LITHOLOGICAL INTERRUPTIONS IN THE SOIL OF THE OUDA MARSH OF SOUTHERN IRAQ.

[**]Wurood Amer Abd Al Ameer [*] Asist prof Amal Radi Jubair
[*,**]College of Agriculture University of Al-Qasim green
wurood1230@gmail.com

ABSTRACT

The study area was selected in the Province of Maysan Hour Ouda the area . For purposes of studying the lithological discontinuities And the variability of the characteristics of the soils of the Marsh, where 6 pedons were excavated and described the prospects of the pedons as morphological and fundamental, studied the cases of homogeneity and micro lithological explosion breakdowns of these soils and their different horizons .

The results indicated that the use of the standard set by ALAsaady and Whiteside, 1982, indicated that there were 14 cases of lithologic discontinuity. The use of the standard set by Scheatzl, 1998, indicated 11 discontinuities and the use of the criterion identified by Cremeen and Makma,(1986), 5cases of lithological explosion .

The results showed that the use of the Scheatzl 1998 criterion is the best criterion used to determine the incidence of lithological disintegration and homogeneity because the overall mean in these soils is -0.65 and is close to the criterion set by <0.6 .

The soil of the study according to the modern American system 2014 was classified into two levels: Entisols and Mollisols MF11, DM125, TF455, DF115, DF115 and MF12.

Keywords: lithological discontinuity, Ouda Marsh, soil Particales, Pedogeomorphological analysis.

*Research paper from thesis of first Author.

الانقطاعات الليثولوجية في ترب هور عودة جنوب العراق

[**]وروداعامر عبد الامير [*]أ. م. د. أمل راضي جبير
[*,**]كلية الزراعة/جامعة القاسم الخضراء
wurood1230@gmail.com

الخلاصة

أختيرت منطقة الدراسة في محافظة ميسان هور عودة , لغراض دراسة الانقطاعات الليثولوجية في ترب الهور وتغاير صفات ترب الهور , أذ تم حفر 6 بيدونات ووصفت أفاق البيدونات وصفاً مورفولوجياً أصولياً , درست حالات التجانس والانقطاعات الليثولوجية الدقيقة لهذه الترب ولمختلف أفاقها .

بينت النتائج أن أستخدام المعيار الذي حدده ALAsaady and Whiteside , 1982 أشرت وجود 14 حالة أنقطاع ليثولوجي , أما استخدام المعيار الذي حدده Scheatzl , 1998 فقد أشر 11 حالة أنقطاع وكذلك اشر أستخدام المعيار الذي حدده Cremeen and Makma , 1986 5 حالات أنقطاع ليثولوجي .

كما أشارت النتائج الى أن أستخدام معيار Scheatzl ,1998 هو أفضل معيار يستخدم لتحديد حالات الانقطاع الليثولوجي وحالات التجانس وذلك لأن المتوسط العام في هذه الترب هو 0.65- وهو قريب من المعيار الذي حدده < 0.6 .

صنفت ترب الدراسة حسب النظام الأمريكي الحديث 2014 الى رتبتين هما رتبة Entisols ورتبة Mollisols وكذلك صنفت بيدونات ترب المنطقة الى نظام السلاسل حسب Alagidi , 1976 الى MF11 وDM125 وTF455 وDF115 وDF115 وMF12 .

كلمات مفتاحية :أنقطاع ليثولوجي , هور عودة , مفصولات التربة , التحليل البيدوجيومورفولوجي.

*البحث مستل من رسالة الباحث الاول.

ISSN 2072-3875

1. INTRODUCTION

The concept of homogeneity of soil in the four-hour period was based(Jenny ,1941) on the need to study the homogeneity of soil material, which should be tested through other methods if possible for the purpose of diagnosing lithological discontinuities that can not be realized by changing Surprising in some characteristics and qualities .

Buol et al., (1989) defined the lithological disconnection as a sudden change in the lithology of the original material and that a sudden, detectable and identifiable transformation that occurs in the vertical direction of the soil body and geological processes and their presence within or near the intestine reflect important biogenic facts.

