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أصل وتجانس أراضي سهل كوم أمبو الغربي بمصر

مجدي حسن خضر

معهد بحوث الأراضي والمياه والبيئة–مركز البحوث الزراعية– الجيزة–مصر

الملخص العربي

يهدف هذا البحث إلي التعرف علي أصل و تكوين أراضي سهل كوم أمبو الغربي و مدي تجانس القطاعات الأرضية بها. ولتحقيق هذا الهدف اختير تسعة قطاعات أرضية لتمثل الوحدات الفيزيوجرافية السائدة في منطقة الدراسة . وقد أجريت الدراسة علي مجموعة الرمل باستخدام التوزيع الحجمي لحبيبات التربة و كذلك الدراسة البتروجرافية لمكون الرمل. وتشير النتائج إلي ما يلي:

أوضحت دراسة التوزيع الحجمي لحبيبات التربة والتحليلات الاحصائية لها الي أن متوسط أقطار الحبيبات (Mean size) تقع معظمها في أطار الرمل المتوسط وقيم التصنيف توضح أن معامل الفرز (Sorting) ردئ مشيرا إلي أن الماء هو المسئول عن نقل و ترسيب حبيبات التربة ومقياس الحيود (skewness) يتراوح بين رمل خشن جدا إلي رمل ناعم جدا وقد تراوحت قيم مقياس الانبعاج (kurtosis) بين مدبب جدا (very leptokurtic) إلي مدبب للغاية (extremely leptokurtic).

وبدراسة التركيب المعدني لمكونات الرمل وجد أن المعادن الخفيفة تتميز بسيادة معدن الكوارتز مع وجود كميات قليلة من الفلسبارات (بلاجيوكليز– أورثوكليز– مسكوفيت). وبالنسبة للمعادن الثقيلة فيسود بها المعادن المعتمة مع وجود كميات قليلة من الجارنت والكيانيت والابيدوت والسليمنيت والاستروليت والبيوتيت والاندلوسيت.

وتشير نتائج دراسة توزيع المعادن المقاومة للتجوية (index minerals) ونسبة التجوية تشير إلي عدم وجود تجانس في طبقات القطاعات الأرضية تحت الدراسة في أراضي سهل كوم أمبو الغربي وان هذه الأراضي تعتبر غير متجانسة وقد فسر ذلك علي حسب الاختلافات في مادة الأصل أو ظروف الترسيب

GENESIS AND UNIFORMITY OF KOM OMBO WESTERN PLAIN SOILS, EGYPT.

M. H. Khider
Soil, Water and Environment Res. Inst., Agric. Res. Center, Giza, Egypt.

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ABSTRACT: *This investigation was performed on the soils of Kom Ombo western plain in order to evaluate their genesis and degree of homogeneity. Accordingly, nine soil profiles were selected to represent the main geomorphological units of the area. Representative soil samples were collected from these soil profiles and analyzed. The grain size distribution indicates that these soils are mainly medium sand and poorly sorted. Moreover, they are strongly coarse skewed to strongly fine skewed and very leptokurtic to extremely leptokurtic. This indicates that these soils are transported and deposited by water action. Mineralogical composition of the sand fraction reveals that the light fraction is generally dominated by quartz with less pronounced amounts of feldspars. The heavy minerals are composed essentially of opaques followed by zircon, amphiboles, pyroxenes, rutile and tourmaline. Granite, epidote, andulusite, silimanite, sturolite, and biotite are also present in less pronounced amounts. Uniformity and weathering ratios show that the soils of Kom Ombo western plain are heterogeneous either duo to their multi-origin or to subsequent variation along the course of sedimentation. Therefore, the soils are considered young from the pedological point of view.*

Key words: *Soil genesis, uniformity, sorting, skewness, kurtosis, heavy and light minerals.*

INTRODUCTION

Due to the rapid increase in population in Egypt, there is a great need to expand the cultivated areas. One of the suggested areas for the horizontal expansion in the western desert is Kom Ombo western plain. It is cover about 220,000 feddans, most of the area (about 200,000 fed.) is considered suitable areas for cultivation.

The area under investigation is bounded by latitudes 24˚ 20' 29" and 24˚ 47' 46" north and longitudes 32˚ 39' 15" and 32˚ 53' 42" east. It is adjacent to the Nile Valley in Aswan Governorate which has a high store of artesian water from multi layers of Nubian sandstone aquifer system and seepage of the River Nile.

According to Said (1990) and Abu Al-Izz (1999) the geological construction of the studied area is covered by Tertiary, Nubian formation (sandstone), Pliocene (gravels and sands) and Quaternary Pleistocene (river silt, sands, and gravels).

Kom Ombo western plain has two geomorphic units; the first one is almost a complete group of river terraces ranging in modernity and elevation toward River Nile. The second unit is a narrow flood plain adjacent to the west bank of the River Nile. The oldest river terraces are Pleopleistocene with elevation + 100 to 110 m. above flood plain elevation. After them we found Pleistocene terraces with elevation +45m., these terraces stretch on the left river bank form of a bar parallel to river narrow in the north and south extend somewhat in the middle. They are followed by terraces with +30 m. elevation which are not complete like upper terraces but they form tow ranges. They belong to the upper Pleistocene and linked to the deposition period of silt SWEI (2008).

Using Egyptian Meteorological Authority (1996) and Soil Survey Staff (1999), the soil temperature regime of the studied area could be defined as hyperthermic and soil moisture regime as torric.

Kom Ombo western plain soils were studied by many workers among them Abu Al-Izz (1971, 1999), Hassanein (1995), Brown (1997), Zahran *et al.,* (2008) and Omran (2008).

