Report No. IAEA - R - 7129-F

TITLE

Monitoring radioactive contamination in food, water sidements and other environmental samples in Egypt

FINAL REPORT FOR THE PERIOD

01 October 1992 - 31 July 1996

AUTHOR(S)

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Final Report of
Research project, Contract No. 7129/RB

"Monitoring Radioactive Contamination in Food, Soil, Water, Sediments and other Environmental Samples in Egypt"

ATOMIC ENERGY AUTHORITY

"National Centre for Nuclear Safety and Radiation Control (NCNSRC)

Central Laboratory for Environmental Radiation Measurements, Intercomparison and Training (CLERMIT)

Chief Scientific investigator : **Morsy El-Tahawy**

Time Period Covered : **1 Oct. 1992 - 31 July 1996***

DESCRIPTION OF RESEARCH CARRIED-OUT

The whole Research Project is dealing with the Egyptian environment. On Map I of Egypt, the regions of interest are indicated.

A- Radioactive analysis of building materials used in Egypt.

The informations about this part are reflected in the attached three publications :

1/A- Radioactive Analysis of Building Materials in the Central Region of Egypt. M.S. El-Tahawy, M.A. Farouk, R.H. Higgy and N.M. Ibrahiem; Nucl. Sci. J. **32**, No.4 (1995) 322.

2/A- Natural Radioactivity in Different Types of Bricks Fabricated and Used in Cairo Region M.S. El-Tahawy and R.H. Higgy; Appl. Radiat. Isot. **46** (1995) 1401.

3/A- Uranium Concentration in Building Materials Used in the Central Region of Egypt. R.H. Higgy, M.S. El-Tahawy and A. Ghods; IAEA Technical Meeting to Review the advantages and Pitfalls of Using Uranium Exploration Data, and Techniques as well as Other Methods for the Preparation of Radioelement and Radon Maps Base Line Information in Environmental Studies and Monitoring, 13-17 May 1996 Vienna, Austria.

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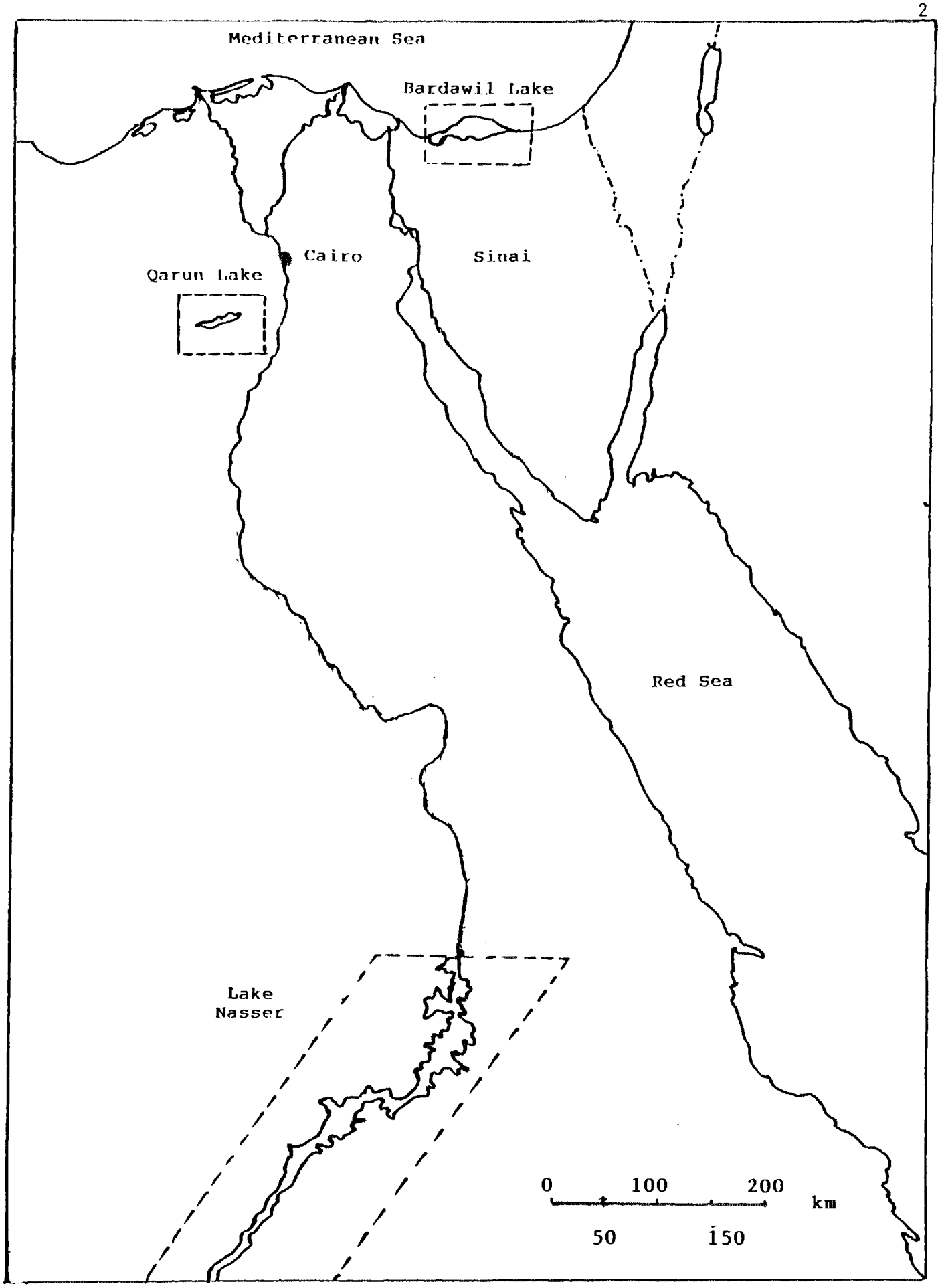
* The period 1 Oct. 1994 - 31 July 1995 was not covered by the IAEA.



