CHAPTER SEVEN

Summary and Conclusion

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The present work deals with the result of the sedimentlogical, mineralogical and geochemical studies carried out on the Nile branches bottom sediments with emphases on the environmental pollution. The River Nile is one of the most remarkable geographic features of Africa. Its catchment's area covers 2,900,000 km², it extends from latitude 4° S to latitude 31° N, and experiences a great variety of climate. The river is the longest in the world, being about 6,700 km long. Its source is at an altitude of 5,120 m above m.s.a. in Central Africa while its estuary is in the Mediterranean Sea. Its course traverses the countries of Uganda, Kenya, Tanzania, Rwanda, Burundi, Zaire, Ethiopia, as well as Sudan and Egypt.

In general, the Nile basin can be divided into four main sub-basins: (1) The White Nile, whose head waters rise south of the Equator, and whose runoff is 29 per cent of the total Nile runoff. Its water is clear. (2) The Atbara River, which rises in North Ethiopia, is a flashy river. It is dry for half the year, and its runoff is muddy and constitutes 14 per cent of the total Nile runoff. (3) The Blue Nile, which also rises in North Ethiopia, has runoff equal to 57 per cent of the total runoff of the Nile. The flow is muddy during the rainy season. (4) The Main Nile flows northward to the sea.

A few km to the north of Cairo begins the Delta or lower Egypt, which is composed of three parts. The first, which is the Delta proper, is comprised of the two branches of the Nile. The two branches are the only two now remaining of the seven ancient arms, the Rosetta arm on the west and the Damietta on the east. The five other branches have been modified and included in the system of irrigation canals. The Delta forms a triangle with an altitude of 160 km and a base of 140 km.

The second part of the Delta lies to the west of the Rosetta arm, with the shape of an elongated triangle whose apex is a little below the separation of the two arms of the Nile and whose base along the sea extends about 70 km in length. While, the third part stretches to the east of the Damietta branch. It also forms a triangle whose base along the sea is 160 km.

The annual Nile flood varies considerably from one year to the other. Its yield may reach 151 x 10^9 m³ as in 1978 or may drop to 42 x10^9 m³ as in 1913. The flood usually occurs in summer from August to October and during this period, it may vary from 36 x 10^9 m³ to 7 x 10^9 m³.

Along Damietta branch, there are about six main industrial plants. These are Talkha fertilizer plant, Talkha Electric power station, Kafer Saad Electric Power Station, Delta Milk, Edfina factories; discharge its effluent directly to the branch besides the sewage and domestic wastes discharging from the neighboring villages without any treatment into the branch.

Also, Rosetta branch of River Nile has a greatest vital importance as an important source of water for municipal, industrial, agricultural, navigational and feeding fish farms. It passed cutting six governorates over a length of about 225 km with average breadth of water course 333 m, maximum depth 23 m, average water velocity 0.5 $m.sec^{-1}$, and mean annual discharge at Qanater El-Khyria 29 million m^3 day^{-1}, the water level fluctuates between 10.55 - 13.81 meter above sea level.

Rosetta branch subjects to three main sources of pollution which, potentially affects and deteriorates the water quality of the branch:-

The first source is El-Rahawy drain, which disposes its wastes into the branches. Its wastes are mixture of agricultural and domestic waste and sanitary drainage from large area of Greater Cairo. It is thought that the impact of this source on the water quality of the branch is extended to long distance from the source.

The second source is Kafr El-Zayat industrial area, which include the industrial effluents from the factories of super phosphate and sulfur compounds, oil and soap industries and pesticides factories. All these effluents are discharged directly from the right bank of the Rosetta branch and their effects on water are very clear.

The third source of pollution is several small agricultural drains that discharge their waters into the branch in addition to sewage discharged from several cities and its neighboring villages that are distributed along the two banks of the Rosetta branch.

Rosetta branch can be divided into two ecological sectors: one of them represent almost fresh water sector extending from branching of the river at El-Qanater El-Khyria Barrage until behind Edfina Barrage (approximately 200 km north Cairo). The other one represent mixed water sector (saline to fresh water) extending from below Edfina Barrage until the branch outlet in the Mediterranean Sea. Nature of the later community depends on time, space and efficiency of barrage operating system. The bottom topography of the estuary is irregular, presenting a succession of depressions, the middle on reaching 18 m in depth. The sill depth at the outlet rises to about 6 m from the surface.

Ten sectors were selected to cover all of the Rosetta branch and nine sectors were selected to cover all of the Damietta branch, in addition to control sector before the Nile branching at the area of El-Kanater El-Khyria, each sector composed of three samples main channel, eastern bank, and western bank the samples will collected with Ekman dredge sampler.

The sediments of Rosetta branch are mainly sand with various amount of mud and very little amount of gravel size, which vary from one station to another but at Damietta branch are consists nearly of semi-equal percent of sand and mud with very little amount of gravel size, which vary from one station to another.