Schaetzl (1998) explained that lithological disconnection in the soil takes place geologically and ideologically, and that the geological-induced lithological disconnects are physical phenomena that are characterized by intermittent discontinuities that occur in the temporal or temporal column indicating conditions in the sedimentation system, Which are transferred by the running water and deposited over the wind-transferred lagoons, and these differ from the interruptions caused by the change in sedimentation processes, since the lithological disconnection, whether geological or biological, is inherited from the origin or due to the pidogenesis processes is important to understand For the breeding and the origin of the soil and soil from which evolved from the soil of the marshlands of soils of biological importance and the importance of the lithological breakout was selected the area of Ouda Marsh and the research to study the study of the micro-lithological disruptions that can not be realized in the field of Ouda Marsh in the province of Maysan, 5 km west of Maimona district on the road Al-Maimouna - Mr. Ahmed Rifai on the river Damad to the west of the Tigris River, which is located within the group of marshes located west of the Tigris River, which extends from the town of Sheikh Saad in the province of Maysan to the city of Qurna in the province of Basra, A portion of the water was returned to this mite after 2003 (Al-Khazal, 2009) .

2. MATERIALS AND METHODS

Information was collected and some previous studies were reviewed on the areas of the marshes and then visit the field of the Center for the revival of the Marshlands in the province of Maysan and director of agriculture Mimouna , The site of the study was selected in Ouda Marsh. A map was obtained from the Ministry of Water Resources, the National Water Resources Center for the sites of Ouda Marsh, the Ministry of Water Resources, Ouda Marsh is located west of the Tigris River in Maysan province, 5 km west of the Maimouna district - Mr. Ahmed Rifai on the river dams as in Fig. 1 and geographically, the study area is confined between the 31 ° 678"901 ' 31 ° 52' 684" North and Linear length 46°83'576" "to 46 ° 91'715"5 East, and the total area is 44 thousand dunums area of the wells after returning part of the water is 12.2 thousand dunums, ie, the area that is considered to be dried is 31.8 thousand dunums (Directorate of Agriculture Mysan - Department of Marshlands Development and Promotion, 2017).