Map I : Map of Egypt with regions of inferest

B- Radioactive Study of Soil and Plants in Upper Egypt

The soil and the principal cattle fodder in the Nile Valley of Upper Egypt were studied. A special attention was paid to the soil to plant transfer behavior of the radioactive nuclides. The informations about this part are given in the attached two publications :

1/B- Soil plant Transfer Factors for Some Natural Radionuclides and for ^{137}Cs. N.M. Ibrahiem, M.S. El-Tahawy and Y.Y. Ebaid; ARE-AEA / Int. Rep. No. **166** (1995).

2/B- Transfer Behavior of ^{40}K, ^{238}U, ^{232}Th and ^{137}Cs from Soil to Plant in South Egypt. M.S. El-Tahawy and Y.Y. Ebaid; Arb. J. NUCL. SC. APPL. **28**, 2 (1995) 111.

C- Radioactive Analysis of Water, Bottom Sediments and Shore Sediments of Nasser Lake Region. (see map on fig Mc/1).

Water samples (WS) of 10 to 20 liter volume were collected using Malchev water sampler consisting of 2 polyethylene tubes with a whole capacity of 3 lt. The water samples were usually collected from 3 different depths 0.5 (surface), middle and bottom. The samples of the given site were mixed, transfered to polyvinyl chloride containers and acified with HCl to pH $\leq$ 3. In the lab. the 20 lt samples were concentrated by evaporation till 1 lt volume.

The bottom sediment (BS) samples from lake Nasser basin were collected using a steel clam-shell snapper automatically closed-up touching the bottom. The surface area of the snapper is 1,000 cm^2.

The shore sediment (SS) samples were collected using corrers of 10.5 cm diameter and 25 cm depth; and /or templates of 25 x 25 cm^2 area and 10 cm depth (the same corrers and templates used for soil sampling).

Sample preparation was described in 1/B and 2/B. Before the radioactive analysis of these samples, the salinity of the water samples was determined. Also, the shore and sediment samples were analyzed mechanically to determine their type.

The average concentration of ^{40}K in Bq/lt. in water samples from lake Nasser and their salinity are given in table C1. The activity concentration of ^{40}K, ^{238}U-series, ^{232}Th-series and ^{137}Cs in Bq/kg (dry weight) in sediment samples from Nasser Lake are given in table C2.

D- Environmental Radiation Study of Quarun Lake Aquatic System.

Quarun lake has an area of 226 km^2 . It streches for 40 km in the east-west direction with an average width of 4.8 km. The average depth of the lake is approximately 4 m with maximum depth of 8m. Qurun lake is located 105 km in the

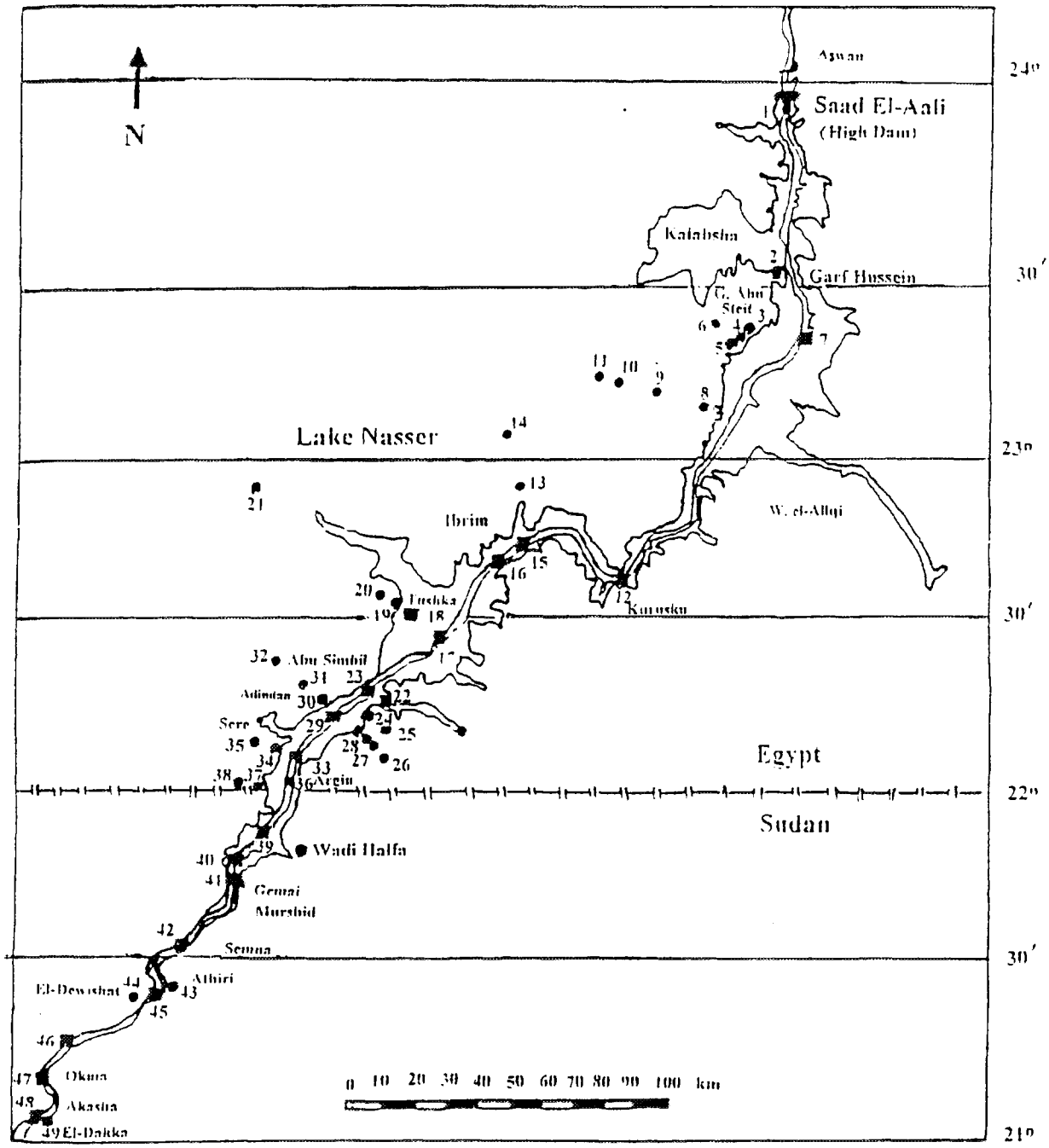


Fig MC/1 :Map of Lake Nasser region showing the sampling sites.

