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Original Article

Mineral Properties of Euphrates and Shatt Al-Arab River Sediments

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ABSTRACT

The mineralogical research described in this paper was carried out during 2018, about 30 samples from twelve river core sediments (from S1 to S12)at six sites in Euphrates and Shatt Al-Arab rivers from Hilla to Basrah cities . The coordinate number of these cores are between 38°41°32.48''N–38°14'24.10''N latitude and 39°56'4.59''E–39°8°13.41''E longitude.The mineralogy is determined by X- ray diffraction, and reveals that carbonate minerals, quartz, and anorthite feldspar are the main of light minerals in the different depth intervals, whileKaolinite, palygoreskite and chlorite are the main of clay minerals. Calcite and dolomite are more abundance than quartz. Calcite is present at high percentage in Basrah city (S11) compare with the other area.The highest value of dolomite is pointed in Diwaniya (S4) and Qurna (S9), whereas the lowest in Simawa and Nasiria cities (S5 and S8). The abundant ratio of quartz reduces to south Euphrates River direction and downward of depth intervals. Anorthite feldspar is absent inNasiria and Basra, whereas it is present in other sites. Major oxides represented by SiO_2,Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, and $TiO_2$are the main in the sediments, it detect by Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES) analyses. Silica is attribute to quartz minerals, while alumina is connect with clay minerals. The domination of calcite with lack of dolomite reflected in the low content of the MgO. Redox elements (Fe and Ti) contents in the sediments of studied cores were high within the uppermost part of the profiles, but with increase the depth it have undergoing some degree of depletion. Sodium is originated from halite, and clay minerals, while potassium from illite. Micro and nano texture features took place by SEM-EDAX. There are several of mechanical and chemical features are detected; conchoidal, rounded, pits,and microgranular. These features resulted from dissolution by river water (chemical) or during long distance of transportation.

KEYWORDS: *Euphrates, Tigris, Shatt Al-Arab, Basrah, Qurna*

1. INTRODUCTION

Euphrates River is one of the most important rivers in the world.In term of hydrography. The Euphrates River is the longest river in western Asia with total length of 2940km, where 1213km which 40% of distance in Iraq` (Al-Bassam and Hassan, 2006). Euphrates enters Iraq at a few kilometers north of Huseiba on the Iraqi-Syrian borders. In its upper reaches in Iraq, the Euphrates cuts through carbonate bed rocks, having a very narrow strip of flood plain. The lithology of Euphrates River channel then is changing to gypsum, limestone, green marl from north Hit to Ramadi. In the middle and lower reaches the Euphrates River meander over the Mesopotamian alluvial plain. The drainage basin here is underlined by the Injana Formation (formerly Upper Fars) (Upper Miocene) which consists of marls and sandstone at south Ramadi (Banat and Al-Rawi, 1986). At lower reaches, the Euphrates River flows over fluviatile recent sediments (Ramadi-Diwania), and the Dibdibba Formation (Pliocene-Pleistocene) which is consist of clastic sediments basically arkosic arenite , as well as some recent sand dune (Nasiriya) (Al-Rawi and Sadik,1981).The river flows through Syria and Iraq before joining the Tigris near of Qurna area to form Shatt Al-Arab in Basrah city (Southern Iraq) , then drains in the Arabian Gulf. Euphrates and Tigris Rivers are provided much of water that supported the development of ancient Mesopotamian culture.The Mesopotamia Plain locatedin the central part of the Mesopotamia Foreland Basin. It has been an area of subsidence since the Late Cretaceous. After various episodes of marine ingression the Late Neogene strata indicate a fluvial depositional environment. The sediments are strongly influenced by the input of the Euphrates and the Tigris rivers and their major tributaries which have their outlet into the Mesopotamia Plain (Aswad et al., 2011). During the uplift of the Zagros Mountains, the rivers of Mesopotamia migrated west and southwest during the Pleistocene and Holocene. The Euphrates River drains through a number of geological formations of sedimentary origin from entering Iraqi territory until meeting with Tigris River in Qurna (Al-Bassam 2000). The outcropping formations age range from the Eocene (Dammam Formation) till modern times (Quaternary deposits) as in figure (1). The Holocene sediments of the Euphrates River consist mainly of unconsolidated to fairly well-indurated deposits of sands, silts and mud. Minor deposits of pebbles are present in some upstream areas.Many of authors have been studied the mineralogy of Euphrates and Shatt Al-Arab Rivers, such as Philip(1968), Jawad Ali(1977), Banat and Al-Rawi (1986), Al-Marsoumiand Al-Jaber, (2007), Al-Mukhtar (2015); Minarikova (2004); Kalender and Aytimur (2016). This study focuses on the mineralogical variations of Euphrates and Shatt Al-Arab River cores sediments.

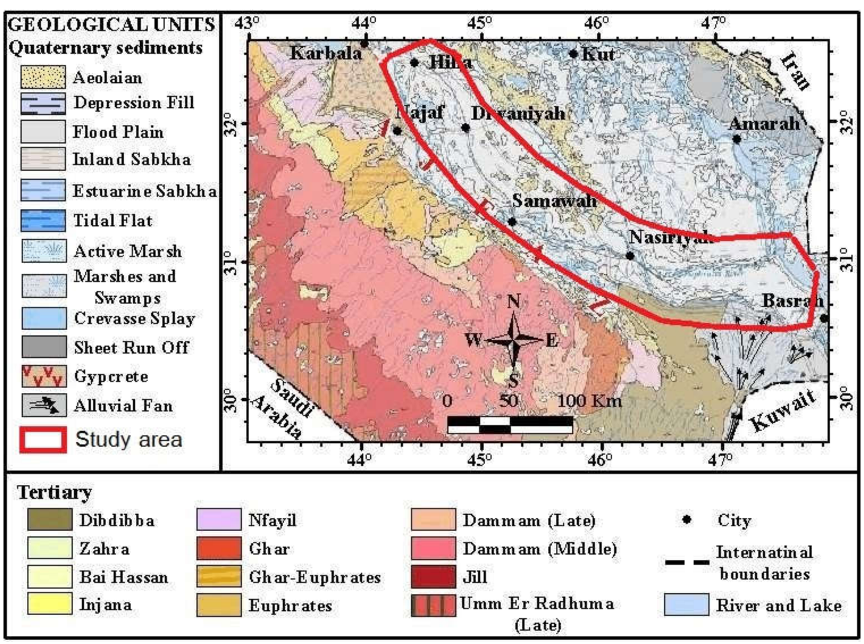

Figure 1: Location of study area in modified geologic map of Mesopotamian plain according to Sissakianand Fouad (2012)

2. LOCATION OF THE STUDY AREA

In the present study, Twelve of river core sediments were collected along of river cross profile in Euphrates River from Hilla city (Babylon) in central Iraq to Shatt Al-Arab river in Basrah city (southern Iraq) . The distance of study area is more than 480Km. It lies between latitude 320 40' 01.147 " - 300 48 ' 8.423 " and longitude 440 19 ' 21.214 " – 470 35 ' 19.32 " as shown in figure(2) and table(1).

