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Geochemical and Radiometric studies on the Soils of Wadi Nugrus, South Eastern Desert, Egypt

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ABSTRACT

The present work is mainly aimed at evaluating the geochemical properties beside the potential effect of some radioactive sources on the agricultural environment of Wadi Nugrus. The studied area is located at the southern part of the Eastern Desert of Egypt. Eleven soil Profiles were selected to represent Wadi Nugrus plain, The profiles were described morphologically in the field and soil physical, chemical and geochemical properties were evaluated. New results are also obtained in this study about the trace and major elements and the soil radioactivity. The obtained results indicate the following.1- Physical and chemical properties:Soil texture class of Wadi Nugrus area is mostly sand and loamy sand or sandy loom; Ca CO_3 content ranges from 2.5 to 5.8%; organic matter content is very low due to the desertic conditions. pH values range from 7.49 to 8.81 indicating that this soils are slight to moderately alkaline. ECe values varied from 0.33 to 6.29 dsm^{-1} indicate that the soils differ from non to slightly saline. Soluble cations are dominated by Na^+ followed by Ca^{++}, Mg^{++} and K^+, while soluble anions followed this order $SO^{=}_4$ >Cl^- >HCO-$_3$3H{ 1- Geochemical Properties: The chemical composition of the major oxides distribution in the studied soils reveal that SiO_2 is the dominant oxides, this concides with the nature of parent material Al_2O_3, Fe_2O_3 and sometimes CaO and MgO come after in abundances, followed by Na_2O and K_2O, while TiO_2 and P_2O_5 constitutes are less pronounced. Trace elements were also determined and show that most of the determined elements (Cr, Cu, Zn, Rb, Y, pb and Nb) are over the permissible limits obtained by different organization (FAO, UNESCO 1974), except for Ni, Zr, Ba, Sr, Ga and V which were in the range of published data by FAO and UNESCO (1974).The radiometric study carried out on the studied soil samples reveals that the studied soils are in enrichment of radioactive elements (uranium and thorium) the high contents of radioactive elements in the studied soils may be related to the leaching process of uranium from the parent country rocks beside adsorption of uranium on surface of ferruginous materials and / or on also clay surface.

Keywords: Geochemical, Radiometric, Trace elements, Does rate, Eastern Desert

INTRODUCTION

Wadi Nugrus area lies in the southern part of the Eastern Desert of Egypt. It's located 90 km. southwest of Marsa Alam and lies between latitudes 24° 40\ and 24° 50\ North and longitudes 34° 32\ and 34° 40\ East (Fig 1). The area could be reached from the Red Sea coast through Wadi El-Gemal area.

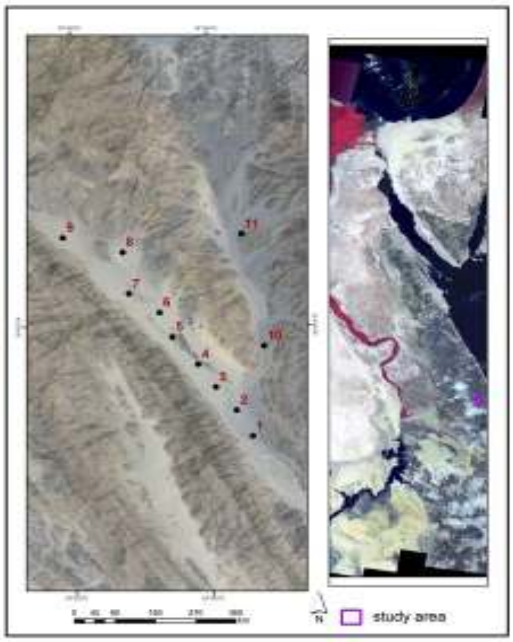

Fig.1. View showing location map of the studied profiles, Wadi Nugrus - Abu Rusheid area, SED, Egypt.

Abu Rushied area and Wadi El-Gemal are very rich in the nuclear materials such as U, Th, Nb, Ta, Zr, Be and Ga, Also wadi Abu Rushied area and Wadi El-Gemal deposits contain high concentration from nuclear materials and mineralized catalciastic rock (Ibrahim *et al.,* 2000*,* Oraby *et al,* 2003 and Ibrahim *et al*., 2007).

*(*El-Gaby *et al.,* 1984) revealed that the southern Eastern Desert domain (SED) extends from Egyptian-Sudanese order to (CED). It's characterized by the presence of ophiolitic belts encompassing between the organic belts trending NW. younger granites are rare in this domain (the striking feature is the ruse occurrence of younger granites). The Migiz –afafit domes and Wadi-Nugrus – Wadi El-Gemal areas, (SED), represent the geologic and tectonic key domains with great significance in the tectonic evolution of the Arabian Nubian Shield, which belongs to the pan African events.

The present work is aming to study the physical, chemical and geochemical properties of Wadi El-Nugrus soils beside the potential effect of some radioactive sources on the agricultural environment of Wadi-Nugrus at Abu-Rusheid area, South Eastern Desert of Egypt.

MATERIALS AND METHODS

On the basis of the obtained topographic map scale 1: 100.000 and the geomorphic map scale 1: 100 000 which are representing the soils of Wadi-Nugrus plain eleven soil profiles were select to represent the soils of Wadi El-Nugrus plain.

These profiles were described following the terminology outlined in the guidelines for soil description (*FAO, 2006*). Samples representing the vertical morphological variation within each profile were collected, air dried crushed and sieved through a 2 mm sieve. Then the necessary analyses were preformed

on the < 2 mm fractions. and subjected for the following analyses.

1- Physical and chemical analyses of the representative soil samples have been done analyzed using the soil Survey Laboratory Methods Manual (*USDA 2004*).

2- Geochemical analyses

Total elemental analyses:

The crushed samples were crushed again to 400 mesh grain size using PW 4018100 philips Mini Zirconia mill and the major oxides were measured using conventional wet chemical technique of Shapire and Brannock (1962) with some modifications given by El – Reedy *et al* (1988).

Determination of major oxides

Si O_2, Ti O_2, Al_2 O_3 and P_2 O_5 were analyzed using UNICAM UV2/100 Spectrophotometer, while Na_2 O and K_2 O were analyzed using PFP7 flame photometer and MnO was analyzed by GBC 932 / 933 Atomic Absorption Spectrophotometer. Fe_2O, FeO, MgO and CaO were analyzed by means complex titrimetric technique using EDTA. Total organic matter (T.O.M) was determined by the loss of Ignition method at 550^o C. H_2 O (water of crystallization) was determined by the same method, but the samples were heated to 1000^o C. Moisture content (H_2 O) and then values were grouped under loss of ignition (L.O. I) category.

