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THE EFFECT OF SEDIMENTATION SOURCES ON THE EXCHANGE PROPERTIES OF THE CLAY PARTICLES OF SOME SOILS IN WASIT AND MAYSAN GOVERNORATES

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Abstract

This study was conducted to find out the effect of sedimentation sources on the exchange properties of clay particles of some soils in Wasit and Maysan governorates , The results showed that the values of the exchangeable Ca^{2+} and Mg^{2+} ions within the soil Pedon affected by the torrents coming from the borderline were higher compared to their values within the soil Pedon affected by sediment of Tigris river, The values of exchangeable Na^{+} and K^{+} ions within the soil Pedons affected by sediment of Tigris river were higher compared to their values in the soils of Pedons affected by the torrents coming from the borderline. The results of the statistical analysis showed a significant relationship (r= 0.442, 0.836) between the values of the clay Cation exchange capacity and both the fine and coarse clay particles respectively. The results showed that there is a clear variation in the values of the clay Cation exchange capacity, linked mainly to the content of the clay particles in the soil under study. The results of the statistical analysis showed that there is a positive relationship with a correlation coefficient (r2 = 0.0657) between the distribution of the active $CaCO_3$ content and the surface area of the $CaCO_3$ minerals in the soils of all study pedons. And the values of the surface area of $CaCO_3$ minerals within the soil of the pedon affected by the torrents coming from the borderline were related to the distribution of the content of the active $CaCO_3$ in those soils. Where the results of the statistical analysis showed a positive relationship and correlation coefficient (r2 = 0.138) between the values of the surface area of $CaCO_3$ minerals and the content of active $CaCO_3$. And the relationship between the content of active CaCO3 and the surface area of $CaCO_3$ minerals of Pedons affected by sediment of Tigris river was negative and by a correlation coefficient (r^2= - 0.086).

***Keywords* :** Sedimentation sources, exchange properties, clay particles

Introduction

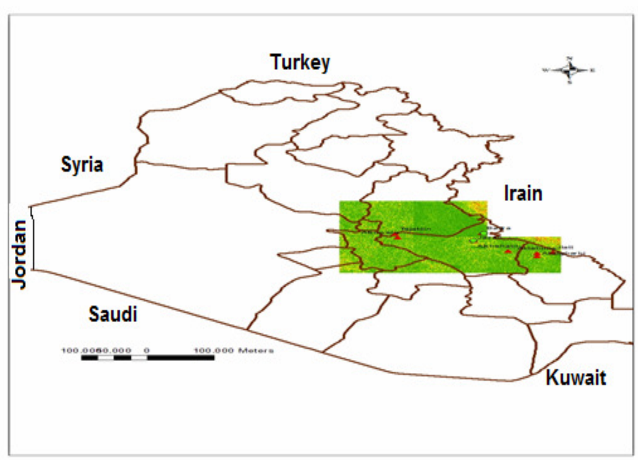
The clay particles play an important role in determining the CEC in the soil, and that is through its expanded minerals components 2: 1, as well as its effect on the Portability of the soil to the retention or readiness of nutrients in it by providing them with adsorption sites on its external and internal surfaces, and also affect the soil to water holding capacity, and that this characteristic is mainly related to the clay Cation exchange capacity, likewise, with its specific surface area Saidi, (2012), Al-Sanjari, 2000 emphasized that the effectiveness of $CaCO_3$ minerals is more related to the size of their grains (surface area) than to the total amount of carbonates, and that carbonate the size of clay particles is the most influential form of carbonate on soil properties, the $CaCO_3$ that accompanies the clay part acts as covers on the surfaces of the clay minerals, this leads to the blocking of part of the exchange sites, and that the removal of these carbonates led to an increase in the values of the clay Cation exchange capacity due to the increase in the ratio of fine clay to the coarse clay as well as the increase in the specific surface area. Bhargava and Subramanian, 2017 confirmed that the $CaCO_3$ in the soil increases the surface area and leads to faster reactions with the soil.