The present study aims at investigation and evaluation the genesis and uniformity of the Kom Ombo western plain soils.

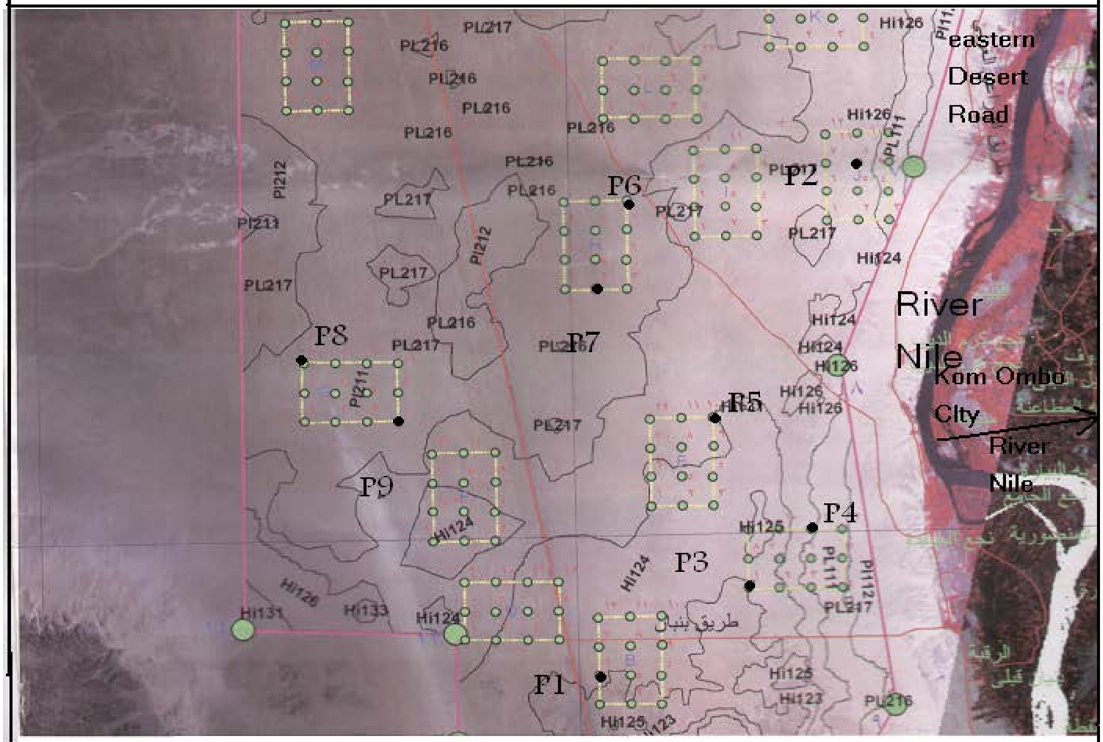
MATERIALS AND METHODS

Nine soil profiles were selected representing the studied area depending on geomorphic units, map (1).

Soil profiles were dug to 150 cm. unless hindered by bedrock or water table. Description of these soil profiles is undertaken according to FAO (1990) Table, 1.

Map (1) Location of the studied soil profiles and geomorphological units of West Kom Ombo

N



Where:

PL alluvial plain   Hi River terraces

● profile location

Km

Scale

Table (1): Morphological description of the studied soil profiles.

Physiographic unit	Profile No.	Location	topography	Soil depth (cm)	Gravels Content %	Soil color		Modified texture class	Soil structure	Soil consist- -ence	Boundary
						Dry	Moist				

River terraces	1	32° 45´51″ E, 24° 24´45″ N	Almost flat	0-20 20-50 50-150	5 20 30	7.5YR6/4 5YR7/6 5YR4/4	7.5YR5/6 5YR6/8 5YR3/3	SL SL SL	Structure less	Soft S. hard S. hard	Clear w. Gradual w.
	2	32° 50´ 57″ E, 24° 32´	Gently undul.	0-15 15-65 65-150	8 55 60	10YR5/6 5YR5/3 5YR5/3	10YR4/4 5YR4/3 5YR3/3	SL SL SL	Structur e less	Soft S. hard S. hard	Clear w. Clear w.
	3	32° 50´ 30″ E, 24° 26´	Flat	0-30 30-70 70-150	2 20 20	10YR7/6 7.5YR4/6 7.5YR5/6	10YR6/6 7.5YR3/4 7.5YR4/6	S LS LS	S. g. S. Less S. less	Loose Soft Soft	Abr. w. Clear w.
	4	32° 49´55E, 24° 26´18″ N	Flat	0-40 40-70 70-150	4 4 4	10YR7/6 7.5YR5/6 7.5YR4/4	10YR6/6 7.5YR4/6 7.5YR3/4	S LS LS	S. g. S. Less S. less	Loose Soft Soft	Abr. w. Clear w
	5	32° 45´ 22″ E, 24° 35´ 25″ N	Gently Undul.	0-20 20-70 70-150	10 30 20	10YR6/4 5YR5/4 5YR4/4	10YR5/6 5YR4/4 5YR3/4	LS LS LS	S.G. S.less S.less	Loose S. hard Hard	Clear w. Diffuse w.
	8	32° 43´ 29″ E, 24° 29´ 06″ N	Almost flat to gently undul.	0-35 35-75 75-150	4 6 25	10YR6/6 2.5YR4/4 2.5YR4/4	10YR5/6 2.5YR3/4 2.5YR3/4	LS LS LS	S.less S.less S.less	Soft Soft S. hard	Clear w. Clear w.
	9	32° 43´ 29″ E, 24° 30´ 09″ N	Almost flat	0-20 20-60 60-150	4 20 5	10YR5/6 7.5YR6/6 7.5YR5/6	10YR4/6 7.5YR5/6 7.5YR4/6	LS LS LS	S.less S.less S.less	Soft S. hard Soft	Clear w. Clear w.
Alluvial plain	6	32° 44´ 46″ E, 24° 35´ 25″ N	Almost flat	0-30 30-80 80-120	5 5 7	10YR7/6 10YR6/3 10YR6/3	10YR6/6 10YR5/4 10YR5/3	LS LS LS	S.g. S.g. S. less	Loose Loose S hard	Clear w. Clear w.
	7	32° 44´ 15″ E, 24° 25´ 25″ N	Almost flat	0-25 25-75 75-125	5 10 20	10YR6/6 10YR5/3 10YR5/3	10YR5/6 10YR4/3 10YR4/3	LS LS S	S.less S.g. S.g.	Soft Loose Loose	Diffuse b. Diffuse b.

