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Effect of Sedimentlogical Characteristics on the Distribution of some Geochemical parameters in Ismailia Canal, Egypt.

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ABSTRACT

Grain size distribution, organic matter content, organic carbon, carbonate, and absolute water content of the bottom sediment of Ismailia Canal were examined in order to investigate the role of sedimentlogical characters in controlling the distribution of geochemical parameters of freshwater ecosystem sediments. Strong positive correlations were found between fine sediment fractions and both of organic matter and absolute water content. Sand fractions showed significant negative correlations with NH_3 especially coarse, medium, and fine sand fractions. PO_4, NO_2, and SiO_2 showed negative correlations with each of medium, fine, very fine silt and clay fractions. The findings of this study could help in drawing general view of the distribution of studied parameters in similar environments.

Key words: Bottom sediment, Ismailia Canal, organic matter, absolute water content

Introduction

Freshwater low order channel's sediments are mixture of different sources collected during transportation processes, and are driven as result of erosion processes of upstream hill-slopes and channels. Evidence of processes occurring in the entire catchment may indicated by assessment of the geochemical and physical characteristics of freshwater sediment (Bowie & Mutchler, 1986).

Freshwater sediments geochemical characteristics surveys increasingly used for environmental investigations including assessment of environmental impacts (Darnley *et al.,* 1995), human and animal health studies (Fordyce *et al.,* 1996), and providing geochemical baseline for any future perturbations may be appraised (Williams *et al.,* 2000).

Within aquatic ecosystems, bottom sediments have an important function as an efficient natural trap for diverse substances (including contaminants) and also as a natural regulator of the processes that occur inside the ecosystem. They can store large amounts of organic matter and affect the oxygen content of bottom water. Bottom sediments also constitute a source of nutrients for the water column above them leading to benthic-pelagic coupling and influencing primary productivity (Jørgensen, 1996). Sediments play a fundamental role in determining concentration, distribution, and final fate of several pollutants acting as a principal transport vehicle and the site of accumulation or release (Fytianos and Kotzakioti, 2005).

Organic matter, whether living or detrital, is generally composed of light-weight materials (El-Askary *et al*., 1988). Organic matter affects the aquatic ecosystem by interacting with inorganic matter to form complex compounds, which include several other elements. It also serves as source of food for several animal groups. Free carbon dioxide and hydrogen sulfide may be released and affect the composition of the sediments even more (Beltagy and Moussa, 1984). Phosphors are commonly the limiting macronutrient for the growth of primary producers in aquatic ecosystem (Lake *et al.,* 2007). Both nitrogen and phosphorus are highly particle reactive and when discharged into a water way, are deposited in bottom sediments incorporated into organic matter (Morse and Beazley, 2008).

The main objective of this study is to evaluate the sedimntlogical characteristics as factors control distributions of geochemical parameters of Ismailia Canal bottom sediments as example of freshwater environment which could help in prognosticate the distribution of studied parameters in sediments of similar ecosystems.

Materials and Methods

Area of study

Ismailia Canal is constructed in the years 1858 ~ 1863 to supply irrigation and drinking water to the villages on the Suez Canal Provence and to workers during digging the Suez Canal Navigation Route. The

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Ismailia Canal extending eastwards for about 125 km from the River Nile at Shoubra, north of Cairo (Figure, 1), and runs directly to the east to the town of Ismailia passing the governorates of Cairo, Kalioubeya and Sharkeya. At Ismailia, it bifurcates into two arms: one to the north to supply Port-Said governorates and the second to the south to Suez governorate. A short part without flow directly connects this canal with the Suez Canal. The canal is 128 km long; its depth about 1 – 3 m and its width about 30 – 70 m. In addition to the southern arm (Suez branch) is ≈ 80 km and Port-Said branch is ≈ 90 km (Geriesh *et al.,* 2008).

Sampling

The sampling program of sediment was commenced during spring of 2011. 16 stations were selected to represent the most distal downstream, water characteristics and habitats. Eight stations (1 – 8) were selected along the area extended from the mouth of the canal at Shoubra region to Ismailia Town, four stations (9 – 12) were collected from the Suez branch and four stations (13 – 16) were collected from Port-Said branch (Figure, 1). Stations 13 and 15 not collected due to the stony structure of the canal bed. Sediments were collected by Ekman dredge sampler, and preserved in plastic bags for analysis.

