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CONTRIBUTIONS TO PHYSICO-CHEMICAL CHARACTERISTECS OF SOILS FROM SOUTH SINAI PENINSULA, EGYPT.

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ABSTRACT

All of the selected plains and wadis for this study are composed of soils of parent materials derived from almost the full suite of basement and sedimentary rocks represented in Sinai Peninsula.

The detailed morphological description of the soil profiles clear that Ramlet Himeir and Dabbt El Quari Plain soils are similar to each other which varies from sandy loam to loamy sand, structureless, slightly to moderately sticky, slightly to moderately plastic and slightly to moderately calcareous and covered with many scattered desert shrubs. These soils are formed of well sorted sediments indicating that wind plays a major role in their formation.

The field observations and data of laboratory analyses show that the soils of the studied wadis have textures fluctuating between loamy sand, sandy loam and sandy clay loam. These soils are commonly massive and slightly to moderately sticky, slightly to moderately plastic and non calcareous.

The soil reaction of the studied plains and wadis tends to the alkaline side mainly moderately alkaline to alkaline character.

Chemical analyses indicate that calcium carbonate and gypsum contents are very low in the soils of the plains. Soils derived from the studied plains are slightly saline. The soils of the studied plains and wadis have one pattern of cationic composition, this pattern characterized by Ca^{++}, Mg^{++}, Na^{+} and K^{+} dominant exchangeable cations. Calcium is the predominates exchangeable cations in the soils of the studied plains and wadis followed by Mg^{++}, Na^{+} while K^{+} is the lowest abundant exceptional cations. Organic matter content is e xtremely low in the studied wadis and plains. Silica content is the most predominant constituent in all the studied soil samples in the studied Plains and Wadis. The increase in Al_2O_3 content may be attributed to the increase of clay minerals content in the all studied soils. In both soil of plains and wadis, there is no indication of iron accumulation at any depth, indicating the absence of horizons and the lack of development. The high content of CaO in both plains and wadis may be attributed to the presence of calcite and dolomite minerals. Sodium and potassium are generally present as traces, because they are easily leached. Barium is the most dominant trace element in the studied plains and wadis. It is clear that, Cr content exhibits low concentration in sandy soil but is high in sandy loam soil. Zirconium is the most dominant element in the studied soil samples in all Wadis and Plains. Zinc seems to be distributed in low values at all soil profiles.

Key Words: Soil reaction, total salinity, electrical conductivity and cation exchange

INTRODUCTION

The studied plains represented by Ramlet Himeir, Dabbt El Quari and the studied wadis (Nasseib, Nukhul and Baba) are located in the Southwest Sinai between longitudes 33° 10` and 33° 40` E, and latitudes 28° 50` and 29° 10` N (Fig.1).

The present study aims to evaluate the physical and chemical properties of the soils in the studied wadis and plains. We hope to give a good account about these soils and their environment to be extended to the planners and decision markers for the agriculture development of Sinai Peninsula.

The general stratigraphic sequence exposed in the north and northwest of the area was given by Barron (1907), Ball (1916), Attia (1956), Omara and Schultz (1965), Kostandi (1969), Solieman and Abu El-Fetouh (1969), Weissbrod (1980), Kora (1984), El-Shahat and Kora (1986) and recently El-Fiky (1988) that gave an account of the stratigraphy of Paleozoic rocks. El-Aref *et al*. (1988) and El-Azzaz (1993) studied the geology of the basement rocks in Umm Bogma area. In wadi El- Berra and wadi Seih-Sidri area, the basement rocks were studied petrographically by El-Sheshtawi (1982), El-Gammal (1986) and El-Metwally (1986), while the geology of Wadi El-Berra and its vicinities is studied by Sherif (1992).

GEOLOGICAL SETTING

All of the selected plains and wadis for this study are composed of soils of parent materials derived from almost the full suite of basement and sedimentary rocks represented in Sinai Peninsula.

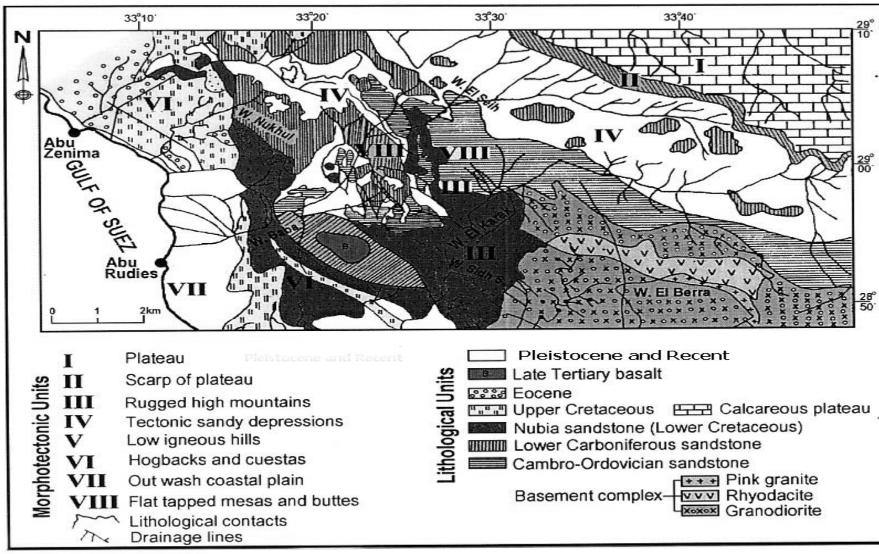

Fig.(1): Geological map of the studied wadis and plains (after Shata, 1997).

According to the geological map of Sinai, the western and northern parts are characterized by Phanerozoic sedimentary rocks, while the Precambrian basement rocks are exposed at the southeastern parts. The basement country rocks neighboring the studied areas are generally differentiated from oldest to youngest into: migmatites, gneisses and schist, diorites, older granitoids (granodiorite), pink granites and dykes (Shata, 1997), (Fig.1).

The sedimentary rocks in the southwestern parts of the studied area are differentiated into: 1. The Cambro-Ordovician rocks, 2. The Lower Carboniferous rocks, 3. The Permo-Triassic Rocks, 4. The Lower Cretaceous rocks, 5. The Upper Cretaceous rocks, 6. Esna Shale Formation (Paleocene),7. Thebes Formation (Lower Eocene) , 8. Lower Tertiary Volcanic rocks and 9. Quaternary Sediments; which include the following varieties: i-Aeolian Deposits are distributed along the pediment of El Tih Plateau and cover the depressions between El Tih Plateau and the southern high mountains of the studied area. These deposits are heavily accumulated and forming Dabbt El Quari and covering the tectonic depression of Ramlet Himeir Plain. ii-Alluvial Sediments, the great portions of all valley floors are composed of alluvial deposits brought down by the streams. In region of Wadi Seih Sidri, huge blocks and boulders of granite exist at the downstream of wadi Libin and wadi Tiema. Wadi El Shellal (Bada basin) is covered by gravel and sand grains, filling the interspaces between the gravel. iii-Outwash Deposits, these types of deposits represented by the fans of major streams along the western coastal areas (Wadi Baba, Wadi Nukhul, Wadi Seih-Sidri and Wadi Fieran) and by the deltaic and tidal flat deposits "beach placer sands".

MATERIALS AND METHODS

On the basis of the obtained geomorphic information, interpretation of uncontrolled aerial photographs scale 1:40.000 and geological map scale 1:100.000, the soil profiles were selected to represent the main geomorphic units and their associated soil groups in the study Plains and Wadis. Soil profiles (18 profiles) were dug to about 150 cm depth from the surface except when rocky substrata or bedrock interfere (Fig.2). These profiles were described following the terminology outlined in the guidelines for soil description, (FAO, 1990). Soil classification was carried out according to the Soil Survey Staff (1994). Samples representing the vertical morphological variation within each profile were collected, air dried and passed through 2 mm sieve. The gravel (>2mm) were stored, then the necessary analyses were performed on the < 2mm fractions.

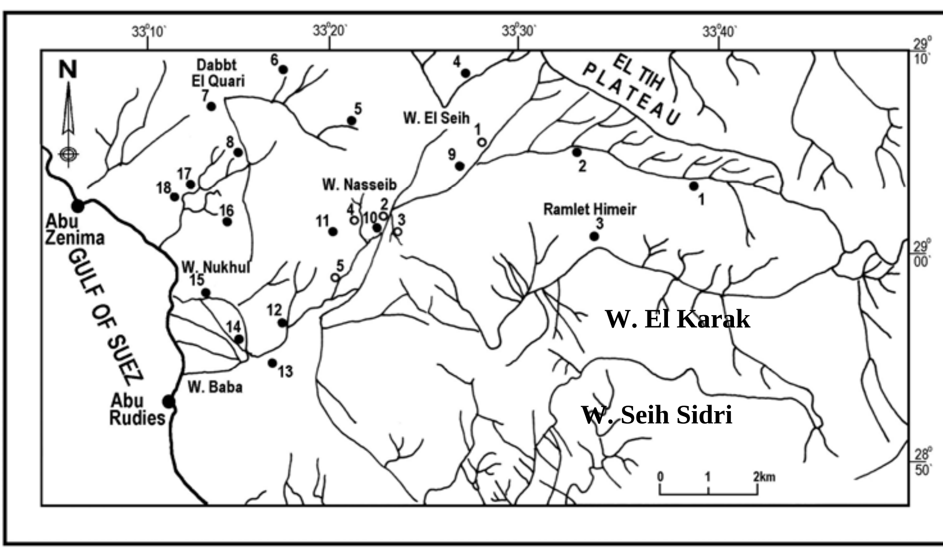

Fig.(2): Profiles (•) and water wells (º) location map of the studied plains and wadis.
º1: Bir El Seih º2: Bir Nasseib º3: Bir Alluga º4: Bir Ramsa º5: Bir Rekas

Particle size distribution was determined following the international pipette method, Piper (1950). Gravel, sand, silt and clay fractions were separated by sieving and sedimentation after removal of cementing materials. Clay and silt were separated by wet sieving from sand using 0.63mm sieve. The clay and silt were transferred to one-liter cylinders for pipette analysis. according to the chemical analyses, Calcium carbonate content was determined volumetrically by Calcimeter, Richards (1954). Gypsum was determined by using the acetone method as outlined by Nelson, (1982). Soil pH was measured in the soil saturation paste, Richards (1954). Organic matters were determined following Walkely and Black rapid titration method, Piper (1950). Total salinity (TDS) was determined through measurement of the electric conductivity in the extracts. Sodium and potassium ions were determined by flame photometry. Calcium, magnesium, chloride, carbonate and bicarbonate were determined titrimetrically.

The major oxides were measured using conventional wet chemical techniques of Shapiro and Brannock (1962). SiO_2, TiO_2, Al_2O_3 and P_2O_5 were analyzed using spectrophotometer while Na_2O and K_2O were analyzed using flame photometer and MnO by atomic absorption spectrometer. Fe_2O_3, FeO, MgO and CaO were analyzed by means of complex titremetric technique using EDTA. Total organic matter (T.O.M) determined by the loss on ignition method at 550ºC. H_2O (water of crystallization) was determined by the same method but the samples were heated to 1000ºC moisture content (H_2O), values were grouped as loss on ignition (L.O.I) category. Trace elements analysis was measured by using PHILIPS X'Unique II spectrometer with automatic sample changer PW 1510, (30 positions). All of these analyses were carried out in Nuclear Materials Authority (NMA) labs., Cairo, Egypt.

FIELD DESCRIPTIONS

The morphological properties of a soil profile could be considered as an indication of the soil formation processes that act upon soil body. Morphology of the studied soils has been evaluated from the insitu examination of the soil profiles representing the Plains and Wadis under study. The morphological properties are then considered as a criterion for differentiating soil profiles and as a base for soil classification.

1-Soil descriptions of the plains

Geomorphic units are represented by profiles No.1, 2, 3 and 4 from Ramlet Himeir Plain and 5, 6, 7 and 8 from Dabbt El Quari Plain. The following are the morphological characteristics of the representative soil profiles, described according to the guidelines of soil description, F.A.O. (1990). In suggested as outlined in the most recent comprehensive system, Soil Survey Staff (1994). Detailed description of the soil profiles is shown in the following paragraphs:

Profile (1) locates at the intersection of Longitude 33° 38` E and Latitude 29° 04` N (Ramlet Himeir Plain) with topography almost flat and the water table more than 200 cm depth (very deep). Depth (0-30 cm) described as Reddish yellow (7.5YR 6/6 dry) to light brown (7YR 6/4 moist) sandy clay loam,; massive, soft; slightly stick; moderately plastic; very few soft lime nodules; very few fine roots; non calcareous and diffuse smooth boundary. Depth (30-70 cm) described as Strong brown (7.5YR 5/6, dry) to brown (7.5 YR 5/4, moist) sandy loam; weak coarse sub-angular blocky; friable; moderately sticky; moderately plastic; non-calcareous and diffuse smooth boundary. Depth (70-140 cm) described as Strong brown (7.5YR 5/6, dry) to brown (7.5 YR 5/2, moist) sandy loam; moderate fine sub-angular blocky; friable; slightly sticky, slightly plastic; non-calcareous and clear smooth boundary. Depth (140-200 cm) brown (7.5YR 5/4, dry) to dark brown (7.5 YR 5/2, moist) (7.5 YR 3/4, moist) loamy sand-sandy loam; massive; soft; slightly sticky; slightly plastic and non-calcareous.