Table 1. Morphological description of the studied soil profiles.

Profile No.	Depth (cm)	Surface feature	Soil colour Dry		Soil colour Moist		Soil texture	Gravel %	Soil structure	Consistence	Efferv-esce-nce	Boundary
	0-50	many fine	10YR	4/3	10YR	6/3	S	few fine gr.	sn.g.	lo .n.st. n.pl.	mo.	c.s
1	50-100	to	10YR	4/3	10YR	6/3	S	few fine gr.	ma.	so. n.st. n.pl.	mo.	c.s
	100-150	medium gr.	5YR	4/4	5YR	5/4	LS	medium gr.	ma.	so. n.st. n.pl.	w	--
	0-50	many fine	7.5YR	5/4	7.5YR	6/4	S	few fine	sn.g.	lo .n.st. n.pl.	mo.	c.s
2	50-100	to	10YR	5/4	10YR	6/4	LS	few fine	ma.	lo .n.st. n.pl.	w	c.s
	100-150	medium gr.	10YR	5/3	10YR	6/3	S	v.few fine & med	ma.	h. n.st.n. pl.	w	--
	0-50	many fine	10YR	4/3	7.5YR	5/3	S	few fine	sn.g.	lo .n.st. n.pl.	mo.	d.s
3	50-100	to	10YR	4/3	7.5YR	5/3	S	mod. fine gr.	ma.	so. n.st. n.pl.	mo.	c.s
	100-150	medium gr.	10YR	4/4	10YR	4/4	LS	mod. med.gr	ma.	h. sl.st.sl. pl.	mo.	--
	0-50	many fine	10YR	4/4	10YR	5/4	LS	mod.fine&med.gr	sn.g.	lo .n.st. n.pl.	mo.	c.s
4	50-100	gr.	10YR	5/3	10YR	6/3	SL	mod. fine gr.	ma.	so. n.st. n.pl.	w	d.s
	100-150		10YR	4/3	10YR	5/3	LS	few fine gr.	ma.	h. n.st.n. pl.	w	--
	0-50	many fine	10YR	4/4	10YR	5/3	LS	mod. fine gr.	sn.g.	lo .n.st. n.pl.	w	c.w
5	50-100	gr.	10YR	4/3	10YR	5/4	SL	mod. fine gr.	ma.	so. sl.st. nslpl.	w	c.w
	100-150		10YR	4/3	10YR	5/3	S	few fine gr.	ma.	h. n.st.n. pl.	w	--
	0-50	many fine	10YR	5/3	10YR	6/3	S	Fine & med. gr.	sn.g.	lo. n.st. n.pl.	w	d.s
6	50-100	to	10YR	5/3	10YR	6/4	S	few fine gr.	ma.	so. n.st. n.pl.	w	d.s
	100-150	medium gr.	10YR	5/3	10YR	6/4	S	few fine gr.	ma.	so. n.st. n.pl.	w	--
	0-50	many fine	10YR	4/4	10YR	5/4	LS	mod. fine gr.	sn.g.	lo. n.st. n.pl.	mo.	c.s
7	50-100	to	10YR	4/4	10YR	5/4	S	few fine gr.	sn.g.	lo. n.st. n.pl.	mo.	d.s
	100-150	medium gr.	10YR	4/4	10YR	5/4	S	few fine gr.	ma.	so. n.st. n.pl.	mo.	--
	0-50	many fine	10YR	5/4	10YR	6/4	S	few fine gr.	sn.g.	lo .n.st. n.pl.	w	c.s
8	50-100	to	10YR	4/4	10YR	5/4	LS	few fine & med.gr.	ma.	so. n.st. n.pl.	w	c.s
	100-150	medium gr.	10YR	4/4	10YR	5/4	LS	few fine gr.	ma.	so. n.st. n.pl.	w	--
	0-50	many fine	10YR	5/4	10YR	6/3	SL	mod. fine gr.	sn.g.	lo. n.st. n.pl.	w	c.s
9	50-100	to	7.5YR	5/4	7.5YR	5/4	S	few fine gr.	sn.g.	lo. n.st. n.pl.	w	c.s
	100-150	coarse gr.	10YR	4/4	10YR	5/4	SL	----	ma.	lo. sl.st. sl.pl.	w	--
	0-50	many fine	10YR	4/4	10YR	5/4	LS	mod.fine gr.	sn.g.	lo. n.st. n.pl.	w	c.s
10	50-100	to	10YR	4/4	10YR	5/4	S	mod. fine gr.	sn.g.	lo. n.st. n.pl.	mo.	c.s
	100-150	medium gr.	7.5YR	4/3	7.5YR	5/3	SL	few fine gr.	ma.	so. sl.st. sl.pl.	mo.	--
	0-50	many fine	5YR	4/4	5YR	5/4	SL	mod.medi gr.	sn.g.	lo. sl.st. sl.pl.	mo.	c.s
11	50-100	to	10YR	4/4	10YR	5/4	S	few fine gr.	sn.g.	lo. n.st. n.pl.	mo.	d.s
	100-150	medium gr.	10YR	4/4	10YR	5/4	LS	few fine gr.	ma.	lo. n.st. n.pl.	mo.	--

Texture
S= Sandy
SL= Sandy Loam
LS= Loamy Sand

Structure
ma= massive
sn. g= single grains

Consistence
(dry)- lo=loss so=soft h=hard sl.h= slightly hard
(moist)- lo=loss fr=friable
st= sticky pl= plastic
(wet)- n.st=non sticky n. pl.=non plastic st=sticky
sl.st.=slightly sticky sl.pl=slightly plastic

Effervescence
w= weak
mod= modrate
Gravel%
gr.=gravel
med.=medium
mod.=moderate
v.= very

Boundary
c.s= clear smooth
d.s= diffuse smooth
c.w= clear wavy

Determination of trace elements

For x-ray fluorescence analysis, a pressed powder pellets were prepared by filling an alumina Cup (diameter 4 cm, highlight 1.2 mm and weight 39), with 9g of crystalline boric acid covered by 1 g, the ground sample, (- 200 mesh grain size) and then pressed under

12 ton using semi-automatic hydraulic press model HERAOGHTP-40. The trace elements concentrations were calculated from the programs calibration curves, which were set up according to international references materials. The detection limits is the lowest concentration and it is a function of the level of background noise relative to an elements signal (**Norrish and Chappell, 1966**). The detection limit for the measured elements by XRF technique is ± 5 ppm.