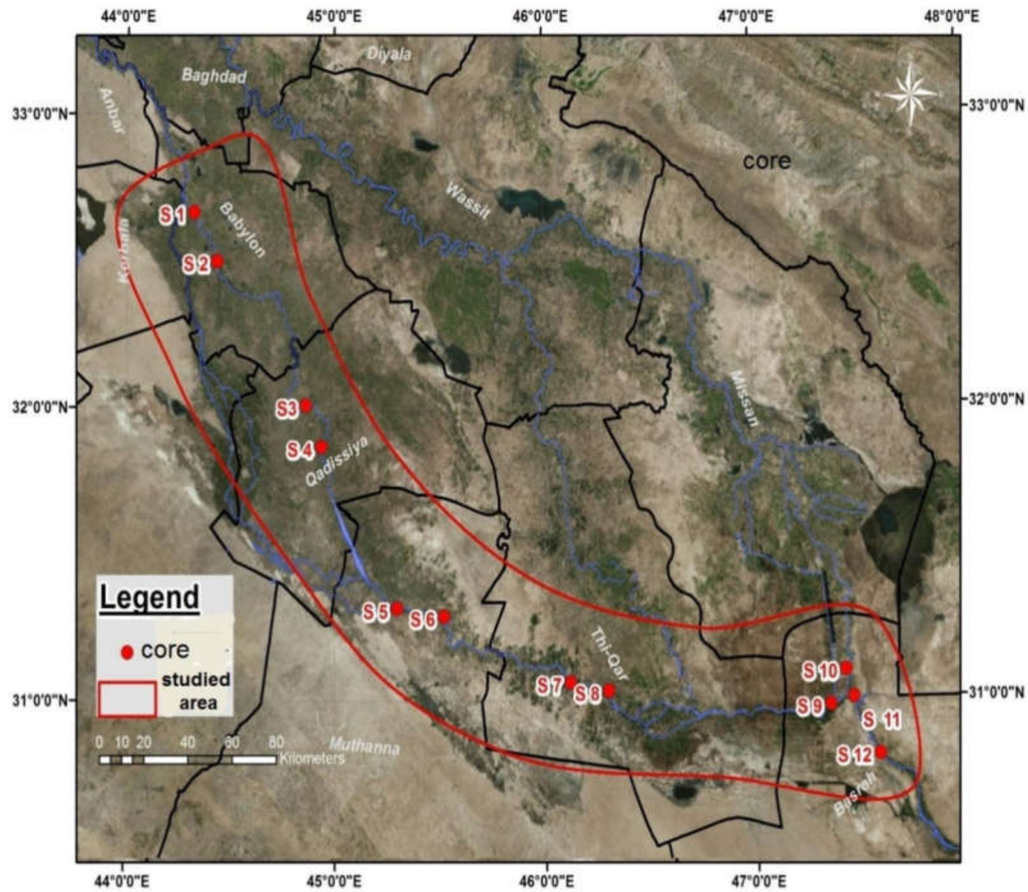

Figure 2: Map of study area.

Table 1: Coordinate number of studied cores

Area name	Core No.	Longtitude(N)	Latitude (E)
Hilla/1	S 1	44 19 21.214	32 40 1.147
Hilla/2	S 2	44 26 3.781	32 30 0.244
Diwania/1	S 3	44 51 42.778	32 0 30.417
Diwania/2	S 4	44 56 10.006	31 52 0.133
Simawa/1	S 5	45 17 46.751	31 18 51.425
Simawa/2	S 6	45 31 11.739	31 17 14.885
Nasiria/1	S 7	46 71 6. 223	31 3 35.641
Nasiria/2	S 8	46 18 0.841	31 1 48.645
Qurna/Furat	S 9	47 21 13.082	30 58 24.692
Qurna//Tigris	S 10	47 25 40.759	31 5 27.987
Qurna//meeting	S 11	47 27 48.024	30 59 56.798
Deer/Shatt Al –Arab (Basrah)	S 12	47 35 19.32	30 48 8.423

3. ANALYTICAL METHODS

Twelve river core sediments at depths between 20-58 cm are collected by using Stream Sediments Core Sampler Device. Table 2 presented the depths and width of studied river. The core sample of any station is preserved and folded by aluminum foil sheets. Thereafter, dried under sun light, then it divided to several parts depending on core depth of each part (10cm +,- 4cm) as shown in figure 3 and table 3.Eight core samples are chosen for this study. All the samples in selected cores are grinded well and mixed together to be a homogenous representative sample. Both of techniques, X-ray diffraction (XRD) in Baghdad University and Scanning Electron Microscope (SEM-EDAX)in Basrah University are used in minerals identification. Where pattern of XDR obtained by means of a D-5000 X-ray diffractometer, using CuKα sources in wavelength, v being 1.54056Å at 40 kV and 30 mA between 5-65°.Each sample is analyzed for SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O , and $TiO_2$by Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES) in ALS laboratory in Spain.