The finer sizes is found behind the both artificial and natural barriers such as barrages which reduce the water body velocity leading to increase siltation process such as at El-Kanater station (artificial barriers) at which the sediments consist mainly from silt and clays (mud fraction) also at eastern bank Zefta station (at which large area of submerged aquatic plants which act as natural barriers leading to decrease the water body velocity leading to increase siltation process by the role leading to increase the percent of fines (mud) vice versa at the front of the barriers water body retrieve its load (which is loss behind barriers by siltation) by washing the sediments at front of the barriers to catch the fines (mud) and leave coarse (sand and gravel) leaving areas with coarse grained bottom sediments such as at the beginning of the branches at E-Rahawy , Sabal and Tamalay station at Rosetta branch and at Benha station at Damietta branch.

It is clear From obtained data that during flood season specially when the barriers is opened the velocity of water body is increased leading to washing processes for sediment decreasing the fines percentage and during winter season the barriers is closed and the velocity is decrease leading to deposition of fines specially at the banks.

Seasonal bottom sediments show that the sediments have nearly uniform size properties. The mean size of both of Rosetta and Damietta Nile branches sediment indicates that in winter and spring the fine grains sediments highly accumulated in the middle and northern ward and decrease in mean size southward. While in summer, the mean size generally decreases which is due to the flood season which cause increase in water body velocity and by role increase in sediment washing. At Rosetta branch , during winter and summer mean-size varied from medium silt to coarse sand with general distribution of fine and very fine sand, during spring varied from fine silt to medium sand with general distribution of fine and very fine sand, at Damietta branch , during winter and summer mean-size varied from medium silt to coarse and very coarse sand with general distribution of fine and very fine sand, during spring varied from coarse silt to coarse sand with general distribution of fine and very fine sand.

During winter, spring and summer at both of Rosetta and Damietta Nile branches, sorting varied from well sorted to very poorly sorted with general trend of moderately sorted, also the samples show general trend of well sorted toward south and very poorly sorted toward north.

Seasonal bottom sediments show that at Rosetta branch, During winter the Skeweness values range between the maximum value of 0.9 and minimum value of -0.5 and the value of symmetrical (0.0) was found at main channel of El-Kanater Station (1), western bank of both of Tamaly and Sabal stations (3,4) and eastern bank of Deswq station (7). During spring, the Skeweness values range between the maximum values of 0.6 to minimum value of -0.5, and the value of symmetrical (0.0) was found at main channel of both of Sabal and Kom-Hamada Stations (4,5) and at eastern bank of Deswq station (7), During summer, Skeweness values range between the maximum values of 0.6 to minimum value of -0.6 and value of symmetrical (0.0) was found at Main channel of Fowa Station (8) and at western bank of El-Rahawy station (2), at Damietta branch the samples show an increase in the fines content. During winter the Skeweness values range between the maximum value of 0.8 and minimum value of -0.7, and the value of symmetrical (0.0) was found at Main channel of both of El-Ratama and Zefta stations (13,19) and at western bank of Talkha station (18). During spring, the Skeweness values range between the maximum values of 0.7 and minimum value of -0.6, and the value of symmetrical (0.0) was found at Main channel of El-Serw station (17) and at western bank of El-Ratama station (13). During summer, the Skeweness values range between the maximum values of 0.6, and the minimum value of -0.5, and the value of symmetrical (0.0) found at eastern bank of El-Serw station (17).

At Rosetta branch, during winter the Kurtosis values range between the maximum value of 2.9, and minimum value of 0.5. During spring, the Kurtosis values range between the maximum values of 3.4 and minimum value of 0.7, value of normal curve (1.0) was found at main channel of Fowa Station (8), western bank of both of Tamaly and Kom-Hamada stations (3,5) and eastern bank of Sabal station (4), During summer, Kurtosis values range between the maximum values of 2.3, to minimum value of 0.3, and the value of normal curve (1.0) was found at eastern bank of both of El-Rahawy and Tamaly stations (2,3), at Damietta branch the samples show an increase in the fines content. During winter the Kurtosis values range between the maximum value of 2.6, and minimum value of 0.4, and the value of normal curve (1.0) was found at main channel of both of Ezpt El-Borg and Zefta stations (11,19) and at western bank of El-Ratama and Northern Farskor Dam stations (13,15).