Table C.1 The average activity concentration of (^{40}K Bq/l) in water samples from Nasser lake and their physical properties.

Site No.	^{40}K (Bq/ lt)	Salinity (ppm)
1	**0.30 ± 0.04**	710
7	0.40 ± 0.04	537
12	0.33 ± 0.04	218
15	0.50 ± 0.05	736
16	**0.70 ± 0.07**	———
17	0.50 ± 0.05	———
23	**0.70 ± 0.07**	———
29	**0.70 ± 0.1**	**1065**
33	0.60 ± 0.2	248
39	0.40 ± 0.04	324
42	0.40 ± 0.06	272
45	0.44 ± 0.05	323
46	0.38 ± 0.04	**150**
48	0.40 ± 0.04	———

The minimum and maximum values are given in bold.

Table C.2 The activity concentration of ^{238}U, ^{232}Th, ^{40}K and ^{137}Cs in Bq/kg (Dry weight) in sediment samples from Nasser lake

Sample code and site No.	^{40}K	^{238}U	^{232}Th	^{137}Cs	Sediment type
B.S.16	305.0 ± 14.0	15.2 ± 1.6	22.5 ± 2.5	10.9 ± 0.9	Loamy
B.S.17	321.0 ± 29.5	14.4 ± 3.1	23.6 ± 4.2	9.0 ± 1.4	Loamy
B.S.18	222.0 ± 25.5	16.0 ± 2.8	18.8 ± 3.1	0.9 ± 0.2	Sandy clay
S.S.19	**56.6 ± 3.1**	**5.5 ± 0.1**	5.6 ± 0.6	**0.3 ± 0.1**	Sandy clay
B.S.22	332.0 ± 16.6	17.3 ± 1.7	**24.4 ± 2.5**	10.0 ± 0.8	Clay
S.S.30	115.0 ± 11.5	**19.1 ± 2.4**	23.9 ± 3.5	———	Sandy
B.S.33	323.0 ± 30.9	15.0 ± 2.4	20.2 ± 4.0	9.4 ± 1.5	Clay loamy
S.S.34	128.0 ± 3.6	17.0 ± 0.7	22.1 ± 1.7	1.1 ± 0.1	Sandy
B.S.36	343.0 ± 29.2	15.8 ± 2.7	20.0 ± 3.8	**10.6 ± 1.4**	Loamy
S.S.37	146.0 ± 3.9	17.8 ± 0.6	21.5 ± 0.8	0.7 ± 0.1	Sandy
B.S.39	332.0 ± 24.1	16.0 ± 2.2	19.6 ± 2.8	7.6 ± 1.0	Loamy
B.S.40	331.0 ± 18.4	16.8 ± 1.5	21.5 ± 2.2	6.4 ± 0.8	Silty clay
B.S.41	**344.0 ± 34.8**	17.4 ± 2.4	22.0 ± 3.2	6.1 ± 1.1	Sandy clay
B.S.42	316.0 ± 8.9	14.4 ± 1.0	13.2 ± 1.0	4.8 ± 0.4	Clay
B.S.45	239.0 ± 11.2	**19.1 ± 1.0**	22.3 ± 1.4	5.1 ± 0.4	Sandy clay
B.S.46	208.0 ± 8.7	10.8 ± 1.3	9.0 ± 1.6	———	Sandy
B.S.47	315.0 ± 11.2	16.0 ± 1.1	14.2 ± 1.3	3.5 ± 0.4	Sandy clay
B.S.48	186.0 ± 11.0	7.2 ± 1.0	**4.7 ± 1.2**	———	Sandy

B.S. - Bottom sediment S.S. - Shore sediment

The minimum and maximum values are given in bold.

south-west direction from Cairo, between30° 25′ and 30° 49′ E longitude and 29° 25′ and 29° 34′ N latitude, in the north part of the natural Fayum depression of about 12,00 km area. This depression is surrounded by desert upland and has underground access to the Nile Vally (which lies at about 30 km to the east of the depression).

Due to the intense evaporation , the direct inflow of drainage water and the low rain fall (the average annual value is 17mm) , the originally fresh water lake become highly saline one. The salts concentration reached about 40% (40 g/lt).

In three stages, 75 bottom sediment (BS) samples, 35 shore sediment (SS) samples, 75 water samples and 40 fish samples were collected from the lake. The sampling location are shown in map MD1. The sediment and water sampling technique is the same as in part C.

These samples were analyzed using two techniques:

i) nondestructive one: Gamma Spectroscopy (GS) technique, and

ii) destructive : Alpha Spectroscopy (AS) technique with chemical separation and electro-deposition of uranium content.