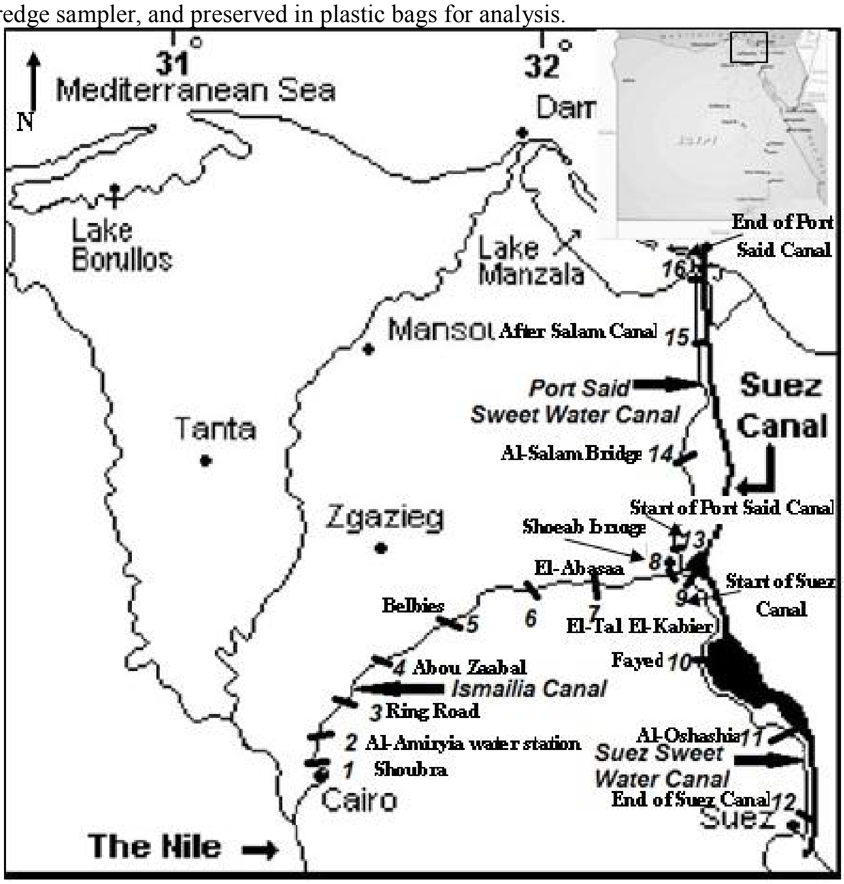

Fig. 1. A map showing sampling sites of Ismailia Canal and its branches. (General location of the canal in Egypt is showed in the top right corner).

Analysis

Sediment samples were prepared by using decantation method (Folk, 1980), grain size analysis was done by dry sieving technique (Folk, 1980). Samples containing more than 5% fine fraction (finer than 4Ø) were analyzed using the pipette method described by Krumbein & Pettijohn (1938), Griffiths (1967) and Carver (1971). Sediment textural classes were deduced according to Folk (1980). The sedimentological parameters were derived according to Folk and ward (1957).

Determination of organic matter in sediment was carried out according to Nelson and Sommers, (1996) by titrimetric method. Determination of absolute water content of sediment was carried out according to Kralik, (1999). Carbonate content in the sediments was determined by the method described by Alexjev (1971) and Vogel (1982). NO_2, NH_3, PO_4, and SiO_2 data that were used in this article are published data by Abdo *et al.,*

(2012). Correlation analysis was carried out using SPSS© program version 20.

Results and Discussion

Grain-size Analysis

Grain-size distribution

Principal fractions composing sediments were represented in (Table 1). There was no clear trend for horizontal distribution of Ismailia Canal and its branches sediments. Sand fraction was the dominant fraction with variable ratios of gravel and mud fractions, except at Belbies and El-Tal El-Kebeer sediments composed from mud fraction, and at Shoieb Bridge and El-Oshashia gravel fraction was the dominant fraction.

Fine and very fine sand were widely distributed at mouth of Ismailia Canal, while medium sand was dominant at El-Abasa. Clay fraction was highly accumulated at Belbas and El-Tal El-Kebier stations, while silt fraction specially medium and fine silt were wide distributed at Ring road, Abu Z'abaal city, Belbies city, El-Tal Al-Kepeir city, and Shoeib Bridge stations.

Sediment textural classes of Ismailia Canal were gravelly muddy sand and muddy gravelly sand at canal mouth, sandy mud, gravelly mud, and mud at middle and end of the canal respectively, while Suez freshwater canal were gravelly sand, muddy gravelly sand and muddy sandy gravel at mouth, middle and near end of Suez branch, respectively, while sediments of Port said branch were gravelly sand and muddy gravelly sand at middle and end of Port Said freshwater canal, respectively.

Table 1. Sediment fractions percent and sediment textural classes of Ismailia Canal and its branches bottom sediment.

