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Some Characteristics of Soils on the Man Made Mounds in The Harran Plain of Turkey

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Abstract: Morphological, chemical and some mineralogical characteristics of five soils, were researched to understand the genesis of soils on the man made mounds in the Harran Plain, in the Southeast Anatolia Region of Turkey. Five soil profiles developed on the man made mounds in the arid region. Time and climate have affected soil formation. Also, parent material has influenced the chemistry of soils. The parent material of man made mounds were carried from around soils in the Harran Plain by men in years ago. The parent materials of around soils are calcareous parent materials and alluvium materials. Pedon 1 was described on the Konuklu man made mounds the northeast of the study area and Pedon 5 was described on the Küplüce man made mounds the southeast of the study area. According to the place of man made mounds were ordered from north to south as following: Pedon 1, Pedon 2, Pedon 3, Pedon 4 and Pedon 5. The old of Konuklu mounds is approximately 5000-6000 years. The old of Sultantepe and Koruklu mounds are approximately 6000 years. Pedon 4 which was described on the old Harran city remnants have the youngest soils of study area. The Harran mounds was made in 1258 A.I. by Mongolians. Mongolians destroyed the Harran City and made the Harran mounds. The most important pedogenic processes is carbonate leaching and accumulation in the pedon 5 on the Küplüce man made mounds. The $CaCO_3$ content of Pedon 5 may be attributed to eolian addition from Syria. Total Al_2O_3 contents of soils higher than total Fe_2O_3 content. According to the degree of soil formation the profiles were ordered as following: Pedon 3>Pedon 5>Pedon 2> Pedon 1>Pedon 4. The results of total elements analysis were used to determine the β leaching factor according to Jenny. The leaching factor were determined as <1 in the Pedon 1 (0.99), Pedon 2 (0.97), Pedon 3 (0.74) and Pedon 5 (0.92). The leaching factor were determined as >1 in the Pedon 4 (1.13).

Key words: Man made mounds, soil characteristics, soil occuration

INTRODUCTION

Soil forms as a result of weathering and disintegration of parental rock and material. Vegetation has been recognized as an important factor in soil formation since the earliest scientific consideration of soils. Jenny (1941) included biota as one of the five soil-forming factor, along with climate, topography, parent material and time, in his formal expressions of soil-forming functions. Jenny (1941) works inspired much soil genesis research, utilizing the factor functions, or sequence approach. In such studies, situations in nature are sought where all factors are constant, except the one under investigation so that the effect of that individual factor on soil formation can be assessed (Buol *et al*., 1980; Graham and Wood, 1991). The soils exhibit similar characteristics where these soil-forming factors are the same.

Among factors of occurance the earth surface soil were, different climates, too much organisms, different rocks, topography and various of old land. If the soils formation factor is seen the soil characteristics will be seen also (Buol *et al*., 1980).

According to Joffe (1949) the formation of soil in a region can occur within a certain period of time depending on the parent material, climate, topography and vegetation of the region (Buol *et al*., 1980; Dinc *et al*., 1987). Different parent materials affect the morphology and chemistry of soils under the same conditions, such as topography and vegetation, especially in arid and semiarid regions. Differences in physical, chemical and mineralogical properties of soils are related primarily to parent material (Washer and Collins, 1988).

The objective of this study was to research morphological, chemical, some mineralogical characteristics and formation of soils, developed on the man made mounds (hill) in the Harran Plain in the Southeast Anatolia Region of Turkey.

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MATERIALS AND METHODS

Site characteristics: The study area is Harran Plain in the Sanliurfa city, the Southeast Anatolia Region of Turkey (Fig. 1). This area is characterized by arid and semiarid climate and lies between 37° 02 and 37° 22° N Latitudes and 37° 58 and 38° 31 E Longitudes with altitude ranging between 500 and 600 m above MSL. The average amount of annual rainfall is 330 mm in the south of study area and 450 mm in the north of study area. Total evaporation is 2152 mm. The mean annual air temperature is 17.6°C. The mean annual soil temperature at 50 cm depth is 18.1°C. According the Soil Survey Staff (1996) criteria, the soil moisture regime is xeric and aridic and the soil temperature regime is thermic. The natural vegetations of study area are grasses, cereal and leguminous crops. Wheat, cotton, maize, pistachio, grape and lentil have beengrowing as commonly in Harran Plain.