Profile (2) locates at the intersection of Longitude 33° 32` E and Latitude 29° 05` N (Ramlet Himeir Plain) with topography slightly undulating, almost flat and the water table more than 150 cm with depth (very deep). Depth (0-15 cm) described as pink (7.5 YR 7/4, dry) to pinkish gray (7.5YR 6/2, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few soft lime segregations; slightly calcareous and diffuse smooth boundary. Depth (15-50 cm) described as pink (7.5 YR 7/4, dry) to pinkish gray (7.5YR 6/2, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; non-calcareous and clear smooth boundary. Depth (50-90 cm) described as pink (7.5 YR 8/4, dry) to light brown (7.5YR 6/4, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; very few soft lime concretions; slightly calcareous and diffuse smooth boundary. Depth (90-150 cm) pink (7.5 YR 8/4, dry) to light brown (7.5YR 6/4, moist) sandy loam; massive; slightly hard; slightly sticky; slightly plastic; non-calcareous boundary.

Profile (3) locates at the intersection of Longitude 33° 34` E and Latitude 29° 00` N (Ramlet Himeir Plain) with topography almost flat and the water table more than 150 cm. depth (very deep). Depth (0-20cm) described as pink (7.5 YR 8/4, dry) to light brown (7.5YR 6/4, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; few soft lime concretions; moderately calcareous and clear smooth boundary. Depth (20-50cm) described as pinkish white (7.5 YR8/2, dry) to light gray (7.5YR7/0, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; few soft lime segregations; slightly calcareous and diffuse smooth boundary. Depth (50-80cm) described as pinkish white (7.5 YR8/2, dry) to light gray (7.5YR7/0, moist) sandy loam; massive; soft; slightly hard; slightly sticky; slightly plastic; few soft lime concretions; very few desert roots; slightly calcareous and clear smooth boundary. Depth (80-150cm) Pink (7.5 YR 8/4, dry) to light brown (7.5YR 6/4, moist) sandy loam; massive; hard; slightly sticky; slightly plastic; few soft lime concretions and slightly calcareous boundary.

Table (1): Particle size distribution and texture classes of the studied soils of Ramlet Himeir and Dabbt El Quari plains.

Profile No.	Depth (cm)	Sand %	SILT %	CLAY %	Texture class
Ramlet Himeir Plain					
P1	0-30	73.90	10.82	15.28	SL
	30-70	75.92	8.88	15.20	SL
	70-140	75.90	8.92	15.18	SL
	140-200	77.92	8.80	13.28	SL
P2	0-15	77.95	10.80	11.25	SL
	15-50	79.92	10.50	9.58	SL
	50-90	79.82	10.90	9.28	SL
	90-150	77.90	12.80	9.20	SL
P3	0-20	79.72	10.95	9.33	SL
	20-50	77.94	10.78	11.28	SL
	50-80	79.80	10.86	9.34	SL
	80-150	79.60	10.90	9.50	SL
P4	0-15	77.72	11.90	10.38	SL
	15-45	79.52	10.90	9.49	SL
	45-80	79.70	9.91	10.39	SL
	80-150	79.92	8.90	11.18	SL
Dabbt El Quari Plain					
P5	0-20	77.60	10.92	11.48	SL
	20-45	77.92	11.80	10.28	SL
	45-90	75.94	13.80	10.26	SL
	90-150	75.62	13.94	10.44	SL
P6	0-30	77.50	12.90	9.60	SL
	30-70	77.70	12.92	9.38	SL
	70-100	73.92	15.60	10.48	SL
	100-150	75.80	14.86	9.34	SL
P7	0-25	75.90	12.81	11.29	SL
	25-50	75.82	13.80	10.38	SL
	50-100	77.52	12.95	9.53	SL
	100-150	77.91	12.81	9.28	SL
P8	0-20	75.92	12.82	11.26	SL
	20-45	75.94	13.75	10.31	SL
	45-90	79.92	9.83	10.25	SL
	90-150	77.52	12.97	9.51	SL

Key of the table: SL = Sandy Loam.

Profile (4) locates at the intersection of Longitude 33° 28` E and Latitude 29° 08` N (Ramlet Himeir Plain) with topography gently undulating, nearly level and the water table more than 150 cm. depth (very deep). Depth (0-15 cm) described as reddish yellow (7.5YR 7/6, dry) to brown (7.5YR5/4, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few soft lime dotes; very few fine dead roots; non-calcareous and clear smooth boundary. Depth (15-45 cm) described as pink (7.5YR 7/4, dry) to pinkish gray (7.5YR 6/2, moist) sandy loam, massive, soft, slightly sticky, slightly plastic, very few soft lime concretions slightly calcareous and clear smooth boundary. Depth (45-80 cm) also, described as reddish yellow (7.5YR 6/6, dry) to strong brown (7.5YR5/6, moist) sandy loam, massive, slightly hard; slightly sticky; slightly plastic; very few soft lime segregations; non-calcareous and clear smooth boundary. Depth (80-150 cm) is light brown (7.5YR 6/4, dry) to brown (7.5YR 4/4, moist) sandy loam; massive; hard; slightly sticky; slightly plastic and non-calcareous boundary.

Profile (5) locates at the intersection of Longitude 33° 21` E and Latitude 29° 07` N (Dabbt El Quari Plain) with topography almost flat , nearly level and the water table more than 150 cm. depth (very deep). Depth (0-20 cm) described as yellow (10YR7/6, dry) to brownish yellow (10YR 6/8, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few fine dead roots; non-calcareous and clear smooth boundary. Depth (20-45 cm) described as brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/8, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; non-calcareous and diffuse smooth boundary. Depth (45-90 cm) is brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/8, moist) sandy loam; massive; slightly hard; slightly sticky; slightly plastic; non-calcareous and diffuse smooth boundary. Depth (90-150 cm) described as brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/8, moist) sandy loam; massive; hard; slightly sticky; slightly plastic and non-calcareous boundary.

Profile (6) locates at the intersection of Longitude 33° 08` E and Latitude 29° 09` N (Dabbt El Quari Plain) with topography gently undulating and the water table more than 150 cm. depth (very deep). Depth (0-30 cm) described as yellow (10YR7/8, dry) to very pale brown (10YR 7/4, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few fine dead roots; non-calcareous and clear smooth boundary. Depth (30-70 cm) described as brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/4, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; few soft lime segregations; very few fine dead roots; slightly calcareous and clear smooth boundary. Depth (70-100 cm) is yellow (10YR7/6, dry) to yellowish brown (10YR 5/6, moist) sandy loam;

massive; slightly hard; slightly sticky; slightly plastic; very few soft lime segregations; slightly calcareous and diffuse smooth boundary. Depth (100-150 cm) is brownish yellow (10YR6/6, dry) to yellowish brown (10YR 5/4, moist) sandy loam; massive; hard; slightly sticky; slightly plastic; very few soft lime concretions and slightly calcareous boundary.

Profile (7) locates at the intersection of Longitude 33° 12` E and Latitude 29° 08` N (Dabbt El Quari Plain) with topography gently undulating, nearly level as well as few scattered desert shrubs in the depressions. The water table more than 150 cm. depth (very deep). Depth (0-25 cm) described as yellow (10YR7/6, dry) to brownish yellow (10YR 6/6, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few soft lime segregations; very fine roots; slightly calcareous and clear smooth boundary. Depth (25-50 cm) described as brownish yellow (10YR6/6, dry) to yellowish brown (10YR 5/4, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; non-calcareous and clear smooth boundary. Depth (50-100 cm) described as brownish yellow (10YR6/6, dry) to yellowish brown (10YR 5/4, moist) sandy loam; massive; slightly hard; slightly sticky; slightly plastic; non-calcareous; diffuse smooth boundary. Depth (100- cm) is brownish yellow (10YR6/6, dry) to yellowish brown (10YR 5/4, moist) sandy loam; massive; hard; slightly sticky; slightly plastic and non-calcareous boundary.

Profile (8) locates at the intersection of Longitude 33° 15` E and Latitude 29° 05` N (Dabbt El Quari Plain) with topography gently undulating, nearly level as well as few scattered desert shrubs in the depressions. Depth (0-25 cm) described as yellow (10 YR7/8, dry) to brownish yellow (10YR 6/6, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few fine to coarse roots; non-calcareous and clear smooth boundary. Depth (25-45cm) described as brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/6, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; very few fine dead roots; non-calcareous and diffuse smooth boundary. Depth (25-95 cm) described as brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/8, moist) sandy loam; massive; slightly hard; slightly sticky; slightly plastic; non-calcareous and diffuse smooth boundary. Also, depth (25-150 cm) described as brownish yellow (10YR6/8, dry) to yellowish brown (10YR 5/4, moist) sandy loam; massive; hard; slightly sticky; slightly plastic and non-calcareous boundary.

So, the detailed description of the soil profiles clear that Ramlet Himeir and Dabbt El Quari soils are similar to each other where characterized by a texture which varies from sandy loam to loamy sand where sand % > silt % > clay % in all profiles of Plains (Table.1), structureless, slightly to moderately sticky, slightly to moderately plastic and slightly to moderately calcareous and covered with many scattered desert shrubs. These soils are formed of well sorted sediments indicating that wind plays a major role in their formation and formed under wind action or being transported by wind across long distance, with less pronounced contribution of water action.

2. Soil description of the wadis

Soils of wadi Nasseib (profiles 9 to 11), wadi Baba (profiles 12 to 15) and wadi Nukhul (profiles 16 to 18) are almost flat and the slope is level to nearly level. Soil parent material is alluvial. The following are the morphological characteristics of the representative soil profiles.

Profile (9) locates at the intersection of Longitude 33° 29` E and Latitude 29° 05` N (wadi Nasseib) with topography gently undulating, nearly level as well as very few scattered desert shrubs in the depressions with water table more than 140 cm depth (deep). Depth (0-25 cm) described as very pale brown (10YR7/4, dry) to pale brown (10YR 6/3, moist); loamy sand single grains; loose; non sticky; non plastic; few soft lime segregations; few fine to medium roots, slightly calcareous and clear smooth boundary. Depth (25-65 cm) described as very pale brown (10YR7/4, dry) to pale brown (10YR 6/3, moist); loamy sand; massive; soft; non sticky; non plastic; very few fine roots; non calcareous and clear wavy boundary. Depth (65-140) is light yellowish brown (10YR6/4, dry) to yellowish brown (10YR5/4, moist) loamy sand; massive; slightly hard; non sticky; non plastic and non calcareous.

Profile (10) locates at the intersection of Longitude 33° 24` E and Latitude 29° 05` N (Wadi Nasseib) with topography almost flat, nearly level as well as few scattered desert shrubs in the depressions with water table more than 130 cm depth (deep). Depth (0-25 cm) described as strong brown (7.5YR5/6, dray) to brown (7.5YR5/2, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few fine to medium roots; non calcareous and diffuse smooth boundary. Depth (25-55 cm) described as strong brown (7.5YR5/6, dry) to brown (7.5YR5/4, moist) sandy loam, massive; soft; slightly sticky; slightly plastic; very few fine roots; non calcareous and diffuse smooth boundary. Depth (55-130 cm) is strong brown (7.5YR5/6, dry) to brown (7.5YR4/2, moist) sandy loam, massive; slightly hard; slightly sticky; slightly plastic; non calcareous and boundary.

Profile (11) locates at the intersection of Longitudes 33° 20` E and Latitudes 29° 02` N (wadi Nasseib) with topography almost flat, nearly level as well as very few scattered desert shrubs in the depressions with water table more than 120 cm depth (deep). Depth (0-25 cm) described as Yellowish brown (10 YR 5/6, dry) to brown (10YR 5/3, moist) sandy clay loam; weak coarse sub-angular blocky; friable; moderately sticky; moderately plastic; few soft lime segregations; very few fine to medium roots; slightly calcareous and clear smooth boundary. Depth (25-75 cm) described as yellowish brown (10 YR 5/6, dry) to grayish brown (10YR 5/2, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; few soft lime concretions; very few fine roots; slightly calcareous and clear smooth boundary. Depth (75-120 cm) is brownish yellow (10YR 6/6, dry) to pale brown (10YR 6/3, moist) sandy loam; massive; slightly hard; slightly sticky; slightly plastic; non-calcareous boundary.

