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The soils of the wind erosion control camp area Karapinar Turkey

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Konya project

Wageningen 1968

ISN
3997 ab

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Summary

This report describes the soils of an area near Karapınar in the drainless depression between Konya and Ereğli in Central Anatolia, Turkey. In this report it is briefly called "Great Konya Basin" (see fig. 1). The area surveyed forms the Erosion Control Camp of Topraksu.

This soil survey is a part of the results of the activities of the "Soil Research- and Trainingsproject" of the Agricultural University of Wageningen in Holland, in co-operation with the Turkish Government.

It covers an area of about 14.000 ha and a semi-detailed soil map was produced on scale 1 : 50.000.

The level of the land averages between 1000 and 1020 meters above mean sea level. Summits of two mountains of volcanic origin rise to over 1100 meters above mean sea level.

The climate is semiarid and continental and a steppe vegetation occurs (A preliminary list of the main plants is made, see chapter 2.6). Many places are barren as result of ancient human activities. The wind has eroded many places and piled sandy materials. So rounded and crescentic dunes were built up.

A small part of the surveyed area is arable land, which is dry-farmed. The main products are wheat and rye. The largest part is idle land.

Physiographically 4 different main landscapes can be recognized within the area surveyed.

All the soils of this area range from calcareous to extremely

calcareous. The lime content ranges from 30 to about 80%. Their drainage conditions are good and no salt efflorescence has been observed.

The following general division of groups of soils can be made:

Light brownish gray, sandy soils occur in the Aeolian sandplain. They have a weak profile development, mainly limited to a faint secundary lime accumulation. In many places the wind has formed light gray, sandy, rounded dunes and barchans, which overlie a caliche-like layer over lacustrine sediments.

Light gray, sandy to clayey soils occur in the lacustrine plain. The profile development is limited to horizons with accumulation of secundary lime and gypsum. They may be weak to strongly expressed. Weak calcic horizons and strongly developed gypsic horizons may occur in places. The substratum is a *lacustrine sediment* of pleistocene age and shells occur.

Very pale brown to pale brown, sandy soils with gravel adjoin the volcanic mountains. They are mainly *beach deposits* and the waterworn pebbles have often lime pendants. The not active volcanic mountains consist of mainly Basalt Rockland.

Light gray, angular cobbly, sandy and gravelly sandy soils occur mainly on and near the limestone platform. The soil overlies a limestone bedrock or a gravelly beach deposit, which is built up of waterworn limestone pebbles.

Detailed descriptions of representative profiles are given in Appendix II and the soils are classified in chapter 6.

Özet

Bu rapor Orta Anadoluda Konya ve Ereğlı arasında Karapınar mevkine yakın drene olamayan topraklardan bahseder. Bu raporda, kısaca "Büyük Konya Havzası" olarak isimlendirilmiştir. (Şekil 1'e bakınız). Etüd edilen arazi Toprak-Su Erezyon kampını meydana getirir. "Bu arazi etüdü Holandada Wageningen Zıraat Üniversitesinin, Türk Hükümeti ile müştereken yürüttüğü Toprak araştırma ve Eğitim projesinin bir parçasıdır.
14.000 ha bir araziyi kaplar ve 1:50.000 öleekli yarı detaylı bir harıtası Hazırlan mıştır.
Arazinin deniz seviyesinden yüksekliği ortalama 1000-1020 metredir. Volkanik orijinli ikidağın Denizden yüksekliği 1100 metredir. İklim yarı kurak kara iklimi olup bitki örtüsü step karekterindedir. (Başlıca bitkilerin basit bir listesi bölüm 2-6' da gösterilmiştir) pek çok yer kıraç olup, bu kıraçlık eski beşeriyetin hareketlerinden olagelmektedir. Rüzgâr erezyonu bir çok sahayı istifadesi guç kumlu topraklar haline getirmiştir.
Ve bu mataryel yuvarlak hilâl şeklinde kumyığınları halinde Tepecikler meydana getirmiştir.
Etüd edilen arazinin ancak kücük bir kısmı ekilebilir'ki burada kuru zıraat yapılmaktadır, başlıca mahsul buğday ve cavdardır. Arazinin büyük bir kısmı boştur.
Tabii coğrafyası bakımından etüd edilen arazide başlıca 4 arazi şekli görülür. Bütün Topraklar aşırı derecede kireçli olup, bu miktar 30% ile 80% arasında değişmektedir. Süzülme durumları iyi olup hiç tuz kristalleşmesi görülmemiştir.

Aşağıda izah edildigi sekilde toprak sınıflandırması yapılabilir:
Aeolian kumluklarda açık kahverengimsi gri kumlu topraklar görülür. Genellikle hafif sekonder kireç birikmesi ile sınırlandırılmış zayıf profil gelişmesi vardır. Bir çok yerlerde rüzgar, göl birikintilerinin üzerindeki kalişe (caliche) benzer tabakaları örten gri, kumlu, yuvarlak kum tepeleri ve barkanlar (barchans) meydana getirmiştir.
Göl birikinti sahasında acık gri, kumlu ve killi topraklar görülür. Profil gelişmesi sekonder kireç ve jips birikmesi olan horizonlara inhisar eder. Zayıf veya kuvvetle belirtilmiş olabilirler. Bazı yerlerde zayıf kalsiyum horizonları ve kuvvetle gelişmiş jips horizonları görülür. Alt tabaka pleistosen devrine ait göl birikintisidir ve fosiller görülür.
Çok acık kahverengi veya acık kahve rengi kumlu, çakıllı topraklar volkanik dağları birleştirir. Bunlar coğunlukla kıyı birikintileridir ve sular tarafından aşındırılmış çakıllar umumiyetle üzerinde kireç birikintileri taşırlar. Aktif olmayan volkanik dağlar-esas olarak Bozalt kayalarından meydana gelmiştir. Açık gri köşeli iri çakıllı, kumlu ve kumlu çakıllı Topraklar umumiyetle kireç taşı platformuna doğru olan uçta görülür Toprak kireçtaşından meydana gelmiş ana kayayı veya aşınmış kireç taşı çakıllarından meydana gelmiş kıyı birikintisini örter.
Ek 2 de örnek profillerin detaylı izahi yapılmış ve bölüm 6. da da topraklar sınıflandırılmıştır.

Preface

According to an agreement between the Government of Turkey and the Agricultural University of Wageningen-Holland, staff and post graduate students from the Department of Tropical Soil Science from this University, in co-operation with post graduates from Turkey, are enabled to carry out the "Soil Research and Training Project" in the Konya plains of Central Anatolia.

The project, mentioned above, is carried out under the guidance of Ir. T. de Meester, senior soil scientist, and is supervised by undersigned.

This report is the fifth in a series of preliminary reports, prepared by staff-members and students about the activities of the Konya Project. It deals with the soils in the area of the Wind Erosion Control Camp of Topraksu at Karapinar. A soilmap of this area on scale 1 : 50.000 is included.

The other preliminary reports are:

Report no. 1 Soil Survey of the Çumra Area-1965 by Ir.T.de Meester

Report no. 2 Soil Survey of the Çumra Experimental Station Area-1965 by P.M. Driessen

Report no. 3 Soil Salinity and Alkalinity in the Çumra Area-1966 by P.M. Driessen

Report no. 4 Soil Survey of the Karaarslan Exp. Station Area-1966 by H.L. Slothouwer

In the course of 1968 and 1969 the above reports will be

combined in two final reports, one about the soils of the Çumra area and one about the soils of the Great Konya Basin. Grateful acknowledgement for their co-operation during the fieldseason 1965 is made to Mr. Naki Uner, General Director of Topraksu, Mr. Mesut Ozuygur, Director of the Soils and Fertilizer Research Institute and Mr. Dursun Çuhadaroğlu, Director of the Sulu Ziraat Deneme Istasyonu (Experimental Station) at Çumra.

Prof. Dr. Ir. P. Buringh
Professor of Tropical Soil Science.

The author wishes to thank Mr. W.F. Andriessen for the make up of the report and maps.

Önsöz

Türk Hükümeti ve Hollandada Wageningen Zıraat Üniversitesi arasındaki anlaşma gereğince, Orta Anadalu Konya ovası Toprak araştırma ve eğitim projesi, Üniversitenin Tropikal Toprak ilmi bölümü eleman ve mezunları tarafından Türk elemanlarının işbirliği ile yürütülmektedir.

Yukarda bahsedilen proje Ir. T.de Meester idaresinde ve yazı sahibinin kontrolu altında yürütülmektedir.

Bu rapor Konya projesi elemanlarınca hazırlanan bir seri önraporun beşincisidir Karapınar yakınındaki Toprak-su Rüzgâr Erezyonu Kontrol Kampı sahasındaki Topraklardan bahseder.

Sahanın 1:50.000 ölçekli bir toprak haritası ilave edilmiştir.

Diğer ön raporlar şunlardır:

Rapor No. 1 - Çumra sahasının toprak etüdü 1965 Ir. T.de Meester.

2 - Çumra Deneme İstasyonu sahasının toprak etüdü 1965 P.M.Driessen.

3 - Çumra sahasında Toprak tuzluluk ve alkaliliği 1966 P.M.Driessen.

4 - Karaarslan Deneme İstasyonu sahası Toprak etüdü 1966 H.L.Slothouwer.

1968-ve 1969 yılları arasındaki devrede yukarıda bahsi gecen raporlar, biri Çumra sahasına diğeri Büyük Konya havzasına ait olmak üzere iki nihai rapor halinde toplanacaktır. 1965 arazi mevsiminde gösterdikleri yardımlardan dolayı, Toprak-su genel müdürü bay Naki Uner'e.

Toprak ve gübre araştırma enistütüsü müdürü bay Mesut Ozuygura, ve Çumra sulu, zıraat deneme istasyonu müdürü bay Dursun Çuhadaroğluna teşekkürlerimi bildiririm.

Prof. Dr. Ir. P. Buringh
Tropikal toprak ilmi profesörü

1 Introduction

1.1 PURPOSE OF THE SURVEY

This soil survey was made in order:

1) to investigate the soils of the Wind Erosion Control Camp Area of Topraksu near Karapınar and their range in characteristics in such a way that the area recorded will serve as "sample area" for the survey of a much larger area in the Great Konya Basin.

2) to furnish the authorities of Topraksu with a report, which describes the soils and which shows their location on a soil map, necessary for a modern and efficient management of the activities in the Wind Erosion Control Camp.

The survey was done in May and June 1965 and the laboratory investigations have been carried out in Ankara, during August 1965 and in Wageningen during the winter 1965-1966.

Unless otherwise mentioned, all statements in this report refer to conditions at the time the survey was in progress.

As this report is compiled and published within the framework of the results of the "Soil Research and Training Project", its chapters are in the same sequence as those in Preliminary Report no. 1 (de Meester, 1965).

Soil surveys provide a base for all land use programms. This report presents information both general and specific about the soils, the crops and the agriculture of the area surveyed. The accompanying map on scale 1:50.000 shows the location and the

extent of the soils.

Report and map may give answers to several different questions. For example: How much material (reed, stakes) and man-hours are needed to control the drifting sand in the Erosion Camp Area? If the reader knows how much material and man-hours (averages) are taken to control 15 ha drifting sandy dune land, he can calculate approximately the total amount of material and man-hours, necessary to control the drifting Active dune land, because the surface and location of this drifting land are given in report and map.