WHERE: S.g. = Single grains S.less= structureless S. hard= slightly hard
W. = wavy LS= loamy sand S= sand undul= undulating

Soil colour was recorded in dry and moist status using soil Munsell colour charts (Soil Survey Stuff, 1975). Twenty seven soil samples were collected representing the different morphological variations throughout the entire profiles. Soil samples were air dried, crushed, sieved through a 2mm sieve and subjected to different analysis. Gravels content was determined as percent by volume.

Chemical composition of the studied soil samples was determined according to (USDA, 2004).

Particle fractionation was carried out using pipette method for fine fraction, namely, Kohn method (Arnold, 1986). Fractionation of sand portion was carried out using a set of standard sieves. The data was presented as texture classes, FAO (1990).

Size fractions of sand portion were obtained and presented as plotted cumulative percentage curves against phi diameter arithmetic probably paper, and seven percentiles; $Ø_5$,$Ø_{16}$,$Ø_{25}$,$Ø_{50}$,$Ø_{75}$,$Ø_{84}$ and $Ø_{95}$. Statistical grain size parameters namely, sorting (S_o), skewness (Sk) and kurtosis (KG) were calculated according to Folk and Word (1957) as follows:

Sorting (S_o) = $\frac{Ø84 - Ø16}{4} + \frac{Ø95 - Ø5}{6.6}$

Skewness (Sk) =

$$\frac{Ø84 + Ø16 - 2\,Ø50}{2(Ø84 - Ø16)} + \frac{Ø95 + Ø5 - 2Ø50}{2(Ø95 - Ø5)}$$

Kurtosis (KG) = $\frac{Ø95 - Ø5}{2.44(Ø75 - Ø25)}$

Mz = $(Ø_{16}+Ø_{50}+Ø_{84})/3$

After the ordinary pretreatments (Jackson,1973) the sand fraction 0.125-0.063 mm, was separated from each sample by dry sieving, cleaned up and further differentiated into heavy and light minerals using bromoform (sp. gr. 2.85 ± 0.02). The heavy and light residues were separated using Canada balsam for identification (Brewer, 1964). About 300 grains were identified by the polarizing microscope, using a gradual mechanical stage, for counting. Identification of minerals was undertaken according to the procedure of Milner (1962).

RESULTS AND DISCUSSION

Physical and chemical characteristics of studied soils

Soil characteristics of the studied area cloud be discussed based on data in Tables 2 and 3. The characteristics could be summarized in the following.

Soil of river terraces

This unit is represented by profiles 1, 2, 3,4,5,8 and 9. data in Tables 2 and 3 reveal that these soils are deep. Texture class ranged from sand to sandy loam. Soil reaction is ranging from 7.1 to 8.1 indicating that these soils are neutral to moderately alkaline. These soils are non to strongly saline indicating from EC data which varies from 1.29 to 101.8 d sm^{-1}. Calcium carbonate content ranges between 2.48 to 13.2% with out regular distribution with depth. The soluble cations followed the descending order Ca^{++} and or Na^{+} > Mg^{++}> K^{+} Vs the soluble anions of Cl^{-} and or SO_4^{--} > HCO_3^{-}.

Soils of alluvial plain

This geomorphic unit is represented by profiles, 6 and 7. Data reveal that soils are deep (150cm.). Texture class is mostly loamy sand throughout the entire profiles depths. Soil reaction ranges from 7.2 to 7.9 indicating that soils are neutral to moderately alkaline. EC data ranges from 1.26 to 5.26 dsm^{-1} indicating non to slightly saline. Calcium carbonate content ranges from 1.24 to 9.08%. Soluble cations are dominated by Ca^{++} ion followed by Mg^{++} and Na^{+}, with very low K^{+}. Soluble anions are dominated by SO_4^{--} followed by Cl^{-} and HCO_3^{-}.

Soil deposition mode

The particle size distribution pattern of the studied soil profiles were used as a criterion for determining the genesis of these profiles and their uniformity. The results of the mechanical analysis are plotted as phi curves. Seven accumulative percentages ($Ø_5$, $Ø_{16}$, $Ø_{25}$, $Ø_{50}$, $Ø_{75}$, $Ø_{84}$ and $Ø_{95}$) are recorded graphically for each sample. Four statistical parameters (Mz, So, Sk and KG) are calculated using the formula of Folk and Word (1957), and presented in table,4. The results could be discussed as followed:

Soils of river terraces

The mean size (Mz) values of river terraces soils are in the range of 0.99 to 2.86 Ø related to the medium sand, except for the uppermost surface layers of profiles 2,8 and 9 which has fine sand. The subsurface layer of profile 5 have coarse sand.