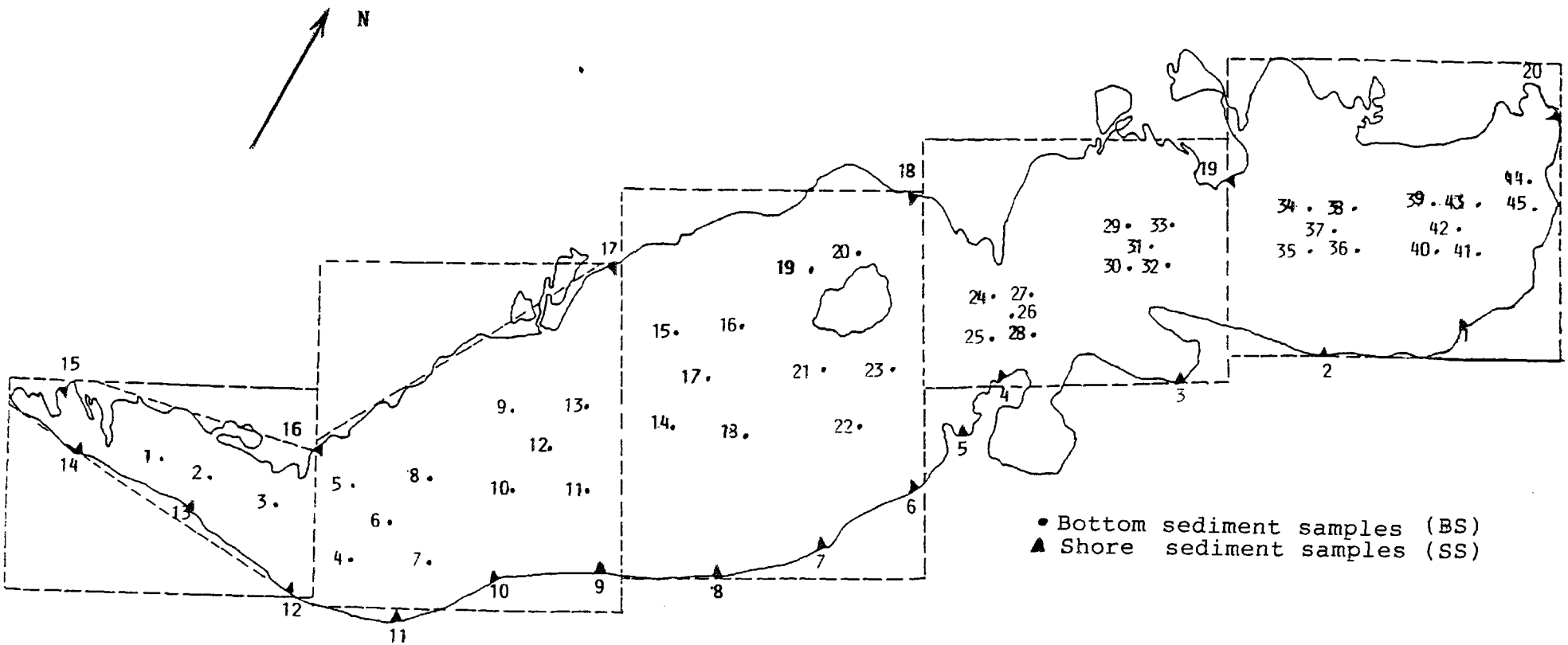
D.i. Gamma spectroscopy (GS) technique is described in parts A, B and C. The results of this analysis is given in table D.1. where the specific activity for ^{238}U, ^{232}Th, ^{40}K, and ^{137}Cs in Bq/kg (dry weight) for the analyzed bottom sediment (BS) and shore sediment (SS) samples are presented.

D.ii. For alpha Spectroscopy (AS) technique, 3-5 gm of sample ash is chemically treated [1] to extract the total uranium content from the sample and then electrically deposited on small (22 mm diameter) stain-less discs for AS analysis. Fig. D_1 illustrates the steps of this procedure.

An alpha spectrometer (Tennelec - TC 257) based on silicon surface-barrier detector of 1,000 mm active area was used for alpha spectroscopy analysis of some samples , which were prepared as ,described above, with addition of U-232 tracer. The results obtained by AS technique are given in table D.2 ,where the concentration of U-238 and U-234 in Bq/kg (dry weight) are presented.

The analysis of water and fish samples are carried out now. One (or two papers) will be published about the environmental radiation study of Quarun lake aquatic system.

Two other lakes (Edku and Maryut) at the north-west of Egypt are also under investigation.



MD 1. Map of Quarun lake with sampling locations.

Table D.1. Concentration of ^{238}U, ^{232}Th, ^{40}K and ^{137}Cs in bottom sediment (BS) and shore sediment (SS) samples from Quarun lake in Bq/kg (dry weight)

Sample Code	^{238}U	^{232}Th	^{40}K	^{137}Cs
BS1	15.4± 0.8	15.0±0.8	304.0±9.7	6.83±0.41
BS2	16.0 ±0.6	12.7±0.4	327.9±5.1	4.08±0.18
BS3	17.0±1.0	12.4±0.8	275.5±10.2	1.68±0.33
BS5	15.1±0.4	13.7±0.4	305.2±4.2	4.98±0.18
BS6	14.6±1.6	14.7±1.4	294.3±16.8	5.64±0.73
BS8	15.7±0.7	13.7±0.7	306.7±8.6	4.7±0.35
BS9	16.6±1.6	13.4±1.7	311.9±20.6	2.56±0.81
BS10	15.3±1.0	14.9±0.9	305.9±10.7	4.08±0.39
BS11	17.1±0.7	16.2±0.6	323.3±7.3	4.98±0.29
BS12	15.8±0.7	16.1±0.7	284.5±6.0	5.79±0.38
BS13	12.9±0.9	10.6±0.7	221.0±8.1	2.93±0.34
BS14	16.7±0.5	14.6±0.4	280.9±4.0	4.07±0.20
BS15	13.0±0.4	11.8±0.4	233.7±3.5	4.25±0.19
BS16	14.3±1.7	12.9±1.4	242.6±16.1	4.31±0.66
BS17	16.1±0.5	12.4±0.4	237.4±4.1	3.20±0.20
BS18	13.4±0.7	-----	221.8±6.0	3.40±0.29
BS19	17.8±0.6	12.7±0.6	253.8±5.6	2.77±0.31
BS20	15.2±1.7	11.4±1.4	246.0±15.7	5.89±0.78
BS21	12.6±0.8	9.0±0.5	204.6±6.5	3.96±0.34
BS22	14.7±0.6	13.4±0.6	269.7±5.8	6.48±0.49
BS23	17.6±0.5	15.3±0.5	297.9±4.0	5.33±0.22
BS24	13.6±1.0	10.2±0.7	204.2±9.1	4.19±0.39
BS26	13.2±0.8	8.9±0.6	180.5±7.4	1.87±0.27

Cont. Table D.1.