Determination of U, Th and K in soils

The radiometric analysis were carried out in the field by using the handling Eberline Smart portable (ESP, Model 9903) instrument, that courts the total gamma rays emitted from the various rocks in Counts Per Second (CPS) as well as by using multi-channel analysis of X-ray detector (gamma ray spectrometer technique) which measure the U and Th concentration (IAEA, 1979).

RESULTS AND DISCUSSION

Physical and chemical properties:

Data of physical and chemical analysis of the studied soils of Wadi El-Nugrus area (Tables 2 and 3), showed that the studied soils fall into three soil texture classes for the faire earth, namely sandy, loamy sand and sandy loam where coarse sand, fine sand, silt and clay varies from 19.97 to 15.79, 16.12 to 43.85, 3.7 to 39.42 and 0.85 to 8.15 % respectively. These variations in soil texture are expected due to the differences in soil origin, natural sedimentation pattern and intensity of weathering. The soils are non to slightly calcareous as shown by calcium carbonate content which varies from 2.5% to 5.8% Organic matter content varied from 0.07% to 0.41%. The extremely low contents of organic matter are expected due to prevailing aridity of the region and its very scanty vegetation.

Data presented in Table (3) revealed that the pH values of the studied soil profiles ranged between 7.49 and 8.81 indicated that these soils are slightly to moderately alkaline. Salinity levels ranged from non saline (0.32 dsm^{-1}) and slightly saline (6.29 dsm^{-1}). Sodium ions are the predominant soluble cations followed by Ca^{++} and Mg^{++} in all the studied soil sites, while the contents of K^{+} ions are rather low, except for the surface layers of profiles No. 1 and 8, where Ca^{++} ion exceeds Na^{+}. Concerning the soluble anions, $SO^{=}4$ surpassel Cl^{-} in the non-saline or slightly saline soils, however the reverse was true for the deepest layers of profiles No. 3 and 5 and all layers of profile 7, then both anions are followed by HCO^{-}_{3}.

Table 2. Particle size distribution, texture class , CaCO3 and O.M content of the studied soil profiles, Wadi Nugrus - Wadi Abu Rusheid area, SED, Egypt.

Profs. No.	Depth (cm)	Particle size distribution (%)				Texture Class	$CaCO_3$ %	OM %
		Clay	Silt	F.S	C.S			
	0-50	1.55	11.45	20.27	66.73	S	3.3	0.25
1	50-100	1.83	6.26	16.12	75.79	S	3.6	0.24
	100-150	4.32	15.68	25.08	54.92	LS	4.1	0.21
	0-50	1.60	4.43	21.72	72.25	S	4.7	0.16
2	50-100	3.24	14.76	32.91	49.09	LS	4.5	0.11
	100-150	1.12	6.88	34.62	57.38	S	4.3	0.11
	0-50	0.85	6.15	28.78	64.22	S	5.2	0.41
3	50-100	1.35	7.65	38.10	52.90	S	5.8	0.18
	100-150	1.85	16.15	29.51	52.49	LS	4.8	0.12
	0-50	3.67	19.33	28.88	46.12	LS	4.3	0.27
4	50-100	8.15	33.25	24.60	34.0	SL	3.7	0.15
	100-150	4.80	14.38	38.35	42.47	LS	3.6	0.10
	0-50	4.32	11.16	30.82	53.70	LS	2.5	0.19
5	50-100	3.15	32.43	35.60	28.82	SL	2.4	0.15
	100-150	3.70	13.30	43.85	39.15	LS	3.3	0.11
	0-50	1.44	6.60	28.71	63.25	S	3.8	0.32
6	50-100	1.25	10.80	31.0	56.95	S	4.1	0.11
	100-150	1.10	6.90	37.48	54.52	S	4.6	0.12
	0-50	3.46	13.54	23.89	59.11	LS	6	0.21
7	50-100	1.85	9.15	31.51	57.49	S	5.2	0.12
	100-150	1.15	7.57	25.08	66.20	S	5.6	0.12
	0-50	0.95	10.10	28.80	60.15	S	3.6	0.31
8	50-100	1.85	15.95	33.5	48.75	LS	2.5	0.19
	100-150	1.62	20.38	40.20	37.80	LS	3.3	0.15
	0-50	3.78	26.22	36.46	33.54	SL	2.7	0.28
9	50-100	1.00	4.93	27.50	66.57	S	2.8	0.22
	100-150	6.70	38.18	35.15	19.97	SL	3.3	0.12
	0-50	6.35	11.65	30.30	51.70	LS	3.4	0.25
10	50-100	1.12	7.84	30.14	60.90	S	4.3	0.13
	100-150	7.18	39.42	31.80	21.60	SL	5.3	0.07
	0-50	5.72	28.88	28.5	36.90	SL	5.2	0.23
11	50-100	0.85	3.70	36.7	58.75	S	5.3	0.17
	100-150	3.72	11.28	22.4	62.60	LS	5.7	0.10

S: Sand, SL: Sandy loam and LS: Loamy sand

Table 3. Chemical composition of major oxides, Wadi Nugrus – Wadi Abu Rusheid area, *SED, Egypt.