During spring, the Kurtosis values range between the maximum values of 2.9, and minimum value of 0.5 at main channel of El-Kayata station (12) and the value of normal curve (1.0) was found at eastern bank of El-Kayata station (12) and at western bank of Benha station (20). During summer, the Kurtosis values range between the maximum values of 3.1, and minimum value of 0.6, and the value of normal curve (1.0) was found at eastern bank of Damietta City station (14) and main channel of Ezpt El-Borg station (11). In winter, the plotting of skewness vs. mean diameter indicates that at eastern bank 33.3% of sediments fall within the field wind processes, while 33.3% of sediments within freshwater processes and 33.3% of sediments within wave processes. while at western bank 33.3% of sediments fall within the field wind processes, while 18.7% of sediments within freshwater processes and 50% of sediments within wave processes and at main channel 18.7% of sediments fall within the field wind processes, while 38.9% of sediments within freshwater processes and 38.9% of sediments within wave processes, In spring, at eastern bank 38.9% of sediments fall within the field wind processes, while 50% of sediments within freshwater processes and 18.7% of sediments within wave processes. while at western bank 33.3% of sediments fall within the field wind processes, while 33.3% of sediments within freshwater processes and 33.3% of sediments within wave processes and at main channel 11.1% of sediments fall within the field wind processes, while 38.9% of sediments within freshwater processes and 44.4% of sediments within wave processes. During summer at eastern bank 29.4% of sediments fall within the field wind processes, while 29.4% of sediments within freshwater processes and 41.2% of sediments within wave processes. while at western bank 50% of sediments fall within the field wind processes, and 50% of sediments within freshwater processes and 0% of sediments within wave processes and at main channel 33.3% of sediments fall within the field wind processes, while 33.3% of sediments within freshwater processes and 33.3% of sediments within wave processes, wind processes may be obtained as a result of the great height of Nile terraces which affected by wind leading to processes which is result by wind.. The plot of skewness vs. standard deviation showed that all the samples in winter, at eastern bank 15% full in beach deposits area and 85% full in fresh water deposits area while at western bank 10% full in beach deposits area and 90% full in fresh water deposits area while at main channel 5% full in beach deposits area and 95% full in fresh water deposits area, during spring at eastern bank 5% full in beach deposits area and 95% full in fresh water deposits area while at western bank 0% full in beach deposits area and 100% full in fresh water deposits area while at main channel 5% full in beach deposits area and 95% full in fresh water deposits area and during summer at eastern and western banks 0% full in beach deposits area and 100% full in fresh water deposits area while at main channel 15% full in beach deposits area and 85% full in fresh water deposits area. The plot of relationship between mean size and standard deviation for the sediments under study showed that during winter at eastern bank 100% full in mixed freshwater and dune processes area while at western bank 15% full in freshwater process area and 85% full in mixed freshwater and dune process area while at main channel 20% full in freshwater process area and 80% full in mixed freshwater and dune process area, during spring at eastern bank 25% full in freshwater process area and 75% full in mixed freshwater and dune processes area while at western bank 20% full in freshwater process area and 80% full in mixed freshwater and dune process area while at main channel 45% full in freshwater process area and 55% full in mixed freshwater and dune process area, during summer at eastern bank 30% full in freshwater process area and 70% full in mixed freshwater and dune processes area while at western bank 20% full in freshwater process area and 80% full in mixed freshwater and dune process area while at main channel 50% full in freshwater process area and 50% full in mixed freshwater and dune process area, dune processes may be obtained as a result of the great height of Nile terraces which affected by wind leading to processes similar in its properties with dune processes. The relationship between sorting and mean diameter indicated that the analyzed samples are out of the slow deposition of quiet water it mean that the main sources of the sediments are mixed sources from freshwater, wave, currents and wind.

By using the application of C-M diagram to the present work analyzed sediments show that during winter at Rosetta branch analyzed sediments at eastern bank indicate that 50%, 10%, 20%, and 10% of the samples full in classes of I, II, IV, and V respectively, while at Damietta branch analyzed sediments at eastern bank indicate that 10%, 20%, 20%, 10%, and 30% of the samples full in classes of I, II, V, VI, and VII respectively while at Rosetta branch analyzed sediments at western bank indicate that 10%, 30%, 20%, 10% and 10% of the samples full in classes of I, III, IV, V and VI respectively, while at Damietta branch analyzed sediments at western bank indicate that 10%, 20%, 10%, 10%, and 30% of the samples full in classes of I, II, III, V, and VI respectively, while at Rosetta branch analyzed sediments at main channel indicate that 60%, 10%, 20%, and 10% of the samples full in classes of I, II, III, and VII respectively, while at Damietta branch analyzed sediments at main channel indicate that 10%, 30%, 50%, and 10% of the samples full in classes of I, II, III, and V respectively During spring at Rosetta branch analyzed sediments at eastern bank indicate that 30%, 20%, 20%, 10% and 10% of the samples full in classes of I, II, IV, V and VII respectively, while at Damietta branch analyzed sediments at eastern bank indicate that 40%, 20%, 10%, 20%, and 10% of the samples full in classes of I, II, III, V, and VII respectively while at Rosetta branch analyzed sediments at western bank indicate that 20%, 10%, 10%, 30% and 10% of the samples full in classes of II, III, IV, V and VII respectively, while at Damietta branch analyzed sediments at western bank indicate that 20%, 30%, 20%, 10%, and 20% of the samples full in classes of I, II, IV, V, and VII respectively, while at Rosetta branch analyzed sediments at main channel indicate that 50%, 10%, 20%, and 20% of the samples full in classes of I, II, III, and VI respectively, while at Damietta branch analyzed sediments at main channel indicate that 10%, 20%, 20%, 10, and 40% of the samples full in classes of I, II, III, IV, and VII respectively. During summer at Rosetta branch analyzed sediments at eastern bank indicate that 20%, 10%, 30%, 20% and 10% of the samples full in classes of I, II, IV, V and VII respectively, while at Damietta branch analyzed sediments at eastern bank indicate that 20%, 10%, 20%, 20%, 10, and 10% of the samples full in classes of I, II, III, V, VI, and VII respectively while at Rosetta branch analyzed sediments at western bank indicate that 40%, 10%, 10%, 10% and 20% of the samples full in classes of I, II, III, VI, and VII respectively, while at Damietta branch analyzed sediments at western bank indicate that 10%, 40%, 30%, and 10% of the samples full in classes of I, II, V, and VII respectively, while at Rosetta branch analyzed sediments at main channel indicate that 50%, 30%, 10%, and 10% of the samples full in classes of I, II, III, and IV respectively, while at Damietta branch analyzed sediments at main channel indicate that 10%, 40%, 20%, 10, and 20% of the samples full in classes of II, III, IV, V, and VI respectively.