Table 2: Depth and width of rivers in the study area

Area name	Core No.	Depth of water(approximately)	Width of the river
Hilla/1	S 1	3m	144m
Hilla/2	S 2	3m	71 m
Diwania/1	S 3	2.75 m	30 m
Diwania/2	S 4	2.5m	25 m
Simawa/1	S 5	3m	95 m
Simawa/2	S 6	3.5m	180 m
Nasiria/1	S 7	5.5 m	125 m
Nasiria/2	S 8	7m	150 m
Qurna/Furat	S 9	4.5 m	250 m
= /Tigris	S 10	7m	74 m
= /meeting	S 11	5 m	280 m
Deer/Shatt Al - Arab	S 12	10m	200 m

Table 3: Core zones and core depth

Name of area	Core NO.	Core zones and zone depth						Sum of zones	Total depth
Hilla/1	S1	1A=10cm	1B=10cm	1C=10cm	1D=10cm	1E=12cm		5	52cm
Hilla/2	S2	2A=10cm	2B=10cm	2C=10cm	2D=10cm			4	40cm
Diwania/1	S3	3A=10cm	3B=10cm	3C=13cm				3	33cm
Diwania/2	S4	4A=10cm	4B=10cm	4C=10cm	4D=8cm			4	38cm
Simawa/1	S5	5A=10cm	5B=10cm	5C=10cm				3	30cm
Simawa/2	S6	6A=10cm	6B=15cm					2	25cm
Nasiria/1	S7	7A=10cm	7B=13cm					2	23cm
Nasiria/2	S8	8A=10cm	8B=14cm					2	24cm
Basra/Qurna/ Furat	S9	9A=10cm	9B=10cm	9C=11cm				3	31cm
Basra/Qurna/ Tigris	S10	10A=10cm	10B=10cm	10C=10cm	10D=12cm			4	42cm
Basra/Qurna/ meeting	S11	11A=10cm	11B=10cm	11C=12cm				3	32cm
Basra/Dear/Shatt Al-Arab	S12	12A=10cm	12B=10cm	12C=10cm	12D=10cm	12E=10cm	12F=8cm	6	58cm

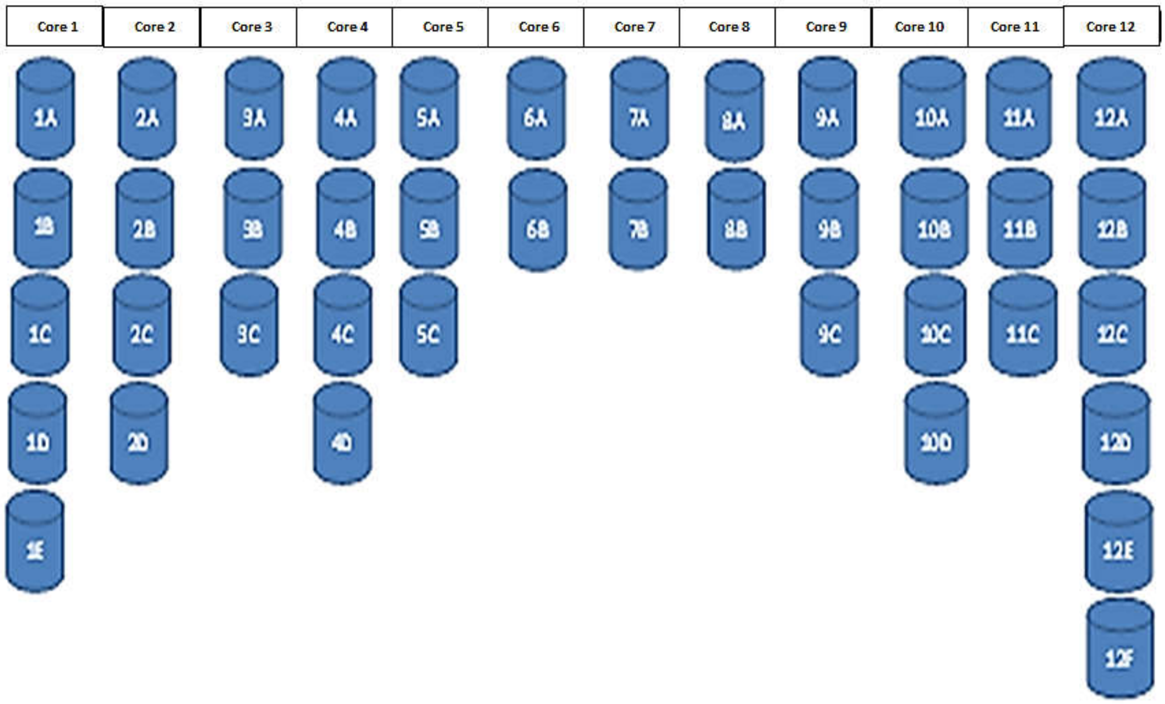

Figure 3: Division the sample cores into zone parts

4. RESULT AND DISCUSSION

A-Mineralogy study The bulk mineral components and the relative abundance of each mineral have been considered on the basis of peak high measurements of a 100% reflection peak; the data attained are summarized in table 4 and selected X-ray diffractograms in figure 4. Light minerals comprised 78.8% from the total minerals in study area, while clay minerals are 21.2% (Table 5). Carbonate minerals, quartz, and anorthite feldspar are the light minerals in the deferent depth intervals of study area, with share of clay fraction consists of Kaolinite, palygoreskite and chlorite. Quartz (SiO2) and Carbonate minerals which are calcite ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$) are the main of non-clay minerals in the studied samples, while anorthite feldspar ($CaAlSi_3O_8$) is the lowest abundance. Carbonates are more abundance than quartz as shown in table 4. The mineralogical investigation of carbonate minerals in this work showed that calcite is highest compare with dolomite. The highest amount of calcite is recorded in Basra /Qurna city; while in Diwaniya and Hilla cities is a lowest amount. Generally, calcite increases southward along of study area of Euphrates River from Hilla (S1) to Basra (S10 and S11). Also, in most studied cores, calcite rises according to increasing of depth intervals. The originate of calcite presented in the sediments may back to Euphrates Formation and for biogenic origin and high carbonate content consisting of relatively pure carbonate clay, silt, and sand that are generally unconsolidated in Euphrates and Shatt Al-Arab Rivers. Al-Hashimi and Amer (1985) mentioned thatEuphrates Formation (Lower Miocene) is composed of dolomitic, fossiliferous, and oolitic limestones with green marls at the top. The highest value of dolomite is pointed in Diwaniya (S4) and Qurna (S9), whereas the lowest in Simawa and Nasiria cities (S5 and S8). Most of dolomite in the sediments of study area is provided from Euphrates and Dammam Formations as pointed by Jassim and Goff (2006). The Sharp peaks of quartz reflect the good crystallinity of this mineral. The highest value of this mineral appeared in Hilla (S1) and the lowest value in Nasiria (S8). The abundant ratio of quartz reduced toward ofsouthEuphratesRiver direction and downward of depth intervals, as a result to decrease of sand fractions downward direction from Hilla to Basrah city. Anorthite feldspar is present inHilla, Diwania and Simawa cities, while is absent in Nasiria and Basra, this result may interpreted by low resistant of anorthite feldspar during transportation via .