BS27	13.7±0.4	12.3±0.4	243.3±4.5	5.54±0.21
BS28	16.5±0.7	15.2±0.6	285.6±6.2	6.44±0.32
BS29	18.5±0.5	14.9±0.4	311.3±4.6	5.00±0.20
BS30	18.1±0.9	13.4±0.9	290.9±10.0	4.37±0.37
BS31	13.8±0.7	11.8±0.6	251.3±7.1	3.39±0.30
BS32	20.7±0.7	12.1±0.6	273.2±8.1	2.19±0.26
BS33	19.7±0.8	15.9±0.7	320.7±6.8	4.64±0.33
BS35	25.8±1.0	16.1±0.8	263.0±6.8	2.03±0.28
BS36	16.2±0.6	10.3±0.5	255.6±7.0	2.03±0.20
BS37	17.4±0.5	15.0±0.4	324.0±4.5	4.08±0.20
BS38	16.3±0.6	15.7±0.5	286.2±4.8	5.57±0.27
BS39	16.1±0.8	14.3±0.7	310.6±6.9	6.81±0.38
BS41	14.4±0.6	13.6±0.6	257.2±0.6	4.69±0.56
BS43	15.5±0.7	14.8±0.7	287.6±6.7	6.69±0.39
BS44	18.5±0.5	14.2±0.4	240.1±3.7	3.71±0.19
BS45	7.3±0.3	5.2±0.3	116.7±3.5	0.78±0.09
BS46	8.7±0.8	8.3±0.7	186.7±7.4	2.52±0.32
BS47	16.1±0.2	8.1±0.2	203.0±2.2	0.30±0.05
SS1	13.6±0.4	9.9±0.4	269.8±3.2	0.76±0.25
SS3	17.6±0.7	13.0±0.6	292.7±3.5	1.06±0.26
SS4	13.3±1.3	5.9± 0.9	64.5±9.4	< DL
SS5	16.5±0.3	9.0±0.2	177.1±2.1	0.49±0.06
SS7	11.7±0.6	6.3±0.5	148.1±3.8	1.71±0.34
SS8	10.0±0.3	5.9±0.3	114.0±3.2	0.25±0.07
SS10	18.6±0.7	15.8±0.6	191.6±3.8	0.26±0.26
SS11	18.9±0.5	13.0±0.4	275.7±4.1	0.75±0.12
SS14	5.2±0.2	3.8±0.2	104.0±2.6	1.10±0.08
SS16	6.8±0.3	4.5±0.2	160.0±3.3	1.35±0.12
SS17	9.5±0.2	8.1±0.2	175.2±1.5	1.58±0.06
SS19	10.0±0.6	7.2±0.5	120.5±5.8	0.27±0.15
SS20	7.8±0.2	6.0±0.1	162.8±1.8	1.54±0.07