By using the application of discriminated functions to the present work analyzed sediments show that during winter at Rosetta branch analyzed sediments at eastern bank indicate that 10%, 50%, 10%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, beach-deltaic, and turbidity current-beach environments respectively, while at Damietta branch analyzed sediments at eastern bank indicate that 30%, 60%, and 10% of the samples have environment of deltaic, turbidity current-deltaic, and beach-deltaic environments respectively while at Rosetta branch analyzed sediments at western bank indicate that 20%, 40%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively, while at Damietta branch analyzed sediments at western bank indicate that 20%, 60%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively, while at Rosetta branch analyzed sediments at main channel indicate that 20%, 50%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively and 10% (one sample; at Rosetta estuary)was shallow marine environment, while at Damietta branch analyzed sediments at main channel indicate that 30%, 60%, and 10% of the samples have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively.

During spring at Rosetta branch analyzed sediments at eastern bank indicate that 10%, 50%, 10%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, beach-deltaic, and turbidity current-beach environments respectively, while at Damietta branch analyzed sediments at eastern bank indicate that 30%, 60%,and 10% of the samples have environment of deltaic, turbidity current-deltaic, and beach-deltaic environments respectively while at Rosetta branch analyzed sediments at western bank indicate that 20%, 40%, and 20% of the have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively, while at Damietta branch analyzed sediments at western bank indicate that 20%, 60%, and 20% of the the have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively, while at Rosetta branch analyzed sediments at main channel indicate that 20%, 50%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively and 10% (one sample; at Rosetta estuary)was shallow marine environment, while at Damietta branch analyzed sediments at main channel indicate that 30%, 60%, and 10% of the samples have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively.

During summer at Rosetta branch analyzed sediments at eastern bank indicate that 10%, 40%, 20%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, beach-deltaic, and turbidity current-beach environments respectively, while at Damietta branch analyzed sediments at eastern bank indicate that 30%, 50%, and 10% of the samples have environment of deltaic, turbidity current-deltaic, and beach-deltaic environments respectively while at Rosetta branch analyzed sediments at western bank indicate that 20%, 50%, 10%, and 10% of the samples have environment of deltaic, turbidity current-deltaic, beach-deltaic, and turbidity current-beach environments respectively, while at Damietta branch analyzed sediments at western bank indicate that 30%, 50%, and 10% of the have environment of deltaic, turbidity current-deltaic, and turbidity current-beach environments respectively, while at Rosetta branch analyzed sediments at main channel indicate that 10%, 50%, 10%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, beach-deltaic, and turbidity current-beach environments respectively, and 10% (one sample; at Rosetta estuary)was shallow marine environment, while at Damietta branch analyzed sediments at main channel indicate that 30%, 50%, and 20% of the samples have environment of deltaic, turbidity current-deltaic, and beach-deltaic environments respectively

The lowest value of hydrogen ion concentration (pH) in Rosetta Branch was recorded at Rosetta Branch was found at Tamalay during winter season 7.11 , When the maximum value of hydrogen ion concentration (pH) 8.47 was recorded during spring at Rosetta Estuary. The maximum Hydrogen Ion Concentration (pH) in Damietta Branch was recorded at Zefta during winter season 8.11, When the lowest value of hydrogen ion concentration (pH) 7.40 was recorded during summer at South Faraskour Dam.

At Rosetta Branch the temperature values in the different stations were found to be in the ranges of 18.4 – 15.6, 27.4 – 24.1, and 29.7 – 27.7 ^{0}C. with seasonal average of 17.2, 25.4, and 28.8 ^{0}C during winter, spring and summer, respectively, at Damietta Branch The values in the different stations were found to be in the ranges of 19.8 – 15.8, 29.0 – 23.9, and 31.2 – 26.3 ^{0}C. with seasonal average of 17.4, 26.1, and 29.0 ^{0}C during winter, spring and summer, respectively. The data indicate that, the highest values recorded in summer season and the minimum values recorded in winter season for all stations, which depicts the water temperature depend on the variations in meteorological conditions and to variation in the time of sampling.

At Rosetta Branch The transparency values in the different stations were found to be in the ranges of 200 – 35, 150 – 25, and 185 – 30 cm. with a seasonal average of 83, 85, and 83 cm during winter, spring and summer, respectively, at Damietta Branch The values in the different stations were found to be in the ranges of 220 – 30, 170 – 45, and 150 – 35 cm. with seasonal average of 96, 83, and 78 cm during winter, spring and summer, respectively.

