Genesis formation classification and evaulation of some soils in the eastern desert egypt

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The present investigation was undertaken to study the genesis, formation, classification and evaluation on some soils of the Eastern Desert of Egypt. The studied area is bounded by longitudes 32° 15- and 32° 42- East and latitudes 29° 00- and 29° 15- North. It is characterized by the presence of four physiographic units namely Wadi Bottom, alluvial plain, coastal plain and Sabkha.To get more soil information on such area, twenty seven soil profiles were chosen to represent the different physiographic units. These profiles were morphologically described and their chemical, physical and mineralogical properties were evaluated. The obtained results could be summarized in the following:1. Physical and chemical properties: a) Soils of Wadi Bottom:Soil texture varied among sand to sandy clay loam. Total carbonate content ranged between 51.72 to 4.31 % with an irregular distribution pattern with depth, except for profile 13. Organic matter content did not exceed 0.72 % with a tending to decrease with depth. Soil reaction was neutral to moderately alkaline as shown by pH values which ranged from 7.2 to 8.3. Soluble salts indicate that the soils were non-saline to moderately saline were EC values ranged between 1.03 to 15.36 dSm"1. The cationic composition is characterized by the dominance of Na+ and/or Ca++ followed by Mg++ and Ie. The soluble anions have the following descending order Cl- > SO4- and HCO3-. Gypsum content is considerably low and varied from0.05 and 0.65 % and tends to decrease throughout the entire profile depth.b)Soils of alluvial plain:Soil texture of these soils ranges from sandy to sandy clay loam. CaCO3 content ranged from 0.43 to 40.51 % without any specific pattern with depth. Organic matter content is very low and never exceed 1.0 %. The soils are slightly acid to moderately alkaline as the pH values varied from 6.4 to 8.3. The soils are non-saline to strong saline (ECe ranged from 0.6 to 53.2 dSm-1). The dominant soluble cation is Na' and/or Ca++ followed by Mg++ and K+, while the soluble anions have the descending order CI- > SO4= > HCO3-. Gypsum content varied from 0.05 to 8.71 % with a tendency to decrease with profile depth.c)Soils of the coastal plain:Soil texture of this physiographic unit varied from sand to sandy clay loam and CaCO3 content varies from 12.07 to 42.92 % with an irregular distribution pattern with depth. Organic matter content did not exceed 0.9 %. The soils were slightly alkaline to moderately alkaline where pH values ranged from 7.4 to 8.2. These soils are non-saline to moderately saline as shown by ECe values which ranged from 1.3 to 14.3 dSm-1. Soluble cations distribution follows the descending order Na+, Ca++' Mg++ and K+, while anions could be arranged in the order Cl- > SO4- > HCO3-. Gypsum content is very low and ranging from 0.1 to 6.5 % with an irregular distribution pattern with depth.d)Soils of Sabkha:These soils have sand texture class in the uppermost surface layers and changed into sandy loam in the deepest one.CaCO3 content ranged from 16.3 to 22.35 % and tends to increase with the depth. Organic matter is extremely low exceed 0.49 %. The soil reaction is neutral to moderately alkaline as revealed by pH values which ranged from 7.0 to 8.1. The soils are very slightly saline to extremely saline (ECe ranged from 2.3 to 69.2 dSm-1). Soluble cations are dominated with Na+ followed by Ca++, Mg++ and K+, while soluble anions are dominated with Cl followed by SO4- and HCO3". Gypsum content is very low and ranged from 0.11 to 0.85 %.2.Cation exchange capacity:Data indicate that the CEC values ranged from 5.68 to 17.93, 4.09 to 20.32, 5.68 to 17.6 and 6.0 to 14.64 cmole kg-1 in the soils of Wadi Bottom, alluvial plain, coastal plain and Sabkha, respectively depending on the soil texture and clay content and mineralogy. Exchangeable calcium

dominated the exchangeable cations followed by Mg++ and/or Nat, while Kt ion is the least abundant exchangeable cations.3.Statistical size parameters:from the grain size parameters, it can noticed that the water, wind and/or water and wind actions are the main factors affecting to transportation and deposition of the studied soils.4.Microelements status in the studied soils:Total and chemically extractable contents of some trace elements ”Fe, Mn, Zn and Cu” were determined in the subsequent layers of the studied soil profiles in a trial to shed light on their depthwise and lateral distribution. Moreover, statistical analysis is performed to evaluate the role of soil variables in controlling trace elements content. Data indicate thatsoil texture and CaCO3 content are the most important factors that correlate with total and available content of such elements. Furthermore, statistical measures of Oertel and Giles (1963) reveal the role of parent material and soil forming processes is affecting trace elements distribution.5. Soil mineralogy:5.1. Mineralogy of the sand fraction:a)Light minerals:Data indicate that the light fraction is composed almost entirely of quartz which constitutes 95.0 — 98.0 %. Other associated minerals are orthoclase, plagioclase and microcline (feldspars). Orthoclase and microcline are the main members of feldspars, while less pronounced occurrence of plagioclase.b)Heavy minerals:The results indicate that opaque minerals are the most common minerals. The non-opaques are mainly dominated by pyroboles (pyroxenes and amphiboles) followed by ultrastable minerals (zircon, rutile and tourmaline), parametamorphic minerals (garnet, staurolite, kyanite and silimanite) and epidote, while the rest of minerals are detected in less pronounced amounts.Uniformity and development of soil profiles shows that the soils are heterogeneous either due to their multi-origin or due to a subsequent variation along the course of sedimentation. Therefore, they are young from the pedological view point.5.2. Clay mineralogy:from X-ray identification of the clay minerals, it can be generally noticed that kaolinite are alternatively dominated in thestudied physiographic units followed by smectite (montimorillonite). Illite, palygroskite and chlorite minerals are the lowest abundant clay minerals in these soils.The identified accessory minerals are mainly dominated by quartz followed by feldspars, while calcite, dolomite and apatite minerals are detected in trace amounts.6. Soil classification:According to the previously mentioned field and analytical results, the soil classification was preformed on basis of the USDA (2003) and the obtained soil classification could be introduced as follows:1- order Aridisols1-Suborder: Gypsids* Great group: Haplogypsids(profiles 8, 17, 21 and 25) * Great group: Calcigypsids(profile 27)2-Suborder: Calcids* Great group: Haplocalcids(profiles 2, 14, 26, 12, 13, 15, 22, 23, 7, ’18, 20, 24, 5 and 16)2- order Entisols Suborder: OrthentsGreat group: Torriorthents(profiles 1, 4, 11, 19, 3, 6, 9, and 10)7. Land evaluation:According to the land capability index, e soils are placed in grade 3 and 5 as follows:1-Grade 3: ”fair soils”, represented by the soils of rofiles 5, 13, 16, 20, 22, 23 and 26 (Wadi Bottom); profiles 2, 3, 6, 10, 11, 12, 14, 18, 21, 24, 25 and 27 (alluvial plain) an profiles 4, 7, 8 and 15 (coastal plain).2-Grade 5 ”very poor soils” represented by profi es 17 and 19 (alluvial plain) and profile 9 (Sabkha).According to the land suitability index, soi s are located within the following suitability classes:S3: marginally suitable with suitability index 25 50. N: non-suitable with suitability index < 25.Suitability for various crops was also assess d. Soils were suitable for growing 16 different crops (8 differen field crops; 4 different vegetable crops and 4 different fruit crops.