Profile (12) locates at the intersection of Longitude 33° 18` E and Latitude 28° 58` N (wadi Baba) with topography gently undulating, nearly level as well as few scattered desert shrubs in the depressions with water table more than 90 cm depth (very deep). Depth (0-25 cm) very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) light clay, massive; soft; very sticky; very plastic; moderate soft lime concretions; very few gypsum dotes; very few fine to moderate roots; moderately calcareous; clear and smooth boundary. Depth (25-45 cm) described as very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) sandy clay loam, weak coarse sub-angular blocky; soft; moderately sticky; moderately plastic; few soft lime segregations; very few fine dead roots; slightly calcareous; and clear smooth boundary. Depth (45-90 cm) is very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) sandy loam, massive; soft; slightly sticky; slightly plastic; few soft lime segregations and slightly calcareous boundary.

Profile (13) locates at the intersection of Longitude 33° 16` E and Latitude 28° 55` N (wadi Baba) with topography gently undulating, nearly level as well as few scattered desert shrubs in the depressions with water table more than 150 cm depth (very deep). Depth (0-30 cm) is yellow (10 YR 7/6, dry) to brownish yellow (10YR 6/6, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; very few soft lime segregations few fine to medium roots; non-calcareous and clear smooth boundary. Depth (30-80 cm) described as very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) loamy sand, massive; soft; non-sticky; non-plastic; very few fine dead roots; non- calcareous and diffuse smooth boundary. Depth (30-80 cm) is yellow (10 YR 7/6, dry) to brownish yellow (10YR 6/8, moist) loamy sand, massive; slightly hard; non-sticky; non-plastic and non-calcareous boundary.

Table (2): Particle size distribution and texture classes of the studied soils of wadis Nasseib, Baba and Nukhul.

Profile No.	Depth (cm)	Sand %	SILT %	CLAY %	Texture class
Wadi Nasseib					
P9	**0-25**	87.32	1.38	11.30	LS
	25-65	87.24	1.61	11.15	LS
	65-140	85.12	3.48	11.40	LS
P10	**0-25**	79.18	6.40	14.42	SL
	25-55	79.13	7.47	13.40	SL
	55-130	81.12	4.48	14.40	SL
P11	**0-25**	73.23	6.47	20.30	SCL
	25-75	81.65	6.45	12.40	SL
	75-120	85.19	2.31	12.50	SL
Wadi Baba					
P12	**0-25**	55.12	16.40	28.48	SCL
	25-45	75.17	4.48	20.35	SCL
	45-90	79.22	6.38	14.40	SL
P13	**0-30**	85.32	2.25	12.43	LS
	30-80	87.12	1.48	11.40	LS
	80-150	85.10	2.52	12.38	LS
P14	**0-25**	85.25	2.45	12.30	LS
	25-55	87.19	1.41	11.40	LS
	55-120	83.12	4.38	12.50	SL
P15	**0-20**	87.15	1.45	11.40	LS
	20-50	87.22	3.48	9.30	LS
	50-90	87.14	2.46	10.40	LS
	90-150	87.25	2.50	10.25	LS
Wadi Nukhul					
P16	**0-15**	87.12	1.50	11.38	LS
	15-45	86.27	2.48	11.15	LS
	45-100	83.16	4.49	12.35	LS
P17	**0-10**	83.12	4.43	12.45	LS
	10-55	81.19	4.42	14.39	SL
	55-120	85.15	2.47	12.38	LS
P18	**0-15**	81.13	4.37	14.50	SL
	15-45	85.22	2.58	12.20	LS
	45-90	85.13	2.27	12.60	LS
	90-120	87.11	1.40	11.49	LS
	120-150	83.00	4.46	12.54	LS

table: SL = Sandy Loam., LS= loamy sand and Sc L = clay sandy loam

Profile (14) locates at the intersection of Longitude 33° 15` E and Latitude 28° 56` N (wadi Baba) with topography almost flat as well as few scattered desert shrubs in the depressions with water table more than 120 cm depth (deep). Depth (0-25 cm) is light yellowish brown (10 YR 7/4, dry) to yellowish brown (10YR 5/6, moist) loamy sand; single grains; loose; non-sticky; non- plastic; very few fine to medium roots; non-calcareous and diffuse smooth boundary. Depth (25-55 cm) described as light yellowish brown (10 YR 6/4, dry) to yellowish brown (10YR 5/6, moist) loamy sand; massive; soft; non-sticky; non- plastic; few soft lime segregations; very few fine roots; slightly calcareous and diffuse smooth boundary. Depth (55-120 cm) is light yellowish brown (10 YR 6/4, dry) to yellowish brown (10YR 5/6, moist) sandy loam; massive; slightly hard; slightly sticky; slightly plastic; non-calcareous boundary.

Profile (15) locates at the intersection of Longitude 33° 12` E and Latitude 28° 57` N (wadi Baba) with topography almost flat as well as few scattered desert shrubs in the depressions with water table more than 150 cm depth (very deep). Depth (0-20 cm) is very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) loamy sand; single grains; loose; non-sticky; non-plastic; very few soft lime segregations; few fine to moderate roots; slightly calcareous and clear smooth boundary. Depth (20-50 cm) described as very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) loamy sand; massive; soft; non-sticky; non-plastic; very few fine dead roots; non- calcareous and diffuse smooth boundary. Depth (50-90 cm) is very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) loamy sand; massive; slightly hard; non-sticky; non-plastic; non-calcareous and diffuse smooth boundary. Depth (90-150 cm) Very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) loamy sand; massive; hard; non-sticky; non-plastic and non-calcareous boundary.

Profile (16) locates at the intersection of Longitude 33° 15` E and Latitude 29° 01` N (wadi Nukhul) with topography almost flat as well as few scattered desert shrubs in the depressions with water table more than 100 cm depth (deep). Depth (0-15 cm) is very pale brown (10 YR 8/4, dry) to pale brown (10YR 6/3, moist) loamy sand; single grains; loose; non-sticky; non-plastic; few fine to moderate roots; non-calcareous; clear smooth boundary. Depth (15-45 cm) described as very pale brown (10 YR 7/4, dry) to light yellowish brown (10YR 6/3, moist) loamy sand; massive; soft; non-sticky; non-plastic; very few fine roots; non-calcareous; diffuse smooth boundary. Depth (45-100 cm) is very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) sandy loam; massive; soft;

slightly sticky; slightly plastic; very few soft lime and slightly calcareous boundary.

Profile (17) locates at the intersection of Longitude 33° 13` E and Latitude 29° 04` N (wadi Nukhul) with topography gently undulating as well as few scattered desert shrubs in the depressions with water table more than 100 cm depth (deep). Depth (0-10 cm) is pinkish white (7.5 YR 8/2, dry) to pinkish gray (7.5 YR 6/2, moist) sand loam; single grains; loose; slightly sticky; slightly plastic; few soft lime segregations; few fine to coarse roots; slightly calcareous and clear smooth boundary. Depth (10-55 cm) described as Pink (7.5 YR 8/4, dry) to brown (7.5 YR 5/4, moist) sandy loam; massive; soft; slightly sticky; slightly plastic; few soft lime concretions; very few fine roots; moderately calcareous; and clear smooth boundary. Depth (55-100 cm) is pink (7.5 YR 7/4, dry) to light brown (7.5 YR 6/4, moist) loamy sand; massive; slightly hard; non-sticky; non-plastic; very few soft lime concretions and non-calcareous boundary.

Profile (18) locates at the intersection of Longitude 33° 12` E and Latitude 28° 03` N (wadi Nukhul) with topography gently undulating, nearly level as well as few scattered desert shrubs in the depressions with water table more than 150 cm depth (very deep). Depth (0-15 cm) is very pale brown (10 YR 8/4, dry) to pale brown (10YR 6/3, moist) sandy loam; single grains; loose; slightly sticky; slightly plastic; many soft lime segregations; few fine to moderate roots; strongly calcareous; clear smooth boundary. Depth (15-45 cm) described as yellow (10 YR 7/6, dry) to brownish yellow (10YR 6/6, moist) loamy sand; massive; soft; non-sticky; non-plastic; few soft lime concretions; very few fine roots; slightly calcareous and clear smooth boundary. Depth (45-90 cm) is Yellow (10 YR 7/6, dry) to yellowish brown (10YR 5/6, moist) loamy sand; massive; soft; non-sticky; non-plastic; few soft lime concretions; slightly calcareous and clear smooth boundary. Depth (90-120 cm) is very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) loamy sand; massive; slightly hard; non-sticky; non-plastic; few soft lime concretions, slightly calcareous and diffuse smooth boundary. Depth (120-150 cm) is very pale brown (10 YR 7/4, dry) to pale brown (10YR 6/3, moist) sandy loam; massive; hard; slightly sticky; slightly plastic; few soft lime concretions; moderately calcareous boundary.

So, the field observations and data of laboratory analyses, show that the soils of the studied Wadis have textures fluctuating between loamy sand, sandy loam and sandy clay loam (Table 2). These soils are commonly massive and slightly to moderately sticky, slightly to moderately plastic and non calcareous.

PHSICAL AND CHEMICAL CHARACTERISTICS

The interpretations of the properties of these soils are summarized in the following paragraphs:

1. Calcium carbonate and gypsum contents

Data in Table (3) illustrate that both calcium carbonate and gypsum contents are very low in the two studied plains, where calcium carbonate values range from 0.75% to 3.74% from profile (1) to profile (8), while gypsum values range from 0.82% to 3.32%. Considering the depth wise distribution of CaCO3 and CaSO4.2H2O, data indicate no specific pattern of distribution throughout the entire depth of soil profiles of the studied Plains.

Also, calcium carbonate content is in general considerably low in all sites of the studied Wadis, indicating non-calcareous nature of the soils, where $CaCO_3$ range in all Wadis between 1.24% to 11.62% (Table 4). Gypsum content is low too and ranges between 0.79% to 1.80% from profile (9) to profile (18). So, The vertical distribution of both calcium carbonate and gypsum through the soil profiles of the studied Wadis do not follow any specific pattern with depth.

2. Soil reaction

The analytical data for the studied plains (Ramlet Himeir and Dabbt El Quari) show that the soil reaction tends to the alkaline side, since pH values range from 7.80 to 8.70 in Ramlet Himeir Plain and range from 8.10 to 8.60 in Dabbt El Quari plain (Table.3).

The soil reaction data of the studied wadis (Table.4) indicate that, the soils reaction tends to moderately alkaline to alkaline character, where pH values range from 7.8 to 8.8 from profile (9) to profile (18), which may be due to water ratio, soluble salts and CO_2 and predominance of the alkaline earth cations, according to Seatz and Peterson (1976).

3. Total salinity

Soils derived from the studied Plains are slightly saline to non saline as indicated by their electrical conductivity (EC) values of the soil saturation extracts which range from 0.50 to 18.30 ds/m in the soils of Ramlet Himeir Plain and range from 0.03 to 2.80 ds/m in the soils of Dabbt El Quari Plain as given in (Table.3). These data show that, soils are saline in the two studied Plains especially at profile (1) while other soils are non-saline considering the depth wise distribution of soil salinity which shows a tendency of decreasing salinity with depth.

According to the chemical composition (Table 4), it is clear that the soil of all studied Wadis are non saline, since electrical conductivity of the soil saturation extracts (EC) ranges from 0.19 dsc/m in to 0.51 dsc/m in wadi Baba and Nukhul. There is an exceptional case at the surface layer in profile No.12 in Wadi Baba where EC values vary from 2.41 to 12.17 dsc/m indicating moderately saline soils. Total salinity does not play any specific pattern of salt distribution through the entire of soil profiles of the studied wadis.

Table (3): Some chemical analyses of the studied soils of The plains.