EC measurements of the area under investigation results showed that, At fresh part of Rosetta Branch (Southern of Edfina barrage) The values in the different stations were found to be in the ranges of 0.523 – 0.240, 0.654 – 0.347, and 0.478 – 0.295 m mohs/cm. and at saline part of Rosetta Branch (Northern of Edfina barrage) The values in the different stations were found to be in the ranges of 33.510 – 42.356, 48.260 – 51.328, and 49.444 – 57.250 m mohs/cm during winter, spring and summer, respectively, At fresh part of Damietta Branch (Southern of Farskour dam) The values in the different stations were found to be in the ranges of 0.632 – 0.270, 0.742 – 0.314, and 0.581 – 0.297 m mohs/cm. and at saline part of Damietta Branch (Northern of Farskour dam) The values in the different stations were Found to be in the ranges of 46.200 – 27.600, 52.900 – 46.200, and 58.562 – 41.200 m mohs/cm during winter, spring and summer, respectively.

The water depth of Rosetta Nile Branch ranged between 2.00m and 19.00m, the maximum depth recorded at Foa (i.e. northward), while the water depth of Damietta Nile Branch varied from 6.00m and 22.00m and the depth increases gradually northwards.

The separation of shells occurred during the mechanical analysis of sediment samples, the fraction of gravel (>2mm) was taken and then each species was separated, each species was weighted; the weight of each species was divided by total weight of the analyzed sample and then multiplied by 100 to calculate the percent by weight of each species.

- **Pelecypod:**

There are seven species of pelecypod recorded in size of >2mm (gravel) in the seasonal bottom samples, which are:

1) *Mytilus edulis*.
2) *Mutela rostrata.*
3) *Mactra* .
4) *Corbicula consobrina*.
5) *Mya arenaria*
6) *Cerastoderma glaucum*.
7) *Caelatura monereus*

- **Gastropoda:**

There are three species of gastropoda recorded in size of >2mm (gravel) in the seasonal bottom samples, which are:

1) *Pirenalla conica.*
2) *Lanistes carinats*
3) *Cleopatra bulimoides*

Corbicula consobrina was the dominant species of pelecypod at both of Rosetta and Damietta branches. Seasonal variations, the highest counts of pelecypods were in winter at middle zone of Rosetta branch and northern part of Damietta branch. While they remained more at northern part of Rosetta branch and at northern and southern part of Damietta branch during spring and summer

The distribution of gastropods is different from place to another and it clear that during winter gastropods was wide distributed at middle and northern part of Rosetta branch while at Damietta branch gastropods was wide distributed at middle and southern part. While during spring there was wide distribution at middle and northern part of Rosetta branch at Damietta branch gastropods was wide distributed at southern part. During summer at both Rosetta and Damietta branches gastropods was wide distributed at middle part. It was observed that the gastropod of the Nile branches sediments reflects that, the *Lanistes carinats* was the dominant species at both of Rosetta and Damietta branches. Zonal a distribution of the gastropod of Nile branches sediments reflects that, the *Lanistes carinats* was the dominant species at both of Rosetta and Damietta branches. And, the middle zone of Rosetta branch has high accumulation of gastropda in winter, spring and summer, while in Damietta branch at southern part except in summer takes place at middle zone.

The seasonal variation of the total weight percent of molluscan shells in the Rosetta Nile branch sediments can be arranged in the following order : in winter > spring > summer and in the eastern and western banks, while in main channel is: in spring > winter > summer. And the highest accumulation of molluscan shells occurs in middle zone and northwards in all seasons.

X-ray diffraction for *Corbicula consobrina* from Rosetta and Damietta branches sediments gave an aragonite and minor amount of calcite. The maximum of value of aragonite in summer and winter was recorded at the northern zone 99.28 % and 99.23 % of Rosetta and Damietta branches, respectively, while the maximum value of calcite 2.42 % and 1.75 % recorded at middle zone Damietta and Rosetta, respectively in winter. While in summer calcite maximum percent 2.16 % and 1.57 % was recorded in middle zone of Damietta branch and southern zone of two branches, respectively.

In gastropods shells, the maximum value of aragonite in summer and winter was at northern zone 99.62 % and 99.31 % of Damietta and Rosetta branches, respectively, while maximum value of calcite 3.62 % was recorded during summer at southern zone of two branches, and during winter maximum value 1.34 % was recorded at middle zone of Rosetta branch.

Generally, the semi-quantitive approximation based on peaks suggests that the carbonate mineral phases of molluscan shells from the recent sediments of Nile branches consist mainly of aragonite and a less amount of calcite.

Higher percent of aragonite in molluscan shells at two branches occurred at northern zone and decrease southward in both of pelecypods and gastropods. The relative order of zonal distribution of aragonite percent was northern zone > middle zone > southern zone. In pelecypods, the relative order of seasonal distribution of aragonite was: in winter > summer in southern zone of two branches and middle zone of Rosetta branch, while in summer > winter in middle zone of Damietta branch. In gastropods the relative order of seasonal distribution of aragonite was: in winter > summer in middle zone of Rosetta and Damietta Nile branches.

Calcite percent in molluscan shells was accumulated southward and decrease northward. The relative order of calcite percent in molluscan shells was: in gastropods > pelecypods in southern zone of two branches and in middle zone of Rosetta branch in summer. And pelecypods > gastropods in winter.