ISSN 2072-3875

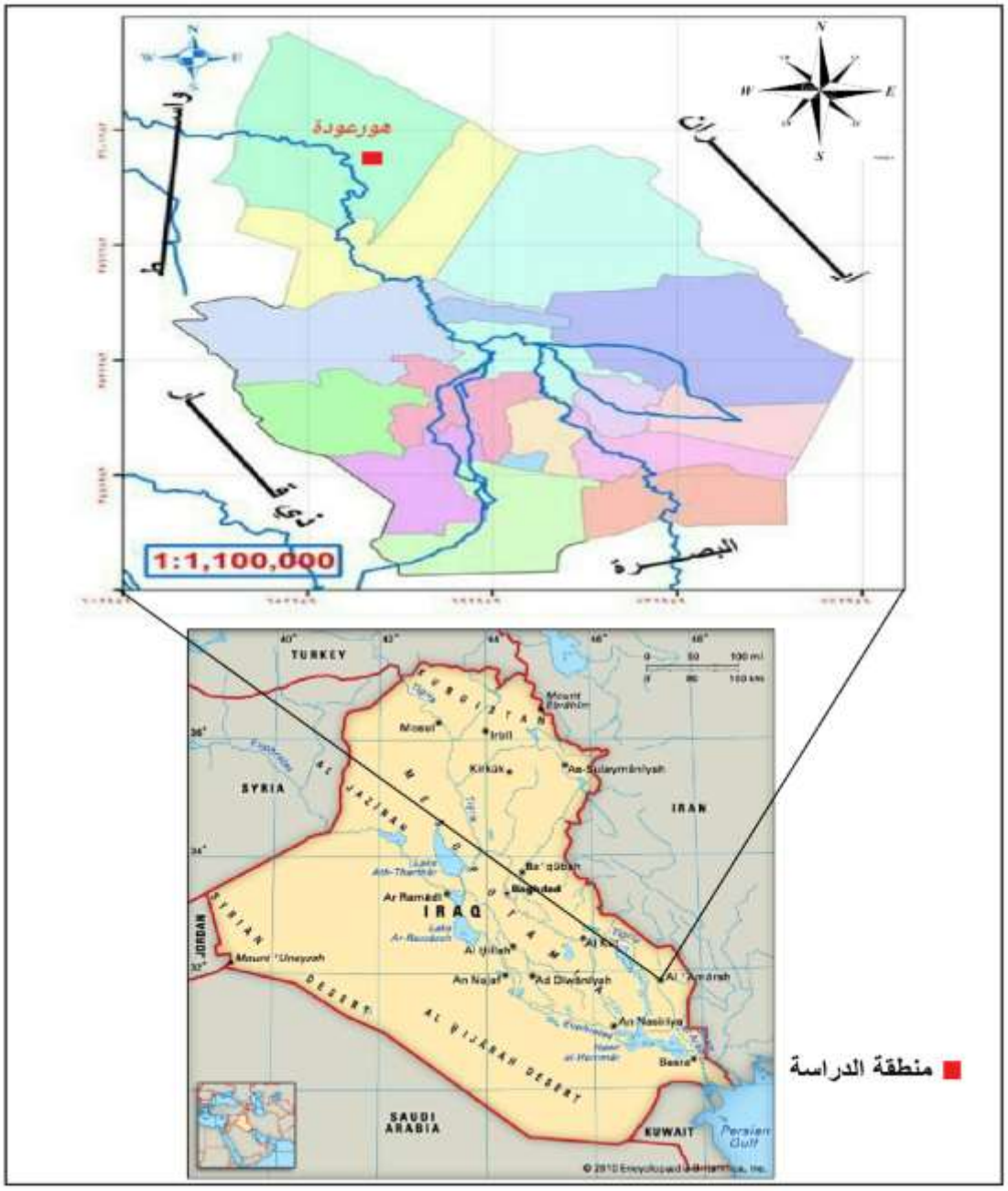

Figure 1: A map showing the location of the study area.

Based on the information obtained in the preliminary phase, a vertical line was identified in the desiccated area of the Marshlands, starting from the borders near the flooded area (Ouda Marsh) to the dried areas. GPS described the morphology as fundamental (Soil Survey Staff, 1993).

Laboratory procedures

After the samples were taken to the laboratory, they were dried, grinded and sifted with a 2 mm sieve. Partical size distribution of the three soil samples (sand, silt and clay) was then estimated using the pipette method and sieves to separate the different sand parts as described in Black, 1965).

Pedogeomorphology Analysis

Harmony values

Based on the results of the analysis of the Partical size distribution of soil minutes and other soil characteristics, uniformity values were calculated for the study soil buds, to determine the lithological discontinuities by using:

ISSN 2072-3875

The equation proposed by Al-Assady and Whiteside (1986)

Uniformity values of U.V. = 1- (the ratio of the silt / sand ratio of the Surface horizon) / (the ratio of the sand / sand ratio of the horizon Surface)……..(1)

The equation proposed by Cremeen and Mokma(1986)

Values of Uniformity U.V = 1- (the ratio of the silt to the upper horizon / the ratio of the silt + the clay ratio to the lower horizon)……(2)

The equation proposed by Schaetzll (1998)

U.V.=1- (sand + fine sand / sand - very fine sand in the Surface horizon / same ratio for the bottom Subsurface)……..(3)

The equations above were chosen by virtue of the volumetric convergence between separators and to ascertain the precise lithological discontinuities that can not be realized in the field.

3. RESULTS AND DISCUSSION

The results of Table (1) indicate that the volume Partical size distribution of the soil Partical for the soil Pedons of the study area, the rule of the clay, then the sand and the sand, were divided by the average of 481.05, 394.04 and 130.5 g .kg $^{-1}$ respectively, show Table (2) which presents the Variability in the ratio of soil Particals reverberation Pedons, to try to find out that they are used as homogeneous homogeneity to correct and separate the soils in the area of the marshes, and for the purpose of interrupting which can not be understood by field or which is obtained from the same type of tuxture sometimes by deposition of thin layers of soft separators over the more rigid joints, and when the water enters the hydraulic tension will increase in the soft layers, and when the arrival of saturation, water will break through the lithology of the layer (hydraulic soft tissue), or the flow is often rapid down and thus causes lithological discontinuities. The percentage has emerged (Silt + Very fine sand/ total Sand - Very fine sand) and the ratio (total silt / total sand) Noting that these are generally distributed at an average of one year 6.68 and 4.21 respectively, as observed from the table (2) When using these ratios, the soil appears to be more homogeneous between the sand and sand separators, and has been divided by an average of 6.68 and 4.21 respectively.