Methods: The five soil Pedon, on the man made mounds, were described in the field according to Soil Survey Staff (1996). The Pedon 1, on the Konuklu man made mounds; Pedon 2, on the Sultantepe man made mounds; Pedon 3 on the Koruklu man made mounds; Pedon 4, on the Harran man made mounds and Pedon 5, on the Küplüce man made mounds, were described. According to the place of man made mounds were ordered from north to south as following: Pedon 1, Pedon 2, Pedon 3, Pedon 4 and Pedon 5.

Soil samples for laboratory analysis were collected from each horizon and air dried to pass a 2 mm sieve. The particle size distribution of each sample was determined by the pipette method (Mc Keague, 1978) after removal of organic matter and carbonates. The pH and salt content (electrical conductivity, EC) were measured on saturation extracts (Radiometer PHM 82 standard pH meter and Radiometer CDM 83 conductivity meter). Percent salt content was calculated from EC values. Cation Exchange Capacity (CEC) was determined by the ammonium acetate (NH_4OAc) at pH 7 method (Soil Conservation Service, 1982). Organic matter was measured by the using a modified Walkley-Black procedure (Nelson and Sommers, 1982). Total soluble salt and pH were measured on saturation extracts using electrodes (Radiometer CDM 83 Conductivity meter and Radiometer PHM 82 standard pH meter). Carbonate content was measured by the Sheibler Calciometer method (Black, 1965). Extractable Fe_2O_3 was measured by the dithionite citrate bicarbonate method and Total Al_2O_3, Fe_2O_3, Na_2O and K_2O analysis were carried out by HF Fusion methods (Jackson, 1954) β leaching factor was determined according to Jenny (1941). β leaching factor was determined by following formulation:

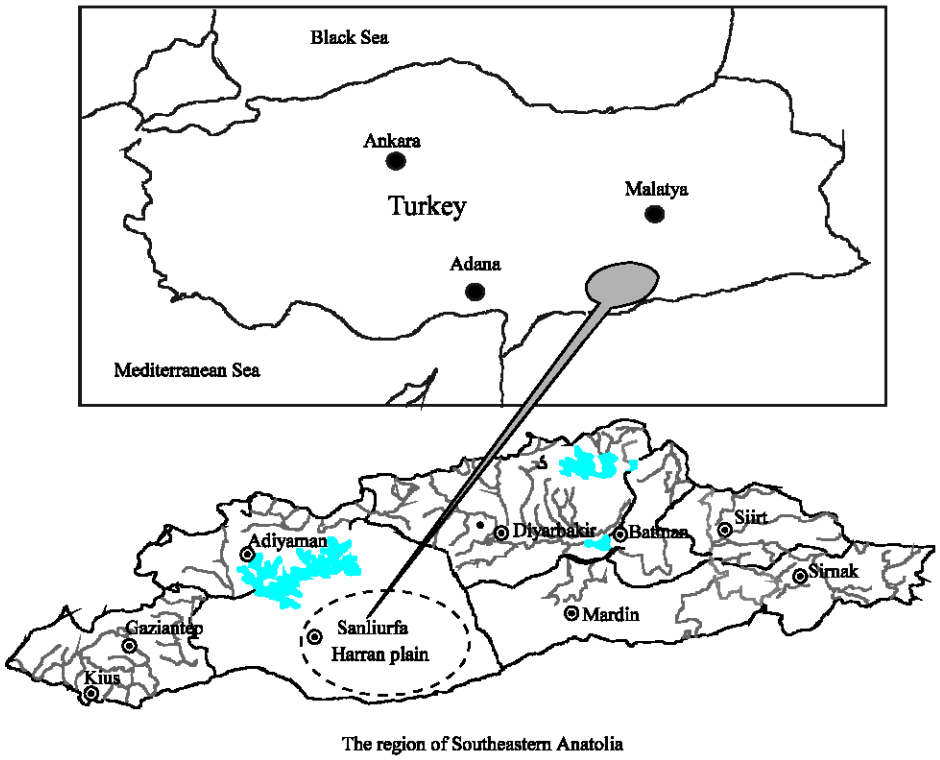

Fig. 1: Description of study area

$$\beta = \frac{\text{The ba value of leached horizon } (A_1)}{\text{The ba value of parent material } (C_1, C_2 \text{ or } C_3 \text{ horizon})}$$