The concentration of sodium, potassium, iron, copper, manganese, zinc, lead, and cadmium in the studied shells of *Corbicula consobrina* and *Lanistes carinats* from bottom sediments, covers the all parts of two branches.

The lowest value of Na^+ in pelecypods from Rosetta branch was recorded in middle and southern part in winter and summer, and for Damietta branch the lowest value of Na^+ in pelecypods was recorded in middle zone in winter and increase northward.

Na^+ level in gastropods shells seems to be the same distribution in pelecypoda shells from Damietta branch, i.e. the lowest value 13.37 mg\g was observed in middle zone in winter and these value tend to increase northward in summer reached to 20.73 mg\g in Rosetta branch and in winter reached to 22.74 mg\g in Damietta branch.

The maximum values of Na^+ in gastropoda shells observed in the northern region ranging from 22.24 mg\g in winter from Damietta branch and 20.73 mg\g in summer from Rosetta branch. The lowest values were recorded at southern part of two branches in summer, the highest levels of Na^+ in molluscan shells from two Nile branches in winter and summer were observed in the northern zone. However there was a tendency of decreasing their concentration in the middle zone and southward.

The highest value of potassium concentration 9.07mg\gwas recorded at northern zone of Rosetta branch in gastropods in winter, when the lowest value of potassium concentration 1.27mg\g was recorded at northern zone of Rosetta branch in gastropods in summer, the relative distribution of potassium concentration in molluscan shells of two branches was: in pelecypods > gastropods in summer and gastropods > pelecypods in winter, in pelecypods shells K^+ level was in northern zone > middle zone > southern zone in summer and winter, while in gastropods shells K^+ level was in middle zone > southern zone > northern zone in summer and northern zone > middle zone > southern zone in winter.

The lowest value of iron concentration 66.21µg\g was recorded at northern zone of Rosetta branch in gastropods in summer. While the highest value of iron concentration 163.82µg\g was recorded at northern zone of Damietta branch in pelecypos in winter. Iron concentration in molluscan shells was in pelecypods > gastropods. iron concentration in molluscan shells in Damietta branch > Rosetta branch in winter while in summer iron concentration in Rosetta branch> Damietta branch. Relative zonal distribution of iron in pelecypods was: northern > middle >southern zone in winter, while in summer southern >middle > northern zone. In gastropods Northern >southern > middle zone in winter, while in summer middle >northern > southern.

Fe content is more abundant in northern zones sediments in both of two branches these may be due to the northern area is saline environment also may be due to these areas are near to fishing harbors.

The maximum value of copper concentration was 42.11 µg\g which was recorded in gastropods shells at northern zone of Rosetta branch in summer and minimum value of 12.11 µg\g was recorded in southern zone of two branches in gastropods shells in summer. Copper concentration in molluscan shells was in gastropoda > pelecypods. copper concentration in molluscan shells in Rosetta branch> Damietta branch in winter and summer, except in gastropods in summer was Damietta branch > Rosetta branch . Relative zonal distribution of copper in pelecypods was: northern > middle >southern zone in winter and summer, and in gastopods takes same manner.

The maximum value of zinc concentration was 70.63 µg\g which was recorded in gastropods shells at middle zone of Damietta branch in summer and minimum value of 22.95 µg\g was recorded in middle zone of Rosetta branch in gastropods shells in summer. Zinc concentration in molluscan shells was in gastropods > pelecypods. Zinc concentration in molluscan shells in Damietta branch > Rosetta branch in summer while in winter zinc concentration in Rosetta branch > Damietta branch. Relative zonal distribution of zinc in pelecypods was: northern > middle >southern zone in winter and summer, while In gastopods northern >southern > middle zone in winter and summer except at in summer southern >middle of Rosetta branch.

Zinc content is more abundant in northern zones sediments in both of two branches these may be due to the northern area is saline environment also may be due to these areas are near to fishing harbors.

The maximum value of manganese concentration was 32.51µg\g which was recorded in gastropods shells at middle zone of Damietta branch in summer and minimum value of 9.32 µg\g was recorded in middle zone of Damietta branche in gastropods shells in winter. Manganese concentration in molluscan shells was in gastropods > pelecypods except in southern part of two branches and in middle zone of Damitta branch. Manganese concentration in molluscan shells in Rosetta branch > Damietta branch in winter, while in summer manganese concentration in Damietta branch > Rosetta branch. Relative zonal distribution of manganese in pelecypods was: northern > middle >southern zone in Rosetta in winter while in Damietta middle > northern >southern zone and in summer southern > northern > middle in Rosetta branch and in Damietta southern > middle, while In gastopods northern >southern > middle zone in winter and summer except at in summer southern >middle of Rosetta and Damietta Nile branches.

The highest value of lead concentration was 3.11µg\g which was recorded in pelecypoda shells at northern zone of Rosetta branch in winter and lowest value of 0.16 µg\g was recorded in middle zone of Damietta branche in gastropods shells in winter. Lead concentration in molluscan shells was in pelecypods > gastropods except in southern part of two branches and in middle zone of Damitta branch. Lead concentration in molluscan shells in. Relative zonal distribution of lead in pelecypods was: northern > middle >southern zone in winter, while in summer northern > southern > middle, while In gastopods northern > middle zone in winter and in summer southern > northern > middle zone.

