5. SUMMARY

This study points to the evaluation of the pedochemical characteristics of some soils representing the northwestern coast of Egypt. The studied area is bounded by longitudes 28° 15` and 29° 00` East and latitudes 30° 15` and 31° 30` North. These were by four physiographic units (aeolian plain, piedmont, alluvial plain and sabkha).

Seventeen soil profiles were chosen to represent the different physiographic units and were morphological described their physical, chemical and mineralogical properties were evaluated. The obtained data could be summarized in the following:

1- Physical and chemical properties

1.1.Soils of Aeolian plain

Soil texture of this physiographic unit ranges from sand to sandy clay loam. Calcium carbonate is commonly very high and ranges from 28.15 to 93.84% with no specific distribution pattern with depth. Organic matter content is very low and does not exceed 0.61%. pH values ranged from 8 and 9.1 indicating that the soils are moderately alkaline to very strongly alkaline. EC_e values range between 0.59 to 32.7 dSm^{-1} indicating that the soils are non saline to strongly saline. Soluble cations are in the order: $Na^{+} > Ca^{++} > Mg^{++} > K^{+}$, while in some layers Ca^{++} ion exceeds Na^{+}. Soluble anions have the order $Cl^{-} > SO_4^{=} > HCO_3^{-}$.

1.2. Soils of piedmont

Soil texture of this physiographic unit varies from sand to clay. $CaCO_3$ content varies from 24.8 to 66.47% and tends to decrease with depth. Organic matter content is very low and does not exceed 0.98%. Soils are slightly alkaline to strongly alkaline (pH 7.7 to 8.9). Soils are non saline to strongly saline and soluble cations are characterized by the dominance of Na^+ followed by Ca^{++} and/or Mg^{++}, while K^+ ions are the least abundant soluble cations. Soluble anions have the order $Cl^- > SO_4^= > HCO_3^-$ while $CO_3^=$ is absent.

1.3. Soils of alluvial plain

Soils texture of this physiographic unit fluctuates between sand to sandy clay loam. $CaCO_3$ content is very high and ranges from 27.73 to 68.42% with an irregular distribution pattern with depth. Organic matter content is extremely low it is not exceeding 0.52%. Soils reaction lies in the moderately alkaline to very strongly alkaline side. Soils are non saline to moderately saline as the EC_e values varies between 0.7 and 9.13 dsm^{-1}. Soluble cations are in the order $Na^+ > Ca^{++} > Mg^{++} > K^+$, while soluble anions have the order $Cl^- > SO_4^= > HCO_3^-$.

1.4. Soils of sabkha

These soils have sandy clay loam and sandy loam textural class throughout the entire profile depth. $CaCO_3$ content ranges from 20.8 to 68.81% indicating that these soils are calcareous. Organic matter content is very low and does not exceed 0.4%. Soil reaction is moderately alkaline and the soils are slightly saline to strongly saline. The dominant soluble cations are Na^+

followed by Mg^{++}, Ca^{++} and K^{+} while soluble anions dominated by Cl^{-} followed by $SO_4^{=}$ and HCO_3^{-}.

1.5. Calcium carbonate distribution

Particle size distribution of carbonate components in the sand sub fraction, indicating that the physical weathering predominates the chemical ones. The increase of carbonate in the sand size fraction may be possibly, due to lime segregation, nearest these sediments to parent rocks and soft nodule formations within the profile layers of these soils. Therefore, these carbonates could be considered as primary, i.e. inherted from parent materials forming these soils.

2. Grain size analysis

From the grain size parameter, it can be noticed that the water action is the main factor affecting transportation and deposition of the studied soils

Generally, the moderate differences of kurtosis value in the studied soils are corresponding to a relatively low energy environment. The (SK) values of these soils show bimodal or non normal distributions, indicating a mixing of two or more model fractions.

3. Trace element status

3.1. Total zinc

Total Zn ranged between 0.1 to 57.0 mg kg^{-1}, having negative correlation with clay %, silt %, OM % and fine sand %, and negative correlation with $CaCO_3$ % and coarse sand.