Table 1: Some physical characteristics of the study soil.

Class the texture	Sand is very Coarse	Coarse sand	Mudum Sand	Fine sand	Very fine Sand	Total sand	Silt	Clay	Horizons	Pedons
	g.Kg^{-1}									
SiC	24.92	18.84	29.42	58.52	47.80	179.50	411.40	409.10	Ag	P1
SiC	18.20	28.17	27.88	46.63	49.03	170.00	560.00	410.00	Ckg_1	
SiC	6.91	11.00	30.19	31.97	27.93	108.00	416.00	470.00	Ckg_2	
SiC	28.6	17.46	26.00	41.22	39.92	153.20	414.20	432.60	Cg_3	
C	0.03	13.33	20.36	28.82	32.46	95.00	381.20	523.80	Ag	P2
C	0.00	2.34	8.23	11.52	9.31	31.40	459.60	509.00	Ckg_1	
C	0.34	26.46	30.83	32.42	38.25	144.30	395.00	460.70	Ckg_2	
SiC	16.60	28.89	34.02	37.48	46.31	163.30	403.80	432.90	Cg_3	
L	22.64	54.09	114.79	98.31	80.87	370.70	381.30	248.00	Ag	P3
Sic	0.76	7.71	9.13	22.40	20.50	60.50	406.00	533.50	Ckg_1	
C	4.61	8.05	7.91	51.62	40.21	112.40	356.20	531.40	Ckg_2	
SiC	9.19	26.77	33.09	49.53	36.82	155.40	421.70	422.90	Ckg_3	

ISSN 2072-3875

SiC	0.71	5.68	10.14	23.85	19.62	60.00	488.00	452.00	Ag	P4
C	3.41	9.20	10.09	41.81	34.95	97.00	374.60	528.40	Ckg_1	
SiC	0.95	4.29	6.33	17.67	12.00	43.70	445.40	510.90	Ckg_2	
C	0.00	3.19	16.78	44.82	53.21	118.00	328.00	554.00	Ckg_3	
SiC	4.27	6.29	15.37	25.42	18.65	70.00	464.20	465.80	Ag	P5
C	4.65	12.31	65.16	61.49	60.65	200.57	312.83	486.61	Ckg_1	
SiC	0.96	8.34	18.11	32.75	24.00	87.85	503.25	408.90	Ckg_2	
C	0.84	7.41	32.31	47.20	59.24	147.00	342.00	512.00	Ckg_3	
SiCL	32.43	24.42	20.66	12.72	46.20	136.43	474.91	388.66	Ag	P6
C	4.65	12.31	65.16	61.49	60.65	200.57	312.83	486.61	Ckg_1	
C	2.38	9.60	13.21	119.52	26.31	168.60	310.07	521.33	Ckg_2	
C	0.00	1.57	9.37	18.48	30.72	56.20	227.42	716.37	Ckg_3	
	7.64	15	26.65	43.55	38.95	130.54	394.04	481.05	General average	

Table 2: Homogeneity ratios particals by the horizons of the study ponds.

Very fine sand / silt	Total clay / total sand	Total Silt / clay + Silt	fine sand / very fine sand	Total clay / total Silt	Total silt / total sand	(Silt + Very fine sand /total Sand - Very fine sand	Horizons	Pe dons
0.12	2.28	0.50	1.22	0.99	2.29	3.49	Ag	P1
0.09	2.41	0.58	0.95	0.73	3.29	5.03	Ckg_1	
0.07	4.35	0.47	1.14	1.13	3.85	5.54	Ckg_2	
0.10	2.82	0.49	1.03	1.04	2.70	4.01	Cg_3	
0.09	2.97	0.51	1.09	0.98	3.04	4.52		mean
0.09	5.51	0.42	0.89	1.37	4.01	6.61	Ag	P2
0.02	16.21	0.47	1.24	1.11	14.64	21.23	Ckg_1	
0.10	3.19	0.46	0.85	1.17	2.74	4.09	Ckg_2	
0.11	2.65	0.48	0.81	1.07	2.47	3.85	Cg_3	
0.08	6.89	0.46	0.95	1.18	5.96	8.94		mean
0.21	0.67	0.61	1.22	0.65	1.03	1.59	Ag	P3
0.05	8.82	0.43	1.09	1.31	6.71	10.66	Ckg_1	
0.11	4.73	0.40	1.28	1.49	3.17	5.49	Ckg_2	
0.09	2.72	0.50	1.35	1.00	2.71	3.87	Ckg_3	
0.12	4.23	0.48	1.23	1.11	3.41	5.40		mean
0.04	7.53	0.52	1.22	0.93	8.13	12.57	Ag	P4
0.09	5.45	0.41	1.20	1.41	3.86	6.60	Ckg_1	
0.03	11.69	0.47	1.47	1.15	10.19	14.43	Ckg_2	
0.16	4.69	0.37	0.84	1.69	2.78	5.88	Ckg_3	
0.08	7.34	0.44	1.18	1.29	6.24	9.87		mean
0.04	6.65	0.50	1.36	1.00	6.63	9.40	Ag	P5
0.19	2.43	0.39	1.01	1.56	1.56	2.67	Ckg_1	