The maximum value of cadmium concentration was 0.99 µg\g which was recorded in gastropods shells at northern zone of Rosetta branch in summer and minimum value of 0.12 µg\g was recorded in middle zone of Damietta branche in pelecypods shells in winter. Relative zonal distribution of cadmium in pelecypods was: northern > southern > middle zone in winter, while in summer northern > middle > southern zone, while In gastopods northern > middle zone in winter and in summer northern > middle > southern zone. Finally, cadmium concentration in molluscan shells was in pelecypods > gastropods except in northern zone of Rosetta in summer, and middle zone of Damitta branch in winter. Cadmium content is more abundant in northern zones sediments in both of two branches these may be due to the northern area is saline environment also may be due to these areas are near to fishing harbors.

The mean heavy metal levels in different regions are shown in Table (29). Data in the literature on the trace metal concentrations in shells are striking by virtue of the apparently very large differences in concentration that can exist between species. in the present work and these are compared with the recent data of some scientists.

Comparison between heavy concentrations in molluscan shells. The level of K, Fe, Mn, Zn, Cu, and Cd from study area were higher than **Ali and Fishar (2005**) on the other hand the level of Na and Pb were lower than **Ali and Fishar (2005).**

In comparison with the data in other sites by **Foster and Cravo (2003), Brooks and Rumsby (1965), Bertine and Goldberg (1972), Krauskopt and Bird (1995), Szefer and Szefer (1990)** and **Kádár and Costa (2006)** the present results showed that the level of Fe, Mn and Cu were higher while Zn was lower in the investigated area of the River Nile Branches.

In comparison with the data in other sites by **Segar et. al. (1971)** the present results showed that the level of Fe, Zn and Cu were higher while Mn was lower in the investigated area of the River Nile Branches.

The mean trace metal concentration in molluscan from different region by **Al-Dabbas et al. (1984)** and **Giusti et al. (1999)** indicate that the level of Mn, Zn and Cu were higher in the investigated area.

Matching the average values of different element with those of Gdansk Bay as reported by **Szefer and Szefer (1985)** indicates that element of molluscan shells in Nile branches showed lower levels in Fe and Mn and higher levels in Zn and Cu.

The levels of metal in the study area did not follow the same pattern of **Lotfy 2003 and 2006** but showed higher levels in all elements while showed the same trend with **Lotfy 2002.**

Determination of the organic matter content through the bottom sediments of both of Rosetta and Damietta Nile branches and factors affecting its distribution. the data shows that bottom sample contain high content of organic matter at station near to human wastes drains or human activity also it was clear that low values of organic matter content was found and submitted to high water velocity areas and high sand percent areas This may be due to the washing of the sediments by running water. The distribution of organic matter content in the recent sediments of Nile branches has a uniform distribution with the distribution of clay fractions, the relatively high contents of organic matter in the sediments are high clay content. Most of the particulate organic materials in transit behave like fine grained sediments. In Nile branches, most of organic matter is stored on the bottom; hence high percentages of organic matter may then occur, especially in fine-grained sediments. More organic matter is added to this store by primary production in situ, and drain sources either by algae or sessile plants. The fauna living in and on the bottom profit from the presence of this large amount of organic matter.

During winter at Rosetta branch organic matter content was varied between maximum value of 41.23% at western bank of El-Rahawy station (at the drain mouth) and minimum value of 0.20% at western bank of Sabal station, while during spring organic matter content was varied between maximum value of 25.64% at main channel of Fewa station, and minimum value of 0.27% at western bank of Tamalay station. During summer organic matter content was varied between maximum value of 26.21% at western bank of El-Rahawy station (at the drain mouth) and minimum value of 0.23% at eastern bank of Tamalay station.

During winter at Damietta branch organic matter content was varied between maximum value of 20.62% at eastern bank of Damietta city station (due to human drain of Damietta city) and minimum value of 0.80% at main channel of Benha station, while during spring organic matter content was varied between maximum value of 17.41% at eastern bank of Ezpet El-Borg station (Due to the wastes of fishing harbor and human wastes) and minimum value of 0.55% at eastern bank of Benha station. During summer organic matter content was varied between maximum value of 19.69% at western bank of Damietta city station station (due to human drain of Damietta city) and minimum value of 0.69% at western bank of Talkha stationCarbonate sediments are usually concentrated in warm tropical or subtropical seawater where carbonate secreting animals are dominant. Carbonate sediments are defined as those in which carbonate deposition occurs so close to land that it contributes, not just to the open sea facies, but also to the shoreline deposits.

During winter at Rosetta branch carbonate percent was varied between maximum value of 17.99% and minimum value of 2.16% . During spring carbonate percent was varied between maximum value of 26.62% and minimum value of 3.60%. During summer carbonate percent was varied between maximum value of 27.34% and minimum value of 2.16%. At Damietta branch, during winter carbonate percent was varied between maximum value of 34.53% and minimum value of 2.16%, while during spring carbonate percent was varied between maximum value of 26.62%, and minimum value of 3.60%. During summer carbonate percent was varied between maximum value of 27.34% and minimum value of 2.16%.

