Cartographic analysis and morphological description of the soil of Abu Gharq in Babylon Governorate using GIS

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Abstract

A test and detection of 12 pedons for the study area, district of Abu Gharq, and after conducting a cartographic analysis and drawing a map of soil chains using geographic information systems, in order to determine the largest chains in area and frequent, and to locate pedons for the purpose of description them morphologically. The results showed that the DW45 series is the largest of the series, with an area of 3020.17 ha, with a rate of 16.49%, and its frequent was 6. The least area was occupied by the DM36 series, which amounted to 52.4 ha, with a rate of 0.29%, and its frequent was 1. The two series occupied a very small area, DM53 and DM46, with an area of 102.09 ha, with a rate of 0.56% and an area of 84.8 ha, with a rate of 0.46% for each of them, respectively, The purpose of this research is to characterize and diagnose the largest and most frequent chains in the study area.

Keywords: Cartographic analysis, Morphological description, GIS, Abu Gharq.

Introduction

The morphological descripted has great importance and capacity to accommodate all the observations that can be taken care of formally and scientifically in identifying a soil or part of it. This capacity or comprehensiveness differs from one place to another and from one purpose to another and is subject to change and alteration. Soil morphology or morphological description means the sum of the apparent characteristics of the soil and its constituent materials and other associated characteristics. This concept was prevalent for a very long time, but the development of soil survey work and the expansion of its concepts led to the development of what is meant by soil morphology and made it accommodate all soil characteristics that can be recorded by analogy or account or note. For the purpose of describing and diagnosing the basic components of the soil and setting the boundaries between its constituent parts represented by the types of genetic horizons, many basic morphological characteristics were used, which are diagnosed using the human senses with the help of some simple aids that increase the ability of the human senses in the diagnosis process, which is the main process. In identifying the basic components of the soil matrix and then identifying the components of the hidden world that is not visible on the surface ,Geographic information systems also have a high capacity and potential through cartographic representation methods to represent statistical data and give an accurate picture of the reality of agriculture in a region (11). Cartography is defined as a science that includes operations related to the preparation of maps, starting with the preparation of base maps in the field using flat and topographic survey methods or using air survey methods, all the way to printing and publishing them, as well as all methods related to preparing maps from converting preliminary field plans to A map or the transfer of various topographical details from aerial photographs and satellite visuals to a previously printed map, and the method of preparing small-scale maps to large-scale maps .A map is a symbolic

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representation of the specific characteristics of a place, usually drawn on a flat surface. Maps can show the distributions of things on the ground, such as settlement patterns. Weather maps make forecasts. Some common features of maps include size, symbols, and grids. All maps are microcosms of reality. Map scales refer to the relationship between distances on the map and actual distances on the ground. This relationship can be expressed in a graphic scale, a verbal scale, or a representational part, and cartographers use symbols to represent geographic features(6).The maps describe a wide range of subjects and use many different imaging technologies to display them. Although these maps are drawn manually, the maps are often created using modern geographic input and geographic information systems. This system includes a wide range of tools, technologies, and ways of thinking about spatial data. How can it be analyzed and presented . Field data is collected using a unit GPS, and then the analysis process is done with desktop computers to understand spatial data. Mapmakers use geographic information systems technology to visualize the information, (10). (5) showed that land use and land cover maps are an advantage and a good tool for planning, especially those that are accomplished in modern technologies such as geographic information systems technology.

Materials and Methods

The current study was selected on the Abi Gharq, with an area of 25026.38 ha, in Babylon Governorate, central Iraq, within the sedimentary plain area. It is confined between longitude 32 N and two latitude 44 E, 50 sites were identified and samples were obtained from them to four depths by the auger drilling machine, and their coordinates were determined by the GPS global positioning device. The identified soil chains were analyzed according to the classification of the chains proposed by (1) .for the purpose of cartographic analysis to determine the largest chains in area. And the most frequent of them for the purpose of identifying the sites of Pedon representing the soil of the district, after that 12 Pedon were detected in the largest and most frequent chains, and their horizons were described and their morphology was described according to the American soil survey guide (8). and then classified according to the Iraqi and American soil classification system.

