pedological and mineralogical aspects as criteria of soil genesis, formation and taxonomy ofthe desert belt region betweeen el-fayoum and the nile valley using remote sensing technique

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This work aims at studying and evaluating some soils in the Arab Republic of Egypt represented by an area between El-Fayoum and Nile Valley. The studied area is bounded by latitudes 29° 11' 37"and 29° 34' 00" North 'and longitude 30° 51' 27"and 31° 16' 20" East. Remote sensing (RS) and geographic information system (GIS) techniques were used in combination a contour map which was obtained from topographic maps at a scale of 1:50,000 and get triangulated irregular network (TIN) maps, slope maps and 3-dimantion (3D) graphic shape for the area. Multispecteral LANDSAT Satellite data were also used to classify the area with module supervisor classification. Panchromatic and multispecteral LANDSAT data were fused to obtained high resolution mutespecteral data so that the study area was defined by six physiographic units as follows:1-Old Terraces.2-Young terraces.3-Alluvial fan basin.4-Alluvial plain (locally terraced).5-Alluvial plain.6-Rock land.For more information, 16 soil profiles were selected to represent these physiographic units, and were morphologically described; and samples were physically, chemically andmineralogically analyzed. The taxa output were processed and sorted according to the system of "Soil Taxonomy" and "Land evaluation".a) Physical soil properties:1.Soil texture classes ranged from clay to sand, with dominance of clayey texture.2.Soil calcium carbonate content ranged from 4.3 to 154.0 g/kg•3.Soil gypsum content ranged from 11.0 to 158.2 g/kg.4.Soil organic matter was generally low and ranged from 0.1 to 18.0 g/kg.b) Soil chemical properties:1.Soil pH ranged from 7.01 to 8.47.2.Soil salinity ranged from non-saline to extremely saline, as the electrical conductivity (EC) of paste-extract values ranged widely from 0.70 to 156.60 dSm-1.3.Soluble cations in most soils followed the order of $Na^+ > Ca^{+2}$ and/or $Mg^{+2} > K^+$, but their arrangement in some layers the order was Ca^{+2} or $Mg^{+2} > Na^+ > K^+$. Soluble anions, in general, followed the order of Cl^- or $SO_4^{-2} > HCO_3^-$, and CO_3^{-2} was not detected.4.Cation exchange capacity (CEC) values ranged from 4.57 to 48.95 cmolc/kg soil. Exchangeable calcium or magnesium was the dominant cation followed by Na^+ while K^+ represented the least exchangeable cation.5.Total Fe ranged from 1500 to 37000 mg/kg, Mn ranged from 32 to 625 mg/kg, Zn ranged from 6.3 to 95 mg/kg and Cu ranged from 11.8 to 60 mg/kg.6.Available Fe ranged from 2 to 22 mg/kg, Mn ranged from 0.4 to 7.3 mg/kg, Zn ranged from 0.2 to 2.4 mg/kg and Cu ranged from 0.2 to 1.2 mg/kg.c)Grain size sedimentation analysis:Results obtained by using statistical size parameters showed that water or wind and their combined actions were the main factors affecting the media of both transportation and deposition (sedimentation) of the soil material. The most probable mechanisms of soil materials transportation are suspension in different forms, suspension and rolling and rollingform.d)Mineralogy of the sand fraction:1-Light minerals:Quartz predominated the light minerals and constituted more than 94.9 % of these minerals, with less pronounced amounts of feldspars (orthoclase, plagioclase and microcline). Orthoclase and plagioclase were the principal members of feldspars, while microcline represented the least content. The presence of feldspars indicates that the soils are young from the pedological viewpoint.2-Heavy minerals: Heavy minerals were, generally, dominated by

opaques. Non-opaques were dominated by amphiboles, pyroxenes, epidote, garnet and zircon; while rutile, tourmalie, staurolite and biotite were detected in few amounts. 3- Uniformity of parent material: This criterion was assessed through statistical size parameters and heavy minerals. Distribution of the resistant mineral ratios and weathering values indicate that the soils are generally formed from multi-origin and/ or multi-depositional regimes and are thus young (immature stage) from the pedological point of view. e) Mineralogical analysis of the clay fraction: Clay minerals are dominated by smectite and followed by kaolinite minerals, while illite occurs in a few amount with traces of vermiculite. The variation in the mineralogical composition of the clay fraction in soils of the studied area reflects multi-origin of sediments. 0 Soil classification: Soils were classified according to the Soil Taxonomy System of the USDA (1975) and the improvisation of USDA (1999), using the Taxonomy Key Manual (USDA, 2003). Accordingly soils were classified into three orders, i.e., Aridisols, Entisols and Vertisols, with further subdivisions of suborders, great groups, subgroups and families. f) Land evaluation: 1-Land suitability for irrigated agriculture: Evaluation of the soils was based on the systems of Sys and Verheye (1978), modified by Sys et al. (1991) on the basis of FAO (1976). The representative physiographic units are as follows: moderately suitable (S2, alluvial fan basin, alluvial plain "locally terraced" and alluvial plain), marginally suitable (S3, old terraces and young terraces), permanently not suitable (N2, rock land). 2-Land suitability for certain crops: Current land suitability: The studied soils were evaluated for some proposed certain crops based on the systems of Sys (1991) and Sys et al. (1993). Their suitability classes were calculated for every specific crop. Most soils are moderately suitable (S2) or marginally suitable (S3) for most of the selected crops, without major land improvements. Potential land suitability: Potential land suitability was evaluated on basis of executing specified major land improvements (salinity and sodicity). Evaluation was done on basis of supreme potential suitability and subsequent prior potential suitability. They were done for the most effective land utilization alternatives giving a possible maximum output. The two productive levels were adapted for soils developed on the identified physiographic units as follows: 1) Soils of old terraces: a) Moderately suitable (S2): olives, guava, grape, alfalfa and cowpea. b) Marginally suitable (S3): barley, groundnuts, maize, sesame, wheat, cabbage, onion, olives, guava, grape, alfalfa and cowpea. 2) Soils of young terraces: a) Moderately suitable (S2): olives. b) Marginally suitable (S3): groundnuts, sesame, cabbage, olives, guava, grape, alfalfa and cowpea. 3) Soils of alluvial fan basin: a) Highly suitable (Si): barley and wheat. b) Moderately suitable (S2): maize, cabbage, onion, olives, guava, alfalfa and cowpea. c) Marginally suitable (S3): groundnuts, sesame, carrots, tomato, mango and grape. 4) Soils of alluvial plain (locally terraced): a) Moderately suitable (S2): barley, olives and alfalfa. b) Marginally suitable (S3): maize, sesame, wheat, cabbage, onion, tomato, guava, grape and cowpea. 5) Soils of alluvial plain: a) Highly suitable (Si): barley, wheat and alfalfa. b) Moderately suitable (S2): maize, cabbage, onion, olives, mango, guava, grape and cowpea. c) Marginally suitable (S3): groundnuts, sesame and tomato.