Fraction name	Gravel	V.C. Sand	C. Sand	M. Sand	F. Sand	V.F. Sand	C. Silt	M. Silt	F. Silt	V.F. Silt	Clay	Gravel%	Sand%	Mud%	Sediment type
Ismailia Canal															
1	1.17	0.00	0.00	22.31	50.14	24.08	****	****	****	****	****	1.17	96.53	2.30	Gravelly muddy sand
2	27.97	2.30	2.24	6.28	39.35	19.47	****	****	****	****	****	27.97	69.65	2.38	Muddy gravelly sand
3	7.40	3.20	0.00	0.00	22.88	31.56	9.58	8.82	6.64	4.22	5.72	7.40	57.64	34.97	Gravelly muddy sand
4	0.00	0.00	0.00	10.31	55.10	25.50	5.27	2.16	0.12	0.51	1.04	0.00	90.91	9.09	Sandy mud
5	0.00	0.00	0.00	0.00	0.00	0.00	12.42	29.43	26.82	13.32	18.00	0.00	0.00	100.00	Mud
6	5.04	2.23	24.59	53.61	13.22	0.84	****	****	****	****	****	5.04	94.49	0.47	Gravelly sand
7	0.00	0.00	0.00	0.00	0.00	0.00	15.88	25.98	23.37	16.78	18.00	0.00	0.00	100.00	Mud
8	63.08	0.00	0.00	0.00	0.00	0.00	17.68	10.37	4.97	3.12	0.79	63.08	0.00	36.92	Gravelly mud
Suez freshwater canal															
9	4.02	5.38	14.28	40.08	28.10	7.77	****	****	****	****	****	4.02	95.61	0.37	Gravelly sand
10	4.77	7.49	17.69	33.02	31.88	4.02	****	****	****	****	****	4.77	94.10	1.13	Muddy gravelly sand
11	49.95	11.18	9.26	11.63	2.92	10.86	****	****	****	****	****	49.95	45.86	4.20	Muddy sandy gravel
12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Port Said freshwater canal															
13	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
14	5.50	0.78	24.84	36.32	28.54	3.39	****	****	****	****	****	5.50	93.87	0.62	Gravelly sand
15	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
16	6.26	4.81	13.13	22.32	34.33	15.18	****	****	****	****	****	6.26	89.78	3.96	Muddy gravelly sand

*****: sample with mud fraction less than 5%   -----: Not collected sample   VC: very coarse, C: coarse, M: medium, F: fine, VF: very fine*

Grain-size parameters

The grain size parameters of Ismailia Canal and its branches sediments were calculated from cumulative curves and given in (Table 2). Mean size was coarse sand to fine silt, coarse sand to medium sand, and medium sand in Ismailia Canal, Suez and Port Said freshwater canals sediments, respectively. Sorting ranged between moderately sorted to very poorly sorted in Ismailia Canal, and poorly sorted in both of Suez and Port Said freshwater canals sediments. The skewness was strongly coarse-skewed to strongly fine-skewed, coarse-skewed to strongly fine-skewed, and strongly coarse-skewed to near symmetrical in Ismailia Canal, Suez, and Port Said freshwater canals sediments, respectively. Kurtosis varied between very platy-kurtic to very lepto-kurtic, platy-kurtic to lepto-kurtic, lepto-kurtic to very lepto-kurtic in Ismailia Canal, Suez, and Port Said freshwater canals sediments, respectively. The results were agreed with these which obtained by Farhat (2010) on Nile branches, Lotfy, (2002) on Rosetta branch, and lofty (1997) on Damietta Branch.

Table.2. Sedimentlogical parameters of Ismailia Canal and its branches bottom sediment according to Folk & Ward, 1957.

Station	Mean size (Mz)		Sorting (σ_I)		Skewness (SK_I)		Kurtosis (K_G)	
	Value(Ø)	Type	Value(Ø)	Type	Value	Type	Value	Type
Ismailia Canal								
1	2.53	Fine sand	0.72	Moderately sorted	0.10	Fine-skewed	0.94	Meso-kurtic
2	1.40	Medium sand	1.81	Poorly sorted	-0.49	Strongly coarse-skewed	0.54	Very platy-kurtic
3	4.07	Coarse silt	2.42	Very poorly sorted	0.21	Fine-skewed	1.57	Very lepto-kurtic
4	3.03	Very fine sand	0.79	Moderately sorted	-0.27	Coarse-skewed	2.97	Very lepto-kurtic
5	6.57	Fine silt	1.24	Poorly sorted	0.12	Fine-skewed	0.73	Platy-kurtic
6	1.23	Medium sand	0.88	Moderately sorted	-0.23	Strongly coarse-skewed	1.30	Lepto-kurtic
7	6.47	Fine silt	1.31	Poorly sorted	0.15	Fine-skewed	0.65	Very platy-kurtic
8	0.97	Coarse sand	2.88	Very poorly sorted	0.93	Strongly fine-skewed	0.57	Very platy-kurtic
Suez freshwater canal								
9	1.70	Medium sand	1.06	Poorly sorted	-0.13	Coarse-skewed	1.37	Lepto-kurtic
10	1.43	Medium sand	1.17	Poorly sorted	-0.25	Coarse-skewed	1.00	Platy-kurtic
11	0.07	coarse sand	1.75	Poorly sorted	0.85	Strongly fine-skewed	0.84	Platy-kurtic
12	------	------	------	------	------	------	------	------
Port Said freshwater canal								
13	------	------	------	------	------	------	------	------
14	1.47	Medium sand	1.23	Poorly sorted	-0.05	Near symmetrical	1.71	Very lepto-kurtic
15	------	------	------	------	------	------	------	------
16	1.87	Medium sand	1.42	Poorly sorted	-0.28	Strongly coarse-skewed	1.18	Lepto-kurtic

-----: Not collected sample

Bottom sediments physical and geochemical characteristics

Absolute water content percent

Absolute water content of Ismailia Canal sediment ranged between 17.96% and 68.48%, while Suez freshwater canal sediments varied between 31.21% and 42.30%, and Port Said freshwater canal sediments between 14.44% and 25.20%. (Table 3).