Technicients, teachers, students and other users will find information about the soils, the crops, the agriculture and other subjects of the area surveyed. Ordinarily one will be able to obtain the informations one needs without reading the whole report.

The recommendations for soil management practices given in this report are intended for individual land-users, like farmers, who must use their land within the economic limitations and in accordance with their facilities.

2 General area description

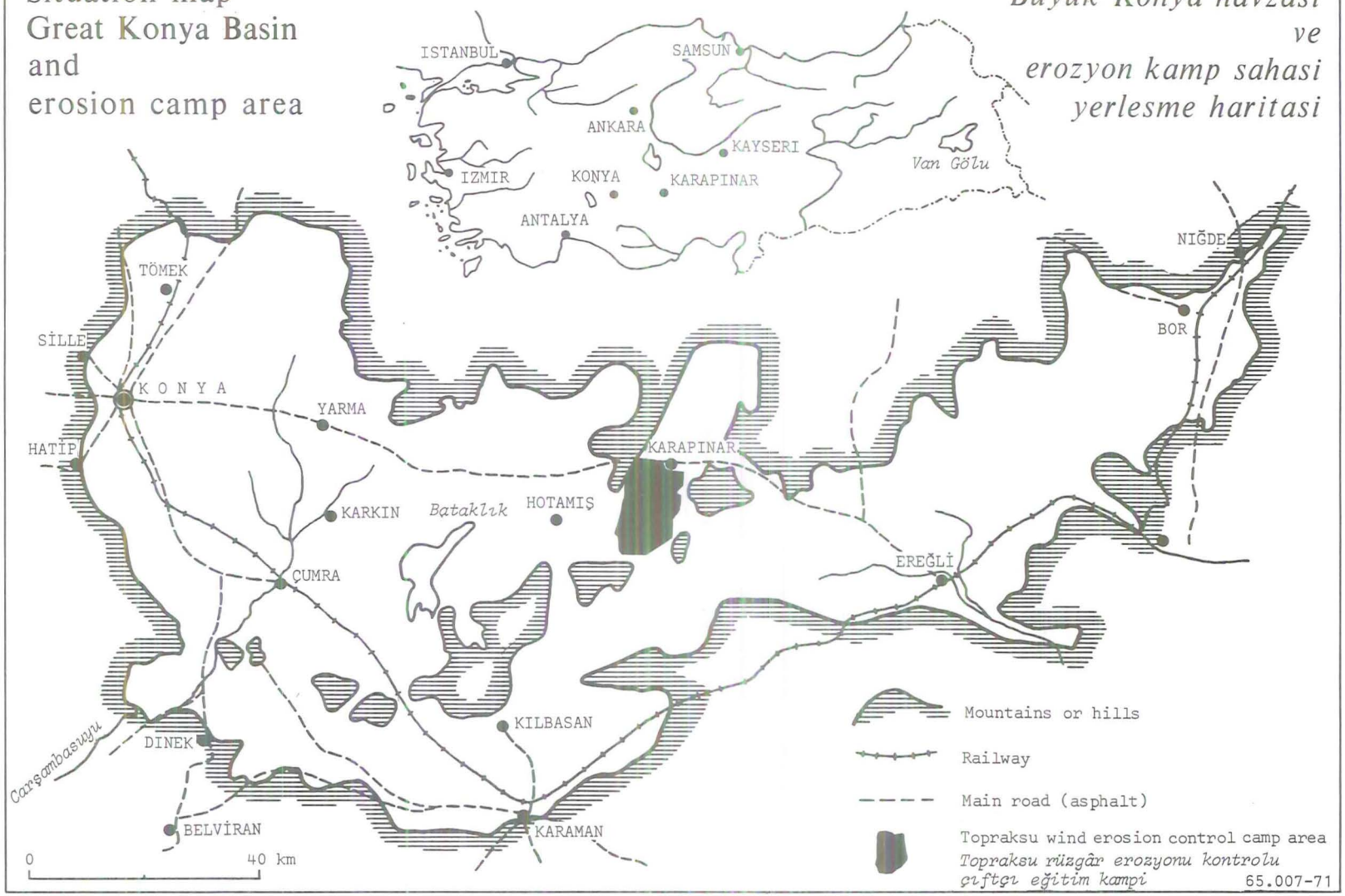
2.1 GEOGRAPHY

The area of the Erosion Control Camp of Topraksu is situated near Karapınar in the central part of the "Great Konya Basin". This is a drainless depression in Central-Anatolia and is roughly located between the towns Konya-Karaman-Niğde-Karapınar. (see situation map, fig. 1)
This basin is cut off by the spurs of the mighty Taurus Mountains on the south. Its northern boundary is formed by a wide rise, built up by several mountains, which separate this basin from the depression of Tuz Gölü.
The imaginary lines, which connect the town Karapınar and the villages Apak Yayla (=Y.)-Çardak Y.-Akkaş Y.-Vahapobası Y., roughly indicate the limits of the studied area (see fig.2).
This area is at the south of the asphalt highway from Konya to Karapınar and Ereğli. The distance from the most northern limit, near the highway, to the southern boundary is about 16 km. At the village Apak Y., the distance from the western boundary to the eastern one is about 10 km.
The area of the Wind Erosion Control Camp of Topraksu (briefly called in this report: the Erosion Camp Area) is fenced in by barbed wire. There are two entries. The main gate is near Karapınar and a second one is near Çardak Y.
Grazing and picking woody plants is forbidden in the Erosion Camp Area. Generally no people reside in this area. All the

FIGURE *ŞEKIL* 1

Situation map
Great Konya Basin
and
erosion camp area

Büyük Konya havzasi
ve
erozyon kamp sahasi
yerlesme haritasi

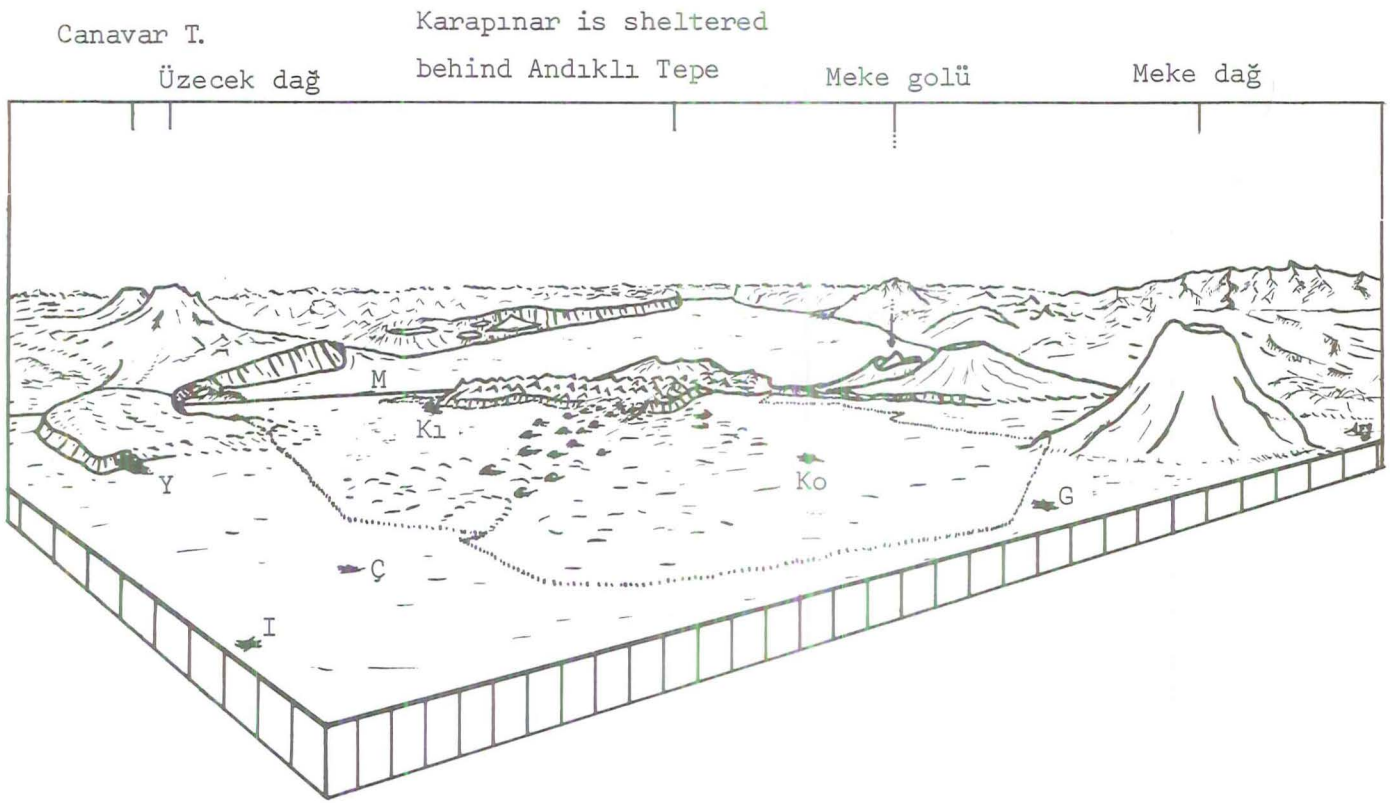


65.007-71

former villages have been vacated, except the village Kındam Y., which is situated about three kilometers southwest from Karapınar. Kındam Y. is uninhabited in winter. In the other seasons it is occupied by people, engaged by Topraksu, for erosion control works and other activities.
Formerly all these deserted villages had been summercamps (=Yayla's). The villages around the Erosion Camp Area still are. In winter the summercamps are deserted and the farmers are living in the towns then.

2.2 GEOGENESIS AND GEOLOGY

During the pleistocene period the central part of the Great Konya Basin was occupied by a shallow lake. This lake has been silted up with erosion products from the surrounding uplands and has dried up since.
The shores of the basin consist mainly of colluvial slopes, but alluvial fans, cliffs and sandridges occur locally along the fringes as well.
The surveyed area is located in a section of the basin with much volcanism. South of Karapınar (see soil association-map fig. 2) and within the camp-area a basalt formation occurs with Andıklı Tepe as its summit. East of the surveyed area a large volcanic formation is found with several fine crater lakes, like Tuzla gölü and Krater gölü. The first is a "nested crater", the latter appears to be a "Maar". Their nearly circular cavities might be the results of an explosive central outbreak, caused by the contact of lava with water. (Cotton 1964). Stratified deposits of volcanic ash and tuff are seen around this place. Several miles south of the described formation, the isolated volcanic ashcone of the Meke Dağ rises out of the lacustrine plain. The ash and other volcanik material


Canavar T.
Üzecek dağ
Karapınar is sheltered
behind Andıklı Tepe
Meke golü
Meke dağ
M
Kı
Y
Ko
G
Ç
I

Block diagram of the area around
Karapınar seen from the southwest
Erozyon kampı sahasının taslağı

Vertical exaggeration is about 10 times
Dikey büyütme 10 mislidir

Y = Yeniceoba Y.
I = Inoba Y.
Kı = Kındam Y.
M = Main road (asphalt)
"""" = Fence and boundary of the Erosion Camp

Ç = Çardak Y.
G = Girginli Y.
Ko = Komoba Y.

deposited in the vicinity of this mountain may have been produced by lava, which had been in contact with water of the pleistocene lake (compare Cotton 1964). Much material was accumulated near the ejecting centre forming the summit. Fine material was thrown farther away from the crater to form gentle concave slopes in radial profile. Landslides and volcanic mud-flows may, be responsible as well for the present conic form of this mountain.