Profile No.	Depth (Cm)	S.P	$CaCO_3$ %	PH	$CaSO_42H_2O$%	EC dS/m	Anions (meq /L)				Cations (Meq /L)				O.M. %
							CO_3^{--}	HCO_3^-	Cl^-	SO_4^-	Ca^{++}	Mg^{++}	Na^+	K^+	
P1	0-30	20	2.49	7.9	1.80	1 8..30	--	6	160	١٧,٥٥	25	95	62.00	1.55	0.68
	٣٠-٧٠	24	1.24	8.1	1.00	9..9	--	3	90	8.14	20	36	44.58	0.56	0.42
	٧٠-١٤٠	32	1.00	7.8	1.00	8.6	--	3	80	3.57	19	31	36.16	0.41	0.28
	-٢٠٠ ١٤٠	23	0.75	8.1	0.92	8.6	--	2.5	79	5.35	15	35	36.48	0.37	0.14
P2	٠-١٥	20	1.74	8.3	1.00	1..9	--	3.5	11.5	4.79	4	6	4.51	5.28	0.52
	15-50	20	2.08	8.7	0.96	1.6	--	5	7.5	3.75	4	8	1.54	2.71	0.22
	50-90	19	1.49	8.7	1.00	0.9	--	3	7	٠,٤٠	2	3	3.43	2.03	0.19
	90-150	19	1.24	8.7	0.96	1.1	--	2.5	6..5	0.90	2	5	1.42	1.48	0.07
P3	0-20	17	3.74	8.4	0.91	1.7	--	2.5	10	4.60	4	9	2.99	1.11	0.57
	20-50	22	2.49	8.6	1.10	1.7	--	3.5	6	7.57	3	12	1.54	0.53	0.32
	50-80	21	2.66	8.6	1.00	1.0	--	4	4.5	1.71	2	7	0.87	0.34	0.19
	80-150	22	2.08	8.6	1.00	0.6	--	3.5	2	0.67	1	4	0.83	0.34	0.12
P4	0-15	20	1.83	8.5	0.91	0.7	--	3	3.5	1.30	2	5	0.52	0.28	0.53
	15-45	21	1.66	8.5	1.00	0.5	--	2	2.5	0.09	2	2	0.31	0.28	0.44
	45-80	21	1.66	8.4	0.82	0.5	--	2	3	0.12	1	3	0.78	0.34	0.20
	80-150	22	1.41	8.7	1.40	0.5	--	2.5	2	0.52	2	2	0.70	0.32	0.12
P5	0-20	19	0.42	8.5	1.10	0.30	--	2.00	3.50	0.39	1.00	4.00	0.63	0.26	0.92
	20-45	20	0.33	8.5	1.00	0.30	--	1.50	2.50	0.75	1.00	3.00	0.49	0.26	0.50
	45-90	21	0.83	8.4	1.00	2.10	--	3.00	17.0	1.06	7.00	10.0	3.34	0.72	0.23
	90-150	19	1.74	8.1	0.85	2.80	--	3.00	23.5	8.85	10.0	18.0	6.36	0.99	0.15
P6	0-30	21	0.08	8.5	0.95	080	--	2.00	5.30	1.24	2.00	5.00	0.87	0.67	0.42
	30-70	20	3.32	8.5	0.90	0.80	--	2.50	5.00	1.27	4.00	4.00	0.49	0.28	0.30
	70-100	24	2.91	8.3	1.00	270	--	2.50	22.5	4.15	14.0	11.0	3.25	0.90	0.18
	100-150	23	2.49	8.4	0.95	3..30	--	2.50	30.5	1.51	14.0	11.0	8.27	1.24	0.11
P7	0-25	19	1.08	8.4	1.00	0.30	--	2.00	3.00	0.79	2.00	3.00	0.55	0.24	0.52
	25-50	21	0.91	8.5	0.95	0.60	--	2.00	4.00	0.16	2.00	3.00	0.88	0.28	0.29
	50-100	23	0.17	8.6	0.96	1.00	--	2.00	6.50	1.84	3.00	6.00	1.00	0.34	0.19
	100-150	22	0.08	8.4	0.86	1.00	--	2.50	5.00	2.87	2.00	7.00	0.96	0.41	0.12
P8	0-25	22	0.08	8.3	0.85	060	--	1.50	5.00	0.35	3.00	3.00	0.59	0.26	0.40
	25-45	21	0.08	8.5	0.85	0.40	--	1.50	4.00	0.31	4.00	1.00	0.59	0.22	0.19
	45-95	21	0.08	8.6	0.91	0.40	--	3.00	6.00	0.49	4.00	1.00	0.29	0.20	0.12
	95-150	22	0.08	8.5	0.80	0.03	--	3.50	5.00	0.22	3.00	1.00	0.52	0.20	0.07

Sp = soil pet, O.M =organic matters, EC = Electrical conductivity

Table (4): Some chemical analyses of the studied soils of wadis.

Profile No.	Depth (Cm)	S.P	$CaCO_3$ %	PH	$CaSO_4 2H_2O$%	EC	Anions (meq /L)				Cations (meq /L)				O.M. %
						dS/m	CO_3^{--}	HCO_3^-	Cl^-	SO_4^-	Ca^{++}	Mg^{++}	Na^+	K^+	
P 9	0-25	22.4	2.49	8.30	0.81	0.32	--	2.50	1.25	0.61	2.50	1.50	0.28	0.08	0.55
	25-65	23.2	1.66	8.40	0.82	0.24	--	2.10	1.50	0.37	2.35	1.25	0.26	0.11	0.42
	65-140	28.0	1.66	8.30	1.01	0.28	--	1.10	1.50	032	2.00	025	0.38	0.29	0.41
P10	0-25	26.5	1.66	7.85	1.02	1.69	--	2.50	9.25	4.90	9.00	4.00	3.18	0.47	0.22
	25-55	25.0	1.49	7.80	0.85	1.16	--	1.50	9.25	0.47	3.75	4.00	3.41	0.06	0.19
	55-130	23.0	1.25	8.04	0.83	0.71	--	1.25	7.75	0.80	4.25	1.75	3.58	0.02	0.14
P11	0-25	24.2	2.08	8.32	0.80	0.77	--	2.50	4.75	2.68	3.00	1.00	5.77	0.16	0.56
	25-75	25.0	3.40	8.36	0.85	0.35	--	2.50	3.00	0.03	3.00	0.25	2.17	0.11	0.52
	75-120	22.5	1.91	8.60	0.79	0.49	--	2.50	2.25	0.98	2.50	1.25	1.91	0.07	0.13
P12	0-25	23	7.06	8.80	1.00	1.17	--	2.50	110.0	6.97	14.25	13.25	89.64	2.33	0.72
	25-45	22	3.32	8.20	1.01	3.64	--	2.50	26.50	10.5	4.00	4.75	29.81	0.94	0.65
	45-90	20	3.24	8.30	0.85	2.41	--	2.50	18.00	3.43	3.50	3.75	16.36	0.32	0.14
P13	0-30	22	1.91	8.70	1.80	0.39	--	2.50	1.76	0.90	3.25	0.75	0.38	0.78	0.58
	30-80	21	1.83	8.80	0.90	036	--	2.50	1.75	0.30	1.50	2.50	0.35	0.20	0.32
	80-150	20	1.83	8.20	0.91	0.41	--	2.50	1.25	0.50	1.50	1.75	0.74	0.26	0.15
P14	0-25	20	1.91	8.50	1.10	0.19	--	2.50	2.75	0.36	1.25	2.75	1.53	0.08	0.62
	25-55	22	2.08	8.40	0.80	0.37	--	2.50	2.00	0.04	1.25	2.50	0.69	0.10	0.56
	55-120	20	1.58	8.40	1.00	031	--	2.50	2.25	0.11	1.75	2.50	0.51	0.10	0.12
P15	0-20	22	1.83	8.30	1.20	0.50	--	2.50	2.50	0.14	2.75	1.75	0.53	0.11	0.80
	20-50	21	1.58	8.30	1.20	049	--	2.50	2.75	0.21	2.75	1.75	0.88	0.08	0.55
	50-90	20	1.49	8.20	1.25	0.39	--	2.50	1.50	0.40	2.25	1.50	0.56	0.09	0.42
	90-150	22	1.74	8.30	1.10	0.40	--	2.50	1.75	0.61	2.75	1.75	0.28	0.08	0.11
P16	0-15	20	1.40	8.30	0.58	0.39	--	2.50	2.25	0.36	2.25	1.50	1.30	0.06	0.71
	15-45	21	1.24	8.30	1.00	0.32	--	2.50	2.12	0.23	2.25	1.25	1.29	0.06	0.56
	45-100	21	2.32	8.20	1.00	0.51	--	2.50	2.25	0.33	2.50	1.25	1.26	0.07	0.18
P17	0-10	22	4.57	8.00	1.00	0.49	--	2.50	2.50	0.35	2.50	1.00	1.69	0.16	0.22
	10-55	23	5.40	8.10	1.10	0.30	--	2.50	1.25	0.36	2.08	1.17	0.73	0.13	0.18
	55-100	21	2.03	8.10	1.12	0.39	--	2.50	1.75	0.20	3.50	0.50	0.38	0.07	0.10
P18	0-15	24	11.62	8.20	1.00	0.45	--	2.50	1.75	0.88	2.75	1.00	0.44	0.94	0.42
	15-45	22	4.32	8.40	0.80	0.40	--	2.50	3.00	0.12	2.75	2.00	0.51	0.36	0.19
	45-90	21	3.32	8.20	0.95	0.49	--	2.50	2.00	0.44	2.75	155	0.57	0.07	0.08
	90-120	21	2.66	8.30	0.82	0.50	--	2.50	1.75	0.94	2.50	1.50	1.08	0.11	0.25
	120-150	23	4.98	8.04	0.65	0.48	--	2.50	2.00	0.56	175	1.15	1.87	0.29	0.22

Sp = soil pet OM =organic matters EC = Electrical conductivity

4. Cationic and anionic composition

Tables (3 and 4) show that the soils of the studied plains and wadis have one pattern of cationic composition. This pattern characterized by Ca^{++}, Mg^{++}, Na^{+} and K^{+} are dominant exchangeable cations. The soluble cations are often dominated especially at profile (1) with Na^{+}, Mg^{++}, and Ca^{++}, while K^{+} is the lowest soluble cation. Considering the anionic composition, data in Tables.3 and 4 reveal that the anionic distribution has the following descending order $Cl^{-} > SO_4^{--} > HCO_3^{-}$, where CO_3^{-} is absent, HCO_3^{-} is shown to be the lowest abundant anions (Figs.3 and 4. With regard to the soils of the studied wadis, soluble calcium is often dominating followed by Mg^{++} and Na^{+} then K^{+} except surface layer in profile No.12 at Wadi Baba where the order is $Na^{+} >$ Ca^{++} and $Mg^{+} > K^{+}$ (Figs.5, 6 and 7).

5. Cation exchange characteristics

Considering the exchangeable cations, data in tables 3 and 4) reveal that Ca^{++} is the predominates exchangeable cations in the soils of the studied plains and wadis, followed by Mg^{++}, Na^{+} while K^{+} is the lowest abundant exceptional cations. The layers of profile (1) are the exception, where Na^{+} is the predominates exchangeable cations followed by Mg^{++}, and Ca^{++}, while K^{+} is the lowest soluble cation.

6. Organic matter

Organic matter content is extremely low in the studied Plains, not exceeding 0.68% to 0.92 % while, range from 0.08% to 0.80% (Table 4) in soils of studied Wadis respectively, owing to the prevailing aridity since the high temperature and dry climate encourage the rapid decomposition of organic matter.

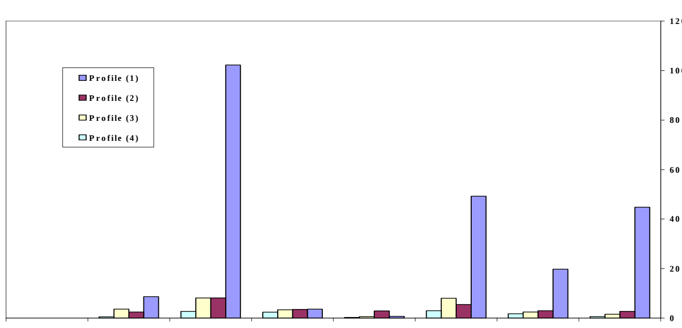

Fig. (3) : Averages of cations and anions variability histogram (in meq/L) of Ramlet Himeir plain.

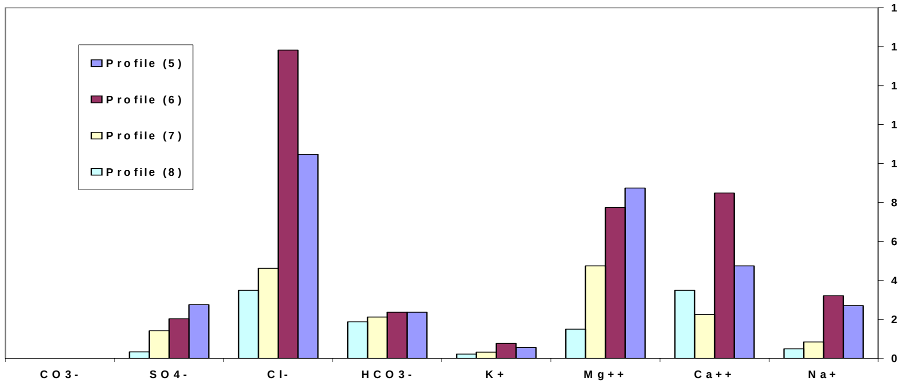

Fig. (4): Averages of cations and anions variability histogram (in meq./L) of Dabbt El Quari plain.