The standard deviation (So) of the grain size values is in the range of 0.76 to 1.41Ø. The distribution of these values indicate that the studied soils of river terraces are poorly sorted. This indicates that the materials of these soils are transported and deposited under water action. With regard to the skewness (Sk), the values are in the range of -0.55 to 0.92Ø indicating that profiles 2, 3 and 8 has strong coarse skewed or coarse skewed in the top layers changes into nearly symmetrical in the deepest layers. In profiles 1 and 9 the upper most surface layers are strongly coarse skewed and strongly fine skewed in the deepest layer. Profile,5 have nearly symmetrical in the surface layer and strongly fine skewed in the deepest layer. The bimodal distribution of skewness values indicates mixing of two modal fractions, i.e. fine and coarse sand in this case.

Table (2) chemical analysis of studied soil profiles

Geo. unit	Profile	Depth	pH	EC dsm^{-1}	CaCO3	Soluble cations				Soluble anions			
						Ca	|Mg	Na	K	Cl	SO4	HCO3	CO3
River terraces	1	0-20	7.7	1.8	3.3	9.73	3.15	3.76	.11	5.2	9.09	2.0	-
		20-50	7.6	9.4	4.13	83.2	14.4	5.82	0.09	80.8	21.21	1.5	-
		50-150	7.6	6.8	3.72	55.5	13.95	3.1	0.06	54.2	16.91	1.5	-
	2	0-15	7.9	25.2	11.18	121.0	116.0	78.5	0.16	223	99.66	2.0	-
		15-65	7.3	57.1	2.89	385.0	176.0	181.0	0.32	371	369.32	2.0	-
		65-150	7.2	101.8	1.65	483.0	291.0	900.0	0.41	998	675.21	1.0	-
	3	0-30	8.1	3.8	10.8	12.3	8.9	17.5	0.78	26.0	11.48	2.0	-
		30-70	7.7	1.3	3.36	5.5	3.3	3.5	0.70	5.5	6.0	1.5	-
		70-150	7.6	4.2	4.13	17.9	11.3	13.6	0.70	19.0	23.5	1.0	-
	4	0-40	7.9	6.7	7.66	31.5	24.5	11.3	0.53	27.0	38.33	2.5	-
		40-70	7.5	1.29	5.78	5.4	5.2	2.2	0.05	10.0	1.75	1.0	-
		70-150	7.5	1.70	7.43	9.7	5.2	2.4	0.06	8.0	8.36	1.0	-
	5	0-20	7.7	1.65	9.13	7.5	6.5	2.7	0.19	8.5	6.42	2.0	-
		20-70	7.4	9.92	4.95	30.8	27.6	48.4	0.24	80.0	25.54	1.5	-
		70-150	7.5	4.3	13.2	24.3	13.9	4.8	0.12	14.0	28.12	1.0	-
	8	0-35	7.8	2.12	11.62	5.4	3.1	12.5	0.62	12.0	7.52	2.0	-
		35-75	7.5	5.84	4.95	26.6	10.6	23.0	0.7	33.0	26.48	1.5	-
		75-150	7.6	20.6	8.25	62.4	14.7	182.4	4.2	170.0	92.2	1.5	-
	9	0-20	7.5	2.11	2.48	7.6	6.0	7.6	0.37	11.0	8.07	2.5	-
		20-60	7.8	5.48	7.43	16.7	7.0	32.5	0.94	32.0	23.14	2.0	-
		60-150	7.6	3.12	4.13	14.2	7.3	12.3	0.40	16.0	16.2	2.0	-
Alluvial plain	6	0-30	7.9	1.41	9.05	7.8	4.5	2.1	0.15	6.0	7.05	1.5	-
		30-80	7.3	4.72	3.3	27.5	13.9	6.5	0.18	31.0	16.08	1.0	-
		80-150	7.6	2.1	1.24	13.3	7.4	2.8	0.21	6.5	15.21	1.0	-
	7	0-25	7.8	1.26	7.4	5.1	2.5	5.2	0.08	4.38	7.0	1.5	-
		25-75	7.2	7.21	4.13	43.9	16.3	13.2	0.19	17.61	55.0	1.0	-
		75-150	7.8	5.62	9.08	22.8	12.2	25.0	1.20	10.2	50.0	1.0	-

Table (3): Particle size distribution of the studied soil profiles

Geomorphic unit	Profile No.	Depth Cm	Particle size distribution %	Texture class

			Coarse sand	Fine sand	Silt	Clay	
River terraces	1	0-20 20-50 50-150	2192 34.27 39.42	48.67 37.65 35.61	15.8 15.1 12.98	13.61 12.98 11.9	SL SL SL
	2	0-15 15-65 65-150	16.83 29.89 31.37	54.57 45.31 43.87	16.43 11.50 10.93	12.17 13.30 13.45	SL SL SL
	3	0-30 30-70 70-150	37.97 31.53 30.28	58.39 53.34 54.71	2.47 8.20 7.19	1.17 6.93 7.82	S LS LS
	4	0-40 40-70 70-150	42.01 30.93 47.49	52.08 55.15 40.04	2.24 7.31 6.17	3.67 6.31 6.30	S LS LS
	5	0-20 20-70 70-150	27.70 60.13 44.81	56.80 35.62 49.48	9.33 3.02 3.40	6.17 1.23 2.31	LS S S
	8	0-35 35-75 75-150	25.85 24.89 30.39	58.34 60.50 51.64	9.25 7.80 8.81	6.56 6.46 6.16	LS LS LS
	9	0-20 20-60 60-150	18.03 23.34 50.28	65.89 61.28 44.31	7.88 7.18 3.06	8.20 8.20 2.35	LS LS S
Alluvial plain	6	0-30 30-80 80-150	24.67 33.31 35.46	58.82 52.08 51.52	9.53 7.78 7.18	6.98 6.83 5.84	LS LS LS
	7	0-25 25-75 75-150	22.47 38.19 60.48	61.67 47.50 35.65	7.39 7.45 2.32	8.47 6.96 1.55	LS LS S