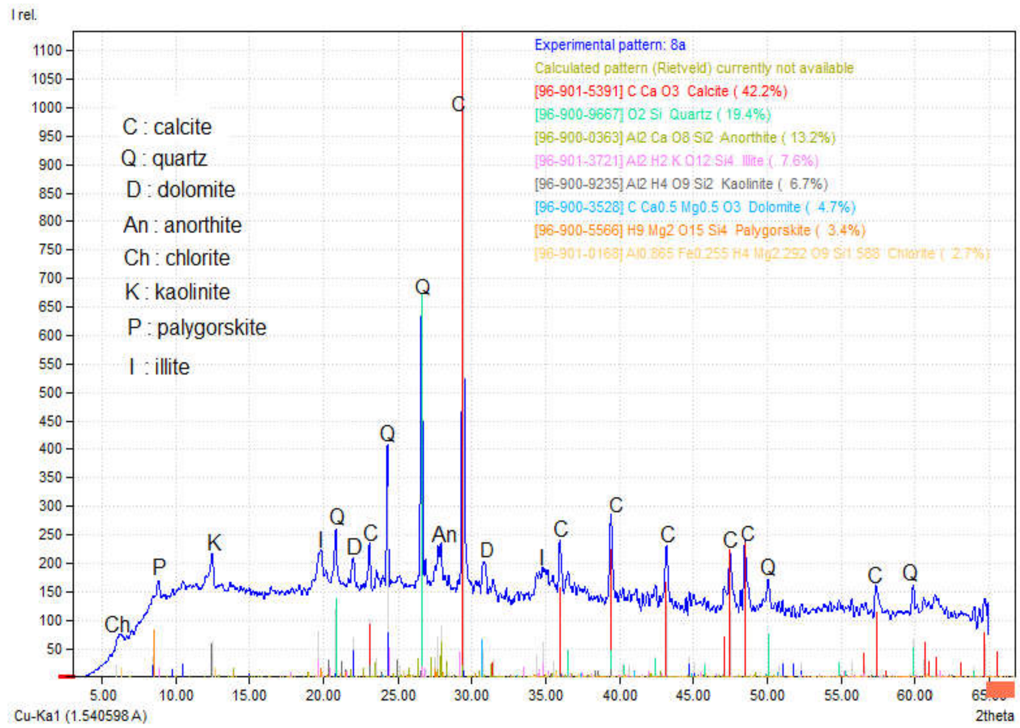

Figure 4: Typical shape of X-Ray Diffraction for the sediments in study area

Table 4: Non clay minerals percentage in the study area

Site/core name	Sample name	Anorthite % $CaAlSi_3O8$	Quartz % SiO_2	Calcite % $CaCO_3$	Dolomite% $CaMg(CO_3)_2$
Hilla 1 /S1	1a	17.1	68.4	14.5	----
	1b	5.4	66.6	28.0	----
	1c	26.0	45.7	28.3	----
	1d	16.3	47.8	25.0	----
	1e	18.7	56.3	25.0	----
average		19.6	56.8	24.1	
Diwaniya 2 /S4	4a	16.3	64.0	19.7	----
	4b	16.0	53.3	17.3	**13.4**
	4c	9.6	69.2	21.2	----
	4d	22.6	41.3	12.0	**24.0**
average		16.1	56.9	17.5	**9.5**
Simawa 1 /S5	5a	19.8	37.9	37.9	**7.8**
	5b	18.4	37.8	36.6	**4.9**
	5c	20.8	41.2	40.0	----
average		19.6	38.0	38.2	**4.2**
Nasiriya 2 /S8	8a	16.5	24.0	53.2	**6.3**
	8b	15.0	25.0	55.0	**5.0**
average		15.7	24.5	54.1	**5.7**
Basra/Qurna/ Furat /S9	9a	5.3	34.2	52.6	**7.9**
	9b	5.4	32.0	53.3	**9.3**
	9c	6.0	29.3	54.9	**9.8**
average		5.6	31.8	53.6	**9.0**
Basra/Qurna/ Tigris /S10	10a	----	32.9	65.8	**1.2**
	10b		33.8	66.2	----

	10c		35.1	64.9	**----**
	10d	----	36.6	62.0	**1.4**
average			34.6	64.7	**0.7**
Basra/Qurna/ Meeting /S11	11a	----	25.6	71.8	**2.6**
	11b		26.0	74.0	**----**
	11c	----	28.3	69.0	**2.7**
average			26.6	71.6	**1.8**
Basra/Deer / S12	12a	9.7	26.8	51.2	**12.3**
	12b	7.5	31.2	52.5	**8.8**
	12c	9.6	36.1	54.3	**-----**
	12d	6.0	35.7	52.3	**6.0**
	12e	6.1	34.6	49.4	**9.9**
	12f	8.4	33.7	48.3	**9.6**
average		7.9	33.0	51.3	**7.8**
Averagetotal		9.6	37.7	46.7	**5.1**

Table 5: Percentage of clay and non-clay minerals in the sediments of study area

Site/core name	**Sample name**	**Clay minerals%**	**Non-clay minerals%**
Hilla / S1	1a	24	**76**
	1b	25	**75**
	1c	18	**92**
	1d	18	**92**
	1e	20	**8o**
Average		21	**83**
Diwania / S4	4a	14	**86**
	4b	25	**75**
	4c	28	**72**
	4d	25	**75**
Average		23	**77**
Simawa / S5	5a	21	**79**
	5b	18	**82**
	5c	20	**80**
Average		19.6	**80.3**
Nasiriya / S8	8a	21	**79**
	8b	20	**80**
Average		20.5	**79.5**
Basra/Qurna/ Furat / S9	9a	24	**76**
	9b	25	**75**
	9c	18	**82**
Average		22.3	**77.6**
Basra/Qurna/ Tigris / S10	10a	18	**82**
	10b	23	**77**
	10c	26	**74**
	10d	29	**71**
Average		2.4	**76**
Basra/Qurna/ Meeting / S11	11a	22	**78**
	11b	27	**73**
	11c	26	**74**
Average		2.5	**75**
Basra/Deer / S12	12a	18	**82**
	12b	20	**80**
	12c	17	**83**
	12d	16	**84**