Materials and Methods

The study area was chosen in the lands located in the governorates of Wasit and Maysan, and this region represents the southern part of the Iraqi sedimentary plain at the latitudes N0 (33.06-) (32.08-) and longitude E0 (44.40-) (46.56-) (Al-Fatlawi, 2016). The study area was divided into three Transects parallel, within the area between the left bank of the Tigris River and the mountainous heights at the Iraq-Iran border in the east, The pedons are determined based on the topographical location , It was divided into sites flooded with floods coming from the border, the sites include Pedons (Badra, Tajaldyine , Al-Shahabi, Jassan, chlatt), Whereas, the sites that are the sediment of the Tigris River included all of the Pedons (Alsawira, Aldabunie, Alialgharbi).

Field procedures

Study sites were chosen within the governorates of Wasit and Maysan, The eight pedons were carved and described a morphological description, according to the approved principles in the Soil Survey and Classification Manual, (Soil Survey Staff, 1993). Coordinates for each location were taken by device GPS For the purpose of drawing a map, the study area represents Map No. (1). Soil samples were collected for each horizon and placed in polyethylene bags, The samples were numbered for the purpose of conducting physical, chemical and mineral analyzes.



Map 1 : distribution of the pedon soil sites under study

Chemical and Physical analysis

The relative distribution of the soil Particals was estimated using the hydrometer method Contained in Day, 1965 to determine the proportions of the soil Particals.

Total carbonate minerals were estimated using the Calcimeter method according to Hesse, 1971 the use of 3 N hydrochloric acid. The amount of carbonate in the clay and silt fractions was calculated using the Calcimeter method according to Hesse, 1971 using 3 N hydrochloric acid. extracted Positive exchange ions, Na^{+} were using ammonium acetate 1 N, Potassium was extracted with calcium chloride solution (0.5M), They were estimated using a device Flame Photometer, Calcium and magnesium exchangeable (Ca^{+2}, Mg^{+2} were estimated by titration with Versnete, Na^{+} and K^{+} were evaluated using a device Flame Photometer according to page *et al*., 1982. The clay Cation exchange capacity was estimated by method of saturating with sodium acetate 1 M pH= 8.2 according to page *et al*. 1982. Surface area of carbonate minerals TSA in soil was estimated according to the method mentioned in the manual of chemical analyzes of soil, water and plants, 2017, which can be calculated as follows:

TSA= The surface area of calcareous soils - (Surface area of non-calcareous soils× ratio in the calcareous soil

Results and Discussion

Physical and Chemical Properties

Particle Size Distribution

The results of Table 1 showed the percentages of soil particles, as they showed that there is a dominance of particles of silt, which ranged between 8.8-88.0 %, followed by percentages of sand, which ranged between 1.6-86.6 %.Then the particles of clay ranged between 2.4 - 56.4%.

It appears from the results of Table 1 that the vertical distribution of sand-particles did not take a specific pattern in all study pedons, because the reason for this is that it is sedimentary soils formed by the influence of the sediments of the Tigris river, the results also showed that the vertical distribution of the percentages of clay particles in the study soils was random and did not take a specific pattern of distribution in that soil, being sedimentary soils formed by the influence of both the Tigris river sediment and the torrents coming from the Iraqi-Iranian border, It was characterized by the heterogeneity of its particles content during successive sedimentary cycles (Al-agidi, 1976).

The results in Table 1 showed that the proportions of particles of clay separated were high in the soil pedons of the border and then decreased towards the left bank of the Tigris River, and that for soil pedons affected by torrents coming from the borderline, where the proportions of particles separated from the clay in the soil of pedon (Badra, Al-Shihabi, and chlatt) compared to the soil pedon that is located to the west of it within the Iraqi lands represented by the sites (Tajaldyine, Jassan, Alialgharbi), with the exception of the slight increase in the proportions of particles of clay in the soil site Alialgharbi, This is due to the topography of the earth and the speed of the water stream, as the slope of the land towards the Iraqi lands decreases, which is accompanied by a decrease in the speed of the flow of torrential water flowing from the borderline towards the Iraqi lands, this results in an increase in the fine particles content in the sediments transported by these torrents, So, explain Al-Aqidi, 1986, sedimentary soils are young, undeveloped, and their texture are fine by moving away from the source transporting their resources.