Results and discussion:

1- Cartographic analysis of the soils of the study area

The area of each soil chain and its frequent were calculated by computer using the Geographic Information Systems (GIS) program. The results of Table 1 and (Fig.1) show that the number of chains diagnosed in the study area was 16, varying in area and frequent. According to the cartographic analysis, the DW45 series is the largest in area, with an area of 3020.17 ha, or 16.49% of the total area, followed by the TM966 series, with an area of 2972.56 ha, or 16.22% of the total area. Then the TM1265 series, with an area of 2451.22 ha, or 13.38%, then the MW5 series, with an area of 1654.38 ha, and a rate of 9.03%. 4 ha, at a rate of 5.09%. And 3020.17 ha, at a rate of 16.49%, 803.92 ha, at a rate of 4.39%, and 423.41 ha, at a rate of 2.31% for each, respectively. As for the least area, it was occupied by the DM36 series, which amounted to 52.4 ha, by 0.29%.

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Table 1 shows the soil series of the study area

Repetition	area ha	%	Series
6	3020.17	16.49	DW45
4	1549.55	8.46	TW976
3	803.92	4.39	TM1165
4	932.44	5.09	DM85
5	2451.22	13.38	TM1265
5	2972.56	16.22	TM966
2	519.01	2.83	DM96
4	1890.17	10.32	MW4
3	1654.38	9.03	MW5
2	339.79	1.87	DM97
3	855.77	4.67	DW95
3	423.41	2.31	TM967
2	102.09	0.56	DM53
2	663.74	3.63	DM95
1	84.8	0.46	DM46
1	52.4	0.29	DM36
50	18315.42	100	Total

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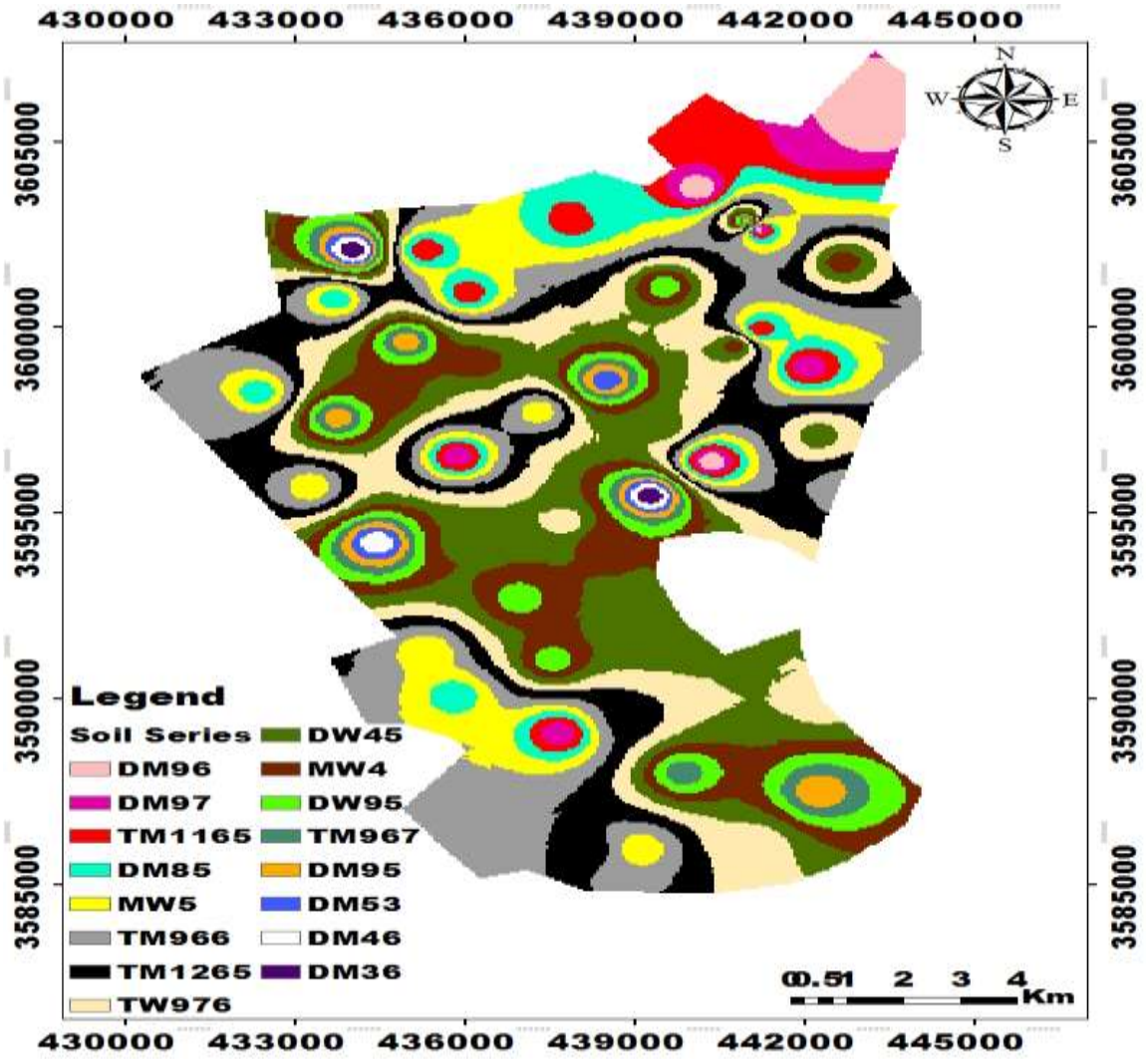