	12e	19	**81**
	12f	17	**83**
Average		17.8	**82.2**
Average total		21.6	**78.8**

B-Geochemical analysis

Table 6 displays the results of chemical analyses. Sediments are consisting mainly of Silica (SiO2), alumina (Al_2O_3), calcium (CaO), and ferric oxide (Fe_2O_3). The combined content of these four of major oxides is about 90%. The remaining of 10% is represented the minor constituent of magnesium (MgO), sodium (Na_2O), potassium (K_2O) and titanium (TiO_2). The concentration of silica ranges from 34.35% to 51.29% Silica concentration is belong to quartz in the sand fractions, this conclusion may back to the same distribution pattern between silica and quartz along river course from Hilla to Basrah. The concentration of CaO ranges from 14.83% to 24.89%.Most of CaO is attributed to limestone formation and carbonate molluscs of various species dominate the river macrofauna. The domination of calcite with lack of dolomite reflected in the content of the MgO which ranged from 3.89% to 4.8%. Alumina concentration ranges from 8.41% to 14.33%. Its originated from clay minerals. Al- Jaberi and Humaidan (2018) stated that Al+3 form a part of structure component of most minerals introduced fluvial and Aeolian source. Another advantage of alumina is high concentration in aluminosilicate of clay minerals (Brumsack, 2006). According for this reason, the percentage of clay minerals is steady increased in the south of study area, especially in Basrah city. Fe_2O_3 ranges between 5.01% to 5.92%. Chlorite and Iron minerals (magnetite, hematite, and goethite) are the source of iron oxides in the Euphrates and Shatt Al-Arab river sediments. TiO2 ranges between 0.7% to 1.18%.Redox elements (ferric) contents in the sediments of studied cores were high within the uppermost part of the profiles, but with increase the depth it have undergoing some degree of depletion (Tables 6), this result may be attributed to oxidation of Fe is very obviously in these sediments as a result of precipitation of iron oxyhydroxides in the surface sediments as mentioned by Kahn et al (1992). Accordingly, there are the same pattern distribution between iron and titanium. Aarabi et al (2011) presented that titanium may interfere with iron metabolism in terms of absorption, transportation, utilization and storage in the cells. MgO concentration ranges between 3.89% to 4.8%. Magnesium is increase downward of Euphrates course towards Shatt Al-Arab river in Basrah city, this may attributed to present of dolomite and palygoreskite. Na_2O concentration ranges from 0.72% to 1.73%. This result is show the highest content of sodium in Hilla compare with Basrah city. Most of sodium content is connect with halite, feldspar and some of clay minerals like palygoreskite and smectite. K_2O concentration ranges from1.05% to 1.47%. The highest percentage of potassium is presence in Basrah city compare with the other areas. Potassium is present in illite.

Table 6: Geochemical analyses results

Site/core name	Sample name	SiO_2 %	CaO %	Al_2O_3 %	Fe_2O_3 %	MgO %	Na_2O %	K_2O %	TiO_2 %
Hilla S1	**1a**	49.37	15.93	8.948	5.923	3.943	1.596	1.050	1.059
	1b	51.29	15.15	9.146	5.792	3.920	1.739	1.055	1.006
	1c	50.35	16.23	8.865	5.235	3.799	1.666	1.005	1.094
	1d	50.93	15.74	9.206	5.359	3.886	1.670	1.088	1.181
	1e	42.22	14.83	8.418	5.240	4.105	1.693	1.113	0.912
	Average	48.83	15.57	8.71	5.5	3.92	1.66	1.04	1.02
Diwaniya S4	**4a**	49.76	15.71	9.645	5.761	4.191	1.640	1.241	0.918
	4b	47.38	16.12	9.765	5.595	4.509	1.724	1.267	1.039
	4c	44.91	15.68	8.855	5.462	3.895	1.594	1.163	0.958
	4d	47.87	16.12	9.495	5.290	4.249	1.706	1.221	1.034
	Average	47.3	15.9	9.43	5.52	4.2	1.66	1.22	0.98
Simawa S5	**5a**	42.38	18.32	10.87	5.43	4.675	1.563	1.342	1.021
	5b	41.91	19.13	10.98	5.214	4.765	1.632	1.41	0.912

	5c	41.57	19.89	11.43	5.198	4.798	1.698	1.452	0.887
	Average	41.95	19.11	11	5.27	4.74	1.62	1.4	0.91
Nasiriya S8	**8a**	39.39	19.96	12.87	5.335	4.64	1.213	1.43	0.813
	8b	39.12	20.54	12.89	5.128	4.53	1.43	1.45	0.743
	Average	39.68	20.25	12.88	5.23	4.54	1.2	1.44	0.78
Basra/Deer S12	**12a**	35.35	21.99	13.36	5.678	4.452	0.739	1.351	0.752
	12b	38.68	24.23	13.14	5.584	4.853	0.726	1.471	0.816
	12c	37.98	21.06	12.06	5.379	4.690	0.808	1.404	0.810
	12d	36.94	24.03	11.79	5.128	4.739	0.675	1.468	0.763
	12e	34.35	23.95	14.16	5.028	4.447	0.732	1.361	0.700
	12f	35.21	24.89	14.33	5.013	4.567	0.795	1.389	0.725
	Average	36.41	23.34	13.14	5.29	4.62	0.74	1.42	0.75

C-Micro and Nano texture features Quartz is the most common detrital mineral of clastic sediments. In spite of quartz mineral is resistant to weathering and erosion of sedimentary processes, quartz grains illustrate a variety of surface textures denoting mechanical and chemical effects developed during transportation of these grains in subaqueous and aeolian environments (Roudgarmi and Farahani, 2016). Scanning electron microscope (SEM) in addition to energy dispersive spectrometry (EDS) tools were used together to determine specific set of micro and nano texture on the surfaces of quartz particles, which can be treated as indicative feature (Morgolis and Krinsley, 1971).

To examine under SEM-EDS, four core samples were selectedfor this purpose. Prominently, the most surface features observed in the studied samples can be described as follow:

1. **Conchoidal surface feature:** It has been referred to mechanical fracture influence during transportation, as displayed in figure 5 for core sample 1A in Hilla (S1) with scale of 10 micrometer.
2. **Roundness:** Particle roundness is defined as the degree of sharpness of the corners and edges of a grain (Boggs, 2006). It may be attributed to long sediments transport. This feature was found in all core samples with different degrees of roundness ranging from angular in core sample 1A in Hilla (S1) to rounded outline shapes in core sample 12A in Basrah (S12), as shown in figures 6 and 7 with scale of 10 micrometer. The rounded quartz grains were noticed in the downward of study area (Basrah city).
3. **Pitted:** This feature was observed in most samples of study area. Etch and solution pits are dominant features by precipitation of chemical processes (Sreenivasa et al., 2014), or may be by mechanical effects. Figure 8 demonstrates pits future in core samples 1A (S1) and 12C (S12), with scales 10 and 20 micrometer, respectively. In case of using high magnification of nanometer, the nano pitted feature can be appeared as in figure 9 which exhibits nano pitted texture in core sample 1A with magnification of 34.36 nm and core sample 12C with magnification of 59.25nm.
4. **Granular micro and Nano texture**: This characterized feature offers quartz as aggregates of irregular granules of different sizes and varies contact packing. Figure 10 explains this property in micro scale of 10 micrometer and nano magnification of 14.92 nanometer for core sample 12A (S12).

