grained sediments rich in organic matter contents. The linear regression relations at Qarun Lake may indicate a high similarity in accumulation sources and conditions. This study can be used as a baseline for future investigations and the data obtained in this study may be useful for natural radioactivity mapping and also be used as a reference data for monitoring possible radioactivity pollutions in future.

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Table 1: Descriptive statistical characteristics of radioactive variables of sediment and water samples of Qarun lake.

	Sediment				Water			
	^{238}U	^{226}Ra	^{232}Th	^{40}K	^{238}U	^{226}Ra	^{232}Th	^{40}K
Mean	23.5	14.1	15.8	933	6.4	7.9	3.2	31.3
St. deviation	9.7	6.2	6.8	384	0.59	2.3	0.43	5.7
Range	32.1	16.2	21.4	1016	2.09	6.98	1.22	17.1
skewness	0.54	0.01	0.15	0.01	0.005	0.32	0.689	0.18
kurtosis	-0.62	-1.78	-1.63	-1.80	-0.56	-1.38	-1.03	-1.48
minimum	11.4	6.2	5.2	410	5.4	4.5	2.8	22.8
maximum	43.5	22.4	26.6	1426	7.49	11.48	4.02	39.9
variance	95.7	38.5	47.2	148103	0.35	5.38	0.18	32.8

Table 2: Comparison of Radiological parameters of present work with other countries

Location	^{238}U (Bq/kg)	^{226}Ra (Bq/kg)	^{232}Th (Bq/kg)	^{40}K (Bq/kg)	Note	References
Egypt	23.5(11.4-43.5)	14.1(6.2-22.4)	15.8(5.2-26.6)	933.3(410-1426)	Qarun lake	Present work
Egypt	17.3(12.6-19.9)		10.03(8.5-10.6)	299.7(258.8-316.8)	Burullus lake	Dar and El Saharty, (2013)
Egypt	12.65(10.5-16)		7.24(5.4-8.3)	518.75(442-582)	Mariout Lake	
Egypt	20.37(11.2-39.3)		26.05(11.4-43.3)	329.05(163-508)	Idku lake	Fahmi et al., (2010)
Egypt	24.6(5.2-105.6)		31.4(2.3-222)	428(98-1011)	Red Sea sediment	El Mamoney & Khater, (2004)
Egypt	14.3-22		18.4-24.4	222-326	Nasser lake	Khater et al., (2005)
Egypt		17.2(12.2-20.8)	17(9.9-23.4)	246(144-360)	Burulus lake	El-Reefy, (2014)
Egypt	20.99(7.06-30.15)		14.8(5.7-20.35)	244.7(68-352)	Qarun sediment	El Zakla, (2013)
Egypt	15.92(9.87-27.28)		15.22(9.35-26.67)	644.6(958.3-3306.4)	Qarun lake	Darwish, (2013)
Egypt		4.9-20.2	3.3-35.4	59-368	Suez canal	El-Tahawy et al. (1994)
Bangladesh	37.9(20-90)		65.5(51-88)	272(217-320)	Karnaphuuli river	Chowdhury et al., (1999)
	25.4(21.6-28.3)		57.5(52.4-61.7)	255(212-292)	Shango river	
Nigeria		19.23(4.6-52.1)	31.59(6.8-46.7)	84.12(43.7-202.3)	Kainji Lake	Adamu, (2013)
KSA	49(21-76)	47(10-108)	34(15-49)	751(262-1387)	Clay	Khater, (2013)
USA	37.8(11.1-74.2)	21.4(11.4-41.2)	45.3(13-185.8)	609.3(385.9-1046.9)	Reedy River	Powell, (2007)
Jordan	11.2-677	5-31	3.6-32.8	71.5-901.1	Gulf of Aqaba	Ababneh et al., (2010)
Greece	28(9-43)	27(10-37)	30(12-46)	483(218-686)	Patras-Rion	Papaefthymiou, (2011)
Ghana	11-31.8		16.8-23.1	68.3-183.9	Beach resorts	Lawluvi et al., 2011
Albania	13-26.6		13.1-38.1	266-675	Butrint Lagoon	Tsabaris et al., (2007)
Korea		55.7(26.7-174)	91.1(30.9-157)	1005(707-1559)	Keum river	Lee et al., (2009)
India	3.67(2.2-20.9)		37.23(2.1-233.9)	387.2(313.3-482.5)	Coastal sediments	Ravisankar et al., (2014)
Turkey		12.2(4-21.5)	9(1.8-27.9)	157.7(19-590.3)	Beach sand	Özmen et al., (2014)
Worldwide	33	32	45	420		UNSCEAR, (2000)