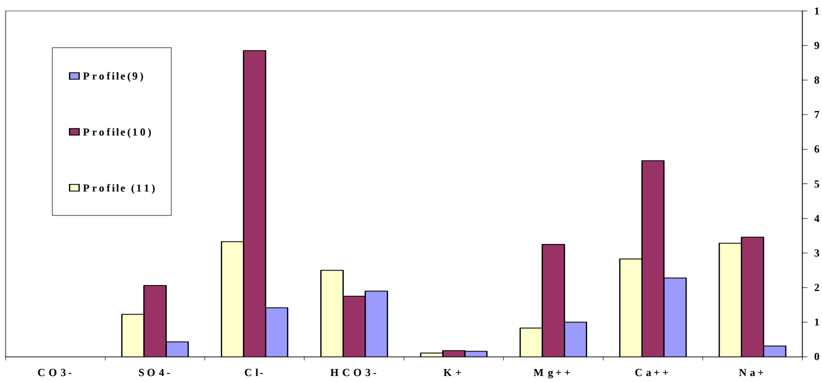

Fig.(5): Averages of cations and anions variability histogram (in meq/L) of Wadi Nasseib.

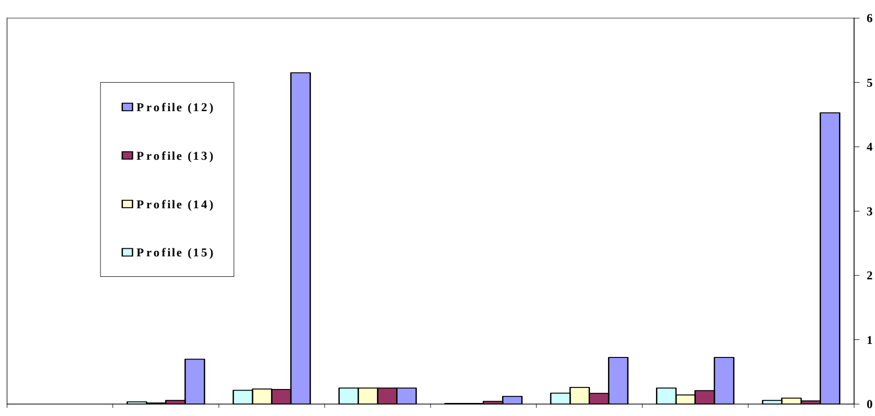

Fig.(6): Averages of cations and anions variability histogram (in meq/L) of Wadi Baba.

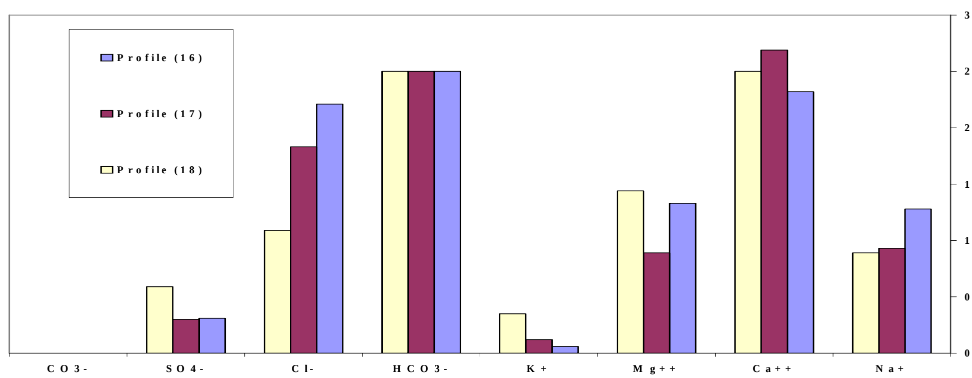

Fig. (7): Averages of cations and anions variability histogram (in meq/L) of wadi Nukhul.

7. Major oxides distributions

Chemical composition of the studied soils was studied in order to obtain intensive information about elemental distribution to determine the origin and parental materials of these soil. The data of major oxides were given as oxides, while trace elements were presented as native elements, (Tables 5, 6, 7 and 8).

The interpretations of the properties of these soils are summarized in the following paragraphs:

Silica (SiO_2)

Silica content is the most predominant constituent in all the studied soil samples in plains and wadis. SiO_2 contents range from 84.14% to 71.50% in Ramlet Himeir plain and from 63.60% to 83.50% in Dabbt El Quari soils. The highest value is recorded at surface sample from profile (1) in the first Plain at depth 0 to 30 cm, while the highest content of silica in Dabbt El Quari is recorded also at the surface sample from profile (7) at depth 0 to 25 cm which may be attributed to the predominance of aeolian sand fractions.

SiO2 content in wadis Nasseib, Baba and Nukhul range from 69.20% to 77.43% and from 68% to 77.5% and from 59.07% to 75.04% respectively. The highest value is recorded in a sample from profile (18) of wadi Nukhul at depth of 120 to 150 cm, which may be attributed to the predominance of quartz mineral.

Table (5) : Major oxides (Wt. %) analyses of the studied plains.

Profile No.	Depth (cm)	SiO_2	TiO_2	Al_2O_3	$Fe_2O_3^t$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	L.O.I	Total
P1	0-30	84.14	0.13	1.35	3.50	0.19	2.18	2.00	0.79	0.17	0.08	5.06	99.58
	30-70	81.35	0.13	1.79	4.11	0.20	3.61	3.01	0.21	0.21	0.08	4.83	99.51
	70-140	82.79	0.09	2.21	3.92	0.17	3.42	2.73	0.20	0.30	0.07	3.99	99.89
	140-200	82.13	0.11	3.20	3.67	0.18	2.91	2.23	0.33	0.19	0.09	5.13	99.99
Average		**82.60**	**0.12**	**2.14**	**3. 8**	**0.19**	**3.03**	**2.50**	**0.38**	**0.22**	**0.08**	**4.80**	**99.74**
P2	0-15	71.90	0.23	3.06	2.50	0.12	1.35	9.00	0.18	0.27	0.10	10.47	99.18
	15-50	71.50	0.21	2.98	2.33	0.10	2.11	8.34	0.19	0.25	0.19	10.83	99.03
	50-90	73.36	0.33	1.96	3.03	0.11	2.01	8.21	0.17	0.33	0.19	11.09	99.80
	90-150	72.92	0.22	3.21	1.97	0.10	1.96	7.91	0.12	0.53	0.18	9.73	99.85
Average		**72.42**	**0.25**	**2.80**	**2.46**	**0.11**	**1.86**	**8.37**	**0.17**	**0.35**	**0.17**	**10.53**	**99.50**
P3	0-20	72.62	0.18	3.72	2.27	0.14	1.45	8.02	0.15	0.24	0.23	9.49	99.51
	20-50	74.07	0.13	2.81	3.02	0.15	2.05	8.01	0.11	0.21	0.17	10.25	99.34
	50-80	74.51	0.15	2.92	2.91	0.12	1.37	7.89	0.14	0.18	0.16	9.45	99.88
	80-150	73.27	0.14	3.03	3.10	0.10	2.00	8.05	0.16	0.26	0.18	9.33	99.62
Average		**73.62**	**0.15**	**3.19**	**2.83**	**0.13**	**1.72**	**7.99**	**0.14**	**0.22**	**0.19**	**9.63**	**99.47**
P4	0-15	73.89	0.12	2.94	2.13	0.90	1.93	7.92	0.13	0.20	0.22	9.77	99.15
	15-45	74.70	0.12	2.97	2.00	0.11	1.45	8.01	0.15	0.10	0.22	9.54	99.28
	45-80	72.60	0.11	2.21	3.01	0.10	2.24	7.97	0.13	0.10	0.27	10.27	99.01
	80-150	73.33	0.13	3.41	2.74	0.11	1.75	8.05	0.11	0.19	0.25	9.81	99.88
Average		**73.63**	**0.12**	**2.83**	**2.47**	**0.31**	**1.84**	**7.79**	**0.13**	**0.15**	**0.24**	**9.85**	**99.33**
P5	0-20	80.90	00.11	2.30	7.96	0.01	0.30	0.84	0.47	0.13	0.05	4.64	102.70
	20-45	83.50	00.14	5.23	5.97	0.12	0.70	1.12	0.47	0.24	0.04	2.27	97.70
	45-90	81.00	00.21	5.13	7.96	0.01	0.40	1.40	0.68	0.27	0.05	4.96	102.0
	90-150	82.00	00.20	3.83	5.97	0.01	1.20	1.40	0.14	0.27	0.01	3.29	98.34
Average		**81.85**	**00.17**	**4.12**	**6.97**	**0.04**	**0.65**	**1.20**	**0.49**	**0.23**	**0.04**	**3.97**	**100.19**
P6	0-30	83.00	00.07	6.50	3.98	0.01	0.60	0.56	0.15	0.14	0.01	2.08	97.00
	30-70	63.60	00.29	21.40	7.96	0.02	1.20	1.12	0.14	0.24	0.04	1.65	79.65
	70-100	81.20	00.20	4.70	5.90	0.02	0.20	2.80	0.35	0.07	0.02	6.12	101.50
	100-150	77.04	00.26	5.12	5.97	0.02	0.60	2.80	0.74	0.27	0.02	7.12	99.95
Average		**76.21**	**00.21**	**9.43**	**5.95**	**0.02**	**0.65**	**1.82**	**0.35**	**0.18**	**0.02**	**4.24**	**99.05**
P7	0-25	83.50	00.21	6.70	5.97	0.01	0.30	0.70	0.68	0.20	0.04	2.83	101.10
	25-50	83.50	00.05	4.80	7.96	0.01	0.20	0.84	0.61	0.13	0.02	1.60	99.70
	50-100	75.50	00.04	16.40	3.90	0.01	0.00	0.56	0.14	0.13	0.60	6.89	99.16
	100-150	76.50	01.05	8.12	2.40	0.01	0.40	0.70	0.10	0.17	1.15	8.80	99.50
Average		**78.38**	**00.34**	**9.01**	**5.06**	**0.01**	**0.23**	**0.70**	**0.38**	**0.16**	**0.45**	**5.03**	**99.87**
P8	0-25	82.60	00.11	3.05	4.90	0.01	0.00	1.12	0.10	0.17	0.46	5.54	97.30
	25-45	73.30	00.12	8.70	3.90	0.01	0.60	0.50	0.61	0.20	0.14	11.26	99.34
	45-95	78.50	00.08	13.35	2.98	0.01	0.60	0.56	0.35	0.17	0.15	5.06	101.80
	95-150	69.60	00.07	15.60	5.90	0.01	0.50	1.40	0.68	0.17	0.10	3.38	97.80
Average		**76.00**	**00.10**	**10.18**	**4.42**	**00.1**	**0.43**	**0.90**	**0.48**	**0.18**	**0.19**	**6.42**	**99.07**

$Fe_2O_3^t$ = Total iron as Fe_2O_3 **L.O.I = Loss on ignition**

Comparing previous data of Ramlet Himeir and Dabbt El Quari with that of the studied wadis, sand is less in the plains while silica is higher. On the other hand sand is more in wadis while silica is less. The presence of silicate clay minerals in higher quantities in the plains accounts quite well for the previous conclusion.

Alumina (Al_2O_3)

Alumina ranges from 1.35% to 3.72% and 2.30% to 21.40 % in Ramlet Himeir and Dabbt El Quari soils respectively, while, in the studied Wadis ranges from 2.10% to 5.33%, 1.50% to 6.31% and 2.08% to 5.16% in wadis Nasseib, Baba and Nukhul soils respectively. Generally, the increase in Al_2O_3 content may be attributed to the increase of clay minerals content in the all studied soils.

Iron oxides ($Fe_2O_3)^t$

Iron oxides $(Fe_2O_3)^t$ are generally present in very low contents in the two studied plains. Ramlet Himeir soils are generally lower in $(Fe_2O_3)^t$ contents (the average content = 2.83%) than Dabbt El Quari soils (the average content 4.42%).

Total iron $(Fe_2O_3)^t$ are generally present in contents higher than Al_2O_3 in the studied wadis. Total iron ranges between 3.20% to 6.50% in wadi Nasseib soils, from 3.50% to 8.22% in wadi Baba soils as well as from 1.68% to 6.58% in Wadi Nukhul soils.

In both soil plains and wadis, there is no indication of iron accumulation at any depth, indicating the absence of horizons and the lack of development.

Magnesium oxide (MgO)

Data in Table (5) reveal that MgO content in the studied soils of Ramlet Himeir ranges from 1.35% to 3.61% but in Dabbt El Quari soils the values are quite low, ranging from 0.01% to 1.20 %.

Magnesium (MgO) content in the studied wadi Nasseib soils ranges from 1.40% to 3.27% but in Wadi Baba soils it ranges from 2.21% to 5.10 %, whereas in wadi Nukhul soils ranges from 0.14% to 0.91%. The highest content (5.10%) was found in the surface samples of profile (12) in wadi Baba, whereas the lowest one (0.14%) was detected in the surface sample from profile (16) in Wadi Nukhul. The high content of MgO in the studied soil plains and Wadis may be due to the addition of weathering products from country rocks or may be partly related to the presence or absence of the silicate minerals.