Water content is considered to be the prim regulator of physical and chemical processes as well as biological activities in the sediment (Baruah and Barthakur, 1997). From Tables 4 and 5, Present study indicates that there is direct relation between absolute water content and fine fraction (i.e. absolute water content increases with increasing of fine fractions). Positive correlations were found between absolute water content and mean size (r = 0.53), mud (r = 0.51) and its fractions medium, fine, very fine silt and clay (r = 0.838, 0.860, 0.883*, and 0.892* respectively), there are significant correlation between water content and both of clay and very fine silt fractions. The present study was agreed with these given by Flemming and Delafontaine (2000) which indicated that there were high correlations between water content and some of sediment fractions.

Organic Carbone (%) and Organic Matter (%)

As shown in Table 3, the organic carbone of Ismailia Canal varied between 0.31% and 5.85%, while varied between 0.94% and 1.68% in Suez freshwater canal, and between 0.31% and 0.94% in Port Said freshwater canal bottom sediments. Organic matter content varied between 0.54% and 10.09%, 1.61% and 2.89%, and 0.54% and 1.61% in bottom sediments of Ismailia Canal, Suez freshwater canal, and Port Said freshwater canal, respectively.

The supply of biomass originating in the euphotic zones and degradation processes which occur in the photic zones are most important factors that have influence on preservation of organic matter in the sediments (Murria and Kuivila, 1990; Lallier-Vergès *et al.,* 1991; Lallier-Vergès *et al.,* 1993; Bertrand *et al.,* 1993; Tribovillard *et al.,* 1994; Ransom *et al.,* 1998; Ganeshram *et al.,* 1999; Duan, 2000). Organic matter flux in the water column, the oxygenation of bottom waters, the water-depth, the distance from the coast, and the sedimentation rate are a series of factors control organic matter content in sediments. Even though it is assumed that these factors may be in synergism with each other, there is no indication as to which factors control this mechanism (Hedges and Keil, 1995;

Thamdrup and Canfield, 1996; Boussafir and Lallier-Vergès, 1997; Lallier-Vergès *et al.,* 1998; Cowie *et al.,* 1999; Vetö *et al.,* 2000). Reimers (1989), Pedersen and Calvert (1990) and Calvert *et al.,* (1992) and Calvert *et al.,* (1996) stated that productivity has a major influence, while Didyk *et al.* (1978), Hollander *et al.* (1992), Ingall and Jahnke (1994), Jones and Manning (1994) and Schulte *et al.* (2000) suggest that the principal factor regulating the preservation of organic matter in sediments is the availability of oxygen.

Table 3. Absolute water content, organic carbon, organic matter and carbonate percent of Ismailia Canal and its branches bottom sediment.

	Abs. Water content %	Organic carbon %	Organic matter %	Carbonate %
Ismailia Canal				
1	47.80	1.09	1.88	14.38
2	68.48	1.48	2.55	20.83
3	49.64	7.50	12.93	11.90
4	23.85	0.16	0.27	19.34
5	54.51	9.00	15.52	13.39
6	17.96	0.31	0.54	14.88
7	59.53	11.50	19.83	12.89
8	58.49	5.85	10.09	26.28
Suez freshwater canal				
9	42.30	0.94	1.61	9.92
10	31.21	1.09	1.88	12.89
11	31.71	1.68	2.89	11.90
12	------	-----	-----	------
Port Said freshwater canal				
13	------	-----	-----	------
14	14.44	0.31	0.54	14.88
15	------	-----	-----	------
16	25.20	0.94	1.61	14.38

-----: Not collected sample

In the case where a sediment layer formed from continuous sedimentation, organic matter attached to the suspended particles settles to the bottom, partly mineralises and partly contributes to the mean organic matter content in the bottom sediments. Due to mineralization, the organic matter content of bottom sediments is expected to decrease with time, and ammonium concentrations to increase steadily with depth in the sediments, which act as a source of ammonia to the overlying water column (Chen *et al.,* 2007).

The variations in organic matter composition during transport from areas of high productivity to depositional basins are determined by competing processes, such as *in situ* primary production, secondary production, alteration and decomposition during sinking and horizontal transport (Henrichs 1992). Such transformations are of major importance for establishing the contribution of organic matter in the global carbon cycle, as well as for the qualitative evaluation of the fate of organic matter (Bouloubassi *et al.* 1997). Sedimentary and near-bottom organic matter is a mixture of constituents derived from a number of sources and covering a wide spectrum of reactivity (Canuel & Martens 1996).

The values of organic matter, in present study, were similar to corresponding values obtained by Abu El-Enain *et al.*, (1997) for the sediments of River Nile (0.33-11.30%); Lotfy, (2001) for the sediments of Manzalah Lake (1-10.5%) and Chen *et al.,* (2007) for sediments of estuaries (9.33-13.08%), while the values of organic matter in sediments of Nile branches (0.41-43.23%) and Lake Qarun (15.39-17.46%), (Farhat, 2010; and Lotfy *et al.,* 2006 respectively) were higher than that obtained in Ismailia Canal during this study.