Profiles No.	Depth (cm)	PH	ECe (dSm^{-1})	Cations (meq/L)				Anions (meq/L)			
				Ca^{++}	M_9^{++}	Na^{+}	K^{+}	$CO^{=}_3$	HCO^{-}_3	Cl^{-}	$SO^{=}_4$
	0-50	7.62	1.05	4.01	3.00	2.90	0.35	0.00	1.28	1.40	7.58
1	50-100	7.60	1.67	5.00	4.00	7.40	0.29	0.00	1.80	5.96	8.94
	100-150	7.60	1.52	3.00	2.00	10.18	0.22	0.00	1.36	5.22	8.82
	0-50	7.74	0.9	3.20	2.1	3.50	0.50	0.00	1.50	2.50	5.00
2	50-100	7.78	0.48	1.94	1.50	2.60	0.10	0.00	0.40	1.90	2.50
	100-150	7.75	1.06	2.20	2.70	5.98	0.22	0.00	3.50	3.22	4.38
	0-50	7.94	0.27	0.65	0.50	1.45	0.10	0.00	0.25	0.85	1.60
3	50-100	7.97	0.48	1.59	1.03	2.15	0.03	0.00	1.12	1.56	2.12
	100-150	7.73	1.11	2.00	2.30	6.56	0.52	0.00	1.25	5.20	5.12
	0-50	7.97	0.42	0.75	1.00	2.35	0.10	0.00	0.25	1.75	2.20
4	50-100	7.75	0.53	1.85	0.30	2.95	0.20	0.00	0.35	1.86	3.10
	100-150	7.88	0.52	1.82	0.37	2.90	0.21	0.00	0.10	1.90	3.20
	0-50	8.03	0.32	0.85	0.33	1.92	0.10	0.00	0.05	1.10	2.05
5	50-100	7.86	0.35	0.90	0.50	i.so	0.20	0.00	0.42	1.23	1.85
	100-150	7.53	0.57	0.80	1.77	2.88	0.23	0.00	0.30	1.83	1.55
	0-50	7.80	0.62	2.12	1.03	2.90	0.15	0.00	1.23	2.05	2.95
6	50-100	7.80	1.75	4.50	5.50	7.80	0.83	0.00	1.00	4.35	12.67
	100-150	8.04	0.40	1.50	0.75	2.31	0.20	0.00	0.16	1.06	3.00
	0-50	8.10	0.50	2.31	0.75	4.50	0.14	0.00	1.60	4.00	2.10
7	50-100	8.81	0.93	4.62	1.52	5.20	0.28	0.00	0.62	7.00	3.00
	100-150	7.65	0.85	2.70	2.01	4.62	1.06	0.00	1.80	5.00	2.89
	0-50	8.06	1.04	4.00	3.00	2.92	0.39	0.00	1.25	1.35	7.71
8	50-100	7.81	0.36	1.35	0.27	1.95	0.03	0.00	0.10	1.45	2.05
	100-150	8.26	1.02	3.21	1.22	5.65	0.12	0.00	0.70	3.15	6.35
	0-50	7.80	6.59	6.50	11.50	47.77	0.33	0.00	3.50	50.21	12.39
9	50-100	7.49	2.75	3.50	2.00	21.93	0.45	0.00	2.12	8.66	17.10
	100-150	7.58	0.86	1.95	1.09	5.35	0.21	0.00	1.40	3.35	3.85
	0-50	7.87	0.88	2.45	2.12	4.12	0.11	0.00	0.85	2.85	5.10
10	50-100	8.08	0.34	0.90	0.80	1.55	0.15	0.00	0.05	1.50	1.85
	100-150	8.02	0.53	1.73	0.82	2.50	0.12	0.00	0.57	1.60	3.00
	0-50	7.82	0.72	3.10	1.63	3.47	0.16	0.00	0.10	2.85	4.56
11	50-100	7.92	0.78	2.15	1.89	3.65	0.11	0.00	1.17	2.65	3.98
	100-150	7.50	0.34	1.20	0.58	1.50	0.12	0.00	0.50	0.95	1.95

*SED= South Eastern Desert

Geochemical Studies:

The chemical composition and the content of elements may give some informations about the nature of sediments and minerals forming the soil matrix. For a certain element, this content may vary from soil to soil according to its origin, ie, parent material soil forming process; etc. The role of parent material in determining the total content of elements inherited by soil and the consequent modifications resulting in their distribution could be extrapolated from the results presented herein. Table (3) gives the values as percent of ignited soil for each element in the subsequent layers of the investigated soil profiles. The table shows that the elements distribution is as follows.

Major Oxides:

Silica (SiO_2) content is the major component in all the studied soil profiles representing Wadi Nugrus. Its content ranges from 47.47 % to 68.55% with different treads in each soil profile layers. The increase in silica content for the studied soils of wadi Nugrus may be due to the presence of a higher content of Kaolinite and illite clay minerals (as detected from the XRD analysis), in addition to the presence of more quartz and feldspars minerals.

Alumina is the second abundant constituent, of Al_2O_3 in the studied soils may be due to its high content of Al-bearing minerals. The high contents of SiO_2 and Al_2O_3 may give another indication to the dominant arid condition, denoting the prevailing weathering process during the formatting of these soils.

Aluminum concentration in the studied soil samples varies between 8.84 % and 14.17 % (Table 4), which is higher than the equivalent world wide range obtained by FAO and UNESCO (1974).

Titanium oxides (TiO_2) content was very low and ranged in a narrow limit between 0.21 % and 0.97 % the lowest value was formed in

The surface layer of profile 10, where the highest value was detected in the subsurface layer of profile 4. TiO_2 content values fall in the world equivalent range obtained by FAO and UNESCO (1974).

Table 4. Major oxides (%) analysis of the Wadi Nugrus - Wadi Abu Rusheid area, SED, Egypt