Calcium oxide (CaO)

Calcium is present in all studied samples, its content ranges from 2.00% to 9.00% (Ramlet Himeir plain) and range from 0.50% to 2.80% (Dabbt El Quari plain) respectively. The high content of CaO in Ramlet Himeir may be attributed to the presence of calcite and dolomite minerals, while the relatively low content of CaO in Dabbt El Quari may be attributed to low content of calcite mineral. Ramlet Himeir soils are previously described as calcareous due to its location near El-Tih limestone plateau.

Also, CaO is present in all studied samples of wadis, its content ranges from 1.20% to 4.00% (Wadi Nasseib) and range from 0.99% to 4.20% (wadi Baba) and from 2.48% to 12.60% (Wadi Nukhul) respectively. The high content of CaO in wadi Nukhul may be attributed to the presence of calcite and dolomite minerals, while the relatively low content of CaO in wadi Nasseib may be attributed to low content of calcite mineral.

Alkalis

Sodium and potassium are generally present as traces, because they are easily leached. The concentration of Na_2O ranges in Ramlet Himeir soils form 0.11% to 0.79% whereas in Dabbt El Quari soils it ranges from 0.10% to 0.47%, while K_2O ranges from 0.10% to 0.53% (Ramlet Himeir soils) and 0.07% to 0.27% (Dabbt El Quari soils).

The concentration of Na_2O ranges form 0.20% to 0.95% whereas K_2O ranges from 0.20% to 0.82% in Wadi Nasseib soils, but the concentration of Na_2O ranges form 0.51% to 2.98% and K_2O ranges from 0.31% to 0.82% in Wadi Baba soils (Table 6), whereas, sodium oxide ranges from 0.35% to 2.31%and potassium oxide from 0.12% to 0.88% in Wadi Nukhul soils.

The low contents of the total alkalis in the studied soil of plains and wadis may be attributed to the low presence of K-bearing hydrous mica and Na-bearing mineral (Na- feldspar).

Generally, the low contents of TiO_2 and P_2O_5 in the studied Plains and Wadis may be due to the origin and the nature of sediments in these soils.

The determined (L.O.I) was ranging from 3.99% to 11.09% (Ramlet Himeir Plain) and1.60% to 11.26% (Dabbt El Quari Plain) while, ranges from 7.82% to 15.20% (Wadi Nasseib), 6.50% to 10.50% (Wadi Baba) and in Wadi Nukhul, it ranges from 8.50% to 16.00%. The relatively high water contents in the studied soils are possibly related to their high content of clay minerals

Table (6): Major oxides (Wt. %) analyses of the studied wadis.

Profile No.	Depth (cm)	SiO_2	TiO_2	Al_2O_3	$Fe_2O_3^t$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	L.O.I	Total
P9	0-25	69.20	0.48	2.18	5.72	0.86	3.12	1.20	0.95	0.82	0.39	14.52	99.45
	25-65	70.30	0.46	3.30	6.13	0.79	2.51	3.10	0.85	0.75	0.28	11.34	99.81
	65-140	70.00	0.50	3.41	3.20	0.90	2.33	2.00	0.74	0.65	0.16	15.20	99.09
Average		**69.83**	**0.48**	**2.96**	**5.02**	**0.85**	**2.65**	**2.10**	**0.85**	**0.74**	**0.28**	**13.69**	**99.45**
P10	0-25	69.50	0.35	3.90	4.72	0.90	3.18	4.00	0.88	0.37	0.38	11.50	99.68
	25-65	70.10	0.22	5.33	3.60	0.82	2.25	3.10	0.81	0.30	0.47	12.50	99.50
	55-130	76.00	0.40	3.20	3.45	0.71	3.27	2.20	0.45	0.27	0.28	9.68	99.91
Average		**71.87**	**0.32**	**4.14**	**3.92**	**0.81**	**2.90**	**3.10**	**0.71**	**0.31**	**0.38**	**11.23**	**99.69**
P11	0-25	73.00	0.45	3.50	6.50	0.85	2.71	1.20	0.20	0.22	0.29	10.12	99.04
	25-75	74.25	0.40	2.98	5.72	0.77	3.18	3.25	0.55	0.21	0.37	7.82	99.50
	75-120	77.43	0.41	2.10	4.60	0.65	1.40	2.10	0.42	0.20	0.27	9.92	99.50
Average		**74.89**	**0.42**	**2.86**	**5.61**	**0.76**	**2.43**	**2.18**	**0.39**	**0.21**	**0.31**	**9.29**	**99.35**
P12	0-25	68.00	0.58	6.12	8.22	0.32	5.10	1.92	1.50	0.82	0.22	6.90	99.70
	25-45	72.50	0.56	4.00	6.32	0.56	3.20	2.80	0.90	0.60	0.45	7.08	99.69
	45-90	71.23	0.59	3.32	5.23	0.38	4.21	3.10	0.99	0.65	0.60	9.00	99.90
Average		**70.58**	**0.61**	**4.48**	**6.59**	**0.42**	**4.17**	**2.61**	**1.13**	**0.69**	**0.42**	**7.90**	**99.76**
P13	0-30	71.00	0.45	4.23	6.21	0.68	3.23	2.50	2.98	0.58	0.35	9.20	99.50
	30-80	73.00	0.57	4.42	5.42	0.72	2.41	2.31	0.80	0.44	0.50	10.10	99.69
	80-150	77.50	0.82	1.50	3.50	0.54	2.53	0.99	0.72	0.60	0.40	10.50	99.60
Average		**73.83**	**0.61**	**3.05**	**5.04**	**0.65**	**2.75**	**1.90**	**0.83**	**0.54**	**0.42**	**9.93**	**99.59**
P14	0-25	69.00	0.50	5.32	7.45	0.66	2.21	2.69	0.81	0.39	0.42	7.50	99.95
	25-55	71.22	0.54	3.21	6.35	0.52	3.19	2.40	0.90	0.31	0.36	9.50	99.50
	55-120	73.00	0.10	2.85	5.82	0.41	4.17	2.21	0.92	0.42	0.34	10.00	99.94
Average		**71.07**	**0.38**	**3.79**	**6.54**	**0.53**	**4.19**	**2.77**	**0.78**	**0.37**	**0.37**	**9.00**	**99.79**
P15	0-20	71.29	0.78	5.61	6.29	0.42	2.22	2.21	0.78	0.48	0.12	9.30	99.50
	20-50	69.00	0.82	6.31	7.35	0.55	4.31	3.40	0.80	0.32	0.22	6.50	99.58
	50-90	71.50	0.64	4.22	6.70	0.60	3.42	3.20	0.72	0.40	0.15	8.00	99.55
	90-150	72.00	0.52	3.21	5.31	0.65	2.31	4.20	0.51	0.55	0.11	10.0	99.37
Average		**70.95**	**0.69**	**4.84**	**6.41**	**0.56**	**3.07**	**3.25**	**0.70**	**0.44**	**0.15**	**8.45**	**99.50**
P16	0-15	59.07	0.36	5.16	3.36	0.18	0.14	12.60	2.10	0.62	0.11	16.00	99.70
	15-45	71.00	0.33	2.81	3.98	0.09	0.20	10.10	2.08	0.58	0.06	8.50	99.73
	45-100	70.00	0.46	3.13	4.82	0.03	0.38	11.12	0.35	0.18	0.09	9.00	99.56
Average		**66.69**	**0.38**	**3.70**	**4.05**	**0.10**	**0.24**	**11.27**	**1.40**	**0.46**	**0.09**	**11.17**	**99.66**
P17	0-10	73.30	0.35	2.08	3.98	0.06	0.91	6.32	2.21	0.68	0.10	10.00	99.99
	10-55	72.12	0.42	2.71	6.58	0.08	0.87	4.82	1.40	0.70	0.80	9.00	99.50
	55-100	74.00	0.50	3.62	1.68	0.07	0.47	5.32	2.31	0.12	0.06	11.50	99.56
Average		**73.14**	**0.42**	**2.80**	**4.08**	**0.07**	**0.75**	**5.49**	**1.97**	**0.50**	**0.32**	**10.17**	**99.71**
P18	0-15	74.00	0.90	2.25	2.62	0.08	0.79	6.12	1.32	0.58	0.08	11.00	99.94
	15-45	74.77	0.47	2.41	1.96	0.05	0.86	5.42	0.42	0.88	0.09	12.00	98.56
	45-90	73.00	0.42	2.62	2.12	0.04	0.89	2.48	0.62	0.55	0.05	14.50	99.29
	90-120	74.00	0.31	2.83	2.92	0.07	0.82	7.60	0.57	0.42	0.02	10.40	99.96
	120-150	75.04	0.35	3.62	1.89	0.06	0.72	2.72	0.48	0.72	0.70	12.70	99.00
Average		**74.10**	**0.49**	**2.79**	**2.30**	**0.06**	**0.82**	**5.29**	**0.68**	**0.63**	**0.19**	**12.12**	**99.35**

$Fe_2O_3^t$ = Total iron as Fe_2O_3

8.Trace elements distributions

The abundance and distribution of the trace elements in the soils of the studied plains and wadis listed in Tables (7and 8). The following is a short account about the distribution of some of the analyzed trace elements in the soils of both Plains and Wadis.

The trace elements content in soils depends on the parent rocks, from which these soils are derived by weathering process, Michael (1975). Krauskopf (1972) stated that many of these trace elements occurred by isomophous substitution in soil materials.

A brief review of each of the concerned trace elements is given:

Barium (Ba)

Barium is the most dominant trace element in the studied samples of Ramlet Himeir and Dabbt El Quari plains especially those of profile (1) with an average 677.5 ppm, and then decreases in profile (4) with an average 44.3 ppm. Its content range in all profiles from 20 to 892 ppm. Ba, (Table 7), is distributed in samples of profile (6) from Dabbt El Quari has an average of about 734 ppm, and then decreases along profile (7) with average of about 516.80 ppm. Its content ranges in all profiles from 310 to 914 ppm.

In all wadis, barium (Ba) is the second dominant element in the studied soils samples. In the soils of wadi Nasseib, Ba ranges from 193 ppm, (profile No.11), to 401 ppm in the same profile. Soils of Wadi Baba have Ba contents in the range of 199 ppm, (profile No.15) to 603 ppm, (profile No.12). Soils of wadi Nukhul have Ba contents in the range of 154 ppm (profile No.17), to 281 ppm, (profile No.16 and profile No.18), Table (13). In comparing the obtained data with those of Mason (1966), it is clear that barium values are lower than those reported for shale (580ppm) and higher than those of igneous rocks (425 ppm).

According to the chemical composition of rocks after Mason (1966), data show that barium values in the two studied plains are higher than those reported for shale (580ppm) and lower than those of the igneous rocks (425 ppm).

Chromium (Cr)

According to Wells (1960), Aubert and Pinta (1977), soils inherited from parent materials derived from mafic and volcanic rocks, which are generally higher in chromium content than others. Chromium (Cr) concentrations in soils of

Ramlet Himeir plain ranges from 84 to 401 ppm. It is clear that, Cr content exhibits low concentration in sandy soil but is high in sandy loam soils. The concentration of Cr in soils of Dabbt El Quari ranges from 162 to 328 ppm. It is clear that, Cr is high because of these soils are related to their sandy loam textures.

Chromium (Cr) concentration ranges from 130 ppm to 162 ppm in soils of wadi Nasseib. Soils of wadi Baba have Cr contents in the range of 90 ppm to 134 ppm (profile No.15). Soils of wadi Nukhul have Cr contents in the range of 94 ppm to 137 ppm. It is clear that, Cr content exhibits low concentration in sandy soil but is highest in sandy loam soils.

Zirconium(Zr)

With respect to Ramlet Himeir plain, the contents of Zr range from 35 to 936 ppm. The highest value recorded in surface samples of profile (3). Zr shows positive very strong correlation (Table 7) with Y (0.62) and positive strong correlation with MgO (0.69) as well as Co (0.61), Rb (0.60), Sr (0.58) and Ni (0.63). In Dabbt El Quari soils, the contents of Zr range from 115 to 390 ppm. It shows very strong positive correlation with Y (0.98). It is known that Zr is highly resistant to weathering; therefore, it is considered only weakly mobile in soils. The transportation of zirconium element from its compounds may be due to the mechanical processes.

Zirconium (Zr) is the most dominant element in the studied soil samples in all wadis. In the soils of wadi Nasseib, Zr ranges from 847 ppm (profile No.11) to 2635 ppm (profile No.10). Soils of Wadi Baba have Zr contents in the range of 432 ppm (profile No.15) to 2408 ppm (profile No.12) showing irregular distribution pattern with depth. The lowest Zr content is associated with the (20-50 cm) layer of profile No.15, while the highest value is detected in the surface layer of profile No.12. Soils of wadi Nukhul have Zr content in the range of 449 ppm (profile No.17) to 912 ppm (profile No.16).