The present study agrees with the opinions state that high rate of fine fraction found in the bottom sediment is related to the organic matter concentration (Berthois *et al.,* 1968). Sedimentation of organic matter follows same laws, as those of fine particles, both accumulate in calm zones. There is a close connection between the presence of fine sediments and their content of organic matter (Szarek-Gwiazda and Sadowska, 2010; Postma, 1981). In this study, organic matter content increases with increasing of fine fractions (Tables 4, 5 and 6); there are significant positive correlation between organic matter content and both of mud fraction ($r = 0.945^{**}$) and mean size ($r = 0.802^{**}$), while significant negative correlation with sand (r = -0.872**) and its fractions (coarse sand, medium sand, and fine sand; r = -0.582*, -0.699**, and -0.658* ,respectively). Positive correlations were found between organic matter content and mud (r = 0.945**) and its fractions coarse, medium, fine, very fine silt and clay (r = 0.672, 0.843, 0.828, 0.873, and 0.813, respectively).

Carbonate (%)

The carbonate content of sediments is an essential parameter that is widely used in sediment investigation, archaeology, clastic sedimentology, and glacial geology for characterization of sediments. The main contributors of the carbonate fraction are biogenic shells and shell fragment. (Lykousis *et al.* 1981).

Carbonate content of Ismailia Canal varied between 12.89% and 26.28%, while ranged between 9.92% and 12.89%, and 14.38% and 14.88% in sediments of Suez freshwater Canal, and Port Said freshwater canal, respectively. (Table 3).

Krauskopf and Bird (1995) proved that many organisms use calcium carbonate in the construction of their shells, but they flourish in greatest numbers in water approximately saturated with calcium where only a minor change in pH values is needed to cause precipitation of carbonate. This is in agreement with those obtained in present study; there is significant positive correlation between carbonate percent and gravel fraction (gravel fraction represented by shells and shell fragments) (r = 0.567*).

Statistical analysis

Person's coefficients between sediment fractions, sedinmentlogical characteristics, and geochemical parameters of Ismailia Canal bottom sediments are shown in Tables 4, 5 & 6. A significant correlation was observed between absolute water content and each of clay, very fine silt and medium sand fractions. A significant correlation was observed between organic matter (by the way organic carbon) and each of Sand, all of sand fractions, mud fraction, and mean size. Carbonate, silicate and ammonia are significantly correlated with gravel, very coarse sand and coarse sand, respectively.

The coefficients between absolute water content and each of mud and most of its fractions show a positive correlation, while negatively correlated with kurtosis, coarse and medium sand fractions. Organic matter content (and organic carbon) positively correlated with mean size and mud and its fraction (silt and clay), while negatively correlated with sand, coarse sand, medium sand, and fine sand fractions. Medium silt, fine silt, very fine silt and clay fractions are positively correlated with both of PO_4 and SiO_2, while negatively correlated with NO_2.

Present study indicated that there are direct relation between sedimentlogical characteristics, especially sediment fractions, and each of (SiO_2, NH_3, NO_2 and PO_4), this is in agreement with opinions stat that: sediments play a fundamental role in determining concentration, distribution, and final fate of several pollutants acting as a principal transport vehicle and the site of accumulation or release (Fytianos and Kotzakioti, 2005). Phosphorus is commonly the limiting macronutrient for the growth of primary producers in aquatic ecosystem (Lake *et al.,* 2007). Both nitrogen and phosphorus are highly particle reactive and when discharged into a water way, are deposited in bottom sediments incorporated into organic matter (Morse and Beazley, 2008). Excess nutrient supplies from atmospheric deposition, agricultural fertilizer runoff, and other anthropogenic sources, can have adverse effects on aquatic ecosystems (Morse *et al.* 2004). And also control the nitrogen and phosphorus distribution and concentrations in overlying waters and sediments. Silicate is significant correlated with very coarse sand (r = 0.698*), while ammonia is significant correlated with coarse sand (r = 0.634*). Medium silt, fine silt, very fine silt and clay fractions are positively correlated with both of PO_4 and SiO_2, while negatively correlated with NO_2.

Table 4. Correlation matrix (Pearson's method) calculated for geochemical parameters, gravel and sand fractions of Ismailia Canal bottom sediments. (NO2, NH3, PO4, and SiO2 are cited from Abdo *et al.,* 2012).

	Gravel	Sand	VC Sand	C Sand	M Sand	F Sand	VF Sand
WC	-.032	-.454	-.183	-.682*	-.598*	-.110	.194
OC	.006	-.872**	-.343	-.582*	-.699**	-.658*	-.230
OM	.006	-.872**	-.343	-.582*	-.699**	-.659*	-.230
Carbonate	.567*	-.248	-.461	-.314	-.332	.053	-.019
NH3	-.031	-.203	-.372	-.634*	-.343	.113	.312
NO2	-.173	.283	-.232	-.241	.077	.453	.391
PO4	-.154	.126	-.145	-.307	-.111	.355	.335
SiO2	.266	-.169	.698**	.289	.066	-.435	-.438

**. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).VC: very coarse, C: coarse, M: medium, F: fine, VF: very fine*

Table 5. Correlation matrix (Pearson's method) calculated for geochemical parameters, Mud, clay and silt fractions of Ismailia Canal bottom sediments. (NO_2, NH_3, PO_4, and SiO_2 are cited from Abdo *et al.,* 2012).

