Praticale size Distribution And Geohcemical Studies On The Recent Sediment Of Damietta And Rosetta Nile Branches, Egypt.

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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 109 m³ as in 1978 or may DROP to 42 x109 m³ as in 1913. The flood usually occurs in summer from August to October and during this period, it may vary from 36 x 109 m³ to 7 x 109 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 m3 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 thesamples 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 respectivelyThe 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 0C. with seasonal average of 17.2, 25.4, and 28.8 0C 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 0C. with seasonal average of 17.4, 26.1, and 29.0 0C 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.