Profile	Depth (m)	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	P2O5	110C	550C	1000C	Total
P1	00-0.50	66.76	0.77	10.42	7.2	4.2	3	3.44	2.58	0.102	0.09	0.81	0.47	99.84
	0.50-1.0	62.95	0.46	11.51	4.8	7	3	4.55	2.68	1.06	0.28	0.82	0.66	99.77
	1.0 -1.50	62.74	0.99	10.56	6.4	8.4	3	3.29	2.01	0.102	0.82	0.59	0.67	99.1
	Average	64.15	0.74	10.83	18.4	6.53	3	3.76	2.42	0.42	0.38	0.74	0.60	99.57
P2	00-0.50	63.25	0.22	12.07	4	7	4	5.06	2.68	0.04	0.31	0.54	0.47	99.63
	0.50-1.0	63.5	0.37	11.84	4.4	7	3	5.4	1.76	0.04	0.3	0.63	1.13	99.37
	1.0 -1.50	61.99	0.34	13.04	4	7	3	4.89	2.10	1.45	0.27	0.6	0.86	99.54
	Average	72.47	0.31	12.32	4.13	7	3.3	5.11	2.18	0.51	0.29	0.59	0.82	99.51
P3	00-0.50	59.82	0.8	10.90	6.4	9.8	4	4.05	2.20	0.122	0.01	0.54	1.04	99.96
	0.50-1.0	63.24	0.7	8.84	2.8	11.2	4.	4.72	2.68	0.102	0.02	0.34	0.32	99.06
	1.0 -1.50	62.24	0.54	13.27	5.2	5.6	4	4.05	2.29	0.613	0.03	0.57	0.86	99.52
	Average	89	0.68	11.00	4.8	8.86	4	4.27	2.39	0.279	0.02	0.48	0.74	99.51
P4	00-0.50	62.39	0.47	11.13	7.2	5.6	4	4.55	2.39	0.102	0.018	0.56	0.93	99.53
	0.50-1.0	62.39	0.97	11.84	6.4	7	3	3.89	2.68	0.081	0.02	0.42	0.94	99.30
	1.0 -1.50	62.24	0.49	9.9	7.2	7.2	3	3.29	2.01	0.102	0.03	0.92	1.16	99.48
	Average	62.34	0.64	10.96	6.9	6.6	3.3	3.91	2.36	0.095	0.022	0.63	1.01	99.44
P5	00-0.50	67.35	0.72	11.09	4	4	3	2.84	2.2	0.26	0.05	0.46	0.77	99.38
	0.50-1.0	64.57	0.43	12.52	7.2	7.2	2	3.29	2.2	0.102	0.01	0.54	0.74	99.59
	1.0 -1.50	64.68	0.49	11.02	8.4	8.4	2	3.29	2.01	0.143	0.03	0.66	0.84	99.62
	Average	65.53	0.54	11.54	6.5	6.53	2.3	3.14	2.13	0.17	0.03	0.55	0.78	99.53
P6	00-0.50	62.77	0.73	11.46	7.2	7.2	3	3.29	2.2	0.102	0.05	0.62	1.07	99.65
	0.50-1.0	65.63	0.73	12.33	5.6	5.6	3.	2.7	1.82	0.102	0.01	0.89	1.16	99.72
	1.0 -1.50	64.35	0.59	11.43	4.4	8.4	3	3.14	2.01	0.28	0.03	0.92	1.2	99.69
	Average	64.25	0.68	11.74	5.73	7.06	3	3.04	2.01	0.161	0.03	0.81	4.74	99.68
P7	00-0.50	59.21	0.41	13.28	7.4	8.4	3	2.99	2.2	0.225	0.20	0.88	1.1	99.5
	0.50-1.0	60.28	0.70	12.61	3.6	11.2	4	3.14	2.2	0.122	0.30	0.82	0.71	99.37
	1.0 -1.50	62.61	0.39	12.82	5.2	7	3	3.29	2.2	0.122	0.50	0.98	1.02	99.08
	Average	60.7	0.5	12.90	5.4	8.86	3.33	3.14	2.2	0.156	0.33	0.89	0.94	99.32
P8	00-0.50	65.82	0.42	11.61	6.8	5.6	2	2.57	2..01	0.143	0.10	0.93	1.37	99.60
	0.50-1.0	59.92	0.33	13.35	6	7	3	4.05	1.46	0.163	0.30	0.82	1.1	99.69
	1.0 -1.50	47.47	0.50	12.97	19.17	7	3	3.29	1.58	2.29	0.20	0.86	1.41	99.6
	Average	57.73	0.41	12.64	10.65	6.53	2.66	3.30	1.68	0.86	0.2	0.87	1.29	99.63
P9	00-0.50	65.65	0.34	13	5.6	5.6	2	2.57	1.58	2.11	0.06	0.9	1.29	99.54
	0.50-1.0	63.63	0.57	12	5.2	7	3	3.14	12.68	0.286	0.04	0.93	0.62	99.59
	1.0 -1.50	62.17	0.28	14.17	6.4	7	3	2.7	1.64	0.613	0.05	0.73	1.14	99.96
	Average	63.82	0.40	13.05	5.73	6.53	2.66	2.80	5.3	1.00	0.05	0.85	1.01	99.69
P10	00-0.50	68.53	0.21	13.72	4	4.2	2	2.7	2.39	0.204	0.02	0.7	0.84	99.63
	0.50-1.0	65.75	0.37	12.1	4.8	5.6	2	4.05	2.39	0.143	0.47	0.71	0.7	99.21
	1.0 -1.50	66.63	0.33	12.14	3.6	5.6	4	2.7	2.68	0.122	0.04	0.66	0.56	99.38
	Average	66.97	0.30	12.65	4.13	5.13	2.66	3.15	2.48	0.823	0.176	0.69	0.7	99.40
P11	00-0.50	66.92	0.64	11.35	6.4	5.6	2	3.14	1.52	0.143	0.02	1.23	0.73	99.94
	0.50-1.0	67.92	0.37	11.90	4.8	5.6	2	2.99	2.2	0.081	0.08	0.89	0.94	99.55
	1.0 -1.50	62.96	0.55	12.93	5.6	5.6	4	2.84	1.64	0.163	0.09	1.23	1.33	99.34
	Average	65.93	0.52	12.06	5.6	5.6	2.6	2.99	1.79	0.129	0.06	1.14	1.00	99.61

Iron Fe_2O_3 content ranges from 2.80% to 19.17% the relatively high content of Fe_2O_3 may be related to the presence of discrete clay minerals in these soil samples as verified from the XRD analysis.

CaO is present in all the analyzed samples and ranged from 4.20% to 11.20%. The wide range of CaO in the studied soils is related to variations in Ca CO_3 content and CaO bearing minerals.

MgO content in the studied soils ranges from narrow limit 2.00 to 4.00%. The narrow range of Mg O content may indicate that Mg content of soils and Mg bearing minerals lie within a narrow range.

NaO is present in all the examined soil samples but in minor content. It varies from 2.57% to 5.40% which may be ascribed to possible presence of Na-bearing minerals such as Na-feldspars (alibte).

The K_2O content ranges between 1.46% and 2.68% for the studied soil profiles. The highest content of K_2O may be due to the relatively high contents of hydrous mica and other K-bearing minerals.

P_2O_5 is generally, present in very low content for the studied soils ranging from 0.04% to 2.29% with an irregular distribution pattern with depth. The low content of P_2O_5 in which Wadi Nugrus soils may be due to the nature of these soils.

Loss of ignition (L. O. I):

The determined water content lost between 110^o c and 1000^o c was found to range from 0.09% and 1.32% for the studied soil profiles. The relatively lower water content in the soils of Wadi Nugurs area is possible related to their lower content of expanding 2:1 clay mineral species.

In conclusion, while the nature of parent material is the major factor determining the general status of elements in the studied soils, the distribution of these elements within the different layers of profiles is a function of the soils characters.