The kurtosis (KG) is distributed between values of 0.58 and 1.5Ø representing very leptokurtic, except for the surface layers of profiles, 2 and 4, subsurface layer of profile, 5 and all layers of profile, 9 which have extremely leptokurtic sediments. The somewhat normal distribution of (KG) values corresponds to very low- energy environment and very high modification of grain size.

Alluvial plain soils

This soil unit is represented by profiles, 6 and 7. Grain size parameters are shown in Table (4). The main size (Mz) values of these soils are in range of 1.08 to 2.06Ø representing medium sand fraction except the surface layer of profile, 7 which have fine sand fraction.

The standard deviation (So) values are normally distributed ranging between 1.04 and 1.97Ø. The values of sorting indicate that these soils are poorly sorted sediments which show that the sediments of these soils are commonly transported and deposited under water action.

Tale 4

The skewness values (sk) are in range of -0.22 to 0.42Ø representing nearly symmetrical in the surface layer and fine skewed in the deepest layers of profile, 6. While in profile 7 the surface layer is coarse skewed whereas the deepest layers are strongly fine skewed. Bimodal distribution of skewness values indicates mixing of two modal fractions, i.e. fine and coarse sand.

The kurtosis (KG) values are non-normal distributed representing two different modals of very leptokurtic and extremely leptokurtic. The moderate different values of kurtosis are corresponding to low-energy environment and high modification of grain size.

In view of the former findings, we can conclude that the studied soils occur in medium sand, sometimes close to fine sand grade. These soils are poorly sorted sediments, strongly coarse skewed to fine skewed and very to extremely leptokurtic.

Mineralogy of sand fraction

Four soil profiles were selected representing the physiographic units of studied area for mineralogical analysis.

Mineralogy of the light fraction:

The light minerals fraction examination (sp. gr. < 2.85) reveal that it is composed almost entirely of quartz which constitutes more than 90% (Table, 5). Other associated light minerals are mainly orthoclase, plagioclase, muscovite and calcite. Quartz mineral ranged from 90.2 to 92.6% and 90.6 to 92.1% in the river terraces and alluvial plain soil, respectively. Quartz grains are present as single grains in different degrees of roundness and extinction and undulase quartz grains are also detected. The distribution pattern of quartz with depth is almost similar within each profile and even in all the profiles studies. The dominancy of quartz over other members of the light fraction is mostly related to its resistance to weathering and the disintegration during the multicyclic processes of sedimentation presence of undulase quartz grains in the sediments is generally indicative of a metamorphic source.

The feldspars minerals constitute about 6.6 to 8.9% and 7.1 and 8.5% in the river terraces and alluvial plain soil, respectively. The members of feldspars can be arranged in the order of their abundance as plagioclase, orthoclase and muscovite. The vertical distribution of the feldspars minerals shows no specific trend with depth. The presence of feldspars could be taken as an indication that weathering prevailing during soil formation was not so drastic to cause their complete decay.

Table (5): Frequncey distribution of light minerals in the sand fraction (0.125- 0.063 mm)

Geomorphic Units	Profile No.	Depth cm	Quartz %	Feldspars%			Calcite %
				Orthoclase	Plagioclase	Muscovite	
River Terraces	2	0-15	92.6	1.9	2.8	1.9	0.8
		15-65	91.3	2.9	3.8	1.1	0.9
		65-150	91.3	2.3	3.4	1.7	0.8
	4	0-40	91.4	2.4	2.9	1.6	1.7
		40-70	90.8	2.3	3.3	2.9	0.7
		70-150	92.3	1.8	3.3	1.8	0.9
	9	0-20	90.7	1.9	3.2	2.1	2.1
		20-60	92.4	2.5	2.9	1.1	1.1
		60-150	90.2	3.0	4.1	0.9	0.9
Alluvial plain	6	0-30	91.3	2.1	3.2	2.1	1.3
		30-80	90.6	3.1	4.5	0.9	0.9
		80-150	92.1	1.8	3.1	2.2	0.8

Heavy minerals:

The study of heavy minerals which are either derived from parent material or altered during the soil formation is considered as useful tools in evaluating profiles uniformity or discontinuity development and weathering as well as predicting the major processes involved in soil formation, (Van Andel, 1959; Mitchell, 1975 and Huang, 1977).

Data in Table, 6 show that opaques are the main constitute with more than 43% of the heavy fractions in all samples. Zircon, amphiboles, pyroxenes, rutile, tourmaline, garnet, epidote, andulusite, silimanite, sturolite and biotite are also present in less pronounced amounts. Their frequency distribution is illustrated in Table, 6 in which the non-opaques are expressed as 100%, while the opaques percentages are recorded alone. The composition characteristics and frequencies of each mineral are given as follows:

1- Opaques minerals:

The opaques minerals constitute the greater part of heavy minerals in all samples (about 43% of the total heavy minerals) with an irregular distribution pattern with depth, except for the soils of alluvial plain where opaques minerals tend to increase with depth. In general, these minerals are characterized by being isotropic between cross Nicole, black colour in plain light, non-peleochroic and having the shape from rounded to subrounded with few subangular grains.