A limestone platform of Neogene age occurs near the north western corner of the surveyed area. This platform protrudes into the lacustrine plain and has cliffs and gravelly beach deposits in many places as a result of former lacustrine abrasion and deposition. Those and other remains of an old shore line (like a zone of waterworn basalt blocks around Andıklı Tepe) are all located at a level between 1010-1015 m. (Louis 1938). This means that the level of the pleistocene lake must have been constant for a long time and this can only be obtained if the excess water is drained away at a certain constant level. Such a drainage may have existed because several dolines occur in the limestone formations.
One of those, the Düden gölü, is still used to drain some lakes and swamps with which it is connected by canals.
A major part of the surveyed area is covered with sanddunes, which are considered as the result of Aeolian erosion and deposition of the older lacustrine sands in this area. The accumulation of sand here might be explained by the fact that this part of the basin is relatively narrow. Where currents have been rather strong, calcareous sand has been deposited instead of the calcareous clay which is found at the surface in most other parts of the lacustrine plain.
After the lake had dried up, the sand was blown to dunes locally and also spread as a blanket over adjacent area's. It

FIGURE *ŞEKIL* 2

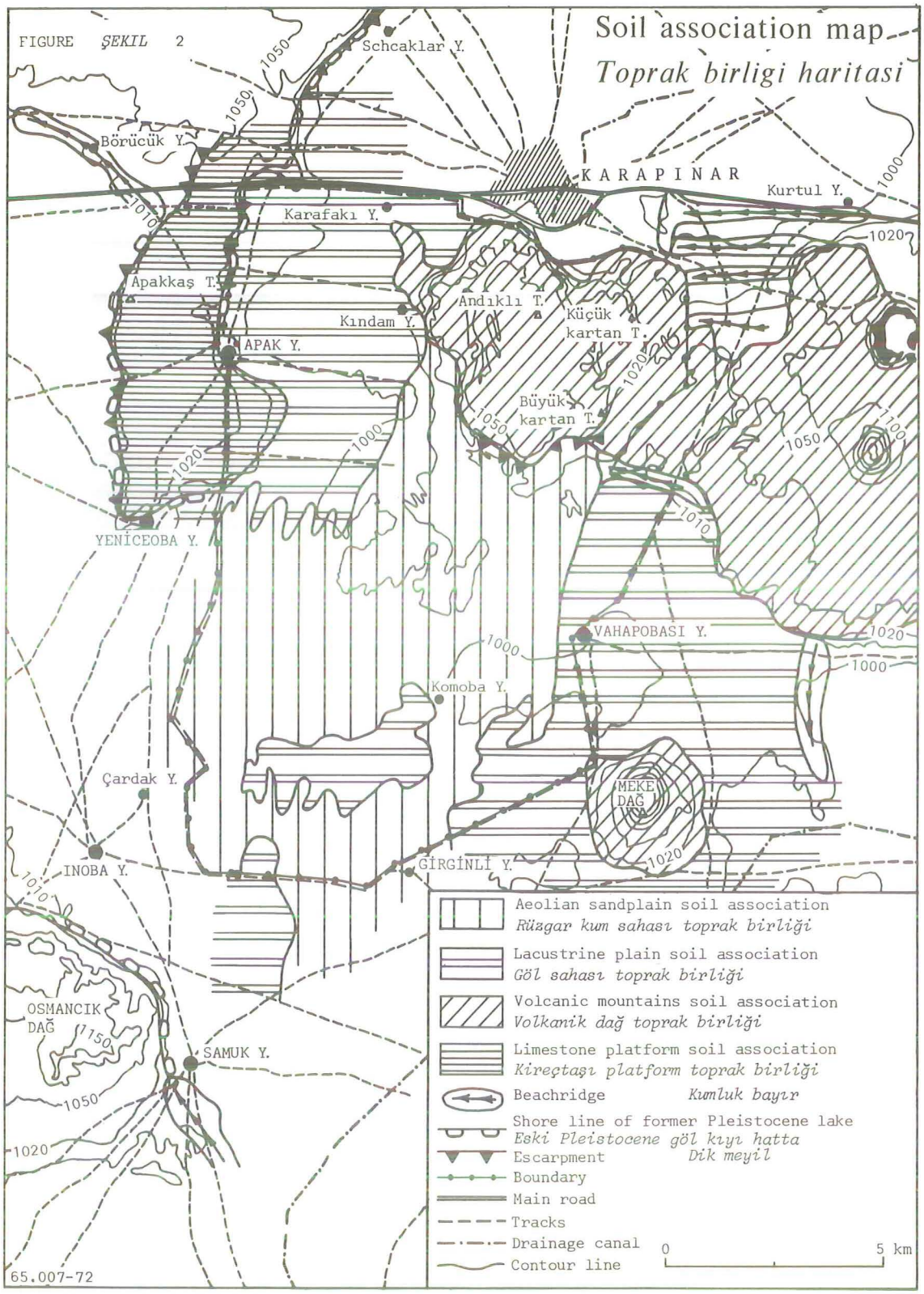


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Fig. 3 *(Şekil 3)*

The "nested crater" with its ring-shaped crater lake (Tuzla Gölü).

Halka şeklindeki krater gölü (Tuzla Gölü) ile birlikte "nested crater".

Fig. 4 *(Şekil 4)*

Stratified deposits of volcanic ash and tuff near Krater Gölü.

Krater gölü yakınında tabakalaş meş volkanik külvetaşlar.

was arrested by a vegetation cover and fixed.
In more recent times however, the vegetation cover became destroyed by overgrazing and other human activities.
As a result the Aeolic shifting sand formations, which cover large portions of the surveyed area at present, came into shape.
See also chapters 2.3, 5.4.1 and appendix I.

2.3 PHYSIOGRAPHY

The forms of the present landscape are mainly the result of the action of internal and external geological forces, the properties of the earthsurface and the quaternary sedimentation.
Four main landscape units can be observed in this region, in which the Erosion Camp Area is situated (see fig. 2).

1. the Aeolian sandplain
2. the lacustrine plain
3. the volcanic mountains
4. the limestone platform

These main landscape units have many obvious differences, for example in form, level, stoniness, etc. and they can easily be found back in the field. They are so closely related with the soils, that they were used as a basis for the principal grouping in "soil associations" in our classification system (see chapter 5.1).
sub. 1. The *Aeolian sandplain* occupies the largest part of the Erosion Camp Area. It is situated in the southern and central part of the surveyed area. The topography ranges from nearly level to very steep crescentic dunes and the altitude ranges from ca. 1000 m to 1010 m or higher.
This plain has been the bottom of the lake in Pleistocene times. It was a relative narrow connection between the lake of Konya

in the west and the lake of Ereğli in the east. The water may have flown faster there than in the central parts of the lakes and so mainly sandy textured material was deposited, mixed with shells (chapter 2-2). This material in turn is mainly of limestone origin (from limestone mountains or platform) in the west of the area surveyed, mainly of sorted reworked volcanic ash origin in the east central part of the area, and of mixed origin in the central part of the area recorded.
When during the process of drying up, the size of the lake contracted and the shorelines moved gradually inward to lower places in the Basin of Konya and Ereğli, the wind blew over the sandy sediments, dried them and set them in motion. The wind removed the finer particles in suspension and shifted the sand by saltation and surface creep. The vegetation cover, which followed the gradually moving shore at a certain distance, has trapped the sand. It also fixed the drifting material and prevented its destruction by the wind. So the ancient dune-like landscape was probably built up.
In more recent times the vegetation cover was damaged, by overgrazing, by trampling and by human activities (Appendix I). The wind eroded parts of this ancient dune-like landscape, altered it in many places and formed many blowouts. The shifting sand accumulated downwind and has built up new dunes, which are still moving on in many places.
The Aeolian sandplain can be divided in two sub-landscape units:

A - The fixed Aeolian sandplain
B - The active duneplain

A - The fixed Aeolian sandplain is situated mainly in the south of the surveyed area. It is the remainder of the ancient dune-like landscape and has vague long dunes.
Mostly, their ridges have a S.S.W.-N.N.E. direction and are

parallel in several places. These forms are often obscured however by the effects of winderosion and sometimes by rocky obstacles. The dunes are overlying lacustrine deposits, which can be found in the elongated depressions between the dunes. This fixed Aeolian sandplain is covered mainly with a poor steppe vegetation. Commonly low hummocks of sand occur and are scattered irregularly over the surface.
Very deep, carbonatic, excessively drained, sandy soils are on the dune ridges and on the sides of the dune slopes. No distinct stratification can be observed and fragments of shells are throughout the profile.
A faint layer, in which secundary lime has accumulated, is commonly recorded. This cemented layer resisted in several places to the wind-erosion.
Very deep, somewhat excessively drained, carbonatic soils are in the elongated depressions and vague valleys. Commonly the shallow or moderately deep sandy layer overlies a lacustrine rust mottled stratified substratum of sandy, loamy or clayey material. Often thin layers of entire shells (Dreissensia spec.) occur. A faint layer, in which secundary lime has accumulated is commonly observed. These layers also often resist to wind-erosion and form commonly the bottom of blowouts.
Krotovinas of the Ziesel (Citellus citellus L.), however, have been recorded in these dry soils.
The described soils have been severaly eroded by wind in many places.

B- The active duneplain occurs chiefly in three irregular belts, mainly in the central part of the Erosion Camp Area. Two isolated areas, which are very large blowouts, lie in the south-western part. This sublandscape unit consists mainly of drifting and moving sand dunes. Two shapes of isolated sand mounts or dunes can be distinguished in the active dune plain.