Table 1 : Partical size distribution of soil separations and the surface area of carbonates in the study soils

Surface area of carbonate $^{m.gm-1}$	Texture class	clay	silt	sand	Depth cm	Horizon	N.pedone
		%					
2.94	Si L	8.7	77.8	13.5	0-25	Ap	1 Badra
4.10	Si L	20.5	69.9	9.6	25-52	C1	
3.57	Si C L	34.8	47.3	17.9	52-85	C2	
2.78	Si C	46.7	41.9	11.4	+85	C3	
3.49	Si	10.5	81.3	8.2	0-10	Ap	2 Tajaldyine
2.23	Si C L	38.8	54.5	6.7	10-34	C1	
1.85	Si	6.4	88.0	5.6	34-58	C2	
2.57	Si C L	28.9	64.1	7.0	+58	Ab	
3.15	Si	6.3	81.2	12.5	0-10	Ap	3 Alsawira
2.99	Si C L	37.9	48.0	14.1	10-60	Cz_1	
2.85	Si C	54.6	43.1	2.3	60-90	Cz_2	
3.27	Si C	56.4	42.0	1.6	+90	Ab	
1.24	C L	30.1	44.5	25.4	0-10	Ap	4 Al-Shahabi
3.78	S C	46.0	20.4	33.6	10-38	Cz_1	
2.80	Si C	40.0	43.9	16.1	38-72	Cz_2	
2.47	C	39.8	36.2	24.0	+72	Ab	
4.03	L S	4.2	17.8	78.0	0-20	Ap	5 Jassan
4.59	Si C	51.5	42.1	6.4	20-83	C1	
3.71	Si C	37.4	55.3	7.3	83-100	C2	
2.21	Si L	19.6	54.2	26.2	+100	Ab	
1.49	Si CL	35.1	48.5	16.4	0-32	Ap	6 Aldabunie
4.00	Si C	45.5	46.2	8.3	32-50	C1	
3.15	Si C	43.6	46.3	10.1	50-75	C2	
1.45	Si L	11.3	74.0	14.7	+75	C3	
2.35	LS	4.6	8.8	86.6	0-10	Ap	7 Chlatt
3.90	S	2.4	12.8	84.8	10-40	C1	
1.62	L S	8.5	17.3	74.2	40-70	C2	
2.10	LS	6.4	12.2	81.4	+70	Ab	
1.80	Si	6.5	82.3	11.2	0-10	Ap	8 Alialgharbi
4.04	Si	4.4	80.9	14.7	10-25	Bz_1	
2.26	Si	10.3	81.2	8.5	25-60	Bz_2	
3.12	Si C L	34.4	59.1	6.9	+60	C3	

Chemical Properties of studied

Total carbonate minerals and active lime in the soil

Table 2 results showed that the values of total carbonate minerals ranged between 17.85 - 52.70%, the results indicated an increase in the values of total carbonate minerals in general in all study soils, this is due to the nature of the calcareous matter of this soil (Al-Fatlawi, 2016). Whereas, the vertical distribution of $CaCO_3$ within these pedons did not take a specific pattern, as they are sedimentary soils characterized by random distribution of their components with depth (Naqash et al., 1986). The horizontal distribution of the values of carbonate minerals also showed an increase in their proportions within the soils affected by the torrents coming from Iranian lands, and starting from the soils of the pedon borderline of Iraq – Iran. With regard to the soils of Pedons affected by the sediments of the Tigris river (Alsawira, Aldabunie, Alialgharbi) the results showed an increase in the values of total carbonate minerals in its soil. AL-juburi, 1973 indicated that the reason for the high level of carbonate minerals in the sediments of the Tigris river is due to the high content of lime within the material transported by the river. The results of Table 2 also showed the values of active carbonate minerals, ranging between 4.76-29.75%, In general, the horizontal distribution of the content of active carbonate minerals showed a consistency with the total carbonate minerals distribution in all study soils, this explains the existence of a succession of the decalcification and calcification processes in these soils (AdI, 2003).

The results in Table 2 showed that the values of active carbonate minerals were more than 50% of the total carbonate minerals content in most of the study pedon horizons, this indicates an increase in the presence of carbonate minerals, the size of clay particles, Which may affect many of the chemical properties of this soil. The results also showed the convergence of the values of the active carbonate minerals in the soils of pedons affected by torrents, which confirm that they are soils affected by sediments derived from a single source and substance and similar precipitation conditions (Aziz, 1997).

