CHAPTER V

SUMMARY AND CONCLUSION

The sediments along the studied locality may be affected by the water currents as well as hydro-morphologic features. The studied locality can be divided into two main geographic parts (southern and northern). The southern geographic part is characterized by its sinuosity, relatively narrow width, shallow depth and narrow cross sectional area. However, the northern geographic part is characterized by its low sinuosity, wide surface, deep bottom and its large cross sectional area.

The western bank mostly slopes gently relative to the eastern bank. The deepest points along the studied locality mainly exist in the eastern side. There is a wide spread of rocky irregularities and ridges along the northern part.

The width increases northward from 360 m at profile 23 to reach about 9800 m at profile 22. The depth gradually increased from 10.5 m at profile 23 to reach 36 m at profile 22. The profile areas increased northward from 2940 m^2 to reach about 217200 m^2 at profile 22.

The interaction between sediments and water is mainly controlled by temperature, current regime, pH, total dissolved salts and the dissolved nutrient salts concentration. The air temperature was higher than the water temperature. Along the southern part, there was no variation in water temperature and total dissolved salts between the surface and the bottom, (i.e.) one water mass. Whereas, the downward decrease in temperature was established along the northern part that may be referred to the width of the channel as well as the depth.

Along the studied locality, the current velocity decreases with increasing the profile area. Therefore, it decreased northward from values reached 87 cm/sec at profile 23 to values as low as 2 cm/sec at profile 22. The pH values varied between 7.33 (slightly alkaline) and 8.55 (moderately alkaline). Along the southern geographic part, the pH values slightly increased northward from 7.43 at profile 23, to 7.72 at profile 19 with nearly no vertical variation. North of profile 19, there was nearly no change in pH values till the end of this part. Along the northern geographic part, the vertical variation in pH values was established, whereas the average pH values increased northward from 7.74 to reach 8.2. The electrical conductivity mainly tends to increase northward due to evaporation, consequently, increases the total dissolved salts. The total dissolved salts ranged between 131 mg/l and 169 mg/l with corresponding electrical conductivity values ranged between 204 and 264 µmohs/cm respectively. Along the southern geographic part, the average values of total dissolved salts tended to decrease northward ranging between 131 mg/l and 156 mg/l. Along the northern geographic part, the average values of total dissolved salts increased northward to reach 165 mg/l at profile 22. The factors controlled total dissolved salts are the hydromorphologic features as will as the nutrient salts concentration. The nutrient salts are represented by Silicates (SiO_2) Phosphates (PO_4) Nitrates (NO_3^-) and Nitrites (NO_2) where silicates formed the main constituent. The total nutrient salts tended to decrease northward ranging between 7.71 mg/l and 20 mg/l.

Water as a medium transports sediments from the upstream to the lake and from adjacent territories. Recent sediments in the studied locality include two main constituents, the suspended matter and the sediments laden on the bottom. The suspended matters increased downward, as well, it intensively decreased northward from 915 mg/l to reach 7 mg/l.

On the bases of the average distribution of the suspended matters, the area under investigation may be divided into two main environments, riverine and lacustrine. The riverine environment located between lat. 21^{o} $2^{'}$ $55.35^{"}$ and 21^{o} $17^{'}$ $01.41^{"}$ and long. 30^{o} $38^{'}$ $54.65^{"}$ and 30^{o} $47^{'}$ $12.99^{"}$, along which, the average suspended matters increased northward from 439 mg/l to reach 642 mg/l. The lacustrine environment located between lat. 21^{o} $17^{'}$ $01.41^{"}$ and 21^{o} $57^{'}$ $13.26^{"}$ and long. 30^{o} $47^{'}$ $12.99^{"}$ and 31^{o} $18^{'}$ 32.99", may be differentiated into two main geographic parts, southern and northern. Along the southern part of lacustrine environment, the average suspended matters showed nearly no change. Along the northern part of lacustrine environment, the average suspended matters decreased northward to reach 13 mg/l.

The main factor affecting the suspended matters are the total dissolved salts, and the current velocities. Along the riverine environment, there was no distinct relation between suspended matters and total dissolved salts, whereas, along the southern part of the lacustrine environment, the suspended matters decreased with decreasing the total dissolved salts. However, along the northern part of lacustrine environment, the total dissolved salts may assist the suspended matters to settle due to coagulation, so, the suspended matters decreased with increasing the total dissolved salts. Along the studied locality, the suspended matters decreased with increasing each of the profiles width, depth and area. Along the riverine environment, although, the current velocity decreased northward, suspended matter increased. Whereas, along the lacustrine environment, the suspended matter decreased with decreasing the current velocity.