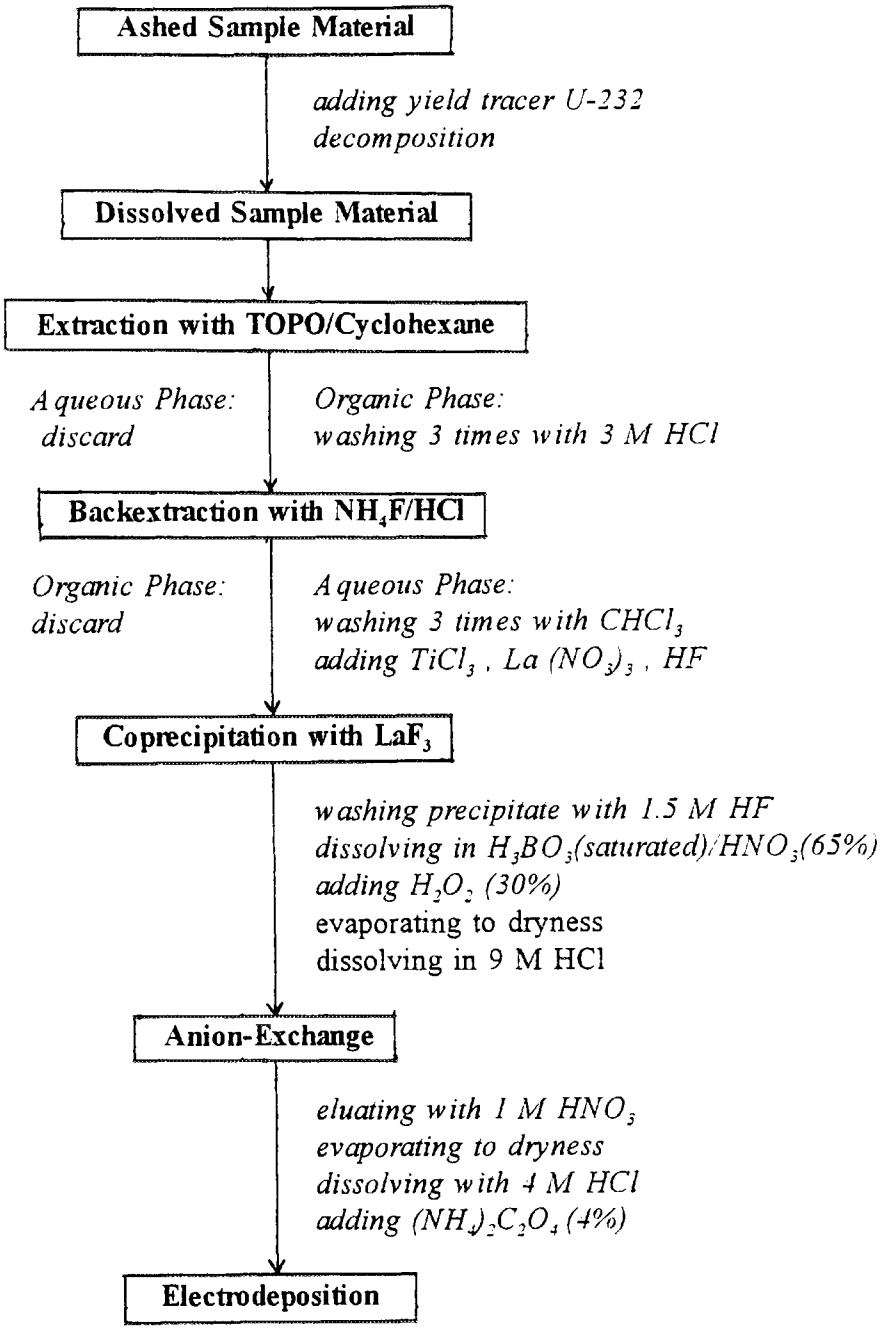


Fig. D_1 : Chemical extraction of the total Uranium Content

Table D.2 Concentration of ^{238}U and ^{234}U in Bq/kg (Dry weight) in some bottom sediment (BS) from Karoun lake

Sample code	^{238}U	^{234}U	$^{234}U/^{238}U$
BS1	38.1 ± 3.2	39.4 ± 3.3	1.04
BS2	70.0 ± 4.2	77.1 ± 4.6	1.10
BS3	21.5 ± 3.2	22.4 ± 3.3	1.04
BS5	30.2 ± 2.1	37.7 ± 2.5	1.25
BS6	78.9 ± 3.6	87.2 ± 3.9	1.10
BS7	27.5 ± 2.2	31.0 ± 2.4	1.13
BS8	29.9 ± 2.4	36.7 ± 2.7	1.23
BS9	72.7 ± 4.6	71.2 ± 4.6	0.98
BS10	74.8 ± 6.2	86.3 ± 6.8	1.15
BS11	40.8 ± 2.5	47.4 ± 2.8	1.16
BS12	32.4 ± 3.5	50.0 ± 5.0	1.54
BS16	49.8 ± 3.6	52.7 ± 3.7	1.08
BS17	34.1 ± 2.5	37.8 ± 2.8	1.11
BS18	70.7 ± 4.2	83.8 ± 4.8	1.19
BS19	43.0 ± 4.1	68.3 ± 5.8	1.59
BS20	37.9 ± 2.9	45.4 ± 3.3	1.20
BS21	37.8 ± 2.9	38.5 ± 3.0	1.02
BS23	60.6 ± 4.9	43.9 ± 3.8	0.72
BS30	45.0 ± 2.7	53.0 ± 3.0	1.18
BS31	37.4 ± 3.3	38.6 ± 3.4	1.03
BS32	41.6 ± 2.8	47.0 ± 3.0	1.13
BS33	66.9 ± 3.8	65.8 ± 3.8	0.98

E- Radioactive Study of the Sinai Environment

E-I. Radioactive study of soil, plant and drinking water samples.

On the map (Fig.ME1) the sampling locations in Sinai peninsula are shown. The regions of high interest*with more intensive sampling are indicated by dotted line frames.

i) The soil samples were collected using 30cm length, 10cm diameter corrers and templates of 5 and10cm depth with 25×25 cm^2 area. The sample preparation was described above. The soil samples prepared and sealed in Marinelli beakers were analyzed using the gamma spectrometers based on HP Ge-detectors described in parts A-D.

In table E-I.1 the specific activities in Bq/kg (dry weight) of the radionuclides of ^{40}K,^{238}U-series,^{232}Th-series and the man-made ^{137}Cs in the soil samples from Sinai are given.The results for the samples coded ST, SC, SSh, SN, STa, SR and SAr (in this table) are the average activities of several representative samples collected in the regions of high interest: El-Tour, St.Catherine, Sharm-El-Sheikh, Nwueiba, Taba, Rafah and El-Arish respectively.

ii) The plant sampling is not rich, desert environment. Attention was paid to the grass, the main fodder of the cattle in Sinai (sheep, goats and camels).
The plant samples were dried in ovens at temperature (85-100)°C, weighed before and after drying to determine the water content, minced and transfered to Marinelli beakers (100cc) or (12cc) cylindric container and sealed for four weaks.

The samples in Marinelli beakers were analyzed using γ-spectrometers based on HP Ge-detectors. The small volume samples (12cc) were analyzed using γ-spectrometer based on well-type scintillation detector, 3″×3″NaI(Tl),production of Quartz & Silica, Model 76SP76.

The activity concentrations of ^{40}K,^{238}U, ^{232}Th and ^{137}Cs in Bq/kg (dry weight) in the grass samples from Sinai are given in table E-I.2

iii) The average values of the total water gains (in the water balance) of the standard man are 2000 ml for the child (~10 y), 2100 ml for the adult woman and 3000 ml for the adult man. The fluid daily intake represents about 65-70% of these amounts[2]. In Sinai, the drinking water forms the predominant part of the fluid intake.

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* i.e.The regions arround towns with relatively intensive population or arround tourist centres.