Table 3: The specific activity ratios of radionuclides in surface sediment and water samples, and the sediment partition coefficient K_d

activity ratios and transfer factor	Range		Mean	
	Sediment	water	Sediment	Water
$^{226}Ra/^{238}U$	0.39-0.79	0.83-1.59	0.59±0.12	1.2±0.25
$^{226}Ra/^{40}K$	0.011-0.021	0.19-0.29	0.015±0.002	0.25±0.03
$^{238}U/^{40}K$	0.016-0.036	0.17-0.24	0.026±0.005	0.21±0.02
$^{232}Th/^{238}U$	0.45-0.88	0.45-0.55	0.67±0.12	0.50±0.03
$^{232}Th/^{226}Ra$	0.81-1.58	0.33-0.62	1.16±0.24	0.42±0.07
$^{232}Th/^{40}K$	0.012-0.024	0.09-0.12	0.017±0.003	0.10±0.008
$K_d(^{238}U)$	1.7-5.8		3.65±1.4	

$K_d(^{226}Ra)$	0.6-3.5	1.84±0.8
$K_d(^{232}Th)$	1.6-8.0	4.9±2.1
$K_d(^{40}K)$	13.4-56.0	30.5±13.5

Table 4: Pearson correlation coefficients between all measured natural radionuclides in the examined sediment (water) samples.

	^{238}U	^{226}Ra	^{232}Th	^{40}K
^{238}U	1			
^{226}Ra	0.82(0.79)	1		
^{232}Th	0.85(0.80)	0.86(0.92)	1	
^{40}K	0.69(0.82)	0.85(0.95)	0.83(0.90)	1