Table 2 : Chemical properties in the study soils

OM%	$CaCO_3$ active %	$CaCO_3$ total	pH	EC $Ds.m^{-1}$	Depth Cm	Horizon	N.pedone
1.90	21.42	28.56	7.22	2.80	0-25	Ap	**1 Badra**
1.63	26.18	41.41	7.24	2.50	25-52	C1	
1.30	27.18	34.75	7.23	2.60	52-85	C2	
0.90	23.08	34.51	7.25	2.70	85+	C3	
0.22	11.90	22.61	8.19	3.30	0-10	Ap	**2 Tajaldyine**
0.31	11.18	21.66	7.97	4.10	10-34	C1	
0.22	11.90	22.85	8.11	3.40	34-58	C2	
0.48	9.52	24.99	8.01	5.30	58+	Ab	
0.10	15.47	19.29	7.64	16.00	0-10	Ap	**3 Alsawira**
1.82	19.51	29.04	7.45	8.60	10-60	Cz_1	
1.37	17.85	39.27	7.70	12.30	60-90	Cz_2	
0.22	9.52	29.27	7.65	1.30	90 +	Ab	
0.44	21.18	37.50	7.78	3.90	0-10	Ap	**4 Al-Shahabi**
0.22	22.13	36.80	7.73	5.90	10-38	Cz_1	
0.66	23.08	45.10	7.53	7.00	38-72	Cz_2	
1.55	27.37	49.70	7.45	2.70	72+	Ab	
0.80	29.75	41.70	7.47	5.80	0-20	Ap	**5 Jassan**
1.99	26.89	50.10	7.24	10.70	20-83	C_1	
1.37	25.46	34.50	7.35	12.30	83-100	C_2	
1.55	27.37	52.70	7.20	11.10	100+	Ab	
1.83	9.75	20.23	7.47	1.60	0-32	Ap	**6 Aldabunie**
2.00	4.76	19.04	7.38	1.00	32-50	C1	
1.11	16.66	24.99	7.49	1.00	50-75	C2	
1.36	14.75	23.80	7.55	0.80	75+	C3	
0.85	14.75	20.71	8.30	0.30	0-10	Ap	**7 Chlatt**
0.74	8.09	17.85	8.50	0.10	10-40	C1	
0.83	14.51	21.66	8.10	0.10	40-70	C2	
0.83	13.56	25.47	8.03	0.20	70+	Ab	
1.50	16.89	24.75	7.68	27.00	0-10	Ap	**8 Alialgharbi**
1.95	18.32	24.99	7.39	39.10	10-25	Bz_1	
1.66	15.47	26.18	7.86	50.00	25-60	Bz_2	
1.89	15.23	23.32	7.49	44.10	60+	Ab	

Exchangeable Cations in studied soils

The results of Table 3 showed the values of the Positive exchange ions in the soil pedons under study. the values of the exchangeable calcium ranged between 5.99-19.22 $Cmol.kg^{-1}$, exchangeable Sodium and potassium ions values ranged between 0.02 - 7.73 and 0.05- 0.81 $Cmol.kg^{-1}$.

In general, it appears through the horizontal distribution of the exchangeable Ca^{2+} and Mg^{2+} ions that it was compatible with the horizontal distribution of both the total and active carbonate mineral content, Carbonate minerals are the main source of both Ca^{2+} and Mg^{2+} ions. Where explain Vitro et al., 2013, the carbonate minerals that make up the mineral calcite and dolomite the basic synthetic for their content are an important source of Ca^{2+} and Mg^{2+} ions in the soil. and according to the mineral studies conducted by Al-Fatlawi, 2016 and Majied, 2017 on soil samples from the same current sites, Which showed that both minerals calcite, dolomite and magnetite were the main content of carbonate minerals in these soils, in addition to the presence of Evaporates salts, which is another source of Ca^{2+}, Mg^{2+} and Na^{+} ions in these soils.