The ba value was determined following formulation:

$$\text{ba value} = \frac{Na_2O + K_2O}{Al_2O_3}$$

RESULTS AND DISCUSSION

Soil formation on the man made mounds: These man made mounds, in Turkey called höyük, were accumulated by human in the past thousand years ago. These man made mounds used as inhabited by Human many succeeding civilizations for a long years. When people left those settlements mounds turned ruin and covered up by rubble on the top and stayed as elevated site. There are hundreds of larger and smaller settlement mounds in Harran Plain. Through out this region most of the mounds completely destroyed by settlement constructions and agricultural activities. There are settlements on top of some man made mounds still in the region.

Soil developing were started on these man made mounds after people left settlements. The time and climate have affected the soil formation in the study area. The age of Konuklu Man Made mounds is about 2000-2500 years (Fig. 2). Also, the age of Sultantepe and Koruklu mounds (man made hill) are about 3000 years (National History Encyclopedia, 1985).

The result of structure formation and biological activity, a Cambic B horizon have developed in the profile of Konuklu man made mounds. The most important pedogenic processes is cay leaching and accumulation in the Pedon 1 (Profile) on the Konuklu mounds. The fine clays which leached from the soil surface have accumulated in the Bw_1 and Bw_2 horizons of Pedon 1 on the Konuklu mounds. The clear line boundary separating the A_2 and Bw_2 horizons apparently pedogenic. The soil texture of A_1 horizon is loam in the surface, A_2 Bw_1 and Bw_2 horizons is clay loam, C_1, C_2, C_3 and C_4 horizons are loam. β leaching factor of the Konuklu mounds is 0.99 (Table 3). The low β leaching factor (<1) may be attributed to weathering of parent material.

Morphology of the Pedon 2 is generally similar to Pedon 1. Also, the most important pedogenic processes is clay leaching and accumulation in the Pedon 2 on the Sultantepe mounds. The fine clay minerals have accumulated in the Bw_2 horizon of Pedon 2 on the Sultantepe mounds. The soil texture of A_1 horizon is loam, A_2 horizon is sandy clay loam, Bw_1 horizon loam, Bw_2 horizon is clay loam, C_1 horizon is loam, C_2 and C_3 horizons of Pedon 2 are sandy loam.. β leaching factor of Pedon 2 on the Sultantepe mounds is 0.97. The low β leaching factor (<1) may be attributed to weathering of parent material.

The most important pedogenic processes is clay leaching and accumulation in the Pedon 3 on the Koruklu mounds. The fine clay minerals have accumulated in the Bw_1 and Bw_2 horizon of Pedon 3 on the Koruklu mounds. The soil texture of A_1 horizon is silty clay loam, A_2 horizon is clay loam, A_3 horizon is silty clay loam, Bw_1 horizon is clay, Bw_2 horizon is silty clay loam, C_3 horizon is silty clay, C_2 horizon is silty clay loam, C_3 horizon is clay, C_4 horizon is silty clay loam, Cs horizon is silty clay. The fine texture can be attributed to extensive decomposition and characteristic of the parent material. Some researchers have claimed that fine textured soils formed on parent materials rich in carbonate (Buol *et al*., 1980; Irmak *et al*., 1991). β leaching factor of Pedon 3 on the Koruklu Man Made mounds is 0.74. The low β-leaching factor (<1) may be attributed to the high weathering.

Harran mounds is the youngest soils of the study area. The Harran mounds was made in 1258 A.D. by Mongolian (National History Encyclopedia, 1985). Pedon 4 which was described on the Harran mounds contains no description horizon, except an Ochric A epipedon at the soil surface. The soil texture of A_1 horizon in the surface is clay loam, A_2 horizon is silty loam, C_1, C_2, C_3 horizons are loam and C_4 horizon is silty loam. β leaching factor of Pedon 4 on the Harran mounds is 1.13. The high β-leaching actor (>1) may be attributed to low weathering of parent material. Also, these soils are very fresh.