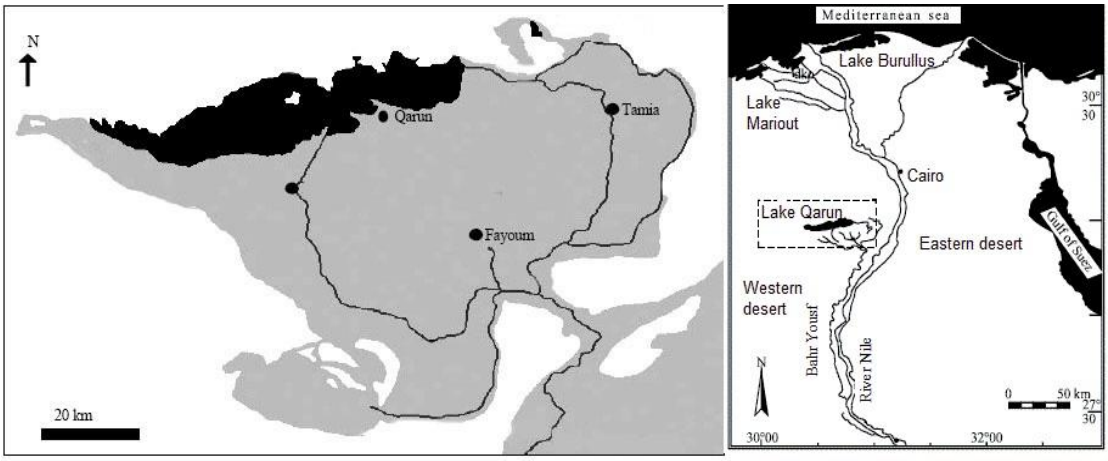

Figure 1: Location map of the studied Qarun lake

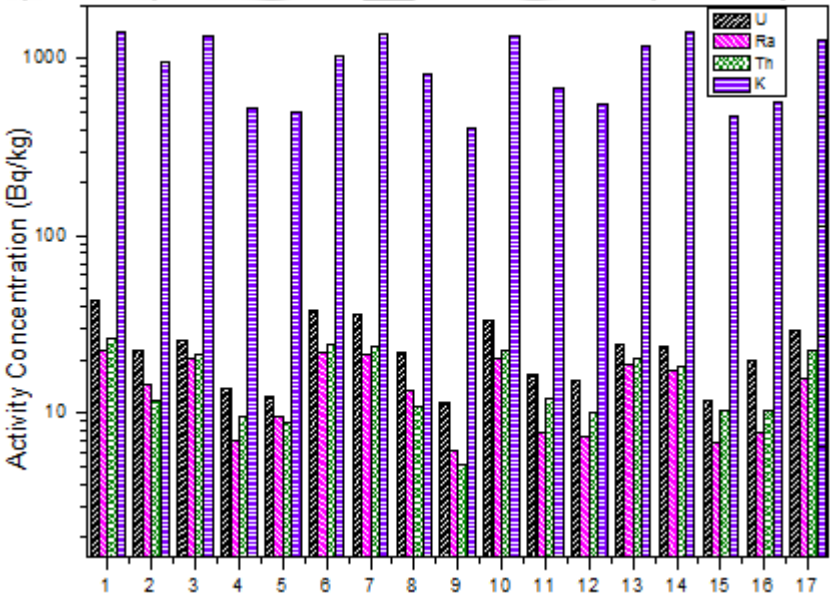

Figure 2: The activity concentrations of ^{238}U, ^{226}Ra, ^{232}Th, and ^{40}K in the sediment samples

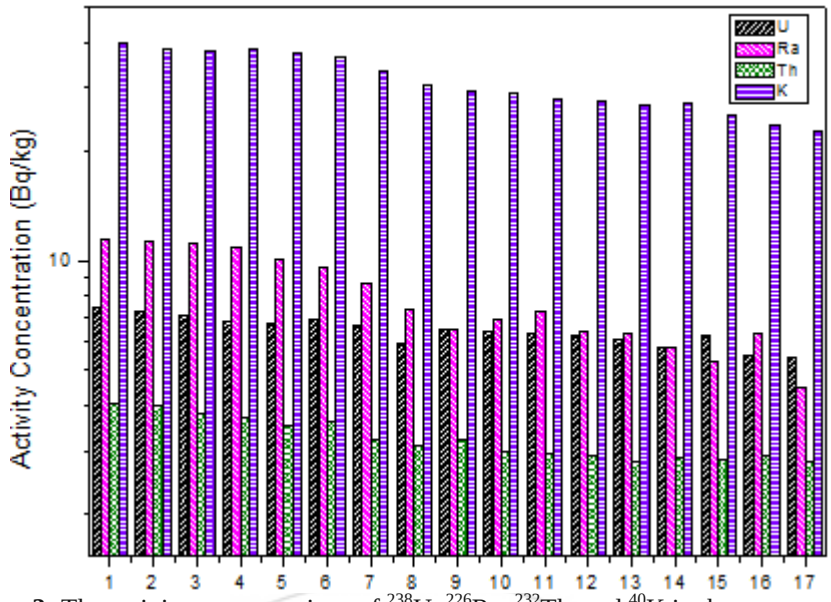

Figure 3: The activity concentrations of ^{238}U, ^{226}Ra, ^{232}Th, and ^{40}K in the water samples