Fig. 1 shows the series of the study area

The two series occupied a very small area, DM53 and DM46, with an area of 102.09 ha, with a rate of 0.56%, and an area of 84.8 ha, with a rate of 0.46% for each of them, respectively As for the frequent, the DW45 series was the most frequently repeated, with a frequent of 6 times, followed by the TM966 series, with a frequent of 5 times. As for the TW976, TM1165, DM85, TM1265, MW4, and DM85 series, the frequent each reached 4 times. As for the DM1165, TM967, DW95, and MW5 series, Its recurrence reached 3 times, hopefully the chains DM69, DM53, DM95 and DM97, each of them reached two times, while the least frequent chains were DM46 and DM36, their recurrence reached only once. The dominance of the DW45 series in terms of the area it occupies and the frequent is due to the fact that it resulted from the nature of water sedimentation in the region that depends on the intensity of the momentum of the sediment-bearing water, which mainly comes from the Euphrates River. Therefore, it formed a type of loam and Silt loam, and the good internal drainage category is due to Until its soil is cultivated and has good water permeability.

1- Morphological description of the study soil peduncles

The results of the morphological description of the pedons that were studied as in Table 2 show that all soils have a newly formed, undeveloped sedimentary origin material, as their pedons had a horizontal sequence of type

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A-C and the absence of a gain horizon in them, and this is a reflection of the nature of the prevailing environmental factors that do not help the development of the soil As well as the nature of the sedimentation process, dry climatic conditions, lack of precipitation, high temperatures, as well as poor vegetation cover, and the topography was almost flat. Of the natural vegetation, it was *Schanginia aegyptiaca*, *farctum Lagonychium* , *Alhagi maurorum*, and *Imperata cylindrica* , The color of the soil in the dry and wet conditions of the study soil pedons had a Hue value 10YR , The color intensity value ranged between 5-7 in the dry state and between 3-6 in the moist state, As for the Chroma, it ranged between 2-8 in those horizons , And that the variation in the color of the horizons is due to the difference in the nature of the soil components of salts and the content of organic matter, especially in the surface horizons (4), which helped the emergence of this variation in the color values, as the color of the soil is determined by a number of morphological characteristics that reflect the condition The general nature of soil components and internal conditions, especially the state of natural perforation and the type of its main components (7) , We conclude from this that the 10YR wavelength prevails in both wet and dry conditions, despite the difference in intensity and color purity. ranged Grade between weak to moderate and Strong , The predominance was of moderate degree of clarity, As for the structure class, it ranged between Fine to moderate , As for the types of structure, the dominance of the angular mass structure was in the surface and subsurface horizons of the pedons sup angular blocky ,