The riverine environment characterized by sand, silty sand, sandy clay silt, clay silt and silty clay sediments, whereas, the lacustrine environment is characterized by silty clay and clay sediments. Sand was found to be restricted

to riverine environment in which it decreased gradually northward. Silt content ranged between 1% and 60% with an average 23%. Along the riverine environment, the average silt content increased northward from 22% to 52% with an average 38%. Along the lacustrine environment, the average silt content decreased northward to reach 12% with an average 19%. The clay content ranged between zero % and 78% with an average 60%. The average clay content regionally increased northward. Along the riverine environment, the average clay content increased northward from 11% to 39% with an average 25%. Along the lacustrine environment, the average clay content continued to increase northward to reach 73% with an average 69%. The colloidal materials ranged between 0% and 19% with an average 11%. The average colloidal materials regionally increased northward (i.e.) reflecting its relation to clay. Along the riverine environment, the average colloid content increased from 1% to 6% with an average 4%. Along the lacustrine environment, the average content increased to reach 15% with an average 12%.

The median diameter (MdØ) ranges between 2.08Ø (fine sand) and 11.40Ø (very fine clay) with an average 9.46Ø (medium clay). Along the riverine environment, the average values of MdØ increased northward from 3.86Ø (very fine sand) to 7.68Ø (very fine silt) with an average 5.8Ø (medium silt). Along the lacustrine environment, the values continued to increase northward to reach 10.92Ø (fine clay). It has an average 10.37Ø (fine clay). The mean size (MzØ) ranged between 2.11Ø (fine sand) and 11.26Ø (very fine clay) with an average 9.27Ø (medium clay). Along the riverine environment, the average values of MzØ increased northward from 4.06Ø (coarse silt) to 8.09Ø (coarse clay) with an average 6.14Ø (fine silt). Along the lacustrine environment, the average values of MzØ continued to increase northward reaching 10.49Ø (fine clay) with an average 10.05Ø (fine clay). In the riverine environment, the mean size

MzØ exceeded the median diameter MdØ whereas the median diameter MdØ exceeded the mean size MzØ in the lacustrine environment. The inclusive sorting σ_I ranged between 0.62 (moderately sorted) and 3.39 (very poorly sorted) with an average 1.91 (poorly sorted). Along the riverine environment, the average value of inclusive sorting σ_I increased northward from 1.3 (poorly sorted) to 2.55 (very poorly sorted) with an average 2.16 (very poorly sorted). Along the lacustrine environment, the average values of the inclusive sorting σ_I decreased northward to reach 1.71 (poorly sorted) with an average 1.85 (poorly sorted). The skewness Sk_I ranged between -0.45 (strongly coarse skewed) and 0.39 (strongly fine skewed) with an average -0.18 (coarse skewed). Along the riverine environment, the average value of skewness Sk_I is slightly increased northward, (i.e.), the sediments tend to skewed toward the fine fraction. Along the lacustrine environment, the average values of skewness decreased northward (i.e.) the sediments tend to skewed towards the coarse fraction. The Kurtosis KG ranged between 0.66 (very platykurtic) and 1.60 (very Leptokurtic) with an average 0.96 (mesokurtic). Along the riverine environment, the average values of Kurtosis KG decreased northward from 0.91 (mesokurtic) to 0.73 (platykurtic) with an average 0.88 (platykurtic). Along the lacustrine environment, the average values Kurtosis KG increased northward to reach 1.26 (leptokurtic) with an average 0.98 (mesokurtic).

The main factor affecting the sediments distribution along the studied locality is the current velocity (especially along the lacustrine environment) that, in turn, affected with the hydromorphologic features.

Along the studied locality, there are two main mechanisms of deposition, river processes (in the riverine environment) and slow depositional processes from quiet water (in the lacustrine environment).

The organic matter content in bottom sediments increased northward where it ranged between 1.26% and 12.78% with an average 9.71%. Along the studied locality, the organic matter content increased with decreasing the grain size of the sediments. i.e., the area under investigation is characterized by fine grain sediments contained organic matter, concentrated in the lacustrine environment.

The carbonate content ranged between 5.05 % and 8.02% with an average 6.54 %. Along the riverine environment, the average distribution of carbonate content increased northward, whereas, it decreased along the southern part of the lacustrine environment. Along the northern part of the lacustrine environment, the carbonate content increased northward.

Along each of the riverine environment and the northern part of the lacustrine environment, the carbonate content increases with decreasing each of the grain size and organic matter content. Wherever, there was a reverse relation along the southern part of the lacustrine environment. Along the studied locality, the carbonate content increases in the sediments with increasing the pH of water.