	Mud	C Silt	M Silt	F Silt	VF Silt	Clay
WC	.512	.391	.838	.860	.883*	.892*
OC	.945**	.672	.843	.828	.873	.813
OM	.945**	.672	.843	.828	.873	.813
Carbonate	-.050	.266	-.485	-.572	-.581	-.700
NH3	.238	.796	.693	.642	.630	.560
NO2	-.210	-.430	-.838	-.820	-.783	-.760
PO4	-.051	.279	.549	.584	.774	.694
SiO2	.034	.480	.637	.632	.790	.666

***. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).VC: very coarse, C: coarse, M: medium, F: fine, VF: very fine*

Table 6. Correlation matrix (Pearson's method) calculated for geochemical parameters, mean size, sorting, skewness and kurtosis of Ismailia Canal bottom sediments. (NO_2, NH_3, PO_4, and SiO_2 are cited from Abdo *et al.,* 2012).

	Mean size	Sorting	Skewness	Kurtosis
WC	.531	.194	-.037	-.521
OC	.802**	.404	.392	-.402
OM	.802**	.404	.392	-.402
Carbonate	-.247	.450	.170	-.048
NH3	.308	-.025	.262	-.315
NO2	-.032	-.323	.012	-.102
PO4	.092	-.264	-.138	-.358
SiO2	-.184	-.041	.360	-.203

***. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

Conclusion

From the results of this study, it may conclude that there is direct relation between absolute water content and fine fractions (i.e. absolute water content increases with increasing of fine fractions). This study also suggests that a close connection is existed between the presence of fine sediments and their higher content of organic matter (Organic matter content increases with increasing of fine fractions). Moreover, there is significant direct relation between carbonate content and gravel fraction (gravel fraction represented by shells and shell fragments). Also, direct relation between silicate and very coarse sand is found. Furthermore, results show direct relation between ammonia and coarse sand, and direct relations between medium silt, fine silt, very fine silt and clay fractions and both of PO_4 and SiO_2, and indirect relation with NO_2.

Further studies are recommended to investigate other relations between the sediment and other parameters, especially heavy metals and some other salts to form a complete view of the effects of sediment characteristics on the aquatic ecosystems.

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References

Abdo, M. H., M.E. Goher and M.F. Sayed, 2012. Environmental evaluation of Ismailia Canal water and sediment, Egypt. J.Egy.Acad.Soc.Environ.Develop. 13(2): 61-78.

Abu El-Enin, F.M., I.M. Lotfy, A.S. El-Sorogy, and A.M. Wahied El-Din, 1997. Sedimentlogical, mineralogical and geochemical studies on the recent sediments of River Nile, near Greater Cairo , Egypt. Egypt. J. Appl. Sci., 12 (C): 1028-1051.

Alexejev, V. 1971. Quantitative analysis. Mir. Publ., Moscow: 563p.

Baruah, T.C. and H.P. Barthakur, 1997. A Text Book of Soil analysis. VIKAS Publishing House PVT LTD. Delhi, India.

Beltagy, A.I. and K.H.A. Moussa, 1984. The distribution of organic matter in the sediments of the Gulf of Suze. Ins. Oceanogr. & Fish., ARE 10: 99-109.

Berthois, L., A. Crosnier and Y. Le Calvez, 1968. Contribution à l'étude sédimentologique du plateau continental dans la baie de Biafra. Cahier ORSTOM Vol. VI: 1–34.

Bertrand, P., E. Lallier-Vergès and M. Boussafir, 1993. Enhancement of accumulation and anoxic degradation of organic matter controlled by cyclic productivity, a model. Organic Geochemistry 22 (3–5): 511–520.

Bouloubassi, I., E. Lipiatou, A. Saliot, I. Tolosa, J.M. Bayona and J. Albaiges, 1997. Carbon sources and cycle in the western Mediterranean – the use of molecular markers to determine the origin of organic matter, Deep-Sea Res. II, 44 (3)–(4), 781–799.

Boussafir, M. and E. Lallier-Vergès, 1997. Accumulation of organic matter in the Kimmeridge Clay Formation (KCF), an update fossilisation model for marine petroleum source-rocks. Marine and Petroleum Geology 14 (1): 75–83.

Bowie, A. J. and C. K. Mutchler, 1986. Sediment sources and yields from complex watersheds. In: Wang, S. Y., Shen, H. W. & Ding, L. Z. (eds), Proceedings of the Third International Symposium on River Sedimentation. pp 1224–1232. University of Miss., Jackson.

Calvert, S., R. Bustin and T. Pedersen, 1992. Lack of evidence for enhanced preservation of sedimentary organic matter in the oxygen minimum of the Gulf of California. Geology, 20: 757–760.

Calvert, S., R. Bustin and E. Ingall, 1996. Influence of water column anoxia and sediment supply on the burial and preservation of organic carbon in marine shales. Geochimica et Cosmochimica Acta 60 (9): 1577–1593.

Canuel, E., and Ch. Martens, 1996. Reactivity of recently deposited organic matter: degradation of lipid compounds near the sediment-water interface, Geochim. Cosmochim. Acta, 60: 1793–1806.

Chen, M. S., S. Wartel, L.M. Lavkulich, W. Baeyens, L. Goeyens, and N. Brion, 2007. Organic matter and dissolved inorganic nitrogen distributions in estuarine muddy deposits,Aquatic Ecosystem Health & Management, 10(1):69–85.