Isolated dunes with mainly rounded shapes occur mostly in the south-western part of the belts and in the two large blowouts. They are 2 to 4 meters or more high.
The more the dunes are moved in north-eastern direction, propelled by the dominant winds from the south-western corner, the more the dunes get a crescentic shape. Isolated dunes with an ideal crescentic form have been found mostly in the north-eastern part of the active dune plain.
These crescentic dunes or "barchans" are 2 to 12 meters or more, high. They have downwind orientated horns.
As the small dunes are moving with a higher speed than the large ones, the dunes often touch each other. Large dunes may absorb even small ones. So they often form a dune complex. This phenomenon and also obstacles obscur often the ideal dune form. (A more detailed description of the mechanism of sand transport and of the formation and forms of barchans is given in Appendix I). The nearly level to very steep dunes have short slopes and are built up of wind-sorted, light gray or pale brown, carbonatic, fine sand material, which is structureless, often stratified and loose when dry. This material is excessively drained. Asymmetrical ripples of a few cm. high occur often on the surface. These shifting dunes lie and move mainly on the slightly hard to hard caliche-like layer or lacustrine sediments which often is exposed in the depressions between the dunes. The surface of these troughs between the dunes is mostly formed by a well-drained, nearly level to level hardened, white layer of material in which secundary lime has accumulated and which overlies carbonatic very deep lacustrine sediments.
The substratum is light gray to white, often stratified, sandy, loamy and clayey material, in which often thin layers of entire shells (Dreissencia sp.) occur.
Krotovinas are commonly recorded here. The active dune plain has no or very little vegetation and is a very droughty sand

desert-like area.
An erosion pavement or desert pavement occurs in the north-eastern part and counteracts the wind erosion. Windbreaks have been erected by Topraksu at right angles to the direction of the dominant wind for protection against winderosion over a certain surface of the active dune land.
All the Aeolian sandplain was native pasture formerly and is idle land now.

sub. 2. *The lacustrine plain* occurs mainly in the north-western part of the Erosion Camp Area. It extends between the limestone platform in the western and the volcanic mountain in the eastern part of the surveyed area.
Scattered areas of this landscape unit occur in the southern and south-eastern parts. It occupies the lower parts of the area at an altitude of about 1000 m or lower.
The topography is level to nearly level.
The parent material is a lacustrine clastic sediment, probably mainly derived from limestone of the mountains and the platform in the environment.
In places in the eastern part of the surveyed area, these sediments contain an important amount of material, which is probably derived from volcanic ash, reworked by water. The deepest place of the former pleistocene lake within the surveyed area was located in the north-western part. The lake was enclosed here by the mountain and by the limestone platform and it seems that the water was more or less quiet here. Mostly clayey or loamy material was deposited here, mainly derived from limestone. They are overlain by a layer of Aeolian material, by gravelly or coarse sandy local beach deposits or by angular cobbly colluvial and abrasion deposits in several places.
The soils of the lacustrine plain are very deep, level to nearly level, well drained, carbonatic, gray or light gray to white,

commonly loamy or clayey, in places overlain by sandy, gravelly sandy or angular cobbly layers.

In this soil a layer has been recorded in which an accumulation of calcium carbonate occurs. It might be a weakly developed calcic horizon in few places. Also a layer, in which an accumulation of gypsum occurs, and that ranges from a gypsiferous "cs"layer to a well developed gypsic horizon is recorded.

The substratum of these soils is often stratified, but no or very faint stratification has been recorded in several places.

This landscape was formerly almost entirely in native pasture, but is now idle land. It is covered by a steppe vegetation.

Fig. 5 *(Şekil 5)*

General view over the lacustrine plain from the limestone platform. The dry-farmed elongated fields extend from the foreground onto the plain. In the background the Basalt rock land. The dark rock outcrop contrasts with white Aeolian deposits, blown from the active dune land.

Kireç taşi platformundan göl birikinti sahasının umumi görünüşü. Kuru zıraat yapılan temdit edilmiş tarlalar on plândan ovaya doğru uzanmaktadır. Arka plânda Bazalt kayalıkları. Koyu renkli kaya cıkıntıları rüzgâr tarafından aktif kumlu sahasından taşınmış beyaz aeolian birikintilerle kontrast meydana getirir.

A small extent is cultivated, mainly in dry farming system. Stripcropping at about right angles to the direction of dominant winds is used. In the last few years pumping-irrigation was applied in some areas.

sub 3. The *volcanic mountains* occur in the north-eastern part and in the south-eastern part of the Erosion Camp Area. This main landscape unit consists of two mountain-types, which differ much in form and structure.
The volcanic mountain in the north-eastern part of the surveyed area is the largest one and its altitude ranges from about 1005 m at the edge to about 1120 m at the top of the mountain, called "Andıklı Tepe".
This mountain consists mostly of areas with dark colored, rough basalt outcrop. The sharp angular rocks have relatively smooth surfaces. Bedrock is exposed as many elongated ledges with sharp crests mainly in the southern part of this rocky mountain. The long sides of the crests seem to be concentrically arranged around the summit of the "Andıklı Tepe". No obvious arrangement of bedrock exposures have been recorded in the other parts of this mountain. The southern boundary of this mainlandscape unit is formed by a very steep escarpment. Here in few places the sand of the plain is blown up high against the mountain, which protects Karapınar against the drifting sand.
In depressions between the bedrockexposures soil material is found, which is made up of volcanic ash, colluvium derived from weathered basalt, and wind borne material. These deposits may occur separately or may be mixed and often contain angular cobblestones.
Included in this main landscape are the beach deposits around this volcanic mountain. Louis (1938) reports about some basalt blocks, polished by the influance of the surf of the

Pleistocene lake and which occur at the edge of the mountain. They can be found in areas at a level of about 1010 to 1015 meters. Around these polished blocks waterworn, dark colored gravel and coarse sand with shell fragments occur. They might have polished the blocks under influence of the to and fro moving water on and near the beach.

No well shaped elongated beach ridges like in other parts of the Great Konya Basin have been recorded in the Erosion Camp Area.

Gravelly and sandy material, derived from the volcanic material

Fig. 6 *(Şekil 6)*

Rock outcrop of the Basalt rock land near Kındam Y. The base of the rock on the foreground has been polished by the pleistocene water action.

Kındam yakınında toprak yüzüne çıkmış Bazalt kayaları. Önplanda Kayanın pleistosen su hareketleriyle cilâlanmiş temeli.

was reworked by water and sedimented adjacent to the volcanic mountain. Only the elevation in the north of Kındam Y. may be conceived as an ofshore gravelly beach ridge in its first stage.

The other volcanic mountain occurs near the south-eastern part of the Erosion Camp Area. The ancient volcano Meke dağ has a typical conical form. Its summit rises about 280 m above the lacustrine plain and has a cup-shaped hollow, which may have

contained some water in the past. The slopes of this mountain, becoming gentler with increasing distance from the summit have many deep gullies, which start at an altitude, ranging from 1050 to 1100 meters and which radiate from the cone downwards to the plain.

The cone is mainly built up of ash, which contains angular stones and in places covers rocks. Only a spur of this mountain lies in the surveyed area.

The soils of the volcanic mountains between the barren bedrock exposures and on the sides of the summits are shallow to very deep, nearly level to moderately steep,somewhat excessively drained, calcareous, light brownish gray to pale brown, sandy soils, which contain in some places angular cobble stones.

At the edges very deep, somewhat excessively to excessively drained, calcareous, pale brown to very pale brown, gravelly material or gravelly sandy soils are adjacent to the mountains. The waterworn pebbles have often lime pendants and the upper part of the gravelly substratum is locally cemented with lime.

The soils of this landscape are covered with a scarce steppe vegetation and were used for grazing. Now it is mainly idle land. Certain areas are planted with young trees and are cultivated and irrigated.

sub. 4. *The limestone* platform occurs in the western part of the Erosion Camp Area. This main landscape has striking features and it is generally built up of successive layers of white hard cavernous limestone and white layers of softer chalky lime. According to Chaput (1947) it is neogene fresh water limestone.

The surface of the platform has a general slope down in south-eastern and partly in eastern direction. Its level ranges from 1050 m in the west near Apakkaş Tepe to 1020 southwards from Apak Y. The surface is dissected by several gullies, which lead the concentration of the runoff in a south-eastern or

eastern direction onto the lacustrine plain.
In Pleistocene times this platform might have been an isthmus and its edges were cut by waves over certain distances. The cliffs, formed by abrasion, are mapped chiefly as very steep escarpments. Their level ranges from about 1020 m to 1005 m on the concave and gentler footslopes of the escarpment.
The orbital motion of the Pleistocene lake water and waves was interfered with by the bottom and converted into a to and fro movement. This was attended with a to and fro movement of the gravel and the coarse sand and caused them to erode or abrade the bottom of the lake and the cliffs of the platform. The erosion products were transported by the current and partly thrown up on more gently sloping land as a protective gravelly and sandy beach, south of Apak Y. The level ranges from about 1020 meters to 1005 meters, but the slopes are gently sloping to nearly level.
No well shaped elongated beach ridges have been thrown up in this part of the surveyed area, unlike those at the western side of the limestone platform near the asfalt road Karapınar-Konya. This beach ridge joins the former cliff or escarpment. The escarpment, westward from Ecelertolu Y., is the cliff of an ancient bay. Here small caverns were eroded into the limestone.
Included in this main landscape are the gravelly and sandy beach deposits, the escarpment with its angular cobbly colluvial deposits, which are thinning out over abrasion debris and lacustrine deposits.
The soils of the limestone platform occur in a minor extent in the surveyed area and vary much. They range from shallow to very deep, nearly level to moderately steep and are carbonatic, very pale brown to light grey, angular cobbly, sandy soils, gravelly sandy soils and sandy soils, overlying limestone bedrock or in places lacustrine deposits.

Fig. 7 *(Sekil 7)*

Small caverns in the escarpment of the limestone Platform near Ecelertolu Y. The crops on the escarpment-footslopes profit by water, coming from the platform.

Ecelertolu yakınlarında kireçtaşı platformunun dik yüzeyinde küçük mağaralar. Dik yüzeyin alt yamaçlarında yetişen mahsül platformdan gelen sudan istifade eder.

The waterworn limestone pebbles have lime pendants and are often mixed with fragments of shells. In some places the upper side of the substratum is cemented with lime.

One part of the soils of this landscape is used for crop-cultivation in dry farming system and wind strip cropping is put into practice. Formerly the greatest part was native pasture, but now it is mainly idle land.

In the reconnaissance survey of the Konya Basin, the limestone platform is included in larger integrant landform-unit, called "Terraces", (Soils of the Great Konya Basin, Reconnaissance survey, in press).

2.4 CLIMATE AND SOIL CLIMATE

2.4.1 The climate

The Erosion Camp Area has a continental semiarid climate. At its level of approximately 1000 m the average monthly pressure ranges from about 899 millibar in springtime to 903 millibar in autumn.

This climate is characterized by wide daily and annual variations in temperature and by well defined seasons.

The summers are dry and have warm day-temperatures, followed by cool nights. They are rarely oppressive, because the humidity is low. There is an occasional hot spell.

The winters are usually cold with an average of twenty days a year in which the soils are covered with snow. The greatest amount of snow falls in January and February.