The most important pedogenic processes is carbonate leaching and accumulation in the Pedon 5 on the Küplüce mounds. The carbonate content of Pedon 5 may be attributed to eolian addition by wind erosion from Syria. These carbonate dusts were carried from the nearby calcareous soil series, especially by the wind from Syria. Secondary carbonate nodules were identified in the Pedon 5, which apparently were evidence for carbonate leaching. and accumulation. A Calcic horizon has developed in these soils due to carbonate accumulation. On the Calcic horizon, a Cambic B definition horizon has developed as a result of structure formation. Some researchers have claimed that a Cambic horizon had developed together with a Calcic horizon in soils of arid and semiarid regions (Buringh, 1979). Some researchers have described the formation of a Cambic horizon as a red colour change of the B horizon in soils with low carbonate content (Buol *et al*., 1980; Dinç *et al*., 1987). The soil texture of A_1 horizon in the surface is clay loam, A_2 horizon is silty loam, Bw horizon is day loam C_1 is silty day loam C_2 is

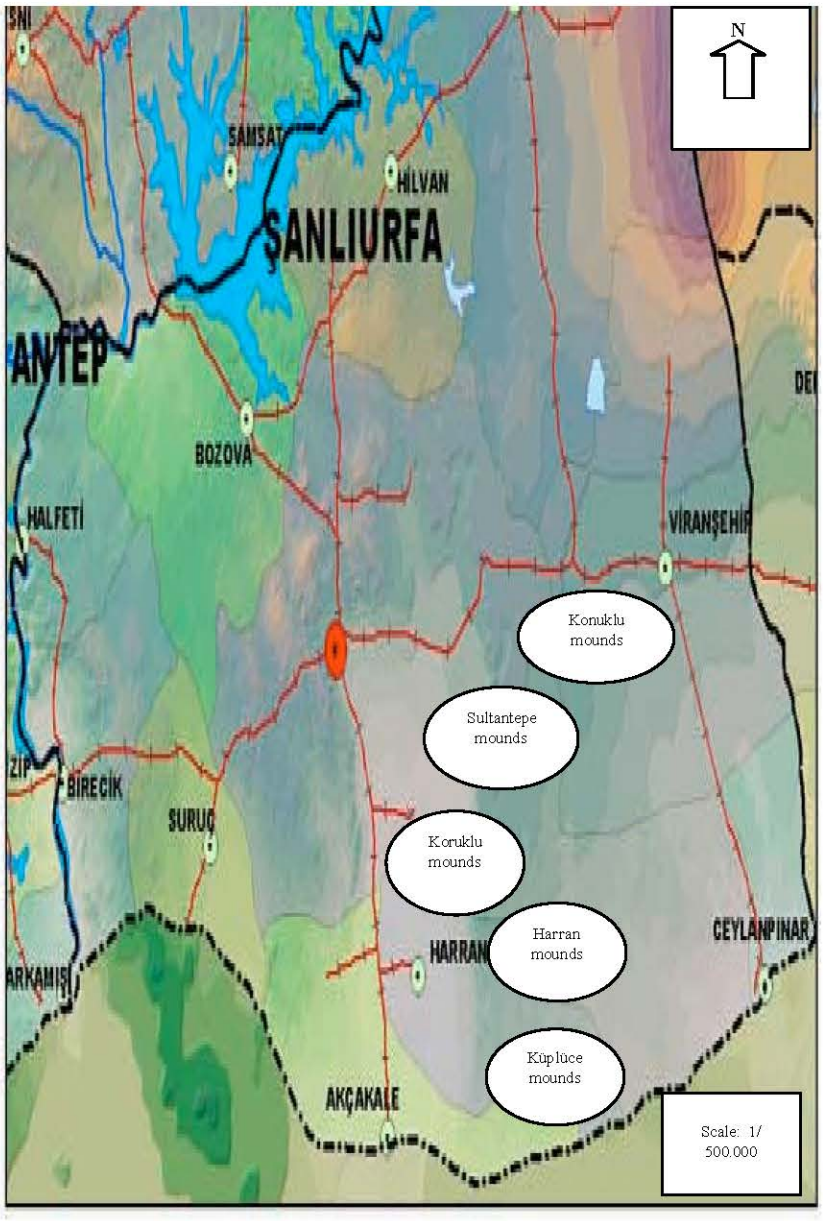

Fig. 2: Man made mounds in the Harran plain

silty clay, C_3 horizons is silty day loam, C_4 and C_5 horizon are clay loam. β leaching factor of Pedon 5 on the Küplüce mounds is 0.92. The low β leaching factor (<1) may be attributed to weathering of parent material.