Trace elements geochemistry:

In the fine grained sediments, such as soils, silt and clay fractions, trace elements may be carried into solutions as fluiddy divide suspended detritus and / or in lattic position with existing minerals. The abundance and distribution of the trace elements in Wadi Nugrus soils are listed in Table (5), the following is, however, a short account of some of the analyzed trace elements.

Chromium (Cr) concentration in the studied soil profiles varied from 137 mg kg^{-1} in the surface layer of profile 5, and 526 mg kg^{-1} in the deepest layer of profile 1 with an average ranged from 162.3 to 370.7 mg kg^{-1}. chromium content in the studied soils lie over the world geometric mean of 72 mg kg^{-1} published by *FAO and UNESCO (1974)*. Also, the high content of Cr in the studied soils may be due to the soils are inherited from parent rocks so, may be drived from mafric and volcanic rocks (*Aubert and pinto, 1977*).

The concentration of Ni with studied soil samples ranged from 51.0 to 269.0 kg^{-1} with an average ranged between 75.3 to 203.3 mg kg^{-1}, which is in the range of the published data by FAO and UNESCO (1974), (5-700 mg kg^{-1}).

Copper (Cu) concentration in the studied soil profiles ranges from 49 to 79 mg kg^{-1} with an average varied from 58.3 to 72.3 mg kg^{-1} , which is higher than the world geometric mean of 33 mg kg^{-1} obtained by FAO and UNESCO (1974).

Table 5. Trace elements analysis for soil samples, Wadi Nugrus - Wadi Abu Rusheid area, SED, Egypt.

Profile No:	Depth/ m	Trace Elements												
		Cr	Ni	Cu	Zn	Zr	Rb	Y	Ba	Pb	Sr	Ga	V	Nb
P1	00-0.50	215	99	59	280	823	335	70	52	98	86	Ad	25	31
	0.50-1.0	222	119	71	446	1048	299	89	67	149	105	2	34	39
	1.0 -1.50	526	153	66	344	516	350	45	54	228	53	3	38	19
	Average	322	123.7	65.3	356.7	795.7	328	68	57.7	158.3	81.3	1.7	32.3	29.7
P2	00-0.50	217	137	68	944	446	313	39	41	136	46	2	22	17
	0.50-1.0	299	267	66	330	359	249	31	74	142	37	2	40	14
	1.0 -1.50	222	125	74	457	267	305	32	77	189	37	3	41	14
	Average	246	176.3	63.9	571	357.3	289	34	64	155.7	40	2.3	34.3	15
P3	00-0.50	286	193	68	504	324	282	28	105	124	33	Ad	57	12
	0.50-1.0	145	51	53	184	258	287	22	68	64	26	Ad	36	10
	1.0 -1.50	273	190	78	413	457	325	39	82	143	17	2	45	17
	Average	234.7	144.7	66.3	367	346.3	298	29.7	85	110.3	25.3	0.7	46	9.4
P4	00-0.50	173	100	53	282	249	242	21	92	71	24	Ad	18	9
	0.50-1.0	161	53	67	223	251	224	22	76	63	26	Ad	38	9
	1.0 -1.50	175	106	68	341	226	144	19	181	80	22	Ad	93	8
	Average	169.7	96.3	62.7	282	242	203.3	20.7	116.3	71.3	24	Ad	49.6	8.7
P5	00-0.50	137	70	49	186	241	196	21	79	62	24	Ad	39	9
	0.50-1.0	166	98	61	251	345	250	20	103	84	36	Ad	50	13
	1.0 -1.50	184	121	72	249	268	194	23	107	66	27	Ad	53	10
	Average	162.3	75.3	60.7	228.7	284.7	213.3	24.7	96.3	70.7	29	Ad	47.3	10.7
P6	00-0.50	223	145	67	373	500	429	43	102	127	50	2	55	19
	0.50-1.0	206	111	76	1034	359	171	34	185	120	37	2	88	14
	1.0 -1.50	196	112	64	347	511	305	44	121	133	53	2	63	19
	Average	211.7	122.7	69	584.7	456.7	335	40.3	136	126.7	46.7	2	68.7	17.3

All Elements are expressed by ppm. * Ad = undetermined

Table 5. Conten.

Profile No:	Depth/ m	Trace Elements												
		Cr	Ni	Cu	Zn	Zr	Rb	Y	Ba	Pb	Sr	Ga	V	Nb
P7	00-0.50	268	217	62	416	334	356	28	99	111	34	Ad	56	12
	0.50-1.0	156	75	64	244	314	237	27	96	78	32	Ad	49	12
	1.0 -1.50	243	164	79	454	415	334	35	117	197	43	3	66	15
	Average	222.3	152	68.3	371.3	355.3	309	30	104	128	36.3	1	57	13
P8	00-0.50	395	222	67	300	289	295	25	109	185	29	2	70	11
	0.50-1.0	336	206	77	287	318	230	27	126	152	33	2	85	12
	1.0 -1.50	381	263	73	344	260	225	22	118	148	27	2	76	10
	Average	370.7	203.3	72.3	310.3	289	250	24.7	117.7	161.7	29.7	2	77	11
P9	00-0.50	223	135	65	333	463	263	40	146	102	48	Ad	76	17
	0.50-1.0	163	84	65	344	341	407	29	79	114	34	Ad	44	13
	1.0 -1.50	273	200	74	410	346	238	29	152	149	35	2	82	13
	Average	219.7	139.7	68	362.3	383.3	302.7	32.7	125.7	121.7	39	0.7	67.3	14.3
P10	00-0.50	188	103	64	245	370	296	32	72	77	39	Ad	40	14
	0.50-1.0	157	80	55	444	207	180	18	99	50	22	Ad	52	8
	1.0 -1.50	153	67	56	500	790	724	68	57	179	81	2	28	10
	Average	166	83.3	58.3	396.3	455.7	393.7	39.3	75	102	47.3	0.7	40	10.7
P11	00-0.50	214	127	74	527	356	281	31	69	149	35	2	37	13
	0.50-1.0	244	269	62	213	302	217	26	58	89	30	Ad	35	11
	1.0 -1.50	203	118	63	299	313	207	27	125	8.5	33	Ad	64	12
	Average	220.3	138	66.3	346.3	323.7	235	28	84.3	82.1	32.7	0.7	45.3	12

Zn concentration of the studied soils varied from 184 mg kg^{-1} in the 50-100 em layer of profile 3 and 1034 mg kg^{-1} in the subsurface layer of profile 6, with an average from 228.7 to 584.7 mg kg^{-1}, which is above the world equivalent geometric mean 94 mg kg^{-1} obtained by *FAO and UNESCO (1974)* .