The results of Table 3 showed that the values of the exchangeable Ca^{2+} and Mg^{2+} ions within the soil pedon affected by the torrents coming from the borderline were higher compared to their values within the soil pedon affected by the Tigris river sediment , because the reason for this is due to the difference in the content of carbonate minerals in the two groups of these soils, as for the exchangeable potassium ions, low values were recorded compared to the values of the exchanged ions, especially within the soil of pedons affected by the torrents coming from the borderline, The reason is due to the low intensity of weathering of potassium-bearing minerals (Muscovite and Biotite) during transport and precipitation due to the short distance of the sources of transported sediments (Zakros Mountains) to the sedimentation areas at the Iraqi-Iranian border.

The results of Table 3 showed that the values of exchangeable Na^{+} and K^{+} ions within the soil Pedon affected by the Tigris river sediment were higher compared to their values within the soil Pedon affected by torrent coming from the borderline, as the reason may be due to the effect of weathering processes in the minerals carrying K^{+} and Na^{+} ions during transport and sedimentation and far Sedimentation sources.

Table 3 : Exchangeable Cations and the CEC of soil and clay in soil studying

CEC	exchangeable Cations $Cmol.kg^{-1}$				Depth cm	Horizontal	N. pedon
Clay	K^{+1}	Na^{+1}	Mg^{+2}	Ca^{+2}			
35.40	0.05	0.20	2.66	19.22	0-25	Ap	1 Badra
40.48	0.23	0.13	4.54	18.34	25-52	C1	
38.70	0.32	0.09	11.02	14.10	52-85	C2	
50.41	0.19	0.24	10.11	13.04	+85	C3	
33.45	0.18	1.57	8.38	11.32	0-10	Ap	2 Tajaldyine
50.20	0.23	1.70	8.76	12.11	10-34	C1	
23.43	0.68	1.52	5.99	11.82	34-58	C2	
46.00	0.10	1.79	4.14	11.12	58+	Ab	
30.33	0.81	5.11	3.11	5.99	0-10	Ap	3 Alsawira
35.02	0.31	2.28	3.00	16.79	10-60	Cz_1	
68.19	0.33	2.23	7.87	13.13	60-90	Cz_2	
52.08	0.31	0.24	6.34	15.11	90+	Ab	
36.70	0.20	0.33	13.00	6.00	0-10	Ap	4 Al-Shahabi
52.35	0.16	0.95	7.00	13.00	10-38	Cz_1	
40.01	0.23	1.12	6.00	11.00	38-72	Cz_2	
49.62	0.15	0.41	2.00	4.00	72+	Ab	
22.62	0.29	1.30	15.00	6.00	0-20	Ap	5 Jassan
56.38	0.18	1.79	9.00	10.00	20-83	C1	
45.67	0.16	2.23	8.00	6.00	83-100	C2	
32.88	0.19	1.66	6.00	9.00	+100	Ab	
38.88	0.12	0.24	4.00	15.00	0-32	Ap	6 Aldabunie
62.29	0.22	0.06	12.00	14.00	32-50	C1	
46.61	0.23	0.02	7.00	9.00	50-75	C2	
37.68	0.40	0.06	5.00	10.00	+75	C3	
23.68	0.09	0.60	14.00	11.00	0-10	Ap	7 Chlatt
20.03	0.18	0.59	22.00	11.00	10-40	C1	
28.11	0.12	0.06	14.00	10.00	40-70	C2	
32.23	0.14	0.50	7.00	9.00	70+	Ab	
27.33	0.19	1.57	20.00	16.00	0-10	Ap	8 Alialgharbi
25.55	0.17	0.86	8.00	15.00	10-25	Bz_1	
33.54	0.26	1.43	8.00	16.00	25-60	Bz_2	
40.22	0.24	7.73	8.00	11.00	60+	Ab	

Clay exchange Capacity of Studied Soils

The results of Table 3 showed the values of the Clay exchange Capacity in the pedon of Studied Soils, The values ranged between 20.03- 68.19 Cmol.kg^{-1}, the results show that the distribution of these values was consistent with the distribution of the clay particles in these soils. where the vertical distribution of the values of the Clay exchange Capacity showed a clear variation and did not take a specific pattern in the distribution within the soil of the study pedons and that this distribution was consistent with the vertical distribution of the clay particle in those soils, as it is sedimentary soils characterized by random distribution of its components (Al-agidi, 1976).