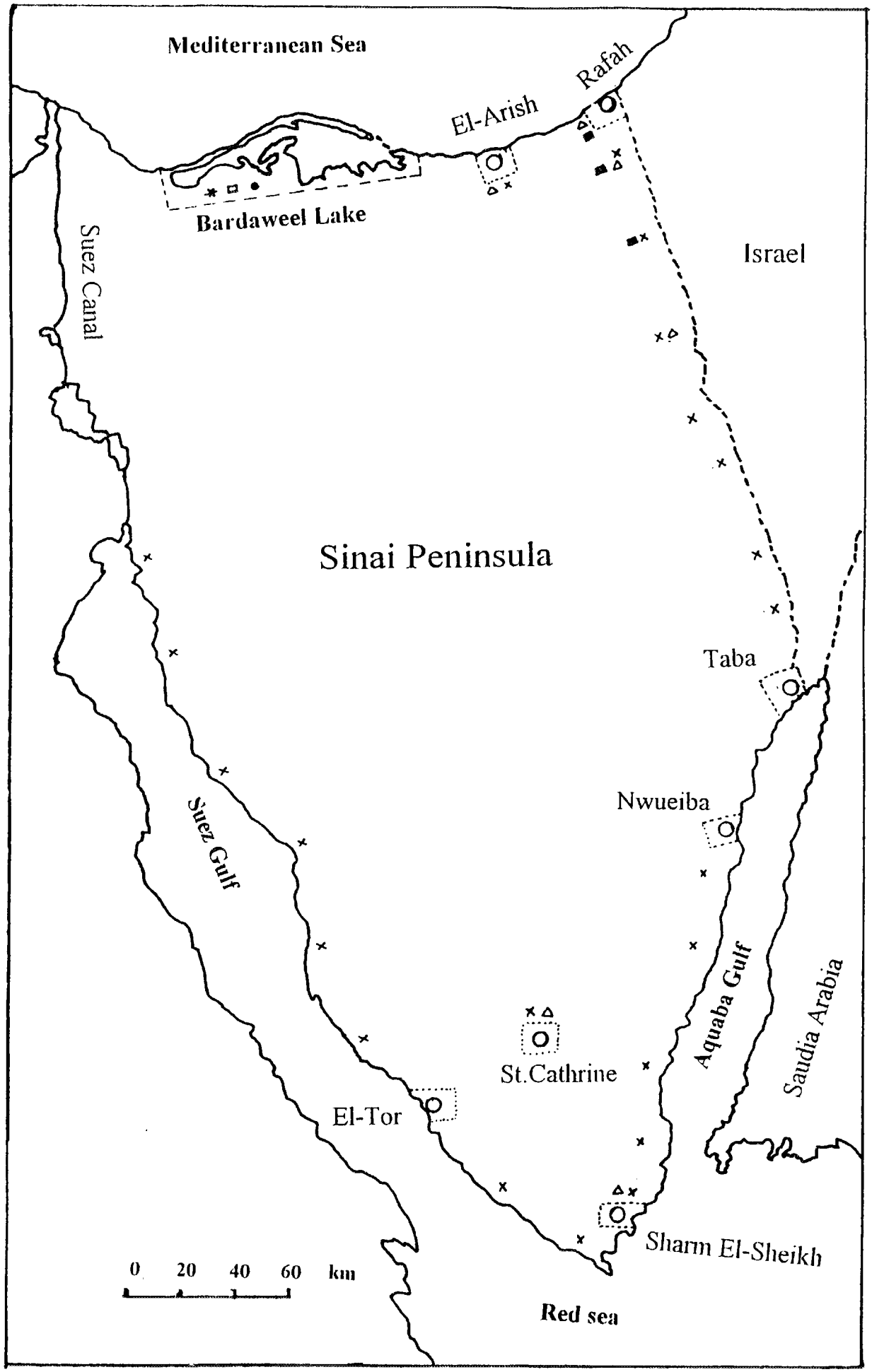

Fig. ME1 Map of Sinai Peninsula with Sampling Locations

✳ Shore sediment
▪ Plant samples
▭ Bottom sediment
× Soil samples
△ Drinking water

Table E-I.1 The specific activities of ^{40}K, ^{238}U, ^{232}Th and ^{137}Cs in Bq/kg in the soil samples from Sinai

Sample code	^{40}K	^{238}U	^{232}Th	^{137}Cs
S1	166.3±10.0	14.0±1.2	9.0±1.3	4.65±0.57
S2	136.2±11.0	21.0±1.5	10.0±1.2	-----
S3	64.1±5.7	20.5±1.3	6.3±1.6	1.37±0.30
S4	200.0±10.8	16.9±1.0	11.9±0.9	1.03±0.33
S5	269.1±15.3	20.8±1.2	18.3±1.6	-----
S6	122.6±7.4	21.4±1.4	14.1±1.3	-----
ST	471.5±7.6	22.4±0.7	21.4±0.6	1.26±0.15
S7	622.0±26.1	44.2±2.4	61.4±3.5	-----
S8	707.2±27.2	22.8±1.4	23.8±1.4	2.20±0.51
S9	107.9±10.2	12.8±1.2	13.4±2.8	-----
S10	59.1±2.6	4.1±0.5	3.6±0.4	-----
S11	67.6±7.3	12.6±2.3	9.1±0.6	0.96±0.32
SC	69.2±3.6	7.1±0.4	10.6±0.5	1.58±0.44
SSh	902.3±25.3	31.5±1.5	27.0±2.2	2.12±0.63
SN	313.9±8.9	11.2±0.4	11.9±0.5	4.09±0.32
S12	561.5±16.9	31.7±1.0	21.1±0.6	1.24±0.18
STa	359.5±8.0	16.1±0.6	8.3±0.6	1.59±0.29
S13	1105.0±7.5	18.4±0.4	12.2±0.2	-----
S14	282.4±3.8	26.3±0.5	8.5±0.2	7.88±0.24
S15	172.9±1.5	29.4±2.0	4.9±0.1	12.02±0.26
S16	231.9±4.6	18.4±0.5	14.4±0.5	8.90±0.27
S17	79.8±4.1	36.9±0.8	2.6±0.3	-----
S18	163.1±1.5	20.8±0.2	3.9±0.1	1.43±0.14
S19	169.1±2.0	9.4±0.2	3.6±0.1	4.34±0.20
SR	68.0±1.9	2.7±0.2	0.9±0.1	-----
SAr	136.0±3.2	4.4±0.3	3.6±0.2	-----

Table E-I.2 The activity concentration of ^{40}K, ^{238}U, ^{232}Th and ^{137}Cs in Bq/kg in grass plant samples from Sinai