ISSN 2072-3875

0.05	4.65	0.55	1.36	0.81	5.72	8.26	Ckg_2	
0.17	3.48	0.40	0.80	1.50	2.33	4.57	Ckg_3	
0.11	4.30	0.46	1.13	1.22	4.06	6.23		mean
0.10	2.85	0.55	0.28	0.82	3.48	5.78	Ag	P6
0.44	3.02	0.23	1.84	3.43	0.88	2.09	Ckg_1	
0.08	3.09	0.37	4.54	1.68	1.84	2.36	Ckg_2	
0.14	12.75	0.24	0.60	3.15	4.05	10.13	Ckg_3	
0.19	5.43	0.35	1.81	2.27	2.56	5.09		mean
0.11	5.19	0.45	1.23	1.34	4.21	6.68		General average

Table (3) Values of heterogeneity and leachological breakdown of the study

Uniformity values by Cremeen	Uniformity values by Schaetzll	Uniformity values by Al-Asaady	Horizons	Pedons
			Ag	P1
0.58	0.31	0.30	Ckg_1	
	0.09	0.14	Ckg_2	
	-0.38	-0.42	Cg_3	
			Ag	P2
0.61	0.69	0.73	Ckg_1	
	4.20-	-4.35	Ckg_2	
	0.06-	-0.11	Cg_3	
			Ag	P3
0.59	1.49-	0.85	Ckg_1	
	0.94 -	-1.12	Ckg_2	
	0.42-	-0.17	Ckg_3	
			Ag	P4
0.46	0.90-	-1.11	Ckg_1	
	0.54	0.62	Ckg_2	
	-1.45	-2.67	Ckg_3	
			Ag	P5
0.42	2.52-	-3.25	Ckg_1	
	0.68	0.73	Ckg_2	
	-0.81	-1.46	Ckg_3	
			Ag	P6
0.40	-1.76	-2.95	Ckg_1	
	0.11	0.52	Ckg_2	
	0.77	0.55	Ckg_3	
0.51	0.65-	0.73-		General average

ISSN 2072-3875

Lithological Disorders:

Table (3) shows the values of homogeneity and lethality of the biodons represented by Tar Ouda Marsh, which resulted from geomorphological and not biologic events. In calculating the values of the homogenization coefficient, several ratios were used in Table (2) (P + q = 1), ie, that the homogeneity (P) is excessive, the case of Variability (q) equals one true, so the case of Variability which means only (2) homogeneity of soils was more pronounced when using the ratio of (silt / clay + silt), which means that the homogeneity between The values of the homogenization coefficient were distributed at 0.61-0.23 with an average of 0.45 and the ratio of (clay / silt) . The values of the homogeneity coefficient were distributed when using this ratio with a range of 3.43-0.65 and a mean average of 1.34.

The values of the lethological breakdown of study horizons were distributed when using ALAsaady and Whtisid, 1982, with 14 discontinuities according to the criterion defined by 0.37 ± and with a mean average of - 0.73. When using Schaetzl's criterion of < 0.6, The survey indicated that there were 11 discontinuities and a mean average of - 0.65. The criterion used by Cremeen and Mokama (1986), which was set by - 0.45, indicated that there were five interruptions and an average of 0.51. These discontinuities were due to the rotation of drying processes And re-immersion and sedimentation between the natural characteristic of tuxture with a clay content that does not Or precipitation caused by the sediment transport process, which is affected by the watering conditions and the characteristics of the marshes or the interruptions due to the overlap between the river basins within the area of the marshes and the water of the marshes and the periods of drying exposed to them. 2002).

