Mineralogical studies on some soils of sinai penisula

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This study aims at evaluating the pedogenic characteristics of the soils of some areas in Sinai peninsula. These areas are El-Qaa plain (Wadi Mahash, Wadi Isla, El-Qaa plain and Wadi Firan) in the south western part; Suez basin (Wadi Sidri, Wadi Wardan, Wadi Sudr, Wadi Kahali and Wadi El-Hage) in the Western-Central Part, in addition to Wadi El-Brouk in the central part of Sinai Peninsula.To achieve this objective, sixteen soil profiles were selected to represent the main geomorphic units in El-Qaa plain, Suez-basin and Wadi El-Brouk. These profiles were described morphologically in the field and their physical, chemical and mineralogical characteristics were evaluated. The investigated soils were classified according to soil Taxonomy, 1998 and evaluated from the agricultural view point. The obtained results can be summarized in the following :1- Physical and chemical properties : a) Soils of El-Qaa plain :Soil texture varied among sand to sandy loam. Total carbonate content ranged between (6.1 and 35.69%) with an irregular distribution pattern with depth except for profiles 2 and 4. Organic matter did not exceed 0.29% in the different layers of soil profiles. Soluble salts indicate that soils were saline to extremely non saline where EC ranged between (0.9 and 36.4 dS/m). The highest value was found in soils of Wadi Firan, while the lowest value was detected in the soils of Wadi Mahash, Soil reaction was neutral to alkaline (pH 7.0-8.7), the cationiccomposition is characterized by the dominance of Na+ and/or Ca’ followed by Mg’ and K+, The soluble anions have the following descending order , SO4- and H03-. Gypsum content varied between 0.05 and 16.0% with an irregular distribution pattern with depth.b)Soils of Suez basin :Generally the soils have sand, sandy loam and loamy sand textures except for the surface layer of profile 8 which is sandy clay loam. CaCO3 content ranged from 13.77 to 65.61% without any specific pattern with depth throughout the soil profiles at Kahali and El-Hage Wadis. Organic matter content did not exceed 0.52%. The soils are neutral to moderately alkaline as the pH values varied between 7.3 and 8.3. The soils are non saline to extremely saline and salinity increases with depth. The dominant soluble cation is Na+ and/or Ca++ followed by me+ and K+, while the soluble anions have the descending order Cl, SO4 and HCO3-. Gypsum content ranged from 0.06% to 38.17%.c)Soils of Wadi El-Brouk :Soil texture of these soils ranges from sand to sandy clay loam, and CaCO3 content ranged between 34.5 and 71.5%. Organic matter content ranged between 0.1 and 0.9%. The soil reaction is neutral to moderately alkaline as pH values ranged between 7.0 to 7.9. Soils of gullied and isolated remnants were extremely saline as the EC values exceeded 17.0 dS/m, while soils of Wadi are non- saline to slightly saline. 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 varied between 6.6% and 10.1% with an irregular distribution pattern with depth.2- Cation exchange capacity :Data indicate that the CEC values range from 1.16 to 9.63, 2.96 to 20.51 and 2.3 to 12.6 me/100g in the soils of El-Qaa plain, Suez basin and Wadi-El-Brouk respectively depending on soil texture, and clay content and mineralogy. Exchangeable Ca’ dominated the exchangeable cations followed by Mg”, Na’ and IC, however in some layers exchangeable mg- exceeded Ca+3-Amorphous inorganic materials :Contents f amorphous inorganic materials were very low and ranged from 0.38 to 1.83%, 0.5 to 1.23% and 0.57 to 1.49% in the soils of El-Qaa plain, Suez basin and Wadi El-Brouk, respectively. It may be noticed that amorphous silica is the most abundant, followed by iron and alumina oxides. The arid

conditions (limited chemical weathering) and the coarse texture of parent materials of the studied soils may be responsible for the relatively less content of amorphous oxides.4- Statistical Size Parameters :a)The sediments are poorly sorted and moderately to moderately well sorted suggesting that transportation and deposition of parent materials either took place by water or formed by wind action and/or formed under both water and wind actions.b)The studied soils are commonly positively skewed except for profiles 1, 2, 8, 12 and 16 and some layers of profiles 3, 4, 7, 11, 14 and 15.c)Kurtosis values are usually more than 0.82 (mesokurtic, leptokurtic, platykurtic and very leptokurtic), indicating that the soil sediments have coarse mode with less fine mode.d)Applying the discriminant functions of Sahu (1964) revealed that the sediments forming the investigated soils are mostly deposited under turbidity current and fluvial environments (aqueous).5- Soil Mineralogy :a)Mineralogy of the clay fraction ;The clay mineralogy revealed the dominance of smectite (montmorillonite) minerals in the examined clay fraction of the soils of El-Qaa plain, Suez-basin and Wadi El-Brouk, followed by kaolinite mineral, while, illite, chlorite and palygorskite minerals were the least abundant clay minerals in these soils.Concerning the accessory minerals, quartz and/or feldspars were the most abundant minerals. Calcite, dolomite and apatite were also detected, yet in trace amounts in some samples.b)Surface area of the clay fraction :Surface area of the clay fraction ranged from 86.0 to 196.0 m2/g. The values being followed the order: El-Qaa plain > Suez-basin > Wadi El-Brouk.c)Cation exchange capacity of the clay fraction :C.E.0 of the clay fraction ranged from 21.2 to 52.4 me/100 g. The highest value characterizes clay fraction of El-Qaa plain, while, the lowest is that of Wadi El-Brouk clay, since smectite was greater in the former soils.6. Mineralogy of the sand fraction :a)Light minerals :The mineralogical examination of the sand fraction showed that the light minerals were dominated by quartz which forms more than 95.31%. Other associated minerals were orthoclase, plagioclase and microcline which were detected in minute amounts.b)Heavy minerals :Heavy minerals were dominated by opaques. Non opaques were dominated by amphiboles, pyroxenes, while zircon, rutile, tourmaline, kyanite, garnet, staurolite and epidote were detected in few amounts and the remaining minerals were of less pronounced occurrence or even absent. A test of uniformity and development of soil profiles leads to the prediction that these soils are heterogeneous or at least partially heterogeneous due to multi parent material and depositional conditions.7- Soil classification :According to the previously mentioned field and analytical results, the soil classification was preformed on basis of the US Soil Taxonomy (1998), and the obtained soil classification could be introduced as follows :1. order Entisols :Suborder : OrthentsGreat group: Torriorthents(profiles 1, 2, 6 and 7)Suborder : FluventsGreat group: Torrifluvents(profile 8)2. order : Aridisols :Suborder: Gypsids.Great group: Haplogypsids(profiles 3, 4, 5, 9 and 10).Suborder: CalcidsGreat group: Haplocalcids(profiles 11, 12, 13, 14, 15 and 16).8- Land evaluation:Application of the capability index for the studied soils revealed that the soils are placed between (IV) and (VI) grades as follows :1)Grade IV: Poor soils, represented by profiles 1, 2, 4, 6 and 8.2)Grade V: Very poor soils, represented by Profiles 3, 5, 7, 11, and 12.3)Grade VI: Non agricultural soils, represented by profiles 9, 10, 13, 14, 15 and 16.