2- Resistant minerals

A- <u>Zircon</u> is the highest resistant mineral. It constitutes 30.3% to 58.6% of the non-opaques minerals. The distribution of zircon shows no specific pattern pertaining to profile location, geomorphology or soil depth and reflects the multi-origin of parent material or their multi-depositional course or depth. Zircon is characterized by colourless grains with high relief. The mineral grains have a common prismatic habit and rarely subrounded edges.

Table (6): Frequency distribution of heavy minerals in the sand fraction (0.125- 0.063 mm)

Geomorphic Units	Profile No	Depth cm	Opaques %	Resistant minerals %			Pyroboles %		Parametamorphic %					Epidote	Biotite	Others
				Zircon	Rutile	Tourmaline	Amphiboles	Pyroxenes	Garnet	Kyanite	Andalusite	Silimanite	Sturolite			
River Terraces	2	0-15	43.1	30.3	11.1	5.1	19.2	11.1	4.5	1.5	2.5	2.5	3.8	1.5	4.5	2.5
		15-65	50.2	36.7	13.8	3.7	20.2	9.2	2.7	0.9	1.8	1.8	2.7	2.7	3.7	3.7
		65-150	52.3	40.2	14.6	4.9	12.2	9.7	3.6	0.0	1.2	1.2	2.4	3.6	2.4	3.6
	4	0-40	50.4	45.1	6.8	3.7	14.3	9.0	3.8	1.5	3.7	1.5	2.3	2.3	3.0	3.0
		40-70	45.1	37.9	14.3	2.8	16.4	10.7	2.8	1.4	1.4	2.1	3.5	0.7	2.8	2.8
		70-150	52.2	58.6	11.7	3.9	7.8	6.3	2.3	0.0	0.7	0.6	1.5	2.3	1.5	2.3
	9	0-20	51.2	52.4	10.5	3.5	10.4	9.1	2.1	0.0	0.7	0.7	1.3	4.9	1.4	2.8
		20-60	51.5	56.2	12.5	2.5	12.5	5.0	1.3	0.0	1.2	1.2	1.3	0.0	3.8	2.5
		60-150	50.6	53.2	13.5	3.5	13.5	4.0	1.5	0.0	1.0	1.1	1.2	1.0	3.7	2.7
Alluvial plain	6	0-30	50.8	57.8	13.2	4.1	7.4	3.3	3.3	0.0	1.6	0.8	2.5	0.8	1.6	3.3
		30-80	54.5	50.0	10.0	2.0	14.0	8.0	2.0	0.0	2.0	0.0	2.0	4.0	2.0	4.1
		80-150	55.6	51.1	15.9	4.5	11.4	4.5	2.3	0.0	1.1	1.1	1.1	2.3	1.1	3.4

Rutile occurs in prismatic crystals of deep brown colour (bloody red) in plain light and crose nicols. Its shape is subrounded, thus reflecting its relatively high resistance to weathering and decay. Rutile has a frequency ranging from 6.8 to 14.6 and 10.0 to 15.9% in river terraces and alluvial plain, respectively. Its distribution does not portray any specific pattern with depth. The distribution of mineral could be explained that the studied soils have multi-origin, i.e are derived from multi-parent materials and/ or show variation associated with depositional regime.

Tourmaline is one of the most resistant minerals, and it is found as prismatic grains exhibiting strong pleochrime. Its content in river terraces and alluvial plain ranges from 2.5 to 5.1 and 2.0 to 4.5%, respectively. The mineral has an irregular pattern of distribution down word the soil profiles.

3- Pyroboles

Pyroboles are designated to minerals related to pyroxenes and amphiboles.

Pyroxenes are present as irregular subangular to subrounded grains and vary in frequency from 3.3 to 11.1%. The minimum value was recorded for the surface layer of profile, 6 (alluvial plain), while the maximum value was found in the surface layer of profile, 2 (river terraces). Most of these variations may be rendered to the nature of parent material, its discontinuity as well as sedimentation regimes and environments.

Amphiboles content ranges from 7.4 to 20.2% and their highest value was recorded in profile, 2 (river terraces), while the lowest ones characterize the surface layer of profile, 6 (alluvial plain). The mineral found as subrounded grains of different varieties, ranging in colour from light green to dark brown and sometimes brown.

4- Parametamorphic

Garnet: is present in subangular to subrounded grains that display isotropy between crossed nicols. It constitutes 1.3 to 4.5% and 20 to 3.3% in the river terraces and alluvial plain soils, respectively. The distribution of garnet does not portray any specific pattern with the entire profile depths.

Kyanite: is found colourless varieties, and gives abnormal interference colours between crossed nicols. Though all layers of profiles, 6 and 9 kyanite is absent and not exceeds 1.5% of non-opaques in whole area.

Andulusite: content varied from 0.7 to 3.7 and 1.1 to 2.0% of non-opaques minerals in the river terraces and alluvial plain soils, respectively.

Silimanite: is detected as colourless prismatic or rectangular grain showing vertical striations and parallel extension. It constitutes 0.6 to 2.5% of non-opaques. The highest value was detected in the surface layer of profile, 2, while the lowest value was found in the deepest layer of profile, 4.