According to the degree of soil formation the pedons were ordered as following Pedon 3>Pedon 5>Pedon 2> Pedon 1>Pedon 4.

Physical and chemical properties of soils: The major physical and chemical properties of the soils, developed on the man made mounds (hill) were presented in the Table 1 and 2.

The clay content of Pedon 1, on the Konuklu mounds, change between 22.7 and 37.9% and generally decrease with dept from surface. The silt content change between 28.7 and 40.3% (Table 1). The pH values are moderately alkaline and change between 8.05 and 8.40. The soluble salt content of pedon 1 change between 0.030 and 0.360% and increase with depth. The organic matter content of the soils is low and decrease gradually with depth. The organic matter content change between 1.06 and 1.79%. The $CaCO_3$ content is high and change between 25.4 and 27.7% The cation exchange capacity value are changes between 10.1 to 16.2 cmol kg^{-1} (Table 2).

Table 1: Selected some morphological characteristics of soils

					Particle-size distribution <2 mm		
Horizon	Depth (cm)	Colours moist	Texture*	Structure**	Sand	Silt	Clay
Pedon 1 (Konuklu mounds)							
A_1	0-15	10 YR 3/4	L	2 mgr	38.5	34.7	26.8
A_2	15-30	10 YR 3/4	CL	2 msbk	40.6	28.8	30.5
Bw_1	30-48	7.5 YR 4/6	CL	3 msbk	36.6	28.7	34.8
Bw_2	48-64	7.5 YR 3/4	CL	3 msbk	26.9	35.4	37..9
C_1	64-88	10 YR 3/4	L	ma	42.5	30.8	26.7
C_2	88-104	10 YR 4/4	L	ma	45.4	31.9	22.7
C_3	104-120	10 YR 3/4	L	ma	38.5	38.7	22.8
C_4	120-150	10 YR 4/4	L	ma	35.0	40.3	24.7
Pedon 2 (Sultantepe mounds)							
A_1	0-16	7.5 YR 4/4	L	3 fgr	40.8	33.4	25.8
A_2	16-22	10 YR 4/4	SCL	2 msbk	48.8	23.5	27.7
Bw_1	22-46	7.5 YR 4/6	L	3 msbk	44.9	29.3	25.8
Bw_2	46-55	7.5 YR 4/6	CL	3 msbk	40.6	29.6	29.8
C_1	55-70	10 YR 3/4	L	ma	46.7	31.8	21.5
C_2	70-96	7.5 YR 4/4	SL	ma	58.8	23.4	17.8
C_3	96-118	7.5 YR 4/6	SL	ma	52.6	31.5	15.9
Pedon 3 (Koruklu mounds)							
A_1	0-12	7.5 YR 4/4	SiCL	2 msbk	15.3	46.7	38.0
A_2	12-22	7.5 YR 4/4	CL	2 msbk	20.7	43.0	36.3
A3	22-39	5 YR 4/6	SiCL	2 msbk	16.2	44.1	39.7
Bw_1	39-54	7.5 YR 4/4	C	3 msbk	19.3	38.7	42.0
Bw_2	54-65	5 YR 4/6	SiCL	3 msbk	15.4	46.6	38.0
C_1	65-75	5 YR 3/6	SiC	ma	13.3	44.7	42.0
C_2	75-90	5 YR 4/6	SiCL	ma	15.2	48.8	36.0
C_3	90-100	10 YR 4/4	C	ma	13.3	40.7	46.0
C_4	100-115	5 YR 4/6	SiCL	ma	15.9	45.6	38.5
C5	115-145	10 YR 4/4	SiC	ma	13.2	44.7	42.1
Pedon 4 (Harran mounds)							
A_1	0-20	10YR 3/4	SiL	2 fgr	36.3	47.2	16.5
A_2	20-34	10YR 3/4	SiL	3 mgr	36.5	48.0	15.5
C_1	34-66	10YR 4/4	L	2 mgr	38.4	44.0	17.6
C_2	66-85	10YR 5/4	L	ma	46.2	38.0	15.8
C_3	85-100	10YR 3/4	L	ma	45.4	39.2	15.4
C_4	100-112	10YR 4/6	SiL	ma	20.5	54.0	25.5
Pedon 5 (Küplüce mounds)							
A_1	0-15	10 YR 4/4	CL	2 mgr	20.5	45.2	34.3
A_2	15-21	10 YR 3/4	SiL	3 mgr	18.2	41.4	40.4
Bwk	21-30	7.5YR 4/4	CL	3 msbk	20.8	39.2	40.0
C_1k_1	30-45	10 YR 3/4	Si CL	ma	18.4	43.8	37.8
C_2k_2	45-70	7.5 YR4/6	SiC	ma	14.2	45.2	40.6
C_3	70-92	7.5 YR4/4	SiCL	ma	16.2	47.5	36.3
C_4	92-120	10 YR 3/2	CL	ma	26.4	40.6	33.0
C_5	120-150	10 YR 3/4	CL	ma	20.3	43.2	36.5