Sample code	^{40}K	^{238}U	^{232}Th	^{137}Cs
P3	708.9±20.4	2.9±0.8	1.2±0.6	1.27±0.20
P4	34.5±3.6	-----	-----	-----
PT	605.0±31.4	2.8±0.3	6.7±0.6	1.03±0.16
PS	824.3±49.2	8.0±1.3	6.2±1.5	2.07±0.60
PTa	413.3±59.5	-----	-----	-----
P18	33.0±2.9	-----	-----	-----
P19	868.4±9.5	4.7±0.7	2.4±0.3	-----
PR	659.5±10.2	12.1±1.0	4.7±0.7	-----

Table E-I.3 The uranium concentrations (in ppb) determined by laser fluorimetry in the water samples collected from Sinai

Sample code	Location	Water type	Uranium concentration
WS1	Rafah	surface water	0.32±0.08
WS2	Bir Ghareab (near El-Arish)	ground water	3.51±0.53
WS3	Bir Zorab (near El-Arish)	surface water	0.63±0.18
WS4	El-Arish	ground water	2.86±0.42
WS5	42 km by the east border from the sea-shore	surface water (rain origin)	0.39±0.09
WS6	Ein-Gadaierat	ground water	3.40±0.51
WS7	Ein-Kedis	ground water	2.84±0.43
WS8	Bir Wadi-Harun	ground water	4.17±0.63
WS9	Bir-Harun	ground water	20.6±3.10
WS10	St. Cathrine	ground water	5.72±0.86
WS11	Sharm El-Sheikh	ground water	6.83±1.01

The uranium isotopes represent an essential part of the natural radioactivity in the drinking water. More than 60% of the total intake by man of natural uranium is assumed to be from drinking water[3].

The laser fluorimetry technique is one of the most convenient and sensitive methods for determination of the total uranium concentration in liquids. Under ultraviolet excitation (which is usually provided by laser) the fluorescence of characteristic emission spectrum with three peaks at 494, 516 and 540 nm, for the inorganic uranyl salts, is used for uranium analysis by measuring the emission intensity. This method is especially simple in application to drinking water as no need for complicated and long intermediate chemical steps for uranium extraction.

For determination of total uranium concentration in the drinking water samples an uranium analyzer of model Sintrex UA-3 is used. The volume of the analyzed sample is ~ 6ml. Its work is based on the flourescence of an uranyl complex formed by addition of about 10% of the sample volume of a reagent, FLURAN (sodium pyrophosphate, sodium dihydrogen phosphate), to convert the uranyl species present in the water sample into a single form that has a high luminescent yield. In the UA-3 the excitation of fluorescence is provided by a small nitrogen laser. The apparatus was calibrated with uranyl standards with concentrations in the range 0.2 - 20 ppb.

The analysis is carried out by measuring the luminescent yield from the sample (D) and the standard (D_S). Then the uranium concentration in the sample (U) is obtained as :

$$U = U_{st} X \frac{D}{D_{st}}$$

where U_{st} is the concentration in the standard.

In table E-I.3 the uranium concentration (in ppb)* determined by laser fluorimetry technique in the water samples are given. The location and water type are also given in the same table.

E-II. Premilinary Radioactive study of environmental samples from Bardaweel lake.

Bardaweel lake is located at the north of Sinai peninsula (see map on fig. ME1) and it is connected with the Mediterranean sea through three straits (one of them is natural). It has an area of 660 km^2. the water of the lake has high salinity which ranges from 37 to 65 part per thousand, depending on the depth which reaches 600-700 m. at the straits. The fishing activity in the lake is growing. In 1994 it gave 1.3% of the total fish production of Egypt.

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* 1ppb = 12.4 mBq/lt (for water)

A preliminary survey was achieved in the lake region. Bottom and shore sediment samples were collected beginning from the east edge in seven sectors to which the lake was divided in this first stage of surveying. Now, a more intensive sampling of sediment, water and fish sampling is carried out.

On table E-II the results of gamma spectroscopy analysis of the bottom (BS) and shore sediment (SS) samples of the first stage are given.

References

1. Pimple et al. Optimization of a radioanalytical procedure for the determination of uranium isotopes in environmental samples, J.Radioanal. Nucl./chem. Articles, **161** (1992) 437.

2. Radiation Handbook, Controls for Environmental Pollution, Santa Fe, New Mexico, 2nd edition, 1992

3. Zhu- Changshan et al , Investigation of Natural Radionuclides in Foods and Waters in China and Evaluation of Internal Dose to Public, Rep. of China, Nuclear Information Centre, Bejing (China) , 1992.

Table E-II Concentration of ^{40}K, ^{238}U, ^{232}Th and ^{137}Cs in Bq/kg (dry weight) in some bottom sediment (BS) and shore sediment (SS) samples from Bardaweel lake

Sample code	^{40}K	^{238}U	^{232}Th	^{137}Cs
BS1	193.6±6.1	8.1±0.4	6.8±0.5	2.55±0.26
BS2	161.9±3.4	6.8±0.3	6.0±0.3	3.17±0.22
BS3	230.9±4.1	5.6±0.3	4.1±0.2	0.52±0.17
BS4	258.3±5.2	10.0±0.7	9.1±0.6	1.32±0.23
BS5	369.5±7.1	11.4±0.5	11.4±0.5	5.80±0.34
BS6	159.8±15.1	4.4±0.9	2.4±0.6	0.35±0.24
BS7	233.7±9.4	7.7±0.7	6.2±0.5	5.58±0.38
SS1	197.6±9.5	6.0±0.9	3.8±0.7	-----
SS2	-----	3.6±0.2	2.3±0.2	-----
SS3	77.1±5.1	3.8±0.3	2.9±0.2	-----
SS4	101.7±4.2	2.8±0.2	1.7±0.2	-----
SS5	87.4±2.9	2.9±0.2	1.7±0.2	0.34±0.21