Carbonate content in the studied sediments ranged between 2.16% and 34.53% with an average 8.86% for the whole area under study.

In the studied sediments, carbonate distribution is not related of the pH values variation in the water; this indicates that carbonate abundance is not controlled by chemical precipitation.

The concentration of sodium, potassium, iron, copper, manganese, zinc, lead, nikl, chromium and cadmium two fraction of bottom sediment (at very fine sand and mud), covers the all parts of two branches.

Sodium values of the analyzed samples fluctuated between 1.49% in main channel of Rosetta branch (southern area (El-Kanater station)) during winter and 3.32% in the main channel of Damietta branch (northern area (Ezpt El-Borg station)) during summer with an average 2.31%.

Potassium content in the studied sediments ranged between 0.40% in the main channel of Rosetta branch (southern area (El-Rahawy station)) during winter and 3.42% in the eastern bank of Rosetta branch (northern area (Rosett city station)) during summer with an average 1.29%.

The positive correlation between Na^+ and K^+ of both very fine sand and mud fractions (r = 0.77 & 0.49) respectively favored the presence of sodic and potassic feldspars.

Iron content ranged from 4.44% in the mud fraction and 5.04% in the very fine sand at western bank of Rosetta branch (southern area (El-Rahawy station)) during winter with an average 4.76 %.

Copper values ranged from 23 ppm in the eastern bank of control station and 312 ppm in the eastern bank of Rosetta branch (northern zone (Rosetta city station)) during summer with an average 103ppm.

Manganese content of the analyzed samples fluctuated between 544 ppm in the eastern bank of Rosetta branch (southern zone (El-Rahawy station) during winter and 2525 ppm in the western bank of Damietta branch (southern zone (Benha station))during summer with an average 1141ppm.

In the very fine sand, the consistent distribution of Fe and Mn (r = 0.50) enhances their simultaneous deposition.

The Zn content of the studied sediments varied between 65 ppm in the eastern bank of the control station (El-Kanater station) during summer and 473 ppm in the eastern bank of Damietta branch (southern area (Benha station)) in summer with an average 244 ppm.

The Zn – Cu scatter diagrams in the very fine sand and mud fractions show a strongly positive correlation (r = 0.91 & 0.84) respectively favoring that they are present mostly in the same mode of occurrence. Zinc and copper are chiefly adsorbed onto clay minerals and hydrate iron and manganese oxides.

The analyzed samples have lead content that fluctuated between 10 ppm in the western bank of Rosetta branch (southern zone (El-Rahawy station)) during winter and 333 ppm in the main channel of Rosetta branch (northern zone (Rosetta city station)) during summer with an average of 77ppm.

In the present study, lead is relatively high in the sediments of the northern sites of Rosetta branch. This may attributed to presence of several dustries at this sectors discharging their waste into the River Nile and to local pollution due to the presence of high density of boats in such localities.

In the very fine sand, Pb – Zn and Cu scatter diagrams show positive correlation (r = 0.46) favored the presence of heavy minerals.

Nikl content ranged in the analyzed samples between 38 ppm in the western bank of Damietta branch (southern zone (Benha station)) and 91 ppm in the eastern bank of Rosetta branch (northern zone (Rosetta city)) during summer with an average value of 74 ppm., Ni content in the very fine sand and mud fractions correlated positively with Fe (r = 0.54). thus may attributed to its co-precipitation with iron oxide.

The values of Cr in the studied sediments ranged from 63 ppm in the western bank of southern zone of Damietta branch (Benha station) in winter and 433ppm in the western bank of southern zone of Rosetta branch (El-Rahawy station) during summer with an average of 152ppm., Cr in the very fine sand has positive correlation with Fe (r = 0.57) with Mn (r = 0.51) and with the organic matter content (r = 0.50), This may be attributed to its co-precipitation with iron oxides, its presence of heavy minerals and to its association with organic matter content.

Cd content in the analyzed samples varied between 6 ppm in the western bank of Damietta branch (northern zone (Ezpt El-Borg)) and 86 ppm in the eastern bank of control sample (El-Kanater station) during summer with an average of 13.5ppm, Cd content in the very fine sand correlated positively with Cu (r = 0.60) favored the presence of heavy minerals.

The northern sites of Rosetta branch are more polluted area as compared with the other sites. The first site show relatively high Pb concentration in the sediments during the period of study. This attributed mainly to presence of several dustries at this sector discharging their waste water into the River Nile and to Local pollution due to the presence of high density of boats in such localities.

Grain size composition and mineral constituents play chief role in the controlling the chemical elements distribution.

The weak and negative correlation coefficient values of these elements (except Cr) with organic matter indicate that the organic matter does not play role as adsorbent in their deposition.

Factors controlling chemical elements distribution in the present sediments are difficult to induce because the distribution of elements is frequently the result of non-equilibrium processes. A consideration of such change in velocity and temperature of water, grain size composition and mineral constituents are not independent but interact with each other to varying extents through out time. Thus the effect of a single factor is difficult to isolate.