The results of Table 3 showed the horizontal distribution of the values of the Clay exchange Capacity, as those values increased within the soils of the borderline (Badra, Al-Shahabi, chlatt), to return to the direction towards the left bank of the Tigris river within the soil pedon (Tajaldyine, Jassan, Alialgharbi), except for the slight rise in these values within the pedon Alialgharbi soil, where the last location is affected by the two types of sediments (coming from the borderline and the Tigris river).

The results also showed that the horizontal distribution of the values of the Clay exchange Capacity in the pedons affected by the sediments of the Tigris river, were also consistent with the distribution of the content of the clay particles in those soils. and that these values were higher than the values of the Clay exchange Capacity were recorded within the soil pedon affected by the torrents coming from the borderline. and affirming the compatibility of the vertical and horizontal distribution of the values of the Clay exchange Capacity with the distribution of the clay particles in all study soils, The results of the statistical analysis table (4) showed a significant relationship r = 0.442, 0.836 between the values of the Clay exchange Capacity and both the fine and coarse clay separations respectively.

Table 4 : Statistical analysis between the values of the Clay exchange Capacity and both the fine and coarse clay separators.

Variables	Straight Linear equation	r	r^2	Level of sig
Course clay	Y=26.101+0.622X	0.836	0.698	**
Fine clay	Y =34.913+0.898X	0.442	0.195	**
**(P<0.01)				

In general, the results showed that the soil with a high content of the clay fraction showed a variation in the values of the Clay exchange Capacity, while the values of the Clay exchange Capacity showed a low variation in soils with a low clay content. for example, some of the soil samples were selected, which were characterized by two different contents of the clay particles (high and low), with the values of the Clay exchange Capacity recorded as follows:

Table 5 : The relationship between two different contents of the clay particles (high and low), with the values of the Clay exchange Capacity

Soils with a low content of clay separator			Soils with a high content of clay separator		
CEC- Clay Cmol.Kg^{-1}	**Clay%**	**Location**	**CEC- Clay Cmol.Kg^{-1}**	**Clay%**	**location**
22.62	4.20	Jassan	68.19	54.60	Alsawira
23.68	4.60	Chlatt	52.08	56.40	Alsawira
25.55	4.40	Alialgharbi	62.29	45.50	Aldabunie
32.23	6.40	Chlatt	46.61	43.60	Aldabunie
30.33	6.60	Alsawira	40.01	46.00	Al-Shahabi
35.40	8.70	Badra	49.62	39.80	Al-Shahabi
33.45	10.50	Tajaldyine	35.02	37.90	Alsawira
33.54	10.30	Alialgharbi	50.20	38.80	Tajaldyine
32.88	19.60	Jassan	45.67	37.40	Jassan

Thus, it appears through Table 5 that there is a clear variation in the values of the Clay exchange Capacity related to the content of clay in the soil under study, especially those soils with a high clay content, According to our belief, the low content of clay particles in the soil will lead to an increase in the content of coarse and medium particles represented by the particles of sand and silt fractions at its expense, It is accompanied by a decrease in the content of expanded minerals 2: 1,With an increase in the content of primary minerals, such as quartz minerals, feldspar, and pyroxenes etc. The latter are characterized by being minerals that do not contribute to the CEC of the soil, And that the low content of minerals 2: 1, represented by minerals Smectite, mica and vermiculite, Which contribute greatly to the Clay exchange Capacity, Its decrease will decrease the values of the Clay exchange Capacity. So, Saidi, 2012 indicated that the Clay exchange Capacity depends mainly on the mineral composition of the clay particles.

Therefore, the high content of clay particles in the soil, which is accompanied by a rise in the content of expanded minerals 2:1, and that the latter are minerals with varying exchange capacities, it will undoubtedly lead in one way to increase the Clay exchange Capacity from one side, With varying values on the other hand in those soils

And that these results were consistent with what Lambooy (1984) found, as it was indicated that the high clay content of smectite, Illite, and vermiculite minerals leads to an increase in the CEC in the soil. as well as increased holding water capacity, compared to soils containing high levels of minerals of low exchange capacity such as kaolinite, Halosite, quartz, and feldspar.