Zirconium (Zr) concentration in the investigated soil profiles ranges from 207 to 1047 mg kg^{-1} with an average varied from 242 to 795.7 mg kg^{-1} , which lie in the obtained range by *FAO and UNESCO (1974)* of 20 to 2000 mg kg^{-1}.

The Rubidium (Rb) concentration in the studied soils of Wadi Nugrus area ranges between 144 and 724 mg kg^{-1}, with an average varied from 203.3 to 393.7 mg kg^{-1}, while it is higher than the world geometic range (20-40 mg kg^{-1}).

The concentration of Yttrium (Y) in the studied soils profiles varied from 18 to 89 mg kg^{-1} with an average ranges from 20.7 and 68.0 mg kg^{-1} . The mean values of the studied soils are above the equivalent world wide concentration of 30 mg kg^{-1} published by *FAO and UNESCO (1974)*.

Data in Table (4) reveal that the concentration of Barium (Ba) in the studied soil profiles varied from 41 mg kg^{-1} to 185 mg kg^{-1} with an average varies between 57 and 136 mg kg^{-1} which is considered under the world equivalent geometric mean 460 mg kg^{-1} obtained by *FAO and UNSECO (1974)*.

The lead (pb) concentration in the studied soil profiles were varied from 50 to 228 mg kg^{-1}, with an average ranges from 70.7 to 161 mg kg^{-1}. the mean values of lead in the studied area are above the world equivalent geometric mean (19 mg kg^{-1}) obtained by *FAO and UNESCO (1974)*.

Strontium (Sr) concentration values of the studied soils ranged between 17 mg kg^{-1} and 105 mg kg^{-1}, with an average values from 24 to 81.3 mg kg^{-1}, which lie in the world soil ranges (5 – 3000 mg kg^{-1}) according to *FAO and UNSECO (1974)*.

Data in Table (4) show that the concentration of Gallium (Ga) in the soils of Wadi-Nugrus ranged from 2 to 3 mg kg^{-1} with an average varied from 0.7 to 2 mg kg^{-1}, which is under the world equivalent geometric mean of 18 mg kg^{-1} obtained by *FAO and UNESCO (1974).*

Result in Table (4) reveal that the concentration of vanadium element (V) in the studied soils varied from 18 mg kg^{-1} and 93 mg kg^{-1} which lie within the ranges published by *FAO and UNESCO (1974)* of 7 to 500 mg kg^{-1}.

Data in Table (4) reveal that the Niobium (Nb) concentration in the studied soils of Wadi Nugrus ranged between 8 mg kg^{-1} and 39 mg kg^{-1} with an average varies from 8.7 to 29.7 mg kg^{-1} which is above the world equivalent geometric mean (13 mg kg^{-1}) obtained by *FAO and UNESCO (1974)*.

Radiometric studies:

Natural radionuclides in agricultural environments were recently explored in order to set levels of environments quality control in Wadi Nugrus area. These radioactive elements may occur naturally in some parent materials drived from rich radioactive rocks, adding fertilizers, especially phosphates rock and K salts, may add radionuclide to intersively managed soils.

The major radioactivity in rocks is a result of the natural decay of three radioactive sources of uranium-radium family, thorium family and of the radioactive isotope of potassium K^{40} (Adams et al., 1956). Each rock type has its own specific radioactivity, may be produced α, β and Y rays. U^{235} ends with stable pb^{207}, while Th^{232} ends with stable pb^{208}. potassium (K^{40}) disintegrate to give argon Ar^{40}, which is stable.

For studing radioactive elements (Th, U, Ra and K) in the soils of Wadi Nugurs, thirty three soil samples representing eleven soil profiles were analyzed by

gamma-ray spectrometric techniques for measuring their uranium, thorium, radium and potassium isotope contents.

Data in Table (6) reveal that Th content of the studied soil profiles varied from 6 to 37 ppm, with an average mean ranged from 9 to 30.7 ppm. eU content ranged between 20 and 150ppm, with an average varied from 33.3 to 104.3 ppm. Ra content in the studied soils ranged from 6 to 23 ppm, with an average varied from 7.0 to 14.3 ppm, while K, isotope content ranged between 1.58 and 3.29% with an average varied between 1.8 and 2.8%.

In the studied soil profiles, eU and Th contents are higher than Ra content. The studied soil samples contain relatively higher values of uranium element as a compared to the standard limiting the presence of uranium in the soils (less than 1 to 8 ppm.), published by IAEA 1988). Also, The average content of U^{238} is still higher than that reported by the IAEA (1988).

It can be noticed that, the enrichment of uranium especially in Wadi Nugrus – Wadi Abu Rusheid area is due to uranium rich minerals most probably zircon ($ZrSO_4$) drived from the parent rocks, beside the altered zircon recored in the area and tifiedified by (XRD) . Altered zircon is found as accessory mineral derived from parent country rocks (Ibrahim et al 2004 and Saleh et al 2013). Accordingly, the previous profiles are enriched with Uranium and thorium radionuclides.

Table 6. eTh, eU, Ra and K contents of the studied soil profiles representing Wadi Nugrus:

Profile No	Depth (cm)	eTh (ppm)	eU (ppm)	Ra (Eu) (ppm)	K%
	0-50	34	104	23	2.53
1	50-100	37	122	20	2.83
	100-150	21	88	15	2.72
	0-50	29	69	15	3.29
2	50-100	24	63	13	2.37
	100-150	16	61	16	2.42
	0-50	10	32	8	2.58
3	50-100	11	90	9	2.88
	100-150	12	34	10	2.58
	0-50	12	26	7	2.84
4	50-100	7	100	6	2.73
	100-150	8	30	8	2.22
	0-50	9	20	6	2.81
5	50-100	10	150	9	2.65
	100-150	9	22	6	2.82
	0-50	16	33	12	1.95
6	50-100	9	58	11	2.45
	100-150	15	100	12	1.85
	0-50	17	39	13	2.25
7	50-100	15	27	9	2.81
	100-150	10	34	11	2.45
	0-50	17	50	12	1.98
8	50-100	8	32	8	1.75
	100-150	13	44	9	1.58
	0-50	22	49	14	2.34
9	50-100	14	37	10	2.85
	100-150	17	29	12	2
	0-50	7	29	8	2.76
10	50-100	6	122	6	2.55
	100-150	24	82	18	2.82
	0-50	13	51	15	2.34
11	50-100	7	82	7	3.18
	100-150	19	95	17	2.41

Radiation exposure rate and equivalent does rate in the studied area.