Zinc (Zn)

Lindsay (1972a) and Krauskopf (1972) show that absorbed Zn has the largest concentration in sedimentary rocks in the crystal lattice of clay minerals. El-Kadi *et al*., (1972) pointed out that the highest Zn value is recorded in the heavy alluvial soils, calcareous soils are moderate, whereas the sandy soils are the lowest. Zinc seems to be distributed in low values at all soil profiles in Ramlet Himeir and Dabbt El Quari plains. It ranges from 22 to 36 ppm in Ramlet Himeir and ranges from 20 to 28 ppm in Dabbt El Quari plain respectively.

Zinc (Zn) ranges from 18 ppm (profile No.9) to 167 ppm (profile No.11) in the soils of wadi Nasseib, while it ranges from 29 ppm (profile No.15) to 90 ppm in the same profile in wadi Baba soils and ranges from 26 ppm (profile No.18) to 151 ppm (profile No.16) in the soils of Wadi Nukhul, Tables (7 and 8). Kabata and Pendias (2000) mentioned that Sr, Ba and Zn are belonging to the alkaline earth elements and behave similarly to Ca and Mg. Their distributions in soil profiles follow the general trends of soil solution circulation and depending on soil properties. Accordingly, their contents in soils are highly controlled by parent rocks (basement rocks), and prevailed climate.

Copper (Cu)

Taylor (1965**)** reported that 55 ppm is the average content of Cu in the earth̓s crust. Granite and basalt contain 10 and 100 ppm cu respectively, (Turekian and Wedepohl, 1961). With regarded to soils, Reuther (1957) pointed out that soils of loamy and clay textures have a total Cu content of 10-200 ppm, while sandy soils contain only 1 to 30 ppm. Copper is most abundant in mafic, intermediate and carbonate rocks and their soils (Kabata and Pendias, 2000).

The concentration of Cu in Ramlet Himeir soils ranges from 37 ppm to 88 ppm, while Rb is ranging from 3 to 265 ppm, (Table.7). In general, Cu and Rb are related to alkali trace elements and concentrated different soil types, especially those lying or derived from granites. However, Cu is less common. They are easily leached and reacted with different trace elements to form different varieties or species. Potassium links Rb in feldspar and micaceous minerals. Accordingly, during weathering process Rb is closely linked to K and therefore, the K: Rb ratio continually decreases in soil. Franz and Carlson (1987) observed that Rb markedly decreased the rate and the activation energy of K released from micaceous minerals. The concentration of Cu in Dabbt El Quari soils ranges from 32 ppm to 38 ppm, while Rb ranges from 2 ppm to 5 ppm.

Soils of wadi Nasseib have Rb contents range from 2 ppm (profile No.9) to 41 ppm in the same profile, whereas it ranges from 5 ppm (profile No.12) to 60 ppm in the same profile in the soils of Wadi Baba. It ranges from 8 ppm (profile18) to 28 ppm (profile No.16) in the soils of wadi Nukhul.

Strontium (Sr)

Strontium (Sr) content in wadi Nasseib soils ranges from 100 ppm (profile No.11) to 284 ppm (profile No.9), while it ranges from 72 ppm (profile No.15) to 426 ppm (profile No.12) in the soils of Wadi Baba. It ranges from 184 ppm (profile No.16) to 519 ppm (profile No.18) in soils of wadi Nukhul. These data are comparatively higher than those reported for igneous rocks (375 ppm) and shale (300 ppm) after Mason (1966) especially in wadi Nukhul Table (8).

Table (7): Trace elements (ppm) Analyses of Ramlet Himeir and Dabbt El Quari soils

Profile No.	Depth (cm)	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Ba	Pb
P1	0-30	32	148	4	8	37	32	2	6	85	15	170	714	39
	30-70	46	104	5	7	41	36	2	5	38	7	86	892	41
	70-140	23	221	3	8	40	25	2	3	31	7	82	518	38
	140-200	26	104	4	7	43	31	2	3	38	8	95	586	39
Average		**31.80**	**144.3**	**4**	**7.5**	**40.3**	**28.5**	**2**	**4.3**	**48**	**9.3**	**108.3**	**677.5**	**39.3**
P2	0-15	40	224	5	34	86	30	2	180	42	52	300	53	35
	15-50	17	84	4	25	72	24	2	4	89	18	101	20	29
	50-90	31	326	6	33	73	27	2	56	69	101	560	37	27
	90-150	26	201	5	30	72	26	2	6	101	74	394	32	20
Average		**28.50**	**208.8**	**5**	**30.5**	**75.8**	**26.8**	**2**	**61.5**	**72.3**	**61.3**	**338.8**	**35.5**	**27.8**
P3	0-20	42	158	6	33	70	32	2	265	134	172	936	66	23
	20-50	23	272	5	34	78	22	2	58	53	48	268	34	29
	50-80	25	186	4	28	76	23	2	102	79	50	276	33	27
	80-150	29	188	5	30	69	24	2	156	89	63	344	40	23
Average		**29.80**	**201**	**5**	**31.3**	**73.3**	**25.3**	**2**	**145.3**	**88.8**	**83.3**	**456**	**43.3**	**25.5**
P4	0-15	31	282	5	31	88	23	2	190	28	34	191	41	35
	15-45	33	401	6	38	79	25	2	43	47	86	485	39	28
	45-80	35	280	6	36	77	26	2	80	70	96	35	49	27
	80-150	32	220	5	37	77	26	2	111	56	87	481	48	29
Average		**32.80**	**295.8**	**5.5**	**35.5**	**80.3**	**25**	**2**	**106**	**45.3**	**75.8**	**298**	**44.3**	**29.8**
P5	0-20	17	224	3	7	37	23	2	5	26	10	116	559	33
	20-45	21	196	4	8	38	27	2	3	35	13	143	723	33
	45-90	23	222	4	8	35	26	2	3	48	18	203	785	32
	90-150	21	224	4	8	34	23	2	4	47	15	172	703	31
Average		**20.5**	**216.5**	**3.75**	**7.8**	**36**	**24.8**	**2**	**3.8**	**39**	**14**	**158.5**	**698.5**	**32.3**
P6	0-30	14	228	3	7	38	23	2	3	17	9	159	450	34
	30-70	26	328	5	10	35	28	2	5	68	29	327	914	28
	70-100	22	187	4	8	33	24	2	4	109	31	340	781	27
	100-150	23	206	4	8	32	24	2	4	127	35	390	791	24
Average		**21.3**	**237.3**	**4**	**8.3**	**34.5**	**24.8**	**2**	**4**	**80.3**	**26**	**304**	**734**	**28.3**
P7	0-25	21	235	5	9	36	24	2	2	56	18	200	675	28
	25-50	12	301	4	9	34	22	2	2	65	12	130	352	24
	50-100	9	221	3	8	33	20	2	2	40	11	115	310	24
	100-150	21	196	4	8	34	27	2	2	46	27	297	730	24
Average		**15.8**	**238.3**	**4**	**8.5**	**34.3**	**23.3**	**2**	**2**	**51.8**	**17**	**185.5**	**516.8**	**25**
P8	0-25	17	178	4	7	33	21	2	2	43	24	271	615	25
	25-45	18	185	4	7	34	26	2	2	46	23	258	634	27
	45-95	17	162	3	7	34	26	2	3	49	18	199	535	27
	95-150	12	188	3	7	34	21	2	3	56	11	125	364	26
Average		**16**	**178.3**	**3.5**	**7**	**33.8**	**23.5**	**2**	**2.5**	**48.5**	**19**	**213.3**	**537**	**26.3**

Table (8) reveal that strontium concentration in Ramlet Himeir plain ranges from 31-to134 ppm in the sandy loam soils, while it ranges from 17 ppm to 127 ppm especially in sandy loam soils of Dabbt El Quari. These data are comparatively lower than those reported for igneous rocks (375 ppm) and shale (300 ppm) after Mason (1966).

Table (8): Chemical composition analyses of trace elements (ppm) of the studied wadis.

Profile No.	Depth (cm)	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Ba	Pb
P9	0-25	19	133	3	10	45	84	2	2	123	29	1197	279	2
	25-65	26	128	4	13	57	40	6	41	284	33	1348	365	2
	65-140	19	143	3	11	44	18	2	8	168	26	1078	261	2
Average		21.3	134.7	3.3	11.3	48.7	47.3	2.7	17	191.7	29.3	1207.7	301.7	2
P10	0-25	36	159	6	19	200	120	2	21	274	68	2635	369	3
	25-65	38	149	6	19	285	159	2	9	200	37	1526	301	3
	55-130	33	156	5	18	228	104	2	9	165	36	1471	253	3
Average		35.7	154.7	5.7	18.7	237.7	127.7	2	13	213	47	1877.3	307.7	3
P11	0-25	38	132	5	19	82	167	4	30	268	42	1532	401	3
	25-75	28	162	4	14	68	119	2	11	100	21	847	248	3
	75-120	23	130	4	15	53	160	2	6	124	37	1229	193	4
Average		29.7	141.3	4.3	16	67.7	148.7	2.66	15.7	164	33.3	1202.7	280.7	3.3
P12	0-25	38	90	4	15	49	47	4	60	426	64	2408	603	2
	25-45	29	127	4	13	68	37	2	29	227	33	1344	405	2
	45-90	18	90	3	9	45	41	2	5	146	31	1275	260	2
Average		28.3	102.3	3.7	12.3	54	41.7	2.66	31.3	266.3	42.7	1675.7	422.7	2
P13	0-30	20	109	3	11	54	38	2	13	180	19	752	252	2
	30-80	19	116	4	13	52	54	2	22	228	21	831	245	2
	80-150	25	125	4	12	53	53	4	32	281	44	1547	404	2
Average		21.3	116.7	3.7	12	53	48.3	2.66	22.3	229	28	1043.3	300.3	2
P14	0-25	18	117	3	11	54	29	2	20	205	16	659	240	2
	25-55	20	131	3	11	51	79	2	22	205	28	1118	258	2
	55-120	22	131	4	12	55	46	2	10	179	23	939	263	2
Average		20	126.3	3.3	11.3	53.3	51.3	2	17.3	196.3	22.3	905.3	253.7	2
P15	0-20	28	124	4	11	49	31	2	19	269	29	883	316	2
	20-50	15	122	3	10	54	90	2	10	72	10	432	222	2
	50-90	17	134	3	11	52	29	2	18	227	18	709	221	2
	90-150	15	119	3	10	44	32	2	21	212	16	660	199	2
Average		18.8	124.8	3.3	10.5	49.8	45.5	2	17	195	18.3	671	239.5	2
P16	0-15	19	107	3	12	48	151	2	17	184	16	663	268	2
	15-45	25	125	4	15	44	47	2	27	298	27	912	281	2
	45-100	21	129	4	17	45	47	2	28	340	22	853	252	2
Average		21.7	120.3	3.6	11	45.6	81.7	2	24	274	21.7	809.3	267	2
P17	0-10	14	136	3	16	41	50	2	4	224	16	526	157	2
	10-55	14	137	3	16	49	38	2	4	360	14	560	158	2
	55-100	11	119	3	13	44	86	2	2	200	11	449	154	2
Average		13	130.6	3	15	44.7	58	2	3.33	328	13.7	511.7	156.3	2
P18	0-15	14	94	3	12	43	26	2	2	519	17	712	183	2
	15-45	16	95	3	11	46	129	2	10	204	15	604	219	2
	45-90	19	126	3	14	45	35	7	21	403	27	801	225	2
	90-120	18	132	3	14	44	89	2	17	389	22	733	200	2
	120-150	21	95	3	14	43	29	2	8	463	22	795	281	2
Average		17.6	108.4	3	13	44.2	61.6	3	11.6	395.6	20.6	729	212.4	2

It can be noted that, all the studied plains and wadis are poorly in radioactive elements, (uranium and thorium), but the enrichment of uranium especially in profile (1) in Ramlet Himeir area and profile (10) in Wadi Nasseib may be related to the leaching of uranium from the parent country basement rocks, beside the altered zircon which recorded in the two profiles.

Correlation Matrix

From the calculated correlation coefficient of Ramlet Himeir soils (Table.9), it can be concluded that; The very clear positive relations are existing between most of the major oxides which are the main constituents of the previously identified minerals, such as dolomite, CaMg $(CO_3)_2$, and ankerite, Ca $(MgO_{0.67}FeO_{0.33})$ $(CO_3)_2$, Kaolinite, $(Al_2Si_2O_5(OH)_4)$, and Calcite, $(CaCO_3)$.

Table (9): Correlation Matrix of Major and Trace Elements of Ramlet Himeir Plain.