Surface areas of $CaCO_3$ in Studied Soils

The results of Table 1 showed the values of the surface area of carbonate minerals in the soil of the study, where those values ranged between 1.24 - 4.59 $m^2.gm^{-1}$, The results showed that there is a clear variation in the surface area values of carbonate minerals in the soil under study, at the same time, it varies within the horizons of one pedon, and this variation is governed by a number of interpretations from it: the size distribution of carbonate minerals particles varies with the external environmental conditions that are associated with the Interior conditions of the soil, and that affects the distribution of carbonate minerals in the ponds of these soils, the size of the carbonate minerals minus is the most important factor in determining the surface area of minerals in carbonate particles, Whereas, Hafshejani and Jafari, 2017 showed that true particle size plays an important role in the difference in the size distribution of carbonate minerals that correlates with the surface area of carbonates and the effectiveness of the carbonate separation, as the results of the statistical analysis showed in Figures (1) that there is a positive correlation with a correlation coefficient (r^2 = 0.0657) between the distribution of the active carbonate content and the surface area of the carbonate minerals in the soils of all study, This is expected, as we have shown that the size of the separates is related to the surface area of carbonate particles, because continuous dissolving processes work and the success of the decalcification and calcification processes in those soils, and that these processes are mainly related to many chemical reactions that occur in the soil, such as the carbonate dissolution kinetics and adsorption reactions, That is we find that increasing the effectiveness of these reactions depends mainly on the moisture state inside the soil body and the amount of water entering it. Therefore, we expect that the variance will be evident in both groups of study soils (the pedons of affected by the torrents coming from the borderline and those soils affected by the sediments of the Tigris river). In confirmation of this assumption, the results obtained were discussed for each of the two groups of the above-mentioned soils separately, as each group has its external environmental conditions that differ from each other.

The results of Table 1 showed that the values of the surface area of carbonate minerals within the soil pedon affected by the torrents coming from the borderline ranged between 1.24 - 4.59 $m^2.gm^{-1}$, it was observed that these values were related to the distribution of the active carbonate content in those soils, where the results of the statistical analysis in Figures (1) showed a positive relationship and a correlation coefficient (r^2 = 0.138) between the surface area values of carbonate minerals and the content of active carbonates, As the results of Table (2) showed an increase in the content of active carbonates in those soils, which was explained on the basis of increasing continuous dissolving processes and the succession of the Decalcification and calcification processes in those soils, So that the soil of the Pedons affected by the torrents coming from the borderline is considered renewable due to what the torrents transfer to it from the materials and deposits annually, in addition to its exposure to continuous waterlogging operations that continue for long periods, all of these external environmental conditions will be reflected in the internal conditions of the soil, especially the increase in the content of active carbonates, which constituted about 50% of the total content of carbonate minerals in those soils (Table 2).

With regard to the soils of pedons affected by the sediments of the Tigris river, the results of Table (1) showed that the values of the surface area of carbonate minerals were between 1.45 - 4.04 $m^2.gm^{-1}$, The results indicated that these values were lower than their Counterparts in the soils of pedons affected by the torrents coming from the borderline, In spite of the high content of total clay particles within the soil of Pedons affected by the sediments of the Tigris river, This situation can be explained until the soil of the Pedons affected by the sediments of the Tigris river is considered to be a long time since its formation, and it is desert soils far from the areas of inundation, worse, the inundation resulting from the flooding of the Tigris River, or the inundation through floods that flow from Iranian lands, according to these conditions the natural state of the carbonate minerals in these soils is heading towards the more crystallized state (the high calcification process) due to the high temperatures and the prolonged period of drought in the sites of these soils, This leads to a decrease in the active carbonate content in these soils, and consequently a decrease in the values of the effective surface area of the carbonate minerals in its soil. In general, through the results obtained in the current study, it appears that the size of the separates is not the only controlling factor in increasing the reactive surface area, It is the extent of their contribution to the influence on the exchange properties of the soil, by contributing to the creation of active exchange sites on its surfaces. and evidence, for this assumption we find that the high content of clay particles in the soil of pedon affected by the Tigris river sediment was not accompanied by a rise in the surface area values of the carbonate minerals in it, therefore, the statistical analysis in figures (1) showed that the relationship between the active carbonate content and the surface area of carbonate minerals was negative and with a correlation coefficient (r^2 = -0.086), This result confirms that the increase in the surface area values of carbonate minerals is related to the increase in the dissolution processes of the primary carbonate minerals and their transformation towards the active carbonates. And that these results were consistent with many studies (Reyhanitabar and Gilkes., 2010; Delcampillo *et al*., 1992). It was shown that the increase in the surface area of carbonate minerals, which is usually accompanied by an increase in the effectiveness of their surfaces, is mainly due to the continued dissolution processes of primary carbonate minerals and their transformation into active carbonates.