X-ray diffraction analysis reflected that the bottom sediments composed mainly of clay minerals including Momtmorillonite, Kaolinite and Illite in addition to Quartz, Feldspar, Calcite and Hematite. Quartz showed its maximum content at the riverine environment. Along the southern part of the lacustrine environment, the quartz content decreased northward. Along the northern part of the lacustrine environment, the quartz content showed nearly no change. The feldspar showed its maximum content at the riverine environment, whereas, there is no change in its content along the lacustrine environment. The calcite content showed relatively lower values along the riverine environment compared with the southern part of the lacustrine

environment. Along the northern part of the lacustrine environment, the calcite content increased northward. The hematite shows its maximum content in the riverine environment, whereas, it decreased northward along the lacustrine environment.

Montmorillonite is the most abundant clay mineral followed by kaolinite, whereas illite has a relatively low abundance. The abundance of montmorilonite and kaolinite increased northward along the studied locality, whereas, illite increased northward till reached its maximum at profile D, then decreased farther north.

From the above mentioned discussion, the following conclusion are reached:

The area under investigation can be distinguished into two main environments (riverine and lacustrine) each of which has its own hydromorphologic, hydrographic and sediments characteristics. The riverine environment located between lat. $21^{o}\ 2^{'}\ 55.35^{"}$ and $21^{o}\ 17^{'}\ 01.41^{"}$ and long. $30^{o}\ 38^{'}\ 54.65^{"}$ and $30^{o}\ 47^{'}\ 12.99^{"}$.

The riverine environment characterized by its sinuosity in addition to its relatively narrow width shallow depth and narrow cross sectional area. The eastern bank mostly slops gently relative to the western bank.

Along the riverine environment, as the profile area increased northward, the current velocity decreased, whereas, pH, electric conductivity and total dissolved salts (including nutrient salts) increased. The nutrient salts mainly included silicates (increased northward) and phosphates (decreased northward) in addition to small amounts of nitrates (increased northward) and nitrites (decreased northward).

Along the riverine environment, as the suspended sediments increased northward, the bottom sediments characterized by relatively coarse grain (very

fine silt to very fine sand), where the mean size MzØ exceeded median diameter MdØ. The northward decrease in the grain size accompanied by the change from poorly to very poorly sorted and from mesokurtic to platykurtic giving rise for the sediment to be skewed towards the fine fraction. Along this environment, the river processes are the dominant mechanism of deposition. The organic matter and carbonate contents were found in a relatively low abundance and increases in percentages northward. In the riverine environment, quartz, feldspar and hematite showed its maximum content, whereas, calcite and clay minerals including montmorillonite, kaolinite and illite, showed there minimum abundance.

The lacustrine environment located between lat. 21^{o} $17^{'}$ $01.41^{"}$ and 21^{o} $57^{'}$ $13.26^{"}$ and long. 30^{o} $47^{'}$ $12.99^{"}$ and 31^{o} $18^{'}$ 32.99". It may be differentiated into two main geographic parts, southern and northern. The southern geographic part is characterized by its sinuosity and its shallow depths, whereas, its profiles became wider and larger in area than that characterizes the riverine environment. In addition, the western bank slobs gently relative to the eastern bank.

Along the southern part of the lacustrine environment, as the profile area continued to increase northward, the current velocity continued to decrease, whereas, electric conductivity and total dissolved salts (including nutrient salts) decreased, however, the pH nearly did not change.

Along the southern part of the lacustrine environment, as the suspended sediments did not change, the bottom sediments tended to be fine grained (fine to medium clay) where the median diameter MdØ exceeded mean size MzØ. The northward decrease in the grain size accompanied by the change from very poorly to poorly sorted and from platykurtic to leptokurtic, whereas, it slightly skewed towards coarse fraction. However, the slow deposition from quite water

was the prevailing mechanism of deposition. The organic matter content increased northward, whereas carbonate content decreased. As the quartz and feldspar content decreased northward, the calcite, hematite and clay minerals content including montmorillonite, kaolinite and illite, increased.

The northern part of the lacustrine environment characterized by its low sinuosity, wide surface, deep bottom and large cross sectional areas. In addition, the western bank slobs gently relative to the eastern bank, whereas, there is a wide spread of the rocky irregularities and ridges.

Along the northern part of the lacustrine environment, as the profile area largely increased northward, the current velocity rapidly decreased, whereas, pH, electric conductivity and total dissolved salts (including nutrient salts) rapidly increased.

Along the northern part of the lacustrine environment, as the suspended sediments rapidly decreased northward, the bottom sediments tended to be fine grained (fine clay) where the median diameter MdØ continued to exceeded mean size MzØ. Along this part of lacustrine environment as the grain size changed in a very narrow range, the sediments restricted to be poorly sorted, leptokurtic and strongly coarse skewed. Along this part, the organic matter and carbonate contents were found in a relatively high abundance and increased in percentages northward. As the feldspar and hematite content continued to decrease northward, the quartz showed nearly no change, whereas, the calcite and clay minerals content including montmorillonite, kaolinite and illite, continued to increase.