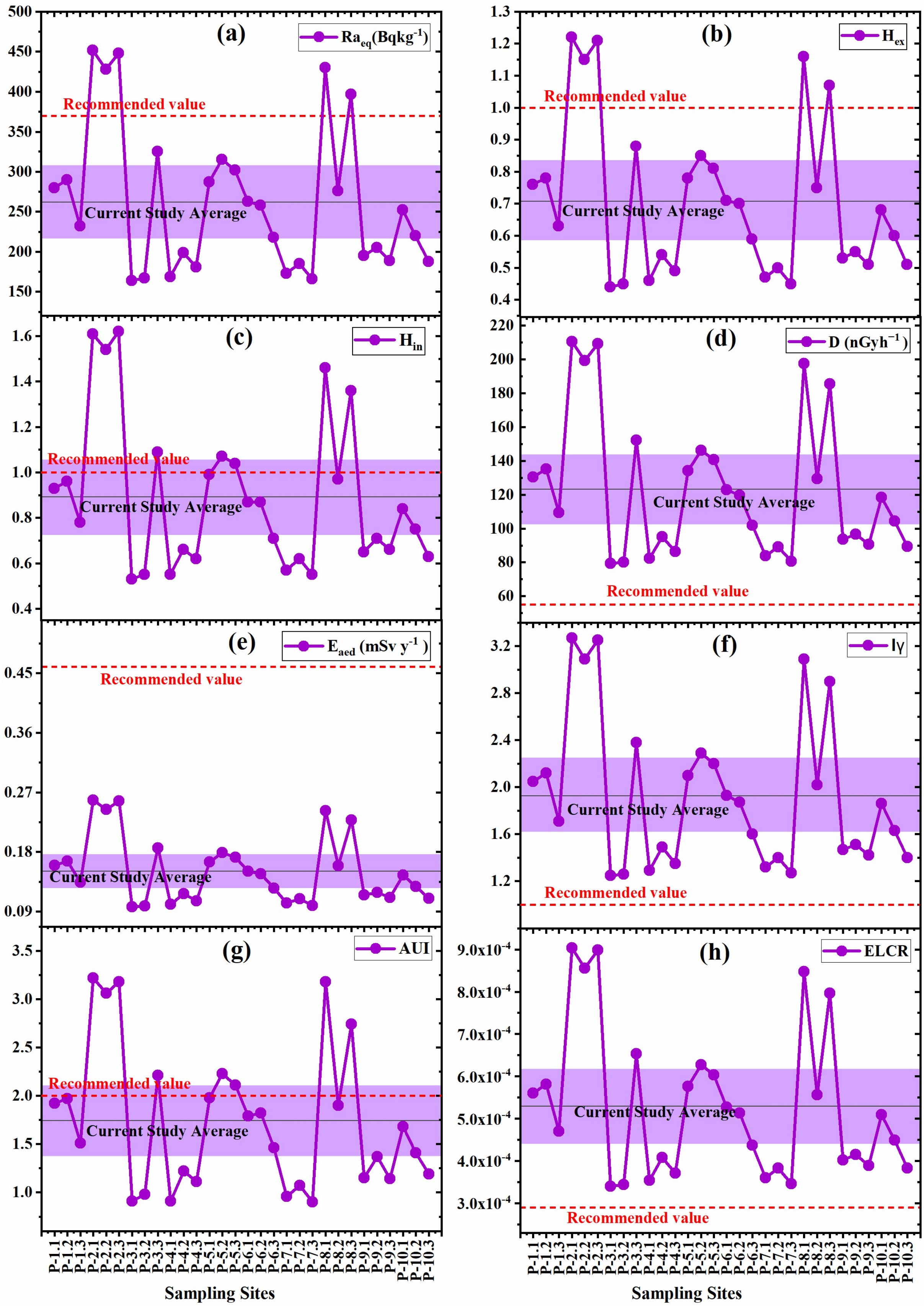


Fig. S5: Calculated radiological indices for the sediment samples (n = 30) collected from the Punarbhaba River basin along with their average ± SD (marked by solid blue line with violet shadow) and recommended (dotted red line) values (OECD 1979; UNSCEAR 2000, 2008; Darwish et al. 2015). The figure represents a) Radium equivalent activity (Ra_{eq}); b) external hazard index (H_{ex}); c) internal hazard index (H_{in}); d) absorbed dose rate (D); e) annual effective dose rate (E_{aed}); f) gamma representative level index (I_{γ}); g) activity utilization index (AUI); and h) excess lifetime cancer risk (ELCR).