The ratios indicated in Table (3) illustrate the cases of lithological disconnection that can not be understood in the field and are accurate interruptions. In accordance with these criteria, the best criterion used to determine the cases of leachological disconnection and homogeneity is the standard used by Scheatzl 1998, In these soils is - 0.65 and is close to the criterion set by> 0.6.

Al-Rifa'i, 2003, confirmed that the fine lithological disconnects may occur in the same type of tissue sometimes by depositing thin layers of soft separators over more rigid joints. When entering the water, the hydraulic tension will increase in the soft layers and when they reach saturation, (From the above study) that the use of the Scheatzl 1998 standard is the best criterion used to determine the incidence of leachological dislocation and tajia Q This is because the overall average -0.65 in these soils is a relative of the standard set by <0.6**.**

Evidence for soil development for the study area

The state of soil development depends on the severity of the influence of some soil composition factors and processes and the surrounding conditions, which lead to the redistribution of their components through the processes of gain and loss Eluviation, which is the result of the evolution of diagnostic prospects to varying degrees, which differ in physical, chemical, mineral and biological, The geomorphology of the marshland has contributed to the effect of sedimentation and the activity of some sedimentation and movement of soluble matter and colloidal materials such as horizontal and vertical mud within the soil body to the evolutionary state of the soil in the soil of the Oud, (Collins and Fenton, 1982), it was possible to study and categorize the soil area of the study area in terms of their degree of development. Table (4) shows the classification of the evolutionary status in the hareda, Between the 268.00 and 249.55, and the average of these pheasants was between 57.68 and 127.61, the lowest level in the horizon was Ckg_2 pedons 6 and

ISSN 2072-3875

the highest degree of development in the horizon Ckg_2 in Pedon 3, due to the distribution of mud in the horizons, and the average horizons of this pesticide NAT has shown that the lowest average was for Pedone 5 and was the highest average of 3 Pedone attributed the reason to the different distribution of the three Mufsolat ratios in the horizons Bedonat study.

As shown in Table (3), the degree of development of the pedons (Levines, 1983) showed that the results of the pedons averages were weak in pedons 1, 4, 5 and 6, while the development rate was high in pedons 2 and 3, probably due to the occurrence of these two pedons The average values of these values were negative due to the lack or weakness of the processes of loss and gain of clay.

According to the general average of these pedons, it is clear that all the pods of these pedons are developed, reaching a mean of 14.52.

The evidence for clay aggregation (Collins and Fenton, 1982) showed that Pedon 1, 2, and 3 were highly developed, with a clay mass index of 1.0, 0.97 and 1.0 respectively, and Pedons 4, 5 and 6 were With a very high degree of development, with the index of clay gathering in them was 1.17, 1.04 and 1.59, respectively, and the overall mean of the clay collection index (Collins and Fenton, 1982) was 1.13, which is that these pods have a very high degree of development, This is due to the state of waterlogging and the high organic matter content, which leads to the transfer of mud from top to bottom, and this is observed, since the surface horizons with a content of mud less than the subterranean horizons The collins and Fenton evidence has shown a better indicator of soil evolution because pedons 4, 5 and 6 were the most developed pedons due to the high content of the soil, Membership in it is added to the diagnosis of the Mollic horizon in those pedons .

The ratio of clay in the lower horizon to the ratio of clay in the upper horizon indicates that the results in Table 4 show that the soil of the study soil is all of a degree of development, because this ratio is more than 1, and Fenton, 1982)), probably because of the reason Pedon Hobs Guide to Clay Collection by Levines Category Guide to Clay Collection by Collins and Fenton Category Guide Pidginis by Santos The ratio of clay to the lower margin to the percentage of the upper edg.

This results in more deposits than the other sites. These results correspond to the increase of mud in the lower horizons over the surface horizons. This confirms the activity of the loss operations and the redistribution of mud with depth, especially in the middle horizons.