3.2. Total copper

Total Cu ranged between 2.0 and 27.4 mg kg^{-1}, having positively correlation with clay %, silt %, and OM %, but negatively correlation with coarse sand % and $CaCO_3$ %.

3.3. Total iron

The total Fe ranged widely between 1110.9 and 12698.6 mg kg^{-1}, and was closely related to soil texture and $CaCO_3$, giving positive correlation with each of OM %, clay %, silt % and fine sand and negatively with $CaCO_3$ % and coarse sand.

3.4. Total manganese

Total Mn ranged between 20.0 and 269.2 mg kg^{-1} having positively correlation with clay %, silt %, OM % and fine sand and negatively correlation with $CaCO_3$ and coarse sand.

The vertical distribution of total trace elements is discussed in light of the statistical measures, i.e. weighted mean, trend and specific range, suggested by **Oertel and Giles (1963).**

3.5. DTPA-Zn

DTPA-extractable Zn ranged from 0.012 to 0.62 mg kg^{-1}, having positive correlation with fine sand %, silt % and clay % and negatively correlation with $CaCO_3$ % and coarse sand.

3.6. DTPA-Cu

DTPA-extractable Cu ranged from 0.004 to 0.82 mg kg^{-1}, having positively correlation with clay %, EC_e and $CaCO_3$ %

3.7. DTPA-Fe

DTPA-extractable Fe varied from 1.18 to 36.8 mg kg^{-1} and having positively correlation with EC_e.

3.8. DTPA-Mn

DTPA-extractable Mn ranged between 1.11 to 36.59 mg kg^{-1}, having positively correlation with EC_e.

5.4. Mineralogical composition of the studied soils

5.4.1. Mineralogical of the sand fraction

a) Light minerals

Quartz predominate the light fraction with less pronounced amounts of feldspars of which orthoclase and plagioclase are the principal members, while microcline is the least abundant.

b) Heavy minerals

Heavy mineral are dominated by opaques, non-opaque minerals are dominated by pyroboles (pyroxenes + Amphiboles) and altrastable minerals (zircon, rutile and tourmaline). Garnite, epidote, kyanite and silimanite minerals are present in moderate amounts, while the remaining minerals are detected in less pronounced occurrences.

c) Uniformity of soil parent materials:

The data of frequency distribution of resistant minerals and weathering ratios leads to the conculusion that the studied soils are heterogeneous either due to their multi-origin or due to multi-depositional regimes.

5.4.2. Mineralogy of the clay fraction

From x-ray identification of the clay minerals it can be generally noticed that palygorskite minerals are alternatively dominated in the studied physiographic units followed by kaolinite. Smectite, illite and chlorite minerals are the lowest abundant clay minerals in these soils.

The identified accessory minerals are mainly dominated by quartz and feldspars followed by calcite, dolomite and apatite.

5.5. Soil classification

According to the previously mentioned field analytical results and soil abservation, the soil classification was performed on the basis of the **USDA (1975)** and the key of **Soil Survey Staff (2001).** The studied soils are generally classified in the one order namely, Aridisols down to the family level.

1- Order: Aridisols

Suborder: Calcids

- Subgroup: Haplocalcids
- Subgroup: Petronodic Haplocalcids (profiles 6, 7, 13, 15, 16, 1, 3, and 9)
- Subgroup: Typic Haplocalcids (profiles 5, 8, 12, 14, 4, 10, 11, 2 and 17)

5.6. Land evaluation

Application of the capability index for the studied soil profiles suggested by **Sys *et al* (1991)** shows that estimated current suitability of the studied soil profiles could be categorized into two classes between grade (III) and grade (VI) as follows:

1- Grade (III): fair soils, represented by profiles 7, 13, 15 and 16 (Aeolian plain), profiles 1 and 9 (piedmont), profiles 8, 10, 11 and 14 (alluvial plain) and profiles 2 and 17 (sabkha).

2- Grade (VI): Non agriculture soils, represented by profiles 6, 3, 4, 5 and 12

The studied soil profiles are evaluated to determine its suitability for growing 12 crops. Results reveal that the studied soil profiles include the suitable classes (S_2, S_3 and N).