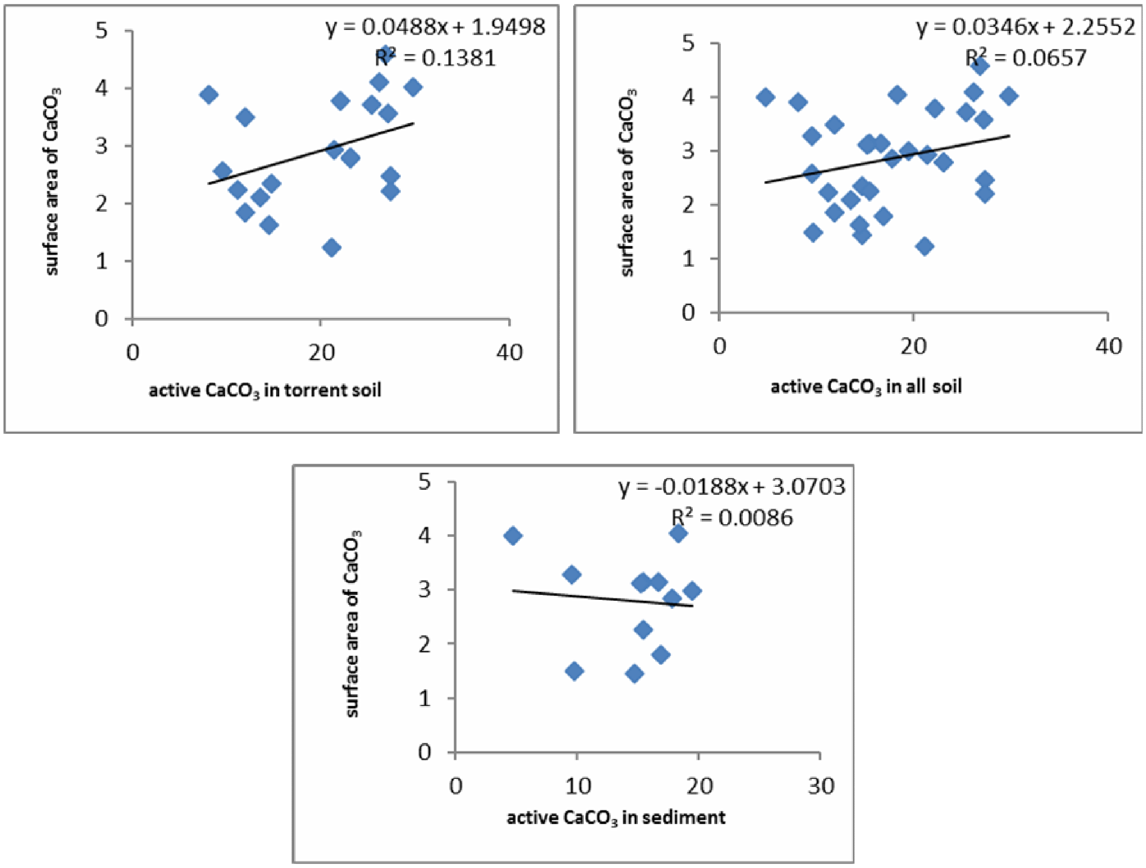


Fig. 1 : The relationship between the active carbonate minerals and the surface area of the carbonate minerals (for all study soils, affected by the torrents and affected by the Tigris river sediment)

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