Carver, R.E., 1971. Procedures in sedimentary petrology, New York, John Wiley and sons.

Cowie, G., S. Calvert, T. Pedersen, H. Schulz, and U. Von Rad, 1999. Organic content and preservational controls in surficial shelf and slope sediments from the Arabian Sea (Pakistan margin). Marine Geology 161: 23–38.

Darnley, A. G., A. Björklund, B. Bolviken, N. Gustavsson and P. Koval, 1995. A Global Geochemical Database: Recommendations for International Geochemical Mapping. Final Report of IGCP Project 259. UNESCO, Paris.

Didyk, B., B. Simoneit, S. Brassell and G. Eglinton, 1978. Organic geochemical indicators of paleoenvironmental conditions of sedimentation. Nature 272: 216–222.

Duan, Y., 2000. Organic geochemistry of recent marine sediments from the Nansha Sea, China. Organic Geochemistry 31: 159–167.

El-Mammony, M.H., 1988. Geochemical approach to the beach and bottom sediments of the Jubal area at the entrance of the Gulf of Suze M. Sc. Thesis, Ain Shams Univ. Egypt, 304 pp.

Farhat, H.I., 2010. Grain size distribution and geochemical studies on the recent sediments of Damietta and Rosetta Nile branches, Egypt. PhD. Thesis, Benha univ. 266 pp.

Flemming, B.W. and M.I. Delafontaine, 2000. Mass physical properties of muddy intertidal sediments: some applications, misapplications and non-applications. Continental shelf research, 20, (10-11):1179-1197.

Folk, R. L., 1980. Petrology of sedimentary rocks, Hemphills, Publ, Co., Austin, Texas, 170 pp.
Folk, R.L. and W. Ward, 1957. Brazos River bar, a study in the significance of grain size parameters. J. Sed. Pet., 27: 3- 26.
Fordyce, F. M., D. Masara and J. D. Appleton, 1996. Stream sediment, soil and forage chemistry as indicators of cattle mineral status in Northeast Zimbawe. In Appleton J. D., R. Fuge & G. J. H. McCall (eds), Environmental Geochemistry and Health, with Special Reference to Developing Countries. Geological Society Special Publication No. 113. The Geological Society, London: 23–37.
Fytianos, k. and A. Kotzakioti, 2005. Sequential fractionation of phosphorus in lake sediments of Northern Greece. Environmental Monitoring and Assessment, 100: 191–200
Ganeshram, R.S., S.E. Calvert, Th. F. Pederson and G. L. Cowie, 1999. Factors controlling the burial of organic matter in laminated and bioturbeted sediments of NW Mexico, Implications for hydrocarbon preservation. Geochimica et Cosmochimica Acta. 63 (11-12):1723–1724.
Geriesh, M.H., K. Balke and A. El-Bayes, 2008. Problems of drinking water treatment along Ismailia Canal Province, Egypt. J. Zhejiang Univ. Sci. B., 9 (3): 232-242.
Griffiths, J.C., 1967. Size versus sorting. Jour. Geol., 59: 211-243.
Hedges, J. and R. Keil, 1995. Sedimentary organic matter preservation, an assessment and speculative synthesys. Marine Chemistry 49, pp. 81–115.
Henrichs, S.M., 1992. Early diagenesis of organic matter in marinesediments-progress and perplexity. Mar. Chem. 39, 119- 149.
Hollander, D., J. Mckenzie and H. Ten Haven, 1992. A 200 year sedimentary record of progressive eutrophication in Lake Greifen (Switzerlan), Implications for the origin of organic carbon-rich sediments. Geology 20, pp. 825–828.
Ingall, E. and R. Jahnke, 1994. Evidence for enhanced phosphorus regeneration from marine sediments overlain by oxygen depleted waters. Geochimica et Cosmochimica Acta 58 11, pp. 2571–2575.
Jones, B. and D. Manning, 1994. Comparison of geochemical indices used for the interpretation of paleoredox conditions in ancient mudstones. Chemical Geology 111: 111–129.
Jorgensen, B., 1996. Material flux in the sediment. In: Jǿrgensen B and Richardson K. (eds.). Coastal and estuarine studies. American Geophysical Union. 115-135pp.
Kralik, M., 1999. A rapid procedure for environmental sampling and evaluation of polluted sediments. Applied Geochemistry, Amsterdam, 14: 807–816.
Krauskopf, K. B. and D.K. Bird, 1995. Introduction to geochemistry. Mc. Graw-Hill, inc.N.Y.. 3rd ed., 647pp.
Krumbien, W.C. and F.J. Pettijohn, 1938. Manual of sedimentary petrography. D. Appleton-century, New York, 549 pp.
Lake, B. A., K.M. Coolidge, S.A. Norton and A. Amirbahman, 2007. Factors contributing to the interimal loading of phosphorus from anoxic sediments in six maine, USA, Lakes. Science of the total environment, 373: 534 – 541.
Lallier-Vergès, E., P. Bertrand, A. Desprairies, and U. Berner, 1991. Geochemical and optical investigations on degradation processes affecting organic matter in Celebes Basin sediments. In: Silver, E., Rangin, C., and Van Breymann, M. (Eds.), Proceedings of the Ocean Drilling Program, Scientific Results, ODP, 124: 239–247
Lallier-Vergès, E., J. Hayes, M. Boussafir, D. Zaback, N. Tribovillard, J. Connan and P. Bertrand, 1993. Productivity-induced sulphur enrichment of hydrocarbon-rich sediments from the Kimmeridge Clay Formation. Chemical Geology. 134 (4): 177–188.
Lallier-Vergès, E., P. Martinez, P. Bertrand, C. Rabouille, J.C. Relexans and D. Keravis, 1998. Sedimentation, reworking and preservation of organic matter in surficial sediments of the N-W african upwelling system. Mineralogical Magazine 62 (A): 846–847.
Lotfy, I. H. M. 1997. Particle size distribution and both light and heavy minerals of bottom sediments at Damietta Nile branch. Menofya J. of Agric. Res., 22 (3): 969 – 999.
Lotfy, I. H. M., 2001.Geochemical Studies on recent sediments of Manzalah Lake, Egypt. Egypt. J. Egypt German. Soc. Zool., 34 (B): 77-103
Lotfy, I. H. M., 2002. Studies on the Particle size distribution and both light and heavy minerals of recent sediments at Rosetta Nile branch, (Egypt). Bull. of National Inst. of Oceanogr. and Fish., A. R. E. 28: 367 – 384.
Lotfy I. M., M.A. El-Dardir, and G.S. Salem, 2006. Abundance and distribution of chemical constituents in lake Qarun sediments, Egypt. African J. Biol. Sci., 2 (1): 61:72.
Lykousis, V., M.B.Collins and G. Ferentinos, 1981, Modern sedimentation in the NW Aegean Sea. Mar. Geol., 43: 111–130.
Morse, J.L., and M.J. Beazley, 2008. Organic matter in deepwater sediments of the Northern Gulf of Mexico and its relationship to the distribution of benthic organisms: Deep-Sea Research II, 55: 2563-2571.