*Texture, L:1oam, C: Clay, SiL: Silty loam, CL: Clay loam, SL: Sandy loam, SiCL: Silty clay loam, SiC: Silty clay: **Structure, 2 : Medium, 3: Strong, f: Fine, sbk: Subangular blocky, abk: Angular blocky, gr: Granülar, ma: massive

Table 2: Selected physical and chemical characteristics of soils

				Total soluble salt	$CaCO_3$	Organic matter
Horizon	Depth (cm)	pH 1/1	CEC* cmol ckg^{-1}	----------%		
Pedon 1 (Konuklu mounds)						
A_1	O-15	8.2	12.4	0.030	26.9	1.76
A_2	15-30	8.2	14.0	0.044	27.7	1.71
Bw_1	30-48	8.1	16.2	0.060	26.2	1.79
Bw_2	48-64	8.3	14.4	0.056	25.8	1.61
C_1	64-88	8.2	10.1	0.070	26.9	1.66
C_2	88-104	8.4	12.3	0.100	25.4	1.59
C_3	104-120	8.2	13.2	0.250	25.8	1.40
C_4	120-150	8.0	13.4	0.360	26.2	1.06
Pedon 2 (Sultantepe mounds)						
A_1	0-16	8.5	14.2	0.032	19.3	1.79
A_2	16-22	8.4	16.8	0.180	23.9	1.77

Table 2: Continued

Horizon	Depth (cm)	pH 1/1	CEC* cmol ckg^{-1}	Total soluble salt	$CaCO_3$	Organic matter
				----------%----------		
Bw_1	22-46	8.2	12.6	0.040	25.4	1.66
Bw_2	46-55	8.2	18.4	0.190	25.4	1.59
C_1	55-70	8.1	12.2	0.200	24.3	1.40
C_2	70-96	8.2	12.4	0.235	25.4	1.30
C_3	96-118	8.2	12.0	0.510	26.2	1.02
Pedon 3 (Koruklu mounds)						
A_1	0-12	8.1	24.2	0.320	25.4	1.69
A_2	12-22	8.3	23.6	0.350	23.4	1.78
A_3	22-39	8.3	26.4	0.350	22.8	1.73
Bw_1	39-54	8.2	30.0	0.580	27.3	1.36
Bw_2	54-65	8.0	28.2	0.500	23.8	1.28
C_1	65-75	7.9	26.8	0.500	19.3	1.18
C_2	75-90	8.0	23.5	0.480	26.9	1.09
C_3	90-100	8.0	30.2	0.450	25.8	0.98
C_4	100-115	8.0	24.7	0.500	26.2	0.92
C5	115-145	8.0	26.5	0.480	26.6	0.90
Pedon 4 (Harran mounds)						
A_1	0-20	8.0	10.2	0.700	23.1	1.63
A_2	20-34	8.3	12.2	0.230	20.5	1.49
C_1	34-66	7.8	12.5	0.580	22.0	1.58
C_2	66-85	7.8	10.6	0.460	23.1	2.26
C_3	85-100	7.8	10.2	0.410	22.0	1.97
C_4	100-112	7.7	17.8	0.660	19.0	1.58
Pedon 5 (Küplüce mounds)						
A_1	0-15	8.0	20.5	0.680	17.8	1.88
A_2	15-21	8.1	22.6	0.740	19.0	1.36
Bwk	21-30	8.3	23.2	0.900	26.5	1.15
C_1k1	30-45	7.9	18.0	0.210	27.8	1.41
C_2k_2	45-70	8.1	21.6	0.900	25.2	1.36
C_3	70-92	7.9	20.9	0.710	19.0	1.52
C_4	92-120	8.0	17.8	0.750	19.7	1.67
C_5	120-150	8.1	21.7	0.700	19.6	1.41