Table 2 Morphological characteristics of the soil horizons of the study pedons

pedon	horizons	depth	color		texture	structure				consistency		porosity	roots	boundary
			dry	moist		grade	class	type		wet				
P1	AP	0-23	3/3	2/2	SiL	2	f	sbk	sh	Fir	Ss	cf	pf	abs
	C1	23-45		3/4	L	2	m	sbk		vFir	Ss sp	cf	mf	gs
	C2	45-66		5/6	L	2	f	sbk		vFir	Ss	mf	ff	gs
	C3	120-66		5/6	SiL	2	m	sbk		Fir	Ss sp	mf	vfc	
P2	AP	0-30	4/4	3/3	SiC	2	m	sbk	sh	Fir	ssp	cf	pf	abs
	C1	30-56		3/3	SiCL	2	f	sbk		Fir	Ss sp	mf	mf	gs
	C2	56-87		3/3	SiC	2	f	sbk		Fir	ssp	mf	ff	gs
	C3	87-130		3/3	SiCL	2	m	sbk		Fir	Ss sp	mf	mf	
P3	AP	0-23	5/3	3/3	SiC	2	m	sbk	sh	Fir	Ss sp	cf	pf	abs
	C1	23-50		5/6	SiC	2	m	sb		fir	Ss	cf	mf	gs

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							k			sp			
	C2	50-81		5/6	CL	2	f	sbk		fir	sp	cf	ff	gs
	C3	81-118		3/3	L	2	m	sbk		Fir	Ss	mf	vfc	
P4	AP	0-25	7/4	4/4	SiCL	2	m	sbk	sh	Fir	ssp	cf	pf	abs
	C1	25-45		4/4	CL	2	m	abk		Fir	Ss sp	cf	ff	gs
	C2	45-70		4/4	CL	2	f	sbk		fir	ssp	mf	ff	gs
	C3	70-115		6/8	L	1	m	sbk		Fir	Ss	mf	vfc	
P5	AP	0-22	5/8	3/4	SiL	2	m	sbk	sh	Fir	Ss	cf	mf	abs
	C1	22-48		3/3	C	3	f	sbk		fir	Vs p	cf	mfc	cs
	C2	48-95		3/4	CL	2	f	sbk		Fir	ssp	cf	mf	gs
	C3	95-130		3/4	L	1	m	sbk		Fir	Ss	mf	Fc	
P6	AP	0-30	4/3	3/3	CL	2	m	sbk	sh	Fir	Ss sp	cm	fc	abs
	C1	30-58		6/8	SiCL	2	m	sbk		Fir	sp	cf	mf	gs
	C2	58-93		3/4	CL	2	f	sbk		Fir	Ss sp	cf	Fc	gs
	C3	93-135		3/3	SiCL	2	m	sbk		Fir	Ss sp	mf	Ff	
P7	AP	0-28	4/4	3/3	SiC	2	m	sbk	h	Fir	ssp	cf	pf	abs
	C1	28-48		3/3	SiCL	2	m	sbk		Fir	Ss sp	mf	mf	gs
	C2	48-65		2/2	SiCL	2	f	sbk		fir	ssp	mf	Ff	gs
	C3	65-110		2/2	CL	2	f	sbk		fir	ssp	mf	Ff	
P8	AP	0-25	4/4	3/3	SiC	2	m	sbk	h	Fir	ssp	cf	pf	abs
	C1	25-53		3/3	L	1	m	sbk		Fir	Ss sp	mf	mfc	gs
	C2	53-80		3/3	L	1	m	sbk		Fir	s	cf	Ff	gs
	C3	80-100		3/3	L	2	f	sbk		Fir	sp	cf	Fc	
P9	AP	0-30	3/3	4/3	CL	2	f	sb	sh	Fir	Ss	mf	cf	abs