Variables	CaO	SiO_2	$Fe2O3^t$	MnO	Ni	Cu	P_2O_5	Na_2O	Al_2O_3	MgO	Pb	Ba	Th	U
$Fe_2O_3^t$										0.83	0.81	0.96	0.89	0.91
Ba	0.95	0.93	0.96	0.80	0.92	0.93	0.77	0.64	o.64	1				

Table (9) shows that $Fe_2O_3^t$ has a strong positive relations with MgO (+0.83), Pb (+0.81), Ba (+0.96), Th (+0.89) and U (+ 0.91).

Also, Ba has very strong positive correlation with CaO (+0.95), SiO_2 (+0.93), $Fe_2O_3^t$ (+0.96), MnO (+0.80), Ni (+0.92) and Cu (+0.93) as well as strong positive relation with P_2O_5 (+0.77), Na_2O (+0.64) and Al_2O_3 (+0.64). These relations are very logic due to the presence of clay minerals such as illite, montmorillonite. Clay minerals usually contain most of the detected trace elements.

From the correlation coefficient of Dabbt El Quari soils (Table .10), very clear positive relations are existing between some of the major oxides as $Fe_2O_3^t$ that has a strong positive relation with CaO (+0.68), CaO correlated with K_2O by strong relation (+0.65) as well as TiO_2 with P_2O_5 (+0.75). These relations are very logic due to the presence of calcite and quartz as well as clay minerals such as kaoline, illite and montmorillonite.

Ba in soils of Dabbt El Quari shows strong positive correlation with Th (+0.92), (Table 10). The very strong and strong correlation with those elements may be due hydrothermal activity occurred in the country rocks from which soils are derived.

Table (10): Correlation Matrix of Major and Trace Elements of Dabbt El Quari Plain

Variables	CaO	K_2O	V	Zn	P_2O_5	Ba	Sr	Y	Zr	Th	Rb
$Fe_2O_3^t$	0..68					0.65					0.75
CaO		0.65									
TiO_2					0.75			0.57	0.55		
Ba			0.85	0.66		0.77	0.57	0.79	0.77	0.92	

Tables (11,12 and 13) show that $Fe_2O_3^t$ has good positive relations with K_2O (+0.56), Rb (+0.52), Ga (+0.0.63) in Wadi Nasseib, and with MgO in Wadi Baba has a good positive relation (+0.66). These relations are very logic due to the presence of many of clay minerals such as illite, montmorillonite and kaolinite. Also, the data of correlation coefficient show that Al_2O_3 has a good positive relation with CaO (+0.66) in Wadi Nasseib and with MnO (+0.73) in Wadi Nukhul. MnO has correlated good positive relation with CaO (+0.53) and Na_2O (+0.57) in Wadi Nukhul soils, whereas it has very strong positive relation with Na_2O (0.84) and good relation with K_2O (0.56) in Wadi Nasseib soils. The very clear positive relations are existed between most of the major oxides which are the main constituents of the previously identified minerals, such as dolomite, CaMg $(CO_3)_2$, and ankerite, Ca $(MgO_{0.67}FeO_{0.33})$ $(CO_3)_2$, Kaolinite, $(Al_2Si_2O_5\ (OH)_4)$, and Calcite, $(CaCO_3)$.

Table (11): Correlation Matrix of Major and Trace Elements of Wadi Nasseib.

Variables	Sr	U	V	Co	Th	Ni	K_2O	MnO	Ba	CaO	Rb	Na_2O	Ga	Zr
$Fe_2O_3^t$							+0.56				+0.52			
Al_2O_3							+0.56	+0.56		+0.66		+0.84		
Ba	+0.91									+0.88	+0.89		+0.54	+0.61
Cr			+0.73	+0.71		+0.72								+.0.67
Y														+0.98
Zr		+0.95			+0.87									

Data illustrated in Table (11) with respect to soils of Wadi Nasseib, Zr shows very strong positive correlation with Y (+0.98) and strong correlation with Th (+0.87) as well as very strong positive relation with U (+0.95). From Tables (12 and 13), it is clear that zirconium contents of both of wadi Baba and wadi Nukhul soils have strong positive relation with yttrium, (+0.99 and +0.87) respectively.

Table (12): Correlation Matrix of Major and Trace Elements of Wadi Baba.

Variables	Al_2O_3	Y	Fe_2O3^t	K2O	Ni	CO	V	Rb	Ba	Sr	Ga	Zr
$Fe_2O_3^t$	0.82		1									
MgO			0.66									
V				0.66	0.79	0.73						
Rb				0.60	0.83		0.80					
Ba				0.74	0.78	0.63	0.95	0.88			+0.82	+0.93
Sr				0.63	0.77		0.83	0.91	0.82			
Ga							0.65	0.79	0.81	0.73		
Zr		+0.99			0.68		0.85	0.81	0.93		0.80	
Y					0.68		0.88		0.95	0.83	0.84	0.99

Ba shows very strong positive correlation with Sr (+0.91 and +0.82) in soils of Wadi Nasseib and Wadi Baba (Tables11 and 12). Also, Ba in soils in soils of Wadi Nasseib is correlated with Ga and Zr with good positive relation (+0.54 and +0.61), whereas in soils of Wadi Baba Ba shows very strong relations (+0.82 and +0.93 respectively).

Table (13): Correlation Matrix of Major and Trace Elements of Wadi Nukhul Soils.

Variables	CO	MgO	CaO	V	Rb	Ba	Zr
V	0.67						
Rb	0.75		0.63	0.85			
Ba				0.91	0.71		
Zr	0.62			0.88	0.78	0.88	
Y				0.84	0.77	0.65	0.87
Th		0.70					

Chromium (Cr) shows strong positive correlation with Ni, Co, V and Zr (+0.72, 0.71, 0.73 and 0.67) in the soils of Wadi Nasseib respectively, whereas it correlated with Ni only with good positive relation (+0.78) in soils of Wadi Nukhul.

Cu is correlated with strong positive relation with Th (+ 0.71) and U (+0.67), good positive relation with both Zn and Zr, (+ 0.56 and +0.53), whereas Rb is correlated with very good positive relation with Ba (+0.75), and Sr (+0.89) in the soils of Wadi Nasseib.

These relations are very logic due to the presence of garnet and clay minerals such as illite, montmorillonite and kaolinite

CONCLUSIONS

Ramlet Himeir and Dabbt El Quari soils are characterized by a texture that varies from sandy clay loam to sandy loam, structureless, slightly to moderately sticky, slightly to moderately plastic and slightly to moderately calcareous, whereas Dabbt El Quari soils are covered with many scattered desert shrubs. Its texture is sandy loam and characterized by slightly sticky, slightly plastic and no calcareous.

The analytical data for Ramlet Himeir shows that the soils reaction tends to the alkaline side. Organic matter content is extremely low, whereas both of calcium carbonate and gypsum contents are very low. The soluble cations are often dominated especially at profile (1) with Mg^{++}, Na^{+} and Ca^{++}, while K^{+} is the least soluble cation. On the other hand, the anionic distribution has the following descending order Cl^{-} > SO_4^{-} > HCO_3^{-}, while CO_3^{-} is absent. Electrical conductivity of the studied soils indicates that they are not saline.

Soils of Dabbt El Quari reaction tend to the alkaline side since pH values range from 8.10 to 8.60. Both calcium carbonate and gypsum content are very low, while the vertical distribution of $CaCO_3$ and $Ca\ SO_4\ 2H_2O$ in soil profiles of Dabbt El Quari do not obey any specific pattern with depth. Ca^{++}, Mg^{++}, Na^{+} and K^{+} are dominant exchangeable cations with depth in the same profile. Electrical conductivity of Dabbt El Quari soil indicates that these soils are not saline. The soluble cations are often dominated with Mg^{++}, Ca^{++}, and Na^{+}, especially at profile (5), while K^{+} is the least soluble cation. On the other hand, the anionic distribution has the following descending order Cl^{-} > SO_4^{--} > HCO_3^{-}, where CO_3^{-} is absent.

From the field observation and data of laboratory analyses show that the soil of the studied Wadis has texture fluctuates between loamy sand, sandy loam and sandy clay loam and are commonly massive and slightly to moderately sticky, slightly to moderately plastic and non calcareous. The reaction of wadi Nasseib soils is moderately alkaline, while those of wadi Baba and wadi Nukhul exhibit alkaline character. Organic matter content ranges from 0.08% in Wadi Nukhul soil to 0.80% in wadi Baba soil, this reflects the arid conditions of the environment at wadi Nukhul. Otherwise, wadi Baba (profile 15) have relatively higher content of organic matter, which may be due to vegetable cultivation processes. Calcium carbonate and gypsum contents are generally considerably low in all Wadis indicating non calcareous nature of their soils.

Soluble calcium is often dominated and followed by Mg^{++} then Na^{+} and K^{+}, except both surface layer in profile (12) at wadi Baba where Na^{+} followed by Ca^{++} then Mg^{+}, but K^{+} is the least soluble cation. On the other hand, the anionic distribution has the following descending order Cl^- > $SO4^{--}$ > $HCO3^-$ with the absence of CO_3^{--} in all studied Wadis.

The chemical composition analyses show that the soils of all studied wadis are non saline. There is an exceptional case at the surface layer in profile No.12 in Wadi Baba where EC values vary from 3.41 to 13.17 ds/m indicating moderately saline soils.

Soils of the studied Wadis are characterized by the dominance of silica followed by iron oxide while alumina is the least.

There are very clear positive relations existed between most of the major oxides which are available for agricultural proposes and the main constituents of the previously identified minerals, such as dolomite, $CaMg\ (CO_3)_2$, ankerite, $Ca\ (MgO_{0.67}FeO_{0.33})\ (CO_3)_2$, Kaolinite, $(Al_2Si_2O_5\ (OH)_4)$, and Calcite, $(CaCO_3)$.

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إسهمات للخواص الطبيعية–الكيميائية للتربة لجنوب شبه جزيرة سيناء، مصر.

محمد أحمد حماد١، محمد عبد السلام حسين١، مصطفي السيد درويش٢، أنس مالك الشريف٢ و ماجدة عبد الحكيم خلف٢
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تتكون جميع الوديان والسهول قيد الدراسة من رواسب وديان ناشئة من العمليات التكتونية لصخور القاعدة والصخور الرسوبية الموجودة في شبة جزيرة سيناء.

وقد أثبتت الدراسات تشابه قطاعات التربة المأخوذة من سهول رملة حمير ودابة الكري من حيث تغير التربة من تربة رملية جيرية الي جيرية رملية، وكذا عدم وجود أي تراكيب جيولوجية بالإضافة إلى أن تربة هذه السهول قليلة إلي متوسطة فى رخويتها، لدانتها و حفرياتها كما انها مغطاة بالعديد من القشور الصحراوية.

وقد دل تجانس حجم حبيبات التربة علي أن الرياح قد لعبت دورا" هاما" في تكوين هذه التربة.

وقد دلت الشواهد الحقلية والتحاليل المعملية علي أن تربة الوديان لها نسيج يتراوح من جيري رملي، رملي جيري ورملي طيني جيري وهذه التربة تكون متماسكة قليلة الي متوسطة فى اللدونة و الرخوية ولا تحتوي علي أى حفريات .

أظهرت التحاليل الكيميائية علي قلة محتوي تربة السهول من كربونات الكالسيوم والجبس و أن هذه التربة قليلة الملوحة وأيضا" تتبع نظام واحد في التكوين الكاتيوني حيث يتميز النظام بسيادة الكالسيوم والماغنسيوم والصوديوم والبوتاسيوم ككاتيونات تبادلية. أما محتوى هذه التربةمن المواد العضوية فيعتبر قليل في كل من الوديان والسهول، أما محتوى السيليكا فهو يمثل الغالبية العظمىمن العناصر الرئيسية فى كل من تربة السهول والوديان قيد الدراسة. أما الزيادة في محتوى الألومنيوم فيعزى لزيادة محتوى المعادن الطينية في التربة. لم تدل التحاليل الكيميائية علي أي تجمعات للحديد في أي من تربة السهول أو الوديان على أي عمق، أما المحتوى العالي من الكالسيوم فيمكن أن يكون نتيجة لوجود بعض معادن الكالسيت والدولوميت. أما وجود آثار قليلة من الصوديوم والبوتاسيوم فذلك يرجع لسهولة تأثرهما بعمليات التجوية.

يعتبر الباريوم العنصر الشحيح السائد في كل من تربة السهول والوديان قيد الدراسة، أما الكروم فذو تركيز منخفض في التربة الرملية ولكنه عالي التركيز فى التربة الرملية الجيرية. أما عنصر الزركونيوم فهو أحد العناصر الشحيحة السائدة في كل من تربة الوديان والسهول. أما الزنك فهو ذو تركيز قليل في كل قطاعات التربة قيد الدراسة.