The radition exposure rate has been calculated from the apparent concentration of eU, eTh in (ppm) and K (%) applying the following expression International Atomic Enerrgy Ageuey (IAEA1991):

Exposure rate(Ur/H)=1.505k(%)+0.653Eu(PPM)+0.287eTh(ppm).

The relation exposure raye can be converted to equivalent radiation does rate through the use of simple conversion factor as follows (IAEA 1979).

Does rate (mSv/y) = 0.0833* exposure rate (Ur/h)

The International commission of Radiological Protection (I.C.R.P.) has recommended that no individual should receive more than 5000 millirems /year (50 mSv/y) rom all a natural and radiation source in human euvivonment (IAEAS. 1979),

(2000), the IAEA. Recommended that the does not exceed one Mill Sievert per year

Table 7. Exposure rate and equivalent does rate for the studied Nugrus Soil samples.

Profile No.	Depth (cm)	Exposure Rate (Ur/h)	Equivalent does rate (mSv/y)
	0-50	81.48	6.697
1	50-100	92.10	7.672
	100-150	65.82	5.483
	0-50	68.98	5.746
2	50-100	54.13	4.509
	100-150	46.85	3.903
	0-50	27.00	2.249
3	50-100	64.46	5.370
	100-150	28.85	2.403
	0-50	24.18	3.763
4	50-100	69.42	5.783
	100-150	24.83	2.052
	0-50	19.47	1.622
5	50-100	101.81	8.481
	100-150	20.75	1.728
	0-50	28.42	2.367
6	50-100	42.98	3.580
	100-150	70.39	5.863
	0-50	32.95	2.745
7	50-100	25.63	2.135
	100-150	28.08	2.339
	0-50	33.96	2.829
8	50-100	25.19	2.098
	100-150	33.96	2.829
	0-50	40.85	3.403
9	50-100	31.73	2.643
	100-150	26.25	2.187
	0-50	24.52	2.043
10	50-100	82.79	6.896
	100-150	63.04	5.251
	0-50	39.54	3.294
11	50-100	58.70	4.890
	100-150	69.22	5.767

In the study area and from Table (7), the highest value of does reach 8.481 mSv/y was recorded in the subsurface layer of profile 5, while the lowest value 1.622 mSv/y was detected in the surface layer of the same profile. These values are in the high side and in

the maximum radiation does rate with harm to the individuals with continues external radiation for the whale body.

From the previous discussion it is found that the main component of soil are quartz, Calcite, Kaolinite and accessory minerals showing that they are drived from igneous rocks. The major elements analysis shows the dominance of SiO_2, Al_2O_3 and Fe_2O_3 oxides, while trace elements are characterized by low concentration except that of Cr, Cu, Zn, Rb, Y,Pb and Nb. The U concentration ranges between 20 and 150 ppm., K40 ranges from 1.58 to 3.29 %, while that of Th content ranges between 6 and 37 ppm. Declaring that Wadi Nugrus area is high radioactive area.

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دراسات جيوكيميائيه وإشعاعية على أراضي وادي نجرس جنوب الصحراء الشرقية – مصر

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يهدف هذا البحث إلى دراسة وتقييم الخواص الجيوكيميائية وكذلك تأثير بعض المصادر المشعة على الأراضي والبيئة في وادي نجرس حيث يقع في الجزء الجنوبي من الصحراء الشرقية – مصر. اختير عدد 11 قطاع أراضي ممثلة لأراضي وادي نجرس وقد تم وصف هذه القطاعات الأرضية وصفًا مورفولوجيا وتم إجراء التحليلات الطبيعية والكيميائية والجيوكيميائية وكذلك تقدير تركيزات بعض العناصر المشعة في عينات هذه القطاعات الأرضية وتشير نتائج الدراسة إلى ما يلي:1- الخواص الطبيعية والكيميائية: تتميز أراضي وادي نجرس بالقوام الخشن حيث يختلف قوام التربة من الرملي إلى الطمي الرملي وقد تراوحت نسبة كربونات الكالسيوم فيها فيما بين 2.5% إلى 5.8 % - ومحتوى التربة من المادة العضوية منخفض جدًا. وتفاعل التربه يختلف من قلوي خفيف الي متوسط القلويه والملوحه ومن غير ملحيه الي ملحيه خفيفه. وقد تميزت الكاتيونات الذاتية بسيادة كايتون الصوديوم يليه الكالسيوم فالمغنسيوم وأخيرًا البوتاسيوم – أما الأنيونات الذائبة فقد أخذت الترتيب التالي $2.SO_4^{=}>Cl^{-}>HCO_3^{-}$- الخواص الجيوكيميائية: أظهرت نتائج التحليل الكيميائي الكلي للعناصر أن أكاسيد السليكا هي المكون الرئيسي تليها أكاسيد الألومنيوم والحديد وأحيانًا أكسيد الكالسيوم ويلي ذلك أكاسيد الماغنسيوم والصوديوم والبوتاسيوم وتمثل أكاسيد التيثانيوم والفوسفور نسبة ضئيلة من مكونات التربة. أوضحت النتائج أن العناصر الشحيحة الزوبان في المحلول الأرضي والتي تشتمل على (Cr, Cu, Zn, Rb, Y, Pb and Nb) و الموجودة في التربة تركيزها أعلى من الحد المسموح به والمنشور بواسطة المنظمات الدولية المختلفة (FAO, WHO, 1974) أما باقي العناصر فهي تقع في حدود المسموح بها. أما بالنسبة إلى النشاط الأشعاعي فقد وجد أن المنطقة تحت الدراسة نشطة إشعاعيًا حيث وجد أن تركز العناصر المشعة والتي تتمثل في عناصر K^{40}, Ra^{226}, Th^{232}, U^{238} أعلى من الحد المسموح به في التربة وقد فسر ذلك على أساس غسيل الصخور والمعادن المحتوية على عنصر اليورانيوم وكذلك إدمصاص اليورانيوم على المواد الـ Ferruginous، وكذلك على سطوح معادن الطين.