*: Cation Exchangeable Capacity

The clay content of Pedon 1, on the Konuklu mounds, change between 22.7 and 37.9% and generally decrease with dept from surface. The silt content change between 28.7 and 40.3% (Table 1). The pH values are moderately alkaline and change between 8.05 and 8.40. The soluble salt content of pedon 1 change between 0.030 and 0.360% and increase with depth. The organic matter content of the soils is low and decrease gradually with depth. The organic matter content change between 1.06 and 1.79%. The $CaCO_3$ content is high and change between 25.4 and 27.7%. The cation exchange capacity value are changes between 10.1 to 16.2 cmol kg^{-1} (Table 2).

The clay content of Pedon 2, on the Sultantepe mounds, change between 15.9 and 29.8% and generally decrease with dept from surface. The silt content change between 23.4 and 33.4%. The organic matter content of the soils is low and change between 1.02 and 1.79%. The pH values are moderately alkaline and change between 8.1 and 8.5. The soluble total salt content is high and change between 0.032 and 0.510%. The $CaCO_3$ content is high and change between 19.3 and 26.2%. The cation exchange capacity values are change between 12.0 and 18.8 cmol kg^{-1}.

The clay content of Pedon 3, on the Koruklu mounds, change between 36.3 and 46.0%. The silt content change between 40.7 and 48.8%. The high clay content of Koruklu mounds may be associated with composition of soil material which were carried from different around by man. The pH values change between 7.9 and 8.3. The organic matter content change between 0.90 and 1.78%. The low organic matter content may be attributed to poor vegetation and oxidation of organic matter in the long arid period. It is known that soils have low organic matter as a result of poor vegetation and oxidation in the long arid period (Buol *et al*., 1980). The $CaCO_3$ content is high and change between 19.3 and 27.3%. The total soluble salt content of Pedon 3 is considerably high and change between 0.320 and 0.580%. The high soluble salt content may be attributed to domestic wastes during old time. The cation exchange capacity values are change between 23.5 and 30.2 cmol kg^{-1}. The high values of CEC may be associated with high clay content of soils.

The clay content of Pedon 4, on the Harran mounds, change between 15.4 and 25.5%. The silt content change between 38.0 and 54.0%. The pH values change between 7.7 and 8.3. The organic matter content change between 1.49 and 2.26%. The $CaCO_3$ content change between

Table 3: Selected some mineralogic characteristics of soils and β leaching factor

Horizon	Extractable Fe_2O_3	Total Fe_2O_3	Total Al_2O_3	Total Na_2O	Total K_2O	β leaching factor
	----------	----------	----------%----------	----------	----------	
Pedon 1 (Konuklu mounds)						
A_1	0.62	3.05	6.01	2.16	4.06	0.99
A_2	0.40	3.96	6.35	1.98	4.20	
Bw_1	0.40	3.12	5.20	2.00	3.98	
C_1	0.26	3.28	5.10	2.35	3.00	
Pedon 2 (Sultantepe mounds)						
A_1	0.28	3.16	6.20	3.10	3.26	0.97
A_2	0.20	3.10	6.40	2.00	2.94	
Bw_1	0.24	2.95	5.00	1.96	3.60	
C_1	0.20	2.18	4.72	1.55	3.41	
Pedon 3 (Koruklu mounds)						
A_1	1.56	4.60	7.30	2.26	2.32	0.74
A_2	1.00	4.10	5.47	2.01	1.97	
Bw_1	0.94	3.98	7.02	2.15	3.00	
C_1	0.98	4.25	4.36	1.62	2.10	
Pedon 4 (Harran mounds)						
A_1	0.36	2.19	4.14	1.08	3.94	1.13
A_2	0.30	2.10	4.00	1.40	2.69	
C_1	0.12	2.10	3.98	1.25	3.00	
Pedon 5 (Küp1üce mounds)						
A_1	0.48	4.05	6.50	2.18	4.48	0.92
A_2	0.40	2.98	5.84	2.07	4.96	
Bwk	0.46	3.14	6.00	2.00	4.00	
C_1k_1	0.10	3.68	5.21	1.86	3.92	

19. 0 and 23.1%. The total soluble salt content is very high and change between 0.230 and 0.700%. The high total salt content may be attributed to domestic wastes during old civilizations. The cation exchange capacity values are change between 10.2 to 17.8 cmol kg^{-1}.