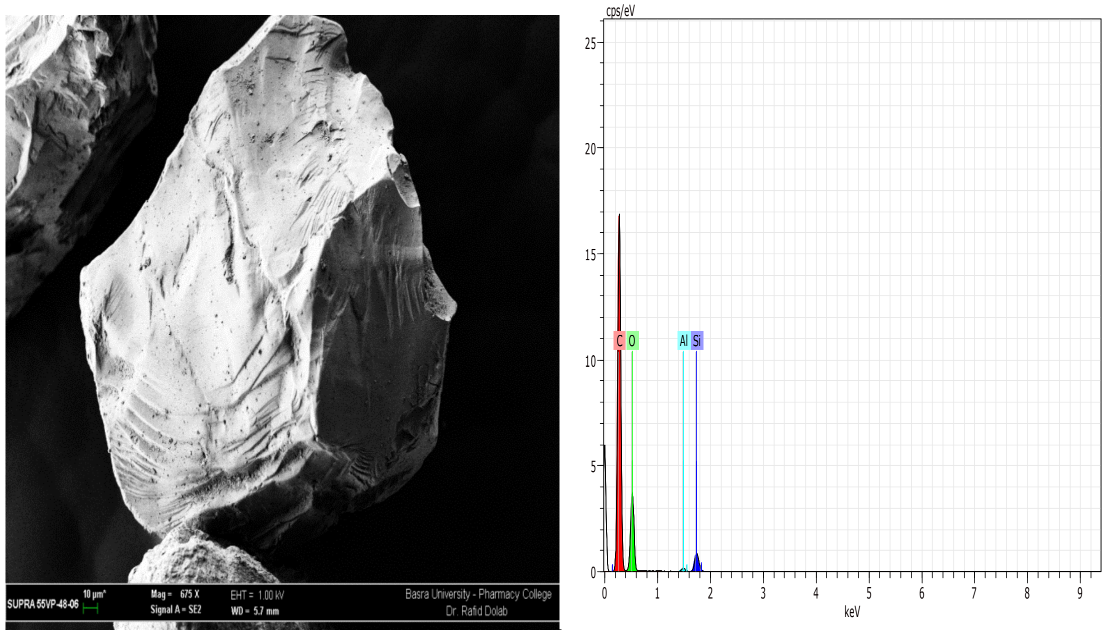

Figure 5: SEM-EDAX backscattered image show the conchoidal fracture in sample 1A. (scale 10 micrometer)

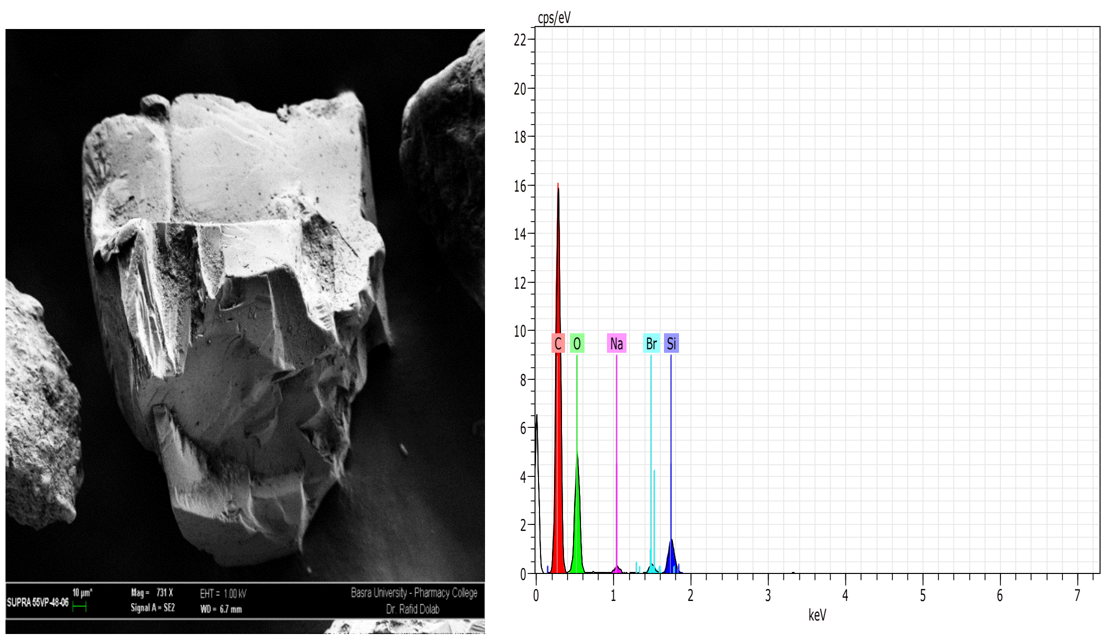

Figure 6: SEM-EDAX backscattered image explain angular shape in sample 1E (Hilla 1/S1) (scale 10 micrometer).