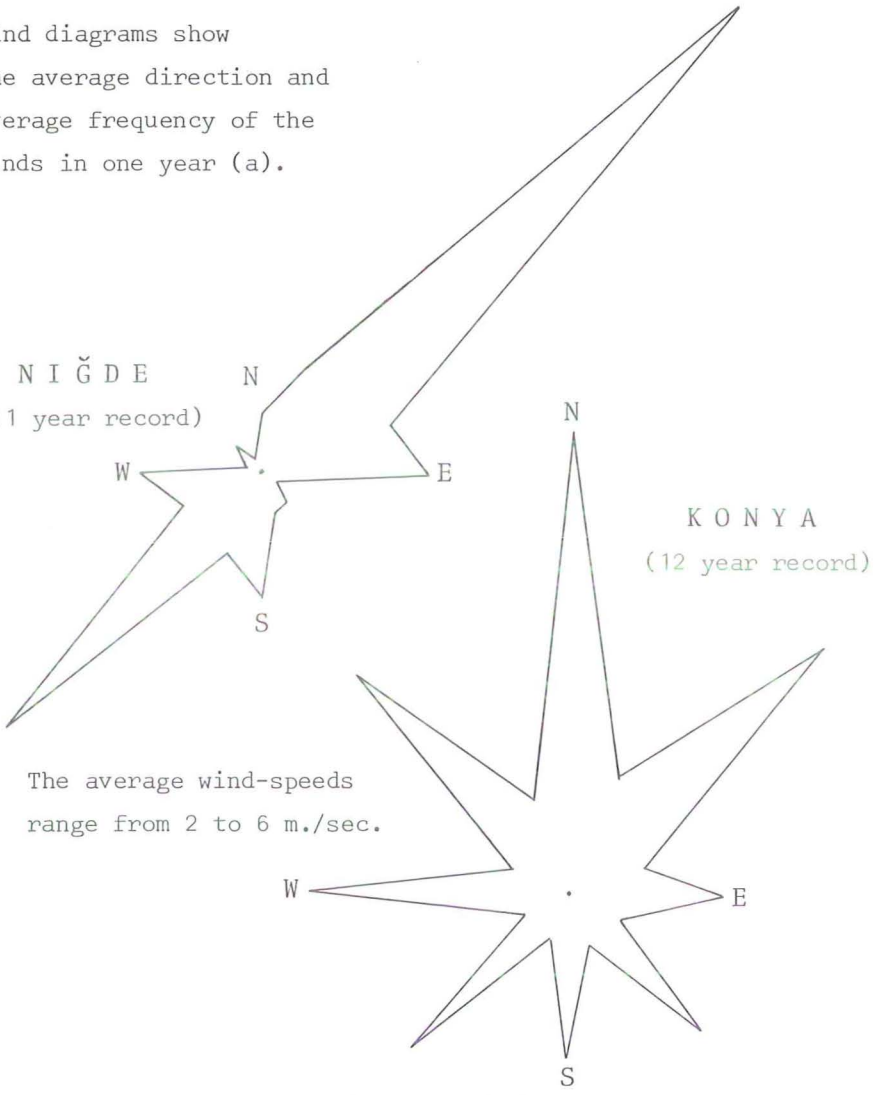
According to the climate classification of Köppen the Csa type climate (average rainindex 2,4) prevails in the Erosion Camp Area. Very dry years are not infrequent (e.g.1873, 1928, 1940, 1956). The normal monthly, seasonal and annual precipitation, temperature and other data, compiled from records of the State Meteorological Service of the Ministry of Agriculture of Turkey at Ankara, are given in table 2 and table 3 and fig. 8. These data are recorded on three Weather Stations, one in Konya, one in Niğde and one at the northern gate of the Erosion Camp Area near Karapınar.

The average annual precipitation in the Erosion Camp Area is about 270 to 280 mm. Of this, about 40% falls in winter. During the growing season rainfall normally amounts to only 90 to 120 mm and is not enough for crops, that are not irrigated. It tends to reduce the yield of small grain crops in dry farming system and the harvest is about one month or more

earlier than that one of the same crops in irrigated areas.
The average precipitation from July through September totals only about 10 mm.
Heavy rainshowers occur a few times a year. Occasionally more than 20 mm falls in one day, often within a few hours.
Snowfall is normally light and the snowperiods total about from 10 to 16 days a year.
Hailstorms, local in nature, are not rare and occur mainly in springtime. Sometimes they may cause damage to certain crops.
The annual precipitation of the places near the mountains, which surround the Great Konya Basin is generally higher (Niğde = 357 mm, Konya = 315 mm, Karaman = 361 mm), than in the central part of this basin (Karapınar = 276, Çumra = 246 mm).
Because the Erosion Camp Area is at fairly high elevation and because the sky is dominantly clear and the air is dry, the daily range in temperature is great. It averages about 10°C in winter and about 15°C in summer.
In winter the nights are cold. The average monthly lowest temp. ranges from about -2 to about -5°C in night. In time the temperature falls below -20°C or lower.
The average frost-free period extends from the middle of May to October, a period of about $4\frac{1}{2}$ months.
In summer the temperature is often between 30 and 35°C and is occasionally above 35°C.
The dominant winds are commonly from the south-western corner, mainly from S.S.W. and rise to dust storms that are disagreeable and destructive. One year has an average of about 2 or 3 stormy days, in which the wind attains speeds of 20 to 25 m/sec or more.
Principally because of the dry air and the warm summer day, the evaporation rate is relatively high. Evaporation from free water surface averages 1189 mm in Konya annually. The average relative humidity ranges between about 40% in summer to 80% in winter.

Figure 8

Wind diagrams show the average direction and average frequency of the winds in one year (a).



a). Data about wind, recorded in Karapınar were not available. Only a tentative comparison can be made with data recorded in Konya and Niğde. Karapınar is situated roughly between these two towns. It lies about 100 km. east of Konya and about 130 km. W.S.W. of Niğde in the Great Konya Basin.

Table 1

	Jan.		Febr.		Mar.		Apr.		May		Jun.	
	c	d	c	d	c	d	c	d	c	d	c	d
Average stormy days (b)	0.1	0.5	0.3	0.3	0.1	0.5	0.3	0.5	0.1	0.2	0.1	0.3
Maximum wind-speed (m/sec.)	18.5	25.8	20.7	19.7	19.5	23.2	19.7	23.2	18.4	19.0	18.3	19.7
and the wind-direction	SSE	S	SW	NW	SSE SSW	SSW	S	SSW	WSW	SSW	SW	NW

Jul.		Aug.		Sept.		Oct.		Nov.		Dec.		Year	
c	d	c	d	c	d	c	d	c	d	c	d	c	d
-	0.2	-	0.3	0.1	0.1	-	0.1	-	0.1	0.2	0.1	1.3	3.1
13.3	20.6	12.9	23.2	19.5	17.9	10.5	24.6	14.2	29.1	19.5	17.2	20.7	29.1
NE	SW	NNE	NNW	WSW	N	S	SW	SW	SW	SSE	NW	SW	SW

b) Storm-winds have wind-speeds > 17.1 m/sec.
c) Data recorded in the Weather Bureau Station near Niğde.
d) Data recorded in the Weather Bureau Station near Konya.

Table 2 - Temperature and precipitation at Karapınar (a).
Elevation : about 1000 m.

month	precipitation in mm.				temperature in °C
	average (b) in mm	driest (c) year 1957	wettest (d) year 1963	max. (e) rainfall	(f) average 1964
December	42.7	35.1	41.8	20.6	1.9
January	38.2	12.6	64.4	32.4	-8.9
February	33.2	26.1	50.7	33.0	0.4
Winter	*114.1*	*73.8*	*156.9*	*33.0*	*-2.2*
March	28.3	24.7	37.8	21.4	6.6
April	24.4	33.0	64.4	29.5	8.9
May	40.3	24.5	110.6	27.5	14.1
Spring	*93.0*	*82.2*	*212.8*	*29.5*	*9.9*

June	22.2	13.9	31.9	25.1	19.0
July	3.0	5.1	6.9	17.0	22.9
August	0.8			4.4	20.7
Summer	*26.0*	*19.0*	*38.8*	*25.1*	*20.9*
September	6.3	0.0	26.6	14.9	15.3
October	14.7	15.5	5.7	28.0	11.2
November	21.9	16.9	16.4	25.6	5.0
Autumn	*42.9*	*32.4*	*48.7*	*28.0*	*10.5*
Year	*276.0*	*207.4*	*457.2*	*33.0*	*9.8*

Notes: (a) The Weather Station near Karapınar is a substation and has been installed several years ago. As its recorded data are limited, data from the stations of Konya and Niğde are given in table 1,3 and fig. 8.

(b) Average precipitation, based on a 11-year record, in the periods 1953-1954 and 1956-1964.

(c) Precipitation in 1957, the driest year in the 11-year record.

(d) Precipitation in 1963, the wettest year in the 11-year record.

(e) The absolute maximum rainfall in one day, based on a 12-year record, in the period 1953-1964.

(f) Since June 1963 temperature data could be obtained. Thus only average monthly temperature on an 1-year record through 1964 is given here. The average temperature based on a 30-year record in the period 1931-1960 in Konya is given in table 3.

Table 3 - Precipitation, Evaporation and Temperature near Konya (a). Elevation : 1026 m.

month	precipitation		evaporation	Temperature		
	average in mm. (b)	snow (days) (c)	average in mm. (d)	average in °C. (e)	absolute maximum (f)	absolute minimum (f)
December	36.9	4.5	22.1	1.6	20.0	-26.0
January	40.9	8.6	20.5	-0.2	16.3	-28.2
February	32.3	5.6	32.9	1.6	23.8	-26.2
Winter	*110.1*	*18.7*	*75.5*	*1.0*	*23.8*	*-28.2*
March	31.0	2.6	65.5	5.0	28.2	-16.4
April	30.5	0.2	103.2	11.0	30.4	- 6.6
May	39.4	.	118.4	15.9	33.8	- 0.7
Spring	*100.9*	*2.8*	*287.1*	*10.6*	*33.8*	*-16.4*
June	25.6	.	145.8	19.8	34.8	1.8
July	6.3	.	204.2	23.1	37.7	6.7
August	3.7	.	206.2	22.9	36.8	5.3
Summer	*35.6*	.	*556.2*	*21.9*	*37.7*	*1.8*
September	10.7	.	142.7	18.2	35.2	- 3.0
October	26.8	.	86.1	12.5	31.6	- 8.4
November	30.8	0,8	41.0	6.5	25.4	-19.0
Autumn	*68.3*	*0,8*	*269.8*	*12.4*	*35.2*	*-19.0*
Year	*315.0*	*22,2*	*1188.8*	*11.5*	*37.7*	*-28.2*

Notes: (a) The Weather Station near Konya has recorded more data than the substation in Karapınar and the averages are based on longer periods. It is situated in the Great Konya Basin about 100 km westward from Karapınar.

(b) Average precipitation in mm., based on a 30-year record, through 1960.

(c) Average number of days, in which the snow covers the soil surface, based on a 30-year record, through 1960.

(d) Average evaporation of a free water surface (Wilt evaporimeter) in mm. on a 28-year record.

(e) Average temperature, based on a 30-year record, through 1960.

(f) Highest and lowest temperatures on a 30-year record, through 1960.

2.4.2 Soil climate

The climate, as it has been described before, is not entirely the same as the climate, which influences the soil-conditions. Big differences in moisture and temperature consequently related to respectively relief and exposure, occur mainly in the mountains and in the limestone platform.
Due to differences in relief a large part of the rainwater runs over the surface and does not penetrate the soil on the mountain and platform slopes. It reaches the footslopes and the lacustrine plain, which therefore have wetter conditions than may be deduced from the rainfall records.
Also the soil temperature may vary much. In winter and in the night cold air flows from the limestone platform and the mountains into the footslopes and the lacustrine plain.
The daily summer temperature in most soils is high, because the vegetation is mainly poor and the soils are barren.
Also soils, exposed on south slopes, will have other variations in temperature than the soils on for example northslopes.
As the soil climate is an important factor in soil formation, it is described more in detail in chapter 3.