The clay content of Pedon 5, on the Küplüce mounds, change between 33.0 and 40.6%. The silt content change between 39.2 and 47.5%. The pH values are moderately alkaline and change between 7.9 and 8.3. The organic matter content change between 1.36 and 1.88%. The $CaCO_3$ content change between 17.8 and 27.8%. The soluble total salt contents are very high and change between 0.210 and 0.900%. The high soluble salt content may be attributed to domestic wastes during old time. The cation exchange capacity values are changes between 17.8 and 23.2 cmol kg^{-1} (Table 2).

Some mineralogic properties of soils: Some mineralogic characteristics were presented in the Table 3. Extractable Fe_2O_3 content of Pedon 1 on the Konuklu mounds is low and change between 0.26 to 0.62%. Extractable Fe_2O_3 contents in the A horizons of all soils higher than C horizons. The high extractable Fe_2O_3 content in the A horizons of soils may be attributed to weathering. Total Fe_2O_3 content of Pedon 1 change between 3.05 and 3.96%. Total Al_2O_3 content changes between 5.10 and 6.35%. The high total Al_2O_3 content may be associated with parent material. Some research claimed that parent material has influenced the chemistry of soils (Kapur, 1975). The parent material of man made tumulus were carried from around soils by men approximately 3500 years ago. The parent materials of around soils are $CaCO_3$ parent rocks and alluvium materials. Total Al Ç $_3$ contents of soils higher than total Fe_2O_3 content. Total Na_2O content change between 1.98 and 2.35%. Total K_2O content is high and change between 3.00 and 4.20%. The high total K_2O content may be associated with domestic ash wastes (Bansal and Viniti, 1998).

Extractable Fe_2O_3 content of Pedon 2 on the Sultantepe mounds is very low and change between 0.20 to 0.28%. Total Fe_2O_3 content changes between 2.18 and 3.16%. Total Al_2O_3 content changes between 4.72 and 6.40%. The high extractable Al_2O_3 content may be associated with parent material its calcareous alluvium material. Parent material has influenced the chemistry of soils. The parent material of man made tumulus were carried from around soils by men years ago. Total Al_2O_3 contents of soils higher than total Fe_2O_3 content. Total Na_2O content change between 1.55 and 3.10%. Total K_2O content change between 2.94 and 3.60%.

Extractable Fe_2O_3 content of Pedon 3 on the Koruklu mounds is high and change between 0.94 to 1.56%. Extractable Fe_2O_3 contents in the A horizon of Pedon 3 is higher than C horizons. The high Extractable Fe_2O_3 content in the A horizons of soils may be attributed to weathering. Total Fe_2O_3 contents change between 3.98 and 4.60%. Total Al_2O_3 contents change between 4.36 and 7.30%. The parent material of man made tumulus were carried from around soils by men. Total Al_2O_3 contents of soils higher than total Fe O_2 çontent. Total Na_2O content change between 1.62 and 2.26%. Total K_2O content change between 1.97 and 3.00%.

Extractable Fe_2O_3 content of Pedon 4 on the Harran mounds is very low and change between 0.12 and 0.36%. Total Fe_2O_3 content changes between 2.10 and 2.19%. Total Al_2O_3 contents change between 3.98 and 4.14%. Total Al_2O_3 contents of soils higher than total Fe_2O_3 content. Total Na_2O contents change between 1.08 and 1.40%. Total K_2O content change between 2.69 and 3.94%.

Extractable Fe_2O_3 content of Pedon 5 on the Küplüce mounds is very low and change between 0.10 and 0.48%. Total Fe_2O_3 content changes between 2.98 and 4.05%. Total Al_2O_3 contents changes between 4.21 and 6.00%. Total Al_2O_3 contents of soils higher than total Fe_2O_3 content. Total Na_2O contents change between 1.86 and 2.18%. Total K_2O content is high and change between 3.92 and 4.96 (Table 3). The high total K_2O content may be associated with domestic ash wastes.

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