Staurolite: is identified as a golden yellow coloured grain both in plain ligh and between crossed nicols. Staurolite constitutes 1.1% in soils of profile, 6 (alluvial plain) to 3.8% in soils of profile, 2 (river terraces).

Epidote: is generally found in form of sharp angular to subangular grains. It is greenish yellow in colour, isotropic, highly peleochroic and shows parallel extension. Epidote content ranges from 0.7 to 4.9 and 0.8 to 4.0% in the river terraces and alluvial plain soils, respectively.

Biotite: shares with tourmaline the phenomenon of darkness in the plain light but can be distinguished by its one set of cleavage. Its shape is subrounded due to susceptibility to weathering during transportation and even after burial. This shape of the mineral grains could be taken as an indication of transportation by water from long distances. Biotite content ranges between 1.4 to 4.5 and 1.1 to 2.0% in the river terraces and alluvial plain soils, respectively.

Uniformity of soil materials

The mineral assemblage as well as the ratio of Z/R, Z/T, Z/R+T, P+A/Z+R and B/Z+R and their distribution pattern with depth are taken as a criterion for profile uniformity as recommended by Brewer (1964).

They were applied to test the uniformity and development of Egyptian soils by El-Demerdashe *et al* (1979 b) and Hassona *et al* (1995). The ratio between the total content of pyroxenes and amphiboles (representing the more susceptible minerals to weathering) and the total content of zircon, rutile and tourmaline (representing the resistant minerals) was calculated for all samples and illustrated in Table, 7. In this respect, if the total percentages of the index minerals and/ or the ratio between any two of them are mostly constant throughout the entire depth of the profile, this might suggest one parent material dominancy and subjected to the same sedimentation cycle. On the other hand, a difference in such trend in the profile marks the existence of parent material heterogeneity and/ or many sedimentation cycles.

The results show that the soil constituting each profile is heterogeneous either due to their multi-origin or to the subsequent variations along the course of sedimentation, and therefore, it is considered young from the pedological point of view.

Data of weathering ratios have no similar trend through profiles layers so their behavior with respect to weathering indicates multi-depositional regimes.

Low values of B/Z+T could be due to the relatively low content of biotite as a weatherable mineral in comprise to the high content of resistant minerals. This may due to effect of geo-chemical weathering processes.

Table (7): Weathering and uniformity ratios of the studied soil profiles.

Geomorphic Units	Profile No.	Depth cm	Index minerals	Uniformity indices			Weathering ratios		Uniformity indication
				Z/R	Z/T	Z/R+T	P+A/Z+R	B/Z+T	
River Terraces	2	0-15	46.5	2.7	5.9	1.9	0.9	0.13	Hetero-geneous
		15-65	54.2	2.7	9.9	2.1	0.7	0.09	
		65-150	59.7	2.8	9.2	2.1	0.5	0.05	
	4	0-40	55.6	6.6	12.2	4.6	0.5	0.06	Hetero-geneous
		40-70	55.0	2.7	13.5	2.2	0.7	0.07	
		70-150	74.2	5.0	15.0	3.8	0.2	0.04	
	9	0-20	66.4	5.0	15.0	3.7	0.3	0.03	Hetero-geneous
		20-60	71.2	4.5	22.5	3.7	0.3	0.06	
		60-150	70.2	3.9	15.2	3.1	0.3	0.07	
Alluvial Plain	6	0-30	75.1	4.4	14.1	3.3	0.2	0.3	Hetero-geneous
		30-80	62.0	5.0	25.0	4.2	0.4	0.04	
		80-150	71.5	3.2	11.3	2.5	0.3	0.02	

Where:

Z= zircon P= pyroxenes
R= Rutile A=Amphiboles
T=Toutmaline B=Biotite
Index minerals= Z+R+T

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أصل وتجانس أراضي سهل كوم أمبو الغربي بمصر

مجدي حسن خضر

معهد بحوث الأراضي والمياه والبيئة–مركز البحوث الزراعية– الجيزة–مصر

الملخص العربي

يهدف هذا البحث إلي التعرف علي أصل و تكوين أراضي سهل كوم أمبو الغربي و مدي تجانس القطاعات الأرضية بها. ولتحقيق هذا الهدف اختير تسعة قطاعات أرضية لتمثل الوحدات الفيزيوجرافية السائدة في منطقة الدراسة . وقد أجريت الدراسة علي مجموعة الرمل باستخدام التوزيع الحجمي لحبيبات التربة و كذلك الدراسة البتروجرافية لمكون الرمل. وتشير النتائج إلي ما يلي:

أوضحت دراسة التوزيع الحجمي لحبيبات التربة والتحليلات الاحصائية لها الي أن متوسط أقطار الحبيبات (Mean size) تقع معظمها في أطار الرمل المتوسط وقيم التصنيف توضح أن معامل الفرز (Sorting) ردئ مشيرا إلي أن الماء هو المسئول عن نقل و ترسيب حبيبات التربة ومقياس الحيود (skewness) يتراوح بين رمل خشن جدا إلي رمل ناعم جدا وقد تراوحت قيم مقياس الانبعاج (kurtosis) بين مدبب جدا (very leptokurtic) إلي مدبب للغاية (extremely leptokurtic).

وبدراسة التركيب المعدني لمكونات الرمل وجد أن المعادن الخفيفة تتميز بسيادة معدن الكوارتز مع وجود كميات قليلة من الفلسبارات (بلاجيوكليز – أورثوكليز – مسكوفيت). وبالنسبة للمعادن الثقيلة فيسود بها المعادن المعتمة مع وجود كميات قليلة من الجارنت والكيانيت والابيدوت والسليمنيت والاستروليت والبيوتيت والاندلوسيت.