Table 4: Development guides for study horizons

The ratio of clay to the Sub surface of to the rate of Sub surface	Guide to Pedigin Santos	For classificati on	Clay accumulati on IndexColli	For classificati on	Clay accumulati on Index by	The horizon	Piedons
1.00						Ag	P1
	0.94	high	1.00	weak	-120	Ckg_1	
				mediu m	93.5	Ckg_2	
						Cg_3	
1.00	0.94		1.00		-13.25		aver age

ISSN 2072-3875

0.97						**Ag**	**P2**
	0.34	**high**	**0.97**	**good**	**125.58**	**Ckg_1**	
				mediu m	**75.06**	**Ckg_2**	
						Cg_3	
0.97	**0.34**		**0.97**		**100.32**		**average**
2.15						**Ag**	**P3**
	0.08	**high**	**1.00**	**mediu m**	**5.67**	**Ckg_1**	
				good	**249.55**	**Ckg_2**	
						Ckg_3	
2.15	**0.08**		**1.00**		**127.61**		**average**
1.13						**Ag**	**P4**
	1.38	**very High**	**1.17**	**mediu m**	**35**	**Ckg_1**	
				weak	**-77.58**	**Ckg_2**	
						Ckg_3	
1.13	**1.38**		**1.17**		**-21.29**		**average**
1.04						**Ag**	**P5**
	2.74	**very High**	**1.04**	**good**	**132.09**	**Ckg_1**	
				weak	**-247.44**	**Ckg_2**	
						Ckg_3	
1.04	**2.74**		**1.04**		**-57.68**		**average**
1.59						**Ag**	**P6**
	0.94	**very High**	**1.59**	**good**	**170.82**	**Ckg_1**	
				weak	**-286**	**Ckg_2**	
						Ckg_3	
1.59	**0.94**		**1.59**		**-48.59**		**average**
1.31	**1.07**		**1.13**		**14.52**		**General average**

REFERENCES

Al-Assady, G.H., and E.P. Whiteside. (1986). Composition of Conver –Brookston map unit in south Eastern Michigan .S.SSA.P., 46(5) 1043-1047

Al-Akidi, Walid Khaled, Shaker Mahmoud Al-Issawi (1989). Soil morphology. Ministry of Higher Education and Scientific Research. Baghdad University . House of Wisdom. Iraq

Aqili, Nazem Shamki Rahl (2002). Biogeomorphology of soil sequences in the river basins in the center of the sedimentary plain of Iraq _ PhD thesis, Faculty of Agriculture. Baghdad University. Iraq.

Al-Rawi, Muthanna Khalil Ibrahim Al-Rifa'i (2003). Characterization and distribution of soil materials for some sedimentary soils and its effect on soils, PhD thesis, Department of Soil Science and Water Resources, Faculty of Agriculture, University of Baghdad

Al-Hathal, Yousef Mohamed Ali Hatem (2009), Drying the Marshlands and its Impact on Differential Climate Characteristics of Southern Iraq, Diyala Journal Issue 41.

ISSN 2072-3875

Black, C.A.; D.D. Evans; L.L. White; L.E. Ensminger and F.E. Clark.(1965). Method of soil analysis. Part 1. In Agronomy Series (9). Am. Soc. Agron.

Boul, S.W, F.D. Hole and McGracken. (1989). "Soil genesis and Classification " 3rd. Ed. Iowa st. Univ-press. Ames, Iowa.

Cremeen, D.L. and D.L. Mokma. (1986). Argillic horizon. Expression and classification in the soils of low michgam hydrosequences. Soil Sci, Soc Am. J. 50 : 1002 -1007.

Collins. M.E, and T.E. Fenton. 1982. Characterization of the colo soil series as Mapped in The North Central Region – soil -Sci -Soc. Am.J. Vol: 46. pp 599-606.

Jenny, H. (1941). Factors of soil formation asystem of quantitative Peology. Mc Graw- Hill Book Co. New York.

Levine, E.R. and E.J. Ciolkosz. (1983). Soil development in till various ages in north east in Pennsylvania. Quat, Res. 19: (85-99).

Soil Survey division Staff (1993). Soil Survey manovl, USDD. Hand book No 18 us Gorement Printing office Waching. tor. Dc. 20402.

Schaetzl, R.J. (1998). Lithologic discontinvities in Some Soils on drumlins. Theory, detection and application Soil. Sci.Vol. 163 (7): 570-590.

ISSN 2072-3875