2.5 HYDROLOGICAL ASPECTS AND SALINITY

By the absence of rivers the hydrological aspects of the surveyed area depends mainly on the precipitation. As the drainage conditions range from well drained to excessively drained, no important accumulations of water occur in the depressions for a long time.
The surface of the limestone platform has locally been cut by several intermittent gullies, which are sloping downward the south-east. There the surface runoff ranges up to rapid (class 4)

The surface water flows over and through the escarpment to the lacustrine plain. If the water has reached this plain it drains soon to the subsoil. The groundwater table depth in the plain varies from about 8 to about 20 meters.
In the past the groundwater table was not so deep in some places. A recent canal drains parts of Karapinar for only about a decade. Other canals have been dug and are draining former marches in the south near Samuk Y., mainly for prevention of malaria.
Salinity. Because of their good internal drainage and the deep groundwater table Salinity is not a hazard to agriculture within the surveyed area. Some salinity may occur in the subsoil of the lowest parts of the lacustrine plain and also on the soils drained from volcanic material. Salt efflorescence on the soil surface has not been observed.

2.6 LANDUSE AND VEGETATION

2.6.1. Idle land

The largest part of the Erosion Camp Area has been idle land for the last years and was in native pasture formerly. Sheeps and goats have been grazed in herds, probably for centuries. Livestock graze selectively and they remove more leaves from some plants than from others. Their selection of plants for grazing varies with the season and the degree of use. For this reason, pasture responds to grazing in different ways. Some kinds of plants decrease ("decreaser"), some increase ("increaser"), and others originally not present, may invade ("invaders").
In this overgrazed area the composition of the vegetation will have been determined mainly by intensive grazing sheeps and

goats.
The plants are mainly increasers and invaders. So, on clayey soils mainly Peganum harmala (Üzerlik) occurs, which is not liked by livestock and mainly Marrubium parviflorum (Tapir) on sandy soils.
The vegetation cover is now very slowly becoming to have a new composition, because grazing is limited.
A provisional collection of the most occurring plants in the Erosion Camp Area has been compiled. The collected plants have been identified by Mr. Dr. Riza Çetik, dozent of the Botanic University of Ankara.

List of scientific and local plant names

Plants on mainly calcareous sandy soils:

Scientific name	*Common turkish name*
Artemisia fragrans	*Piren*
" " scoparia	"
Bromus tectorum	*Ipelek*
Ajuga chia	*Şaplak or Kisa mahmut*
Marrubium parviflorum	*Tapir*
Salvia cryptantha	*Ada çay*
Alhagi camelorum	*Yandak*
Astragalus microcephalus	*Geven*
Verbascum cheiranthifolium	--

Plants on mainly calcareous loamy and clayey soils:

Halimione portulacoides	--
Achillea santolina	*Bin Yaprak Otu*

Centaurea triumettii	*Gökbaş*
Cirsium acarna	--
Inula	--
Tragopogon pratensis	*Yemlik*
Convolvulus lineatus	*Kahkana çiçeğli*
Isatis tinctoria	*Delı sarı*
Sinapis arvensis	*Hardol*
Euphorbia tinctoria	*Sütleğen*
Phlomis ameniaca	--
Teucrium orientale	*Alanotu or Hazeran*
Alhagi camelorum 1)	*Yandak*
Onobrychis sativa	--
Glaucium corniculatum	*Gelincik*
Melilotus officinalis	
Adonis flammea	*Kan damlasi*
Reseda lutea	*Çiçeği*
Verbascum ballsianum	--
" lasianthum	*Suğir kuyruğu*
Zozimia absinthifolia	*Cörtük*
Peganum harmala	*Üzerlık*

1) Occurs on sandy, loamy and clayey soils.

Appendix III gives the scientific names of plants, which may occur in the Great Konya Basin and which are listed by ZHUKOVSKY, P. and H. BIRAND.

2.6.2 Management of pasture land.

Many areas in the Erosion Camp Area are not suitable for crop cultivation. In the future, when the vegetation of the idle land will be returned to excellent conditions, it seems to be possible to allow some limited grazing here. Succesful grazing can only be obtained if the principles of grazing management are respected (USDA 1954, no. 61).

There are four primary requirements which need to be met to practice pasture conservation through management of grazing:

1. Proper degree of pasture use, considering the kinds of pasture plants to be encouraged in the pasture.
2. Proper season of use, considering the need of the vegetation for improvement and the need of livestock for forage.
3. Proper distribution of grazing throughout the pasture, so that, within practical limits, most of the pasture will be grazed to the proper degree.
4. Proper kinds of livestock, considering the nature of the pastureland and the kind of forage furnished by pasture plants.

Several areas, around the Erosion Camp Area are overgrazed and become more and more susceptible to wind-erosion. It should be very useful, when the herdsmen and people around the Erosion Camp Area would learn about the methods and the profits of a proper use of their grazing land. Properly grazing can be done by careful herding.

sub. 1. *Proper degree of pastureland use.*

Degree of pasture use refers to the amount of the current annual forage growth which is removed by grazing. This is important to the herdsman because it affects the physiology of the plant, which in turn governs its production and ability

to compete with the plants around it.
Proper pastureland use is a degree of grazing that will restore or maintain high pastureland condition. For rapid improvement of pastureland in poor condition, the pasture should not be used during the growing season.
The proper degree of pasture use on pastureland in excellent condition is removal by grazing of about half the current years growth. The growth left on the pasture forms a mulch that slows erosion and increases intake of moisture for growth the following year.

sub 2. *Proper season of use.*
The proper time to graze a given pastureland depends on the characteristics of that land, the pasture plants it supports, the growth periods of the principal plants, and the condition of the pastureland.
If pastureland improvement is the main objective, it can be hastened by permitting the plants to grow unmolested for part or all of the growing season. The longer the rest period, the more rapidly the pasture improves toward excellent pastureland condition. If no forage growth is removed, a mulch accumulates. This mulch brings more rapid improvement of the pastureland because it creates a condition most favorable to the decreaser plants. The practice of not grazing pastureland for a time during the growth period is called deferred grazing (USDA 1954).

sub. 3. *Proper distribution of grazing.*
If proper degree of pastureland use is to be accomplished over an entire pasture, the distribution of grazing within the pasture requires planning. Livestock tend to graze most in areas near water, where the relief is gentle and near roads and trails. Distant corners and steep terrain are likely to be undergrazed. Poor grazing distribution may be caused by too few

watering places, or by locating shade, resting grounds, and water all at one place. Concentration of livestock causes severe use in parts of a pasture. Too few watering places, or watering places that are poorly located, are the indirect cause of blowouts.

Watering places should be distributed in a way which will encourage livestock to graze a pasture uniformly. When sheep and goats are under herd, the herdsman can see that all parts of the pastureland are uniformly grazed. To avoid excessive trampling, livestock should be held in open and well spreadout bands and not be driven over the same trails day after day to water or bed grounds. Frequent shifting of bed grounds also is desirable or herds should be allowed to bed-down where night overtakes them. Modern sheepmen in other places of the world, fence their lands into paddocks, thereby eliminating herding and the concentration of animals which occurs with herding even under the most careful management.

Control of blowouts. Blowouts produce little or no forage and are centers from where shifting sand blows and destroys more soils and vegetation. They can be revegetated to productive pasture.

Burning of pasture is likely to be very harmful.

2.6.3 Cropland and young woodland

Arable land occurs mainly in the northwestern part of the described area. Chiefly wheat, rye and barley are cultivated in dry farming system here.

The original allotment was not suitable. Farmland was split-up to a great extend in this area. A re-allotment has been carried out inside the Erosion Camp Area a few years ago. Now the fields are rectangular and are arranged in strips. These

strips are uniform in width (about 50 meters), usually straight and are laid out as nearly as possible at right angles to the direction of the dominant winds.

Dry farming practices are applied in this wind-strip cropping system. The cultivated strip, which is left fallow every second year, adjoins a fallow plowed one and serves as a buffer strip.

Crop yields in dry farming depend largely on the climate. Yields of wheat and rye range from about 400 to 900 kilograms per ha. and generally depend on the amount and distribution of rainfall. Crop yields are also affected by diseases, insects, fertility of the soils and differences in soil management.

Conserving moisture is most important in the Erosion Camp Area It seems that the yields of small grains in the fields on the footslopes of the escarpment are somewhat larger than those in the plain, probably because the crops on the footslopes can profit from water, that comes from the limestone platform.

All the soils of the Erosion Camp Area have a very low content of organic matter. Additional organic matter is needed by all the soils to improve structure and to increase the water-holding capacity. Organic matter can be supplied by a crop rotation of low intensity by green-manure crops and by heavy application of animal manure. To add manure, however, is not easy at the moment.

Acarla (1956) has described this problem as follows:

"Unfortunately under present conditions, one can not recommend to the farmers to use the animal manure exclusively for their fields either. It is a common practice among the farmers to use the animal manure as a source of heat. Only in the future, when fuel prices will be low enough to warrant the use of animal manure for fertilizing purposes, that the farmers may start using it to fertilize their fields".

During the survey some experiments were undertaken by Topraksu

with papilionaceous crops like Onobriches sativa and Melilotus officinalis in a wind-strip cropping system.
A number of wells have been dug and several pumping stations have been built in the last years.
By pumping irrigation is tried to reduce the water shortage of certain crops in several new reclamations. These reclamations vary from the cultivation of vegetables to the care of young tree plantations.
Young trees of, for example, Pinus nigrum, Acacia, Tamarix, wild cherry, wild olive and wild almond have been planted along tracks and in several other places in the Erosion Camp Area. They are watered by hand with water, transported in tank-wagons. No big trees occur in the Erosion Camp Area. Some larger trees can be found only outside the Erosion Camp Area, planted along the asfalt road.
Nitrogen and phosphorus are most likely to be the next limiting factors in the irrigated fields, when the water deficit has sufficiently been reduced by irrigation.
Nitrogen because the content of organic matter is low and phosphorus because the soils have a very high content of lime. Only the most water-soluble forms of phosphorus should be used. The lime interferes with the absorption of iron by some crops and this causes chlorosis in some crops in several places.
All the arable land in the Erosion Camp Area needs special care, that will prevent damage by winderosion. Practices, which help to control winderosion are growing crops in a suitable sequence, stripcropping and a proper use of crop residues.

2.7 THE ACTIVITIES IN THE EROSION CAMP AREA.

This chapter mentions very briefly the activities in the Erosion Camp Area.

According to the Topraksu authorities the most important task in the Erosion Camp Area is to stabilize the drifting sand. In about 1962 a rule has been made, which forbids grazing inside the area surveyed. This area has been fenced in by barbed wires in the years 1962 and 1963 and several new tracks have been made to attain that the area is better accessible. Drifting dunes are being stabilized by reed windbreaks since that time. In several places the drifting sand between the windbreaks has been planted with rye. Here the dune sand is very sensitive for winderosion. In other places young trees of different kind have been planted in the dune sand along tracks and in the fields. All these plantations seemed to be in an experimental stage, during the time of the soil survey (1965).

Several pumping stations have been built and the water is added to the different crops by basin- and furrowirrigation, by sprinkles irrigation, or plants are watered by hand.

Several new reclamations were carried out. x)

Topraksu employs labourers, who live mainly in the region around Karapınar. These people can learn about modern conservation of soil and water here. They are taught in modern management of cropland and pasture too (see chapter 2.6.2).

x) In 1966 a large experimental irrigated garden was established near Kındam, which seemed to succeed very well. Still more pumps and storage basins are under construction T.de Meester

2.8 WILDLIFE

The soils of the Erosion Camp Area produce food, cover and protection for a few species of wildlife.