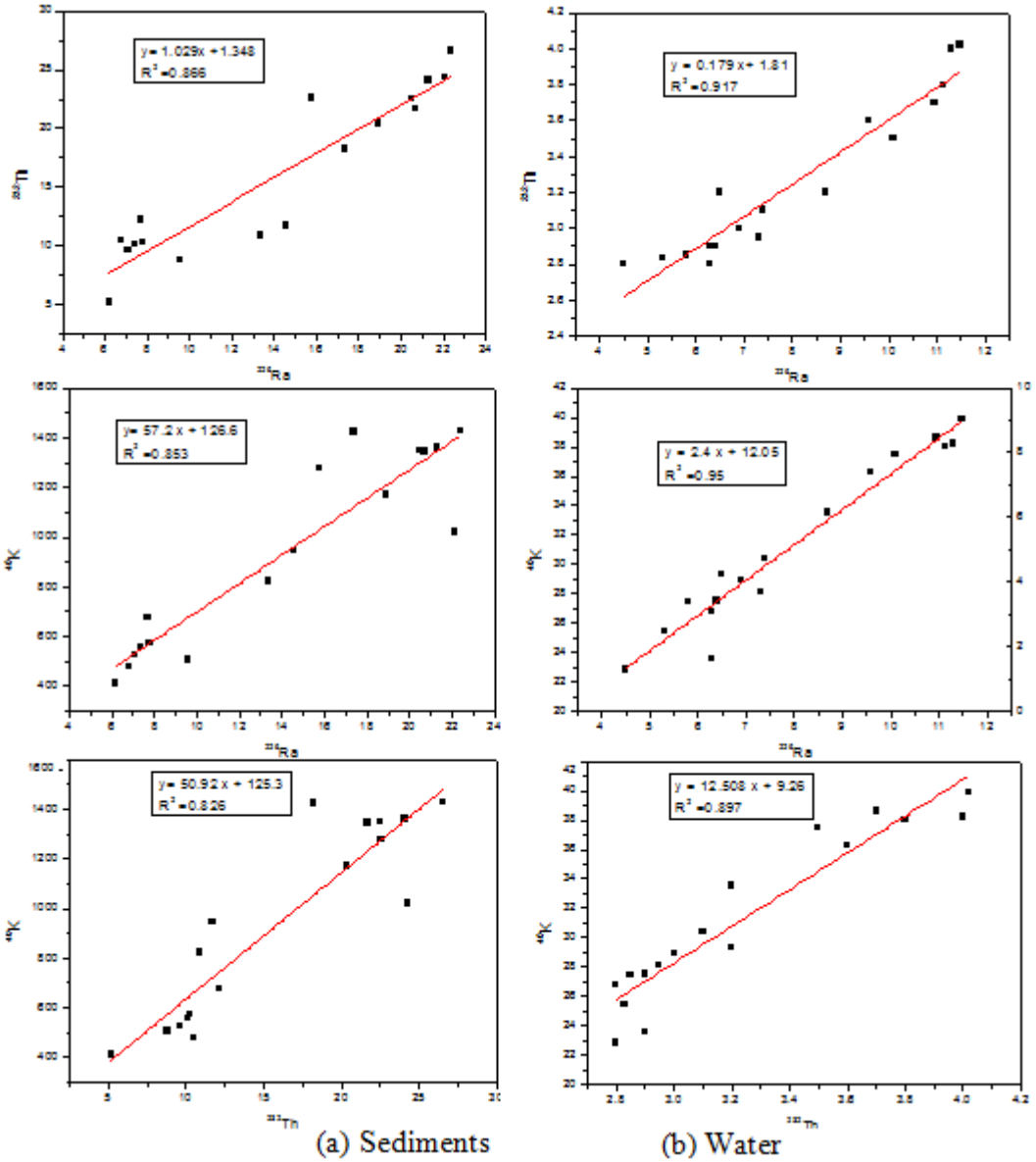

Figure 4: Correlation between activity (Bq/kg) of (^{226}Ra, ^{232}Th), (^{226}Ra, ^{40}K) and (^{232}Th, ^{40}K) in (a) sediments and (b) waters