وتشير نتائج دراسة توزيع المعادن المقاومة للتجوية (index minerals) ونسبة التجوية تشير إلي عدم وجود تجانس في طبقات القطاعات الأرضية تحت الدراسة في أراضي سهل كوم أمبو الغربي وان هذه الأراضي تعتبر غير متجانسة وقد فسر ذلك علي حسب الاختلافات في مادة الأصل أو ظروف الترسيب

Table (4): Phi units and statistical parameters for grain size distribution of the sand fraction of the studied soil profile

Geomorphic unit	Profile No.	Depth Cm	Ø5	Ø16	Ø25	Ø50	Ø75	Ø84	Ø95	Mz		Sorting		Skewnss		Kurtosis	
										Values	Classes	Values	Classes	Values	Classes	Values	Classes
River terraces	1	0-20	-0.17	0.5	0.77	2.3	3.09	3.17	3.43	1.99	MS	1.2	PS	-0.36	SCK	0.64	VL
		20-50	-0.33	-0.2	0.5	1.33	2.62	3.10	3.40	1.41	MS	1.4	PS	0.12	FK	0.72	VL
		50-150	-0.33	-0.2	-0.1	0.75	2.17	3.00	3.22	1.19	MS	1.3	PS	0.41	SFK	0.64	VL
	2	0-15	0.75	2.17	2.5	3.04	3.22	3.36	3.50	2.86	FS	0.8	MS	-0.54	SCK	1.5	EL
		15-65	-0.33	0.17	0.5	2.0	3.13	3.27	3.42	1.81	MS	1.3	PS	-0.21	CK	0.58	L
		65-150	-0.42	0.0	0.45	1.58	3.09	3.21	3.42	1.60	MS	1.4	PS	-0.01	NS	0.60	VL
	3	0-30	0.25	0.58	0.86	1.58	2.64	3.04	3.22	1.73	MS	1.1	PS	0.16	FK	0.68	VL
		30-70	-0.17	0.33	0.55	1.67	3.00	3.18	3.50	1.73	MS	1.3	PS	-0.05	NS	0.61	VL
		70-150	-0.18	0.58	0.82	1.75	2.91	3.18	3.50	1.84	MS	1.2	PS	0.01	NS	0.72	VL
	4	0-40	0.25	0.67	0.72	1.25	2.00	2.46	3.18	1.46	MS	0.8	MS	0.33	SFK	0.93	EL
		40-70	0.18	0.54	0.72	1.50	2.50	2.75	3.23	1.60	MS	1.0	PS	0.13	FK	0.70	VL
		70-150	-0.17	0.25	0.45	0.83	1.86	2.42	3.18	1.17	MS	1.3	PS	0.43	SFK	0.97	EL
	5	0-20	-0.08	0.62	0.86	1.75	2.91	3.14	3.41	1.84	MS	1.2	PS	0.03	NS	0.69	VL
		20-70	-0.33	0.0	0.23	0.75	1.72	2.21	3.00	0.99	CS	1.1	PS	0.92	SFK	0.91	EL
		70-150	-0.33	0.04	0.28	0.71	2.64	3.04	3.33	1.24	MS	1.3	PS	0.48	SFK	0.65	VL
	8	0-35	0.18	0.79	0.91	2.33	3.09	3.22	3.42	2.11	FS	1.1	PS	-0.21	CK	0.61	VL
		35-75	0.18	0.67	0.87	2.0	3.04	3.18	3.41	1.95	MS	1.1	PS	-0.09	NS	0.61	VL
		75-150	-0.21	0.42	0.64	1.67	2.72	3.04	3.33	1.71	MS	1.1	PS	0.00	NS	0.69	VL
	9	0-20	0.42	0.92	1.5	2.75	3.02	3.25	3.46	2.31	MS	1.0	PS	-0.55	SCK	0.77	EL
		20-60	0.0-	0.75	1.33	2.58	3.18	3.28	3.45	2.20	MS	1.1	PS	-0.47	SCK	0.76	EL
		60-150	0.33	0.0	0.33	0.88	2.17	2.58	3.27	1.15	MS	1.2	PS	0.32	SFK	0.80	EL
Alluvial plain	6	0-30	0.33	0.79	1.0	1.75	2.83	3.13	3.33	1.89	FS	1.0	PS	0.02	NS	0.67	VL
		30-80	-0.17	0.33	0.73	1.33	2.5	3.00	3.33	1.55	FS	1.2	PS	0.20	FK	0.81	EL
		80-150	-0.25	0.21	0.45	1.25	2.41	2.92	3.27	1.46	MS	1.1	PS	0.20	FK	0.74	VL
	7	0-25	0.25	0.79	1.14	2.21	3.04	3.18	3.27	2.06	FS	2.0	PS	-0.22	CK	0.67	VL
		25-75	-0.33	0.18	0.33	1.0	2.23	2.75	3.23	1.31	MS	1.3	PS	0.30	SCK	0.74	VL
		75-150	-0.42	-0.1	-0.0	0.71	1.96	2.62	3.54	1.08	MS	1.3	PS	0.42	SFK	0.81	EL

Mean size (Mz)
FS fine sand
MS medium sand
CS coarse sand

Sorting (So)
PS poorly sorted
MS moderately sorted

Skewness (SK):
SCK strongly coarse skewed
SFK strongly fine skewed
NS nearly symmetrical.

Kurtosis (KG):
VL very leptokurtic
EL extremely leptokurtic
L leptokurtic