The common game in the area surveyed is the hare, which has

more protection in the fenced surveyed area than in the surrounding grazing areas in the Great Konya Basin.
Very few foxes live in this area and it seems that in winter wolves may come from the mountains into the plain.
Few kinds of birds live in the recorded area. Pigeons are most common. A few birds of prey hunt on rodents, mainly Citellus spp. Also vultures occur.
The surveyed area serves occasionally as meeting place for migratory birds, mainly storks.

3 Pedogenesis and biological activity

The factors of soil formation are so closely interrelated in their effects, that only a few general remarks can be made. The main factors, governing the soil forming processes in the Erosian Camp Area are:

1. The parent material
2. The soil climate
3. The relief and drainage
4. The time
5. The biosphere
6. The human being

sub. 1. Several classes of parent material can be distinguished in the area surveyed.

a. Parent material, which has been transported and redeposited, occurs in the Aeolian sandplain, in the lacustrine plain and partly in the volcanic mountains.

Aeolian, carbonatic, sandy material of the sandplain is probably of lacustrine origin, derived from limestone of the surrounding limestone mountains. The sandy material has been sorted by wind to a uniform fine sand and blown into a complex pattern of dunes or in sheets over the underlying lacustrine deposits. The weathered material and volcanic ash may partly be reworked by wind in the volcanic mountains.

Lacustrine sediments are carbonatic, often stratified sandy, loamy and clayey and occur in the lacustrine plain or are underlying the Aeolian sandplain. They seem mainly

to be derived from limestone of the limestone platform and mountains and have often layers of entire shells in which Dreissensia spec. are dominant. In places it is mixed with volcanic ash or with sandy beach deposits.

Beach deposits, which are carbonatic and calcareous, often stratified and gravelly to sandy, have been thrown up at a level of about 1010 to 1015 meters along the foreshore of the pleistocene lake. The material is derived from the limestone platform or the volcanic mountain, and is commonly thinning out over the lacustrine deposits.
In a few places it seems to be mixed with volcanic ash. Fragments of shells occur throughout the profile.

Colluvial sandy deposits, which are carbonatic and angular cobbly, occur along the escarpment of the limestone platform and are thinning out over abrasion debris and over the lacustrine deposits.

b. Parent material formed in places from unconsolidated igneous and soft rocks are also in the recorded area.

Parent material produced from unconsolidated igneous rocks occur in the volcanic mountains, between the rock outcrop. They are mainly angular cobbly volcanic sandy materials, which may be reworked by wind and water in some places.

Parent material produced from soft to hard limestone occurs on the limestone platform. The soil has mainly been formed in the chalky material, which often overlies hard limestone.

sub. 2. The soil climate may differ much from the atmospheric climate and comprises a number of climatic factors (Mohr 1954) They are mainly: a - The soiltemperature
b - The watercondition
c - The humidity of the air
d - The nature and state of vegetation

Exact data of the three first factors in the area surveyed were not available. Only a tentative comparison with some data, recorded in Konya, may give the size-order of several data.

a. The average year temperature of the soil is 13,1°C at 15 cm and 13,6°C at 50 cm depth near Konya. In winter the average monthly temperature ranges from 1,4°C to 3,0°C at 15 cm and from 4,2°C to 6,8°C at 50 cm. In summer the average monthly temperature ranges from 22,0°C to 25,5°C at 15 cm and from 19,5°C to 23,9°C at 50 cm depth. Thus these soils belong to the class of mesic soils (USDA 7th Appr. 1964).

b. As the groundwatertable is deep (depth ranges from 8 to 25 meters or more), the watercondition of the well drained to excessively drained soils depends mainly on the distribution and amount of the precipitation in the year, on the fieldcapacity, on the soil, on the exposure and on the evapotranspiration.

c. The relative humidity of the air in Konya has a year average of 60 %. It is characterized by wide daily and seasonal variations. The monthly average ranges from 40 % in August to 80 % in December.
In the afternoon the daily variation has its minimum humidity value. Occasionally it may fall below 4 %.

d. In the idle land the surface is barren or covered with a poor steppe vegetation, which will not have important influence on the daily temperature variations of the soil. The arable land is cultivated according to principles of dry farming. So the cultivated fields are left fallow and plowed every other year.

sub 3. The relief and drainage.

The Aeolian sandplain consists of mainly excessively drained to somewhat excessively drained dunes which are nearly level to very steep.

The lacustrine plain is mainly level to nearly level and is

in some places gently undulating. Its soils are well- to somewhat excessively drained.
The volcanic mountains are nearly level to very steep and run-off flows over the barren rock outcrops to the well drained to excessively drained depressions.
The limestone platform is nearly level to very steep and has somewhat excessively drained soils.
No reduced soils, even subsoils, have been found in the area surveyed. Iron occurs in ferric forms as faint, small mottles in the substratum, indicating that the drainage conditions of the soils in the plain may have been a little wetter before the drainage canals were made.
sub 4. The time.
According to Chaput (1947), the limestone platform dates from tertiary periods. Thus these soils are older than those of the plains. The soils of the platform, which lie inside the Erosion Camp Area, are on the edge of the platform and are eroded.
Also the soils of the volcanic mountains existed before the pleistocene lake dried up, except the beachdeposits. These last ones date from pleistocene periods and a ca-horizon occurs, in which calciumcarbonate has accumulated as lime pendants and has cemented the pebbles in some places.
The soils of the Aeolian sandplain are younger, but show partly more soilformation. A faint ca-layer with lime accumulation occurs at a certain depth. These soils occur near very recent sandy deposits, which are still drifting.
The soils of the lacustrine plain date also of pleistocene periods. These soils have a faint to well expressed ca layer, which may be a weak calcic horizon in some places. They also have a cs layer with gypsum accumulation in the substratum. In some places a gypsic horizon occur.
sub 5. The biosphere.
Because of the soils of the Erosion Camp Area are well drained

to excessively drained and are dry for long periods, the former overgrazed plantcover is poor. The plants add little organic matter to the soil, give scant protection against water and wind, and provide very meager shade. For this reason the soils seem to be poor habitats for microorganisms and have a very low content of organic matter (< 1 %).

The biological activity, however, is considerable. All soils of the surveyed area except the sandy material of the drifting dunes, have been more or less subject to the disturbing activities of soil digging rodents mainly species of Citellus (German: ziesel, Turkish: tarla fare). Also some few Spalax species (blind mouse or Köstebek) occur. The disturbed soil is clearly shown in the soil profile by the occurence of Krotovinas. Another kind of disturbance is also observed. Rounded casts of about 1 mm diameter occur in the solum or fill earthy cocoonlike elongated holes of about 1 cm diameter. The walls of these holes are plastered with massive soil material and often occur in the caliche-like layer too. These cocoon-like tubular pieces of soil are probably built by insects.

sub.6. It seems that this region, in which the Erosion Camp Area lies, has been inhabited in neolithic times. Fragments made of obsidian, like those found on Catal Hüyük and described by the Mellaert (1964) are occasionally found between dunes. Also human homes, fragments of ancient potteries, ancient tracks, several very old wells occur aboriginal in places. Also the very few and relative small dwelling mounts (Turkish: hüyüks), which occur in this region, indicate that this region was sparsely populated and the influence of men on the soils has mainly been through his livestock. The herds of mainly sheeps and goats have overgrazed the poor steppe vegetation. In few places the soils have been disturbed by men, mainly around villages, where the soil is often excavated for manufactoring sun-dried bricks.

4 Mapping procedures

The soil survey was carried out according to modern methods. The fieldwork has been supported by the use of aerial photographs as a result of which the soil boundaries could be plotted accurately and time could be saved for the fieldwork necessary to investigate the soil properties of the map units in great detail.

4.1 PHOTOINTERPRETATION

The scale of the available photographs was about 1:40.000. The quality of these glossy contact prints on single weight paper was excellent.
After an exploratory survey and previous to the fieldwork, a "preliminary photointerpretation map for soil survey purposes" was compiled by means of stereoscopic study, interpretation and analysis of the aerial photographs of the area surveyed. The analysis was directly drawn with grease pencil on the photos. Next, the field survey was planned and the fieldwork was started.

4.2 FIELDWORK

The fieldwork was carried out in the months May and June 1965.

When the author travelled over the Erosion Camp Area, he observed and recorded steepness, length and shape of slopes, kinds of native plants or crops, kinds of rocks and many facts about the soils. He examined about 40 soilpits, which expose undisturbed soil profiles.

A soil profile is the sequence of natural layers or horizons in a soil. It extends from the surface down into the parent material, which has not been changed much by leaching or by roots of plants. The main soil properties of the profile, such as texture, gravel, stones, colour (according to the Munsell notation), structure, consistency, porosity, mottling, roots, etc. were determined and recorded on the spot.

Other features taken into consideration are the external characteristics like topography, surface morphology, etc.

The places of the profiles were carefully chosen and located on the aerial photo or topographic field map (scale 1:25.000).

At representative sites the soilprofile was described in detail according to the instructions of the Soil Survey Manual (Handbook 18) of the U.S.D.A. (1951). The diagnostic horizons of these selected profiles were determined and these profiles were classified according to the 7th Approximation of the new U.S.D.A. soil classification system (1960).

The soils are also classified in great soil groups (Thorp 1949)

Two soil peels (large monoliths) have been made from selected, well sampled and well described profiles. Photographs of these 2 soil peels are printed in Appendix II. Soil samples, taken from these soil profiles have been used for research in Ankara and Wageningen. The results are given in tables 4 and 5, Appendix II. Also about 800 holes were bored to expose soil profiles by means of a soil auger (Edelman type).

In some places deep borings were done to a depth of 300 to 400 cm in order to investigate the nature of the subsoil.

The observation sites were precisely pinpointed on the aerial

photo and on the topographic field map. Also the landuse was precisely noted.
Finally a field check was carried out of the entire obtained field soil map (scale 1:25.000) by checking the characteristics of the soils in all mapping units and by checking the correct position of the majority of map unit boundaries.

4.3 SOIL MAP COMPILATION

By compiling the soildata, obtained by fieldwork as well as by the results of photointerpretation, a semi-detailed soilmap on scale 1:50.000 has been produced. The field soilmap has been compiled on a basis of a tracing copy from the national topographic sheets 1:25.000. Later this field soilmap was reduced photographically to scale 1:50.000.
The soilmap published has a high standard of accuracy with regard to the topographic position of the plotted soil boundaries as well as to the nature of the soil units. The mapping units are uniform within the limits of tolerated impurity.

4.4 METHODS OF ANALYSES

The physical and chemical properties of selected soils in the Erosion Camp Area are shown in table 3 and 4, Appendix II.
The tests were made in the laboratories in Ankara and Wageningen.
The mechanical analyses were made with the pipette method with dispersion by sodium hexametaphosphate and with and without HCl treatment. The basic texture classes, used in this report, are based on the size distribution, without elimination of lime.

In the field the texture is estimated by the way the soil feels, when rubbed between the fingers and it is later checked by laboratory analyses as often as possible.
The chemical properties were determinated according the methods, described in Agriculture Handbook, no 60 of United States Salinity Laboratory Staff.(1954).
Soil chemical analysis has been limited very much.

5 The soil map

Soil surveying consists of the examination, classification, and mapping of soils in the fields. The soils are classified and named according to uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in this local soil classification.