Morse, J. L., F. P. Megonigal and M. R.Walbridge, 2004. Sediment nutrient accumulation and nutrient availability in two ideal freshwater marches along the Mattaponi River, Virginia, USA, Biogeochemistry. 69: 175 – 206.
Murria, J. and K. Kuivila, 1990. Organic matter diagenesis in the northeast Pacific, transition from aerobic red clay to suboxic hemipelagic sediments. Deep-Sea Research 37 (1): 59–80.
Nelson, D.W. and L.E. Sommers, 1996. Total carbon, organic carbon, and organic matter. In: Methods of Soil Analysis, Part 2, 2nd ed., A.L. Page *et al.,* Ed. Agronomy. 9:961-1010. Am. Soc. of Agron., Inc. Madison, WI.
Pedersen, T. and S. Calvert, 1990. Anoxia vs. productivity, What controls the formation of organic-carbon-rich sediments and sedimentary rocks?. American Association of Petroleum Geologists. 74: 454–466.
Potsma, H., 1981. Chemistry of coastal Lagoons. Unamunesco, Novamber (28-30), Mexico, D. F. : 421-430.
Ransom, B., D. Kim, M. Kastner and S.Wainwright, 1998. Organic matter preservation on continental slope,Importance of mineralogy and surface area. Geochimica et Cosmochimica Acta. 62 (8): 1329–1345.
Reimers, C., 1989. Control of bemthic fluxes by particulate supply. In: Berger, W.H., *et al.,* (eds.), Productivity of the ocean, past and present. Life Sciences Research Report, Wiley. 44: 217–234.
Schulte, S., K. Mangelsdorf and J. Rullkotter, 2000. Organic matter preservation on the Pakistan continental margin as revealed by biomarkers geochemistry. Organic Geochemistry. 31: 1005–1022.
Szarek-Gwiazda, E., and I. Sadowska, 2010. Distribution of grain size and organic matter content in sediments of submontane dam reservoir. Environment Protection Engineering. 36 (1).
Thamdrup, B. and D. Canfield, 1996. Pathways of carbon oxidation in continental margin.sediments off central Chile. Limnology and Oceanography 41 (8): 1629–1650.
Tribovillard, N., A. Desprairies, E. Lallier-Vergès, P. Bertrand, N. Moureau, A. Ramdani and L. Ramanampisoa,1994. Geochemical study of organic-matter rich cycles from the Kimmeridge Clay Formation of Yorkshire (UK), productivity versus anoxia. Palaeogeography, Palaeoeclimatology and Palaeoecology 108: 165–181.
Vetö, I., M. Hetenyi, M. Hamor-Vido, H. Hufnagel, and J. Haas, 2000. Anaerobic degradation of organic matter controlled by productivity variation in a restricted Late Triassic basin. Organic Geochemistry. 31: 439–452.
Vogel, A.L., 1982. "A text book of quantitative inorganic analysis" 4th ed. John Wiley & Sons Inc., N.Y.USA.
Williams, M.A.J., D. Adamson, B. Cock, and R. McEvedy, 2000. Late Quaternary environments in the White Nile region, Sudan. Global and Planetary Change, 26: 305–316.