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							k			sp			
	C1	30-60		4/3	SiL	2	m	sbk		Fir	ssp	mm	f	gs
	C2	60-82		4/3	SiL	2	m	sbk		Fir	sp	cc	Ff	gs
	C3	82-100		4/3	SiL	2	m	sbk		Fir	Ss sp	mvf	vFc	
P10	AP	0-20	4/3	4/3	SiC	2	m	sbk	h	Fir	ssp	cf	pf	abs
	C1	20-45		3/3	SiCL	2	m	sbk		Fir	Ss sp	mf	mf	gs
	C2	45-65		3/3	SiCL	2	f	sbk		Fir	ssp	mf	Ff	gs
	C3	65-120		3/3	SiC	2	f	sbk		Fir	ssp	mf	Ff	
P11	AP	0-20	4/3	3/3	SiC	2	m	sbk	h	Fir	Ss sp	cf	pf	abs
	C1	20-45		3/3	SiCL	2	m	sbk		Fir	sp	mf	mf	gs
	C2	45-63		3/3	SiL	2	f	sbk		Fir	ss	mf	Ff	gs
	C3	63-100		3/3	SiL	2	f	sbk		Fir	Ss sp	mf	Ff	
P12	AP	0-18	4/6	6/8	SiCL	2	m	sbk	h	fir	sp	cf	pf	abs
	C1	18-38		6/8	SiCL	2	m	sbk		Fir	ssp	cf	pf	gs
	C2	38-70		4/3	CL	2	m	sbk		Fir	Ss sp	cf	Ff	gs
	C3	70-105		4/4	C	3	f	sbk		fir	sp	cf	vFc	

and consistency ranged between Slightly hard to hard , And in the moist state ranged between friable to firm , and wet state ranged between Slightly sticky and Slightly plastic These results are consistent with what was mentioned by (9). that the soil content of clay leads to the soil being sticky when wet and hard when dry. The results showed that the soil consistency was close to each other in all the study location due to the cohesion of the soil due to the dominance of fine particles represented by silt and clay particles in most of the study location, and this depends on the soil texture in those location. As for porosity ranged between Few to Common and many . and roots distribution ranged between Few to Plentiful , And the size ranged Fine to coarse , This is consistent with (2). Because of the soft and medium weave that helped provide moisture and encouraged the growth of natural plants in it, as well as the nature of the cultivated plants and their ramifications and spread in the surface horizons, As for the boundary between the horizons, in general, the gradient includes gradual borders gradual to abrupt , As for topography, it was the

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characteristic of levelness Smooth the dominant characteristic in all horizons of pedons in the study area (3).

Table 3 The weighted average for the study area

characteristics soil	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
EC	5.98	4.62	4.75	4.22	6.80	7.42	5.94	4.61	4.15	4.25	6.82	7.78
PH	7.48	7.30	8.25	7.74	7.41	7.55	7.25	7.47	7.89	7.32	7.61	7.41
Na^{+2}	16.69	19.90	19.71	17.68	20.05	19.43	11.08	10.05	14.50	18.99	17.60	22.10
Ca^{+2}	20.00	16.49	16.80	13.66	18.37	22.90	12.52	15.53	14.39	16.99	17.42	21.26
Mg^{+2}	12.60	12.03	12.10	10.45	13.53	19.31	5.10	6.86	11.25	9.29	11.48	19.60
ExNa	3.57	2.53	3.67	3.54	3.71	2.71	3.77	2.35	2.88	4.84	4.65	3.23
SAR	4.13	5.30	5.53	5.10	5.02	4.25	3.74	3.01	4.05	5.24	4.63	4.89
ESP	21.29	13.07	19.25	20.22	20.33	13.80	25.72	34.65	38.52	40.69	39.03	16.73
CaCO3	22.02	19.47	21.82	17.42	20.91	24.94	17.24	18.48	17.93	22.12	23.08	24.61
Gypsum	2.42	1.87	4.29	1.85	3.14	2.86	2.78	2.78	3.67	3.35	2.73	3.56
SOM	0.70	0.78	0.87	0.70	0.65	0.80	0.75	0.77	0.76	0.67	0.50	0.64
CEC	17.01	19.63	21.70	17.61	18.27	19.78	20.00	18.11	17.96	19.38	18.09	19.25
رمل	286	103	166	219	238	230	138	251	242	123	175	168
غرين	559	471	470	450	443	442	464	401	471	474	538	465
طين	155	426	494	332	319	328	398	348	256	403	288	366

Conclusion

We conclude that the DW45 series is the largest of the series, with an area of 3020.17 ha, with a rate of 16.49%, and its frequent was 6. That all soils have a newly formed, undeveloped sedimentary origin material, as their Pedons had horizontal sequences of type A-C, and the absence of a gain horizon, and all of them belong to the order of Entisol. GIS technology showed high efficiency and effectiveness, as well as accuracy and shortness of time and effort to meet the work requirements of map production processes.

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