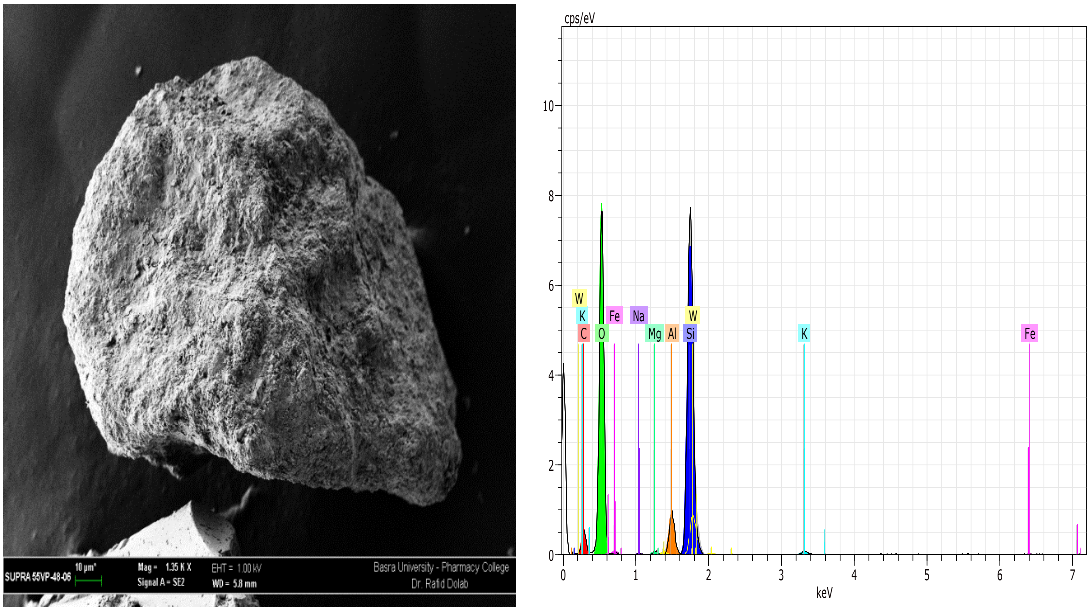

Figure 7: SEM-EDAX backscattered image explain rounded shape in core sample 12A (Basrah/Deer/S12) (scale 10 micrometer).

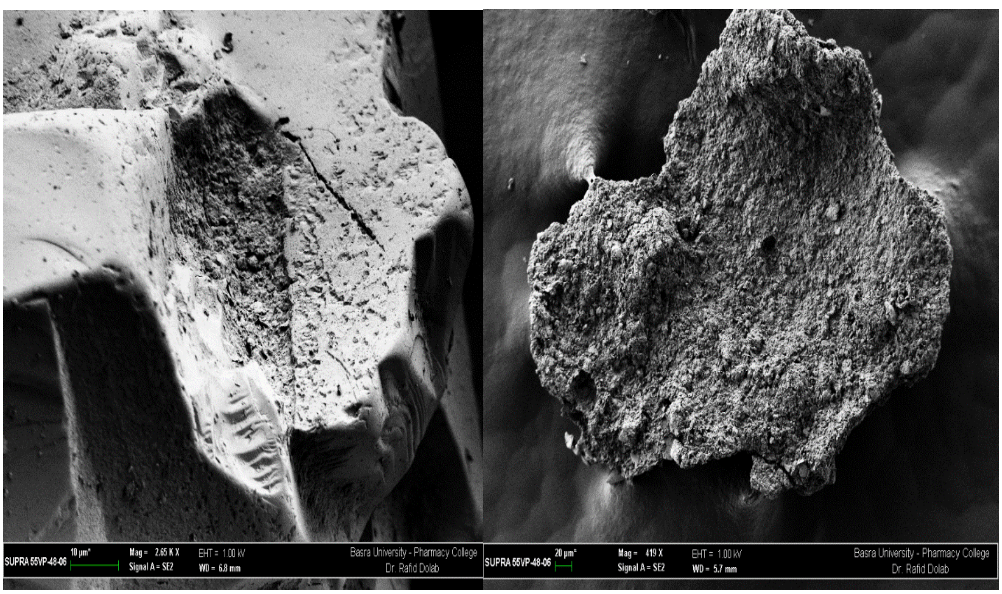

Figure 8: SEM-EDAX backscattered image explains pitted feature in core sample 1E (Hilla 1/S1) as in left image and 12C (Basrah/Deer/S12), (scales 10 and 20 micrometer).

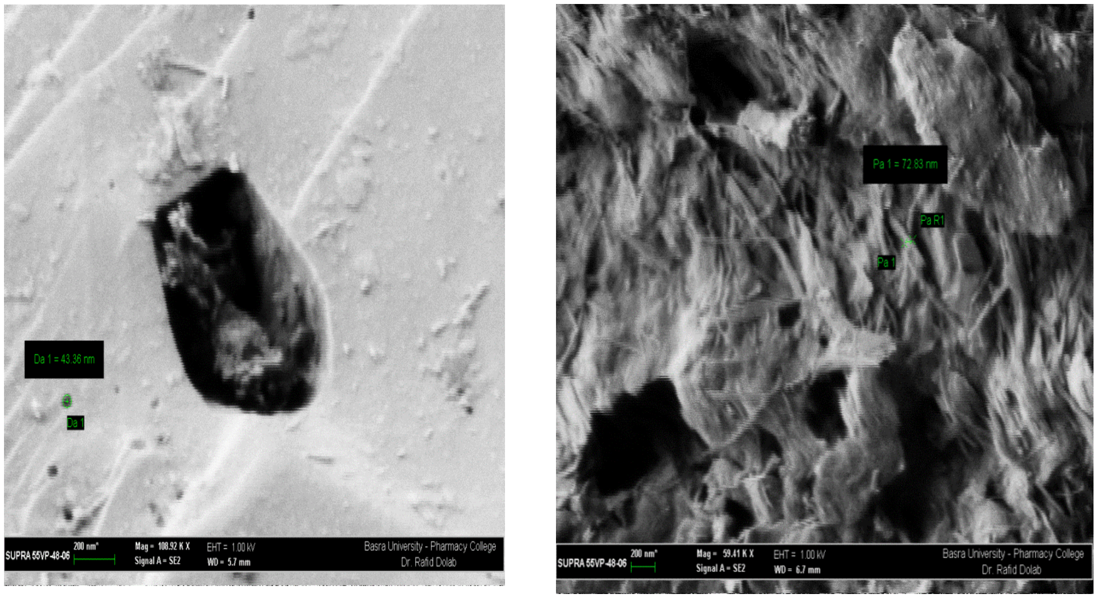

Figure 9: SEM-EDAX backscattered image explains nano pitted feature in core sample 1A(Hilla 1/S1) with magnification of 43.36nm (left image) and 1E in the same site with magnification of 72.85nm (scale 200nm).

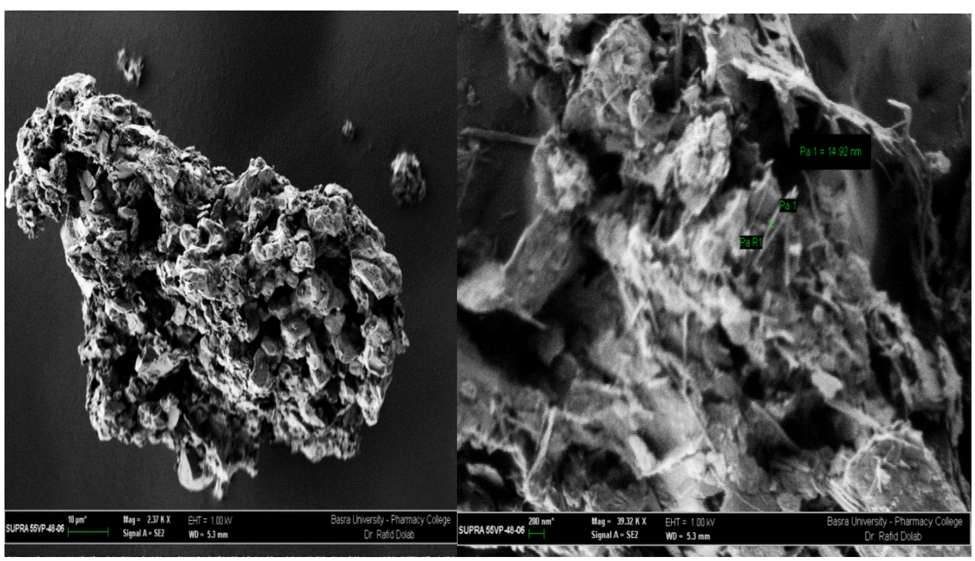

Figure 10: SEM-EDAX backscattered image explains granular feature in core sample 12A (Basrah/Deer/S12) as in left image (scale 10 micrometer) and right image (magnified to 14.92 nm).

5. CONCLUSION

1. Carbonate minerals, quartz, and anorthite feldspar are the light minerals in the deferent depth intervals of study area, with share of clay fraction consists of Kaolinite, palygoreskite and chlorite.
2. Carbonate minerals which are calcite and dolomite are the main of non-clay minerals.
3. Carbonates are more abundance than quartz.
4. The highest amount of calcite is recorded in Basra /Qurna city; while in Diwaniya and Hilla cities is a lowest.

5. The highest value of dolomite is pointed in Diwaniya (S4) and Qurna (S9), whereas the lowest in Simawa and Nasiria cities (S5 and S8).
6. The highest value of quartz appeared in Hilla (S1) and the lowest value in Nasiria (S8).
7. Most of CaO is attributed to limestone formation and carbonate molluscs of various species dominate the river macrofauna.
8. The domination of calcite with lack of dolomite reflected in the content of the MgO.
9. 9-Redox elements (ferric) contents in the sediments of studied cores were high within the uppermost part of the profiles.
10. 10-There are several of mechanical and chemical features are detected; conchoidal, rounded, pits, and granular micro.

REFERENCES

[1]. Hassan, K.M., & Al-Bassam, K.S. (2006). Distribution and ecology of recent mollusks in the Euphrates River–Iraq. Iraqi Bulletin of Geology and Mining, 2(1), 57-66.

[2]. Al-Hashimi, H.A.J., &Amer, R.M. (1985). Tertiary microfacies of Iraq. DG geol. Surv. Min. Invest. Puli., Baghdad, 56pp, 17figs., 159pls.(SOM).

[3]. Jawad Ali, A. (1977). Heavy minerals provinces of the recent sediments of Euphrates-tigris basin. Journal of the Geological Society of Iraq, 10, 33-48.

[4]. Al-Jaberi, M H., & Al-Humaidan, Z.A. (2018). Geochemistry of trace elements in Iraqi marine environment. Bulletin of Pure & Applied Sciences-Geology, 37(2), 172-185.

[5]. Al-Marsoumi, A.M.H., & Al-Jabbri, M.H.A. (2007). Basrah Soils; Geochemical Aspects and Physical Properties-A Review. basrah journal of science, 25 (1C english), 89-103.

[6]. Al-Mukhtar, L.E. (2015). Heavy Mineral Analysis of the Quaternary Sediments in the Southern Part of the Mesopotamia Plain, Iraq. Iraqi Bulletin of Geology and Mining, 11(2), 59-73..

[7]. Al-Rawi, Y., & Sadik, J.M. (1981). Sedimentology of the Dibdibba Clastic Formation, Iraq. J GeolSoc Iraq, 14(1), 55-69.

[8]. Aswad, K.J., Aziz, N.R., &Koyi, H.A. (2011). Cr-spinel compositions in serpentinites and their implications for the petrotectonic history of the Zagros Suture Zone, Kurdistan Region, Iraq. Geological magazine, 148(5-6), 802-818.

[9]. Banat, K.M., & Al-Rawi, Y.T. (1986). Hydrochemestry, clay minerals and carbonates of the Euphrates River. Iraqi J. Sci, 27, 347-362.

[10]. Brumsack, H.J. (2006). The trace metal content of recent organic carbon-rich sediments: implications for Cretaceous black shale formation. Palaeogeography, Palaeoclimatology, Palaeoecology, 232(2-4), 344-361.

[11]. Jassim, S.Z., & Goff, J.C. (2006). Geology of Iraq (p. 341). Brno: Dolin, Prague and Moravian Museum.

[12]. Kahn, A.H., Nolting, R.F., Van der Gaast, S.J., & Van Raaphorst, W. (1992). Trace element geochemistry at the sediment-water interface in the North Sea and the Western Wadden Sea. NIOZ-RAPPORT, 10.

[13]. Kalender, L., &Aytimur, G. (2016). REE Geochemistry of Euphrates River, Turkey. Journal of Chemistry, 2016.

[14]. Aarabi, M.H., Mirhashemi, S.M., Ani, M., &Moshtaghie, A.A. (2011). Comparative binding studies of titanium and iron to human serum transferrin. Asian J Biochem, 6, 191-199.

[15]. Margolis, S.V., &Krinsley, D.H. (1971). Submicroscopic frosting on eolian and subaqueous quartz sand grains. Geological Society of America Bulletin, 82(12), 3395-3406.

[16]. Philip, G. (1968). Mineralogy of the recent sediments of Tigris and Euphrates rivers and some of the older detrital deposits. Journal of Sedimentary Research, 38(1), 35-44.

[17]. Roudgarmi, P., &Farahani, E. (2016). Characterization of Sand Dunes to Detect the Sand Source and their Stabilization, Abardej, Iran. International Journal of Geography and Geology, 5(1), 1-9.

[18]. Sissakian, V.K., & Fouad, S.F. (2012). Geological Map of Iraq, scale 1: 1000 000, 4th edit. GEOSURV, Baghdad, Iraq.