5.1 SOIL CLASSIFICATION

Soils, that have profiles almost alike, make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement and other important distinguishing characteristics. Each soil series is named for a village, mountain or other geographic feature near the place where a soil of that series was first mapped in the Erosion Camp Area.
Many soil series contain soils that differ in minor characteristics such as texture. Such differences in texture make it necessary to separate a series into types. Owing to the semi-detailed character of the survey, the soils are mostly mapped on series-level. Several times subdivision of a soil series into a group of soil types was possible. This subdivision is based on the texture of the surface soil, which is grouped in general terms of three classes (See glossary, Chap.5.2)
Karafakı clayey soils and Karafakı sandy soils are two groups

of soil types in the Karafakı series. The general difference in texture of their surface layer is apparent from their names. Some soil series, groups of soil types or complexes of soil series vary so much in degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestion about their management could not be made if they were shown on the soil map as one unit. Such soil series, groups of soil types or complex of soil series are divided into soil phases. The name of a soil phase indicates a feature which affects management. For example, Günağılı complex, stabilized dark sandy soils (map unit Dd.3.1) and Günağılı complex, dark sandy soils, wind-eroded phase,(map unit Dd.3.2) are two of several phases of Günağili complex, a complex of soil series which ranges in erosion from stabilized to wind-eroded.
In some areas different kinds of soils occur in such small areas or in such intricate association that it is not practical to show them separately on the soil map at this scale. Therefore this mixture of soils is shown as one mapping unit and is called a soil complex. A soil complex is named for the major soil series in it, in this report. For example, in the Ecelertolu complex (mapunit Tp 3-2), sandy soils, the Ecelertolu soil series is the most important series.
Sometimes, very few clear geographic features occur in the field and on the topographic map. In that case the name of the occurring feature is divided in A and B. For example, the Komoba complex (mapunit Dd 1.1) consists of two soil series, namely; the Komoba A soil series and the Komoba B soil series.
Also, on the soil map, areas are shown that are so rocky, or so frequently worked by wind that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Active dune land or Basalt rock land, and are called miscellaneous land types rather than soils.

For the sake of convenience the various soils in the Erosion Camp Area have been arranged in a number of "soil associations". Some of the soil associations are closely related and in places merge with one another without a distinct line of demarcation. Others are more distinct and are separated by more obvious boundaries.
For the grouping of the soils in soil associations, the 4 main landscape units (see chapter 2.3) are used, because they have all a specific range of geographically related soils.

5.2 TERMINOLOGY AND GLOSSARY

The terminology (terms and abbreviations) used in this report and in soil descriptions is according to those recommanded for international use by the Soil Survey Manual et al.
The most common terms and abbreviations are repeated:
Aeolian (eolian) soils: Soils formed from materials deposited by winds.
Alluvial soil: Soil formed from alluvium and showing little or no modification of the original materials by soil-forming processes.
Alluvium: Fine material, such as sand, silt or clay, that has been deposited by streams.
Association, soil: A group of soils physiographically and geographically associated in a characteristic pattern.
Barchan: is an isolated mound of sand travelling forward as a dune of crescentic form. The sandfall is on the concave side and the horns of the crescent trail forward in advance of the main body.
Blowout : An excavation produced by wind action in loose soil, generally sand.

Calcareous soil: Soil which contains enough calcium carbonate (often with magnesium carbonate) to form bubbles visible to the naked eye when treated with cold, dilute hydrochloric acid. Soil that is alkine in reaction because of the presence of free calcium carbonate.

Calcisol: A soil which occurs on highly calcareous parent material in arid and semi-arid regions. In these soils accumulated calcium carbonate has formed a horizon. Calcisols differ from zonal soils in not having an accumulation of silicate clay minerals in the B horizon.

Caliche: A broad term for more or less strongly cemented deposits of calcium carbonate in many soils of arid and semi-arid areas.

When near the surface or exposed by erosion, the material hardens.

Carbonatic soil: A soil containing more than 40 percent carbonates (often calcium, carbonates and magnesium carbonate) in the fine earth portion (less than 2 mm).

Clay: Mineral soil particles less than 0.002 mm in diameter. See also texture.

Clayey soil: See texture.

Climax vegetation: The stabilized plant community on a particlar natural environment; it reproduces itself and does not change so long as the environment does not change.

Colluvium:(colluvial deposits). Mixed deposits of rock fragments and coarse soil materials near the bases of steep slopes. The deposits have accumulated as the result of soil creep, slides or local wash.

Complex, soil: An association in which two or more soils are so intricately intermixed that it is not practical to show them separately at the scale of mapping used.

Decreasers: Any of the climax plants most heavily grazed. Because they are the most palatable, they are the first to be

destroyed by overgrazing.

Deferred grazing: Postponing grazing for a prescribed period to improve the vigor of the vegetation stand or to allow seed production.

Desert pavement: (erosion pavement). A cover of gravel and small rock fragments left on the surface of the soil after finer particles have been removed from the surface horizons by wind.

Dominant winds: As used in this report, winds which produce the largest and most damaging wind-erosion.

Dune: A mound or ridge of sand piled up by wind.

Erosion: The wearing away or removal of soil material by wind or water.

Erosion hazard: Relative susceptibility to wind or water erosion. Relative terms are slight, moderate and severe.

Great soil group: Any one of several broad groups of soils with fundamental characteristics in common.

Increasers: Species in the climax vegetation which increase in relative amount as the more desirable plants are reduced by close grazing; they are commonly shorter than decreasers, and some are less palatable to livestock.

Intrazonal soil: Any of the great soil groups having rather well developed soil characteristics that reflect the dominating influence of some local factor of relief, parent materials, or age over the affect of the climate and vegetation.

Invaders: Plants which come in and grow after the climax vegetation has been reduced by grazing.

Lithosol: A soil having little or no evidence of soil development and consisting mainly of a partly weathered mass of rock fragments or of nearly barren rock.

Loamy soil: See texture.

Marl: In this report a broad term for an earthy deposit mainly of calcium carbonate mixed with clay and other impurities.

Neogene: A period of geologic time which occured between about

2 and 30 million years ago. Also, geologic materials deposited during the Neogene period.

Phase, soil: In this report, a subdivision of a soil series, soil type, or other unit in the natural, or taxonomic, classification of soils. The subdivision is based on differences in the soil series, which affect management.

Prevalent winds: Winds, which blow with the greatest frequency at any place.

Regosol: An Azonal group of soils without definite genetic horizons and developing from deep unconsolidated or soft rocky deposits.

Sand: Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. See texture.

Sandy soils: See texture.

Series, soil: A group of soils that have genetic horizons similar, except for the texture of the surface soil, as to differentiating characteristics and arrangement in the soil profile and developed from a particular type of parent material. A series may include two or more soil types that differ from one another in the texture of the surface soil.

Silt: See texture.

Slip-face: A lee slope of the dune, where the slope of the surface reaches the limit of steepness imposed by the angle of shear of deposited material.

Soil: The natural medium for the growth of land plants on the surface of the earth; composed of organic and mineral materials.

Soil depth: The depth of soil material, in which plant roots can penetrate readily to obtain water and nutrients. It is the depth to a layer which, in physical properties, differs from the overlying material to such extend as to prevent or seriously retard the growth of roots. The depth classes are:

Shallow soils	0-40 cm
Moder. deep soils	0-80 cm

Deep	soils	0-120 cm
Very deep	"	0- > 120 cm

Surface layer: The topmost layer in the soil profile, regardless of the thickness of this layer.

Surface soil	approx.	0-20 cm (ploughlayer)
Subsurface soil	"	20-100 cm (solum)
Subsoil	"	100 cm

Substratum : Any layer lying beneath the solum, or true soil; the C horizon.

Texture, soil: The relative proportions of sand, silt and clay particles in a mass of soil.

Basic soil textural Class names:	Abbr.	General terms: Four classes:	Three classes:
Sands	s	Coarse-textured soils	Sandy soils
Loamy sands	ls		
Sandy loam	sl	Moder.coarse-tex. soils	
Fine sandy loam	fsl		
Loam	l	Medium-textured soils	Loamy soils
Silt loam	sil		
Silt	si		
Clay loam	cl	Fine text. soils	Clayey soils
Sandy clay loam	scl		
Silty clay	sicl		
Sandy clay loam	sc		
Silty clay	sic		
Clay	c		

Type, soil: A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Winnowed soil: Soil from which the wind has removed the finer particles.

5.3 MAP LEGEND; THE GUIDE TO THE SERIES AND MAPPING UNITS; PROPORTIONAL AND ABSOLUTE EXTENT OF THE MAPPING UNITS. [1]

		page	per-cent	hectares
D	AEOLIAN SANDPLAIN. [2]	*68*	*49*	*6770*
Dd	Shifting and stabilized sand dunes [3]			
Dd.1	Komoba A and B series			
Dd.1.1	Komoba complex, stabilized sandy soils, low hummocky	70	19	2600
Dd.1.2	Komoba complex, sandy soils, wind eroded phase	73	10	1330
Dd.1.3	Komoba complex, sandy soils, over-blown phase, high hummocky	75	3	355
Dd.2.1	Active dune land	76	12	1720
Dd.3	Günağılı A and B series			
Dd.3.1	Günağılı complex, stabilized dark sandy soils, low hummocky	80	3	370
Dd.3.2	Günağılı complex, dark sandy soils, wind eroded phase	83	x	95
Dd.4.1	Dark active dune land	84	2	300
L	LACUSTRINE PLAIN [2]		*29*	*3965*
Lm	Marl soils [3]			
Lm.4	Karafakı series			
Lm.4.1	Karafakı clayey soils	90	3	460
Lm.4.2	Karafakı clayey soils, phase with few to common low sandhills	91	1	170
Lm.4.3	Karafakı sandy soils, phase with common to many low sandhills	92	2	265
Lm.4.4	Karafakı sandy soils	93	2	330
Lp	Soils of the sandplain [3]			
Lp.1	Kındam series			
Lp.1.1	Kındam sandy soils	96	19	2555
Lp.2	Kayırlıkaşı series			
Lp.2.1	Kayırlıkaşı dark gravelly sandy soils	98	1	185

Mv	VOLCANIC MOUNTAINS [2]		*18*	*2425*
Mv	Soils of volcanic mountains and hills [3]			
Mv.1	Andıklı series			
Mv.1.1	Andıklı angular cobbly sandy soils	100	x	25
Mv.2	Kartan series			
Mv.2.1	Kartan gravelly sandy soils	101	3	470
Mv.3.1	Basalt rock land	102	14	1930
T	LIMESTONE PLATFORM (TERRACES) [4] [2]		*4*	*600*
Tp	Soils of flat terraces [3]			
Tp.1	Apak series			
Tp.1.1	Apak angular cobbly sandy soils	106	x	55
	Karataş series			
Tp.2.1	Karataş gravelly sandy soils	107	1	185
Tp.2.2	Karataş sandy soils	108	x	135
Tp.3	Ecelertolu series			
Tp.3.1	Ecelertolu complex, angular cobbly sandy soils	110	x	45
Tp.3.2	Ecelertolu complex, sandy soils	111	1	180
U	MAN DISTURBED LAND		x	100
U.1	Recent man disturbed land	113	x	55
U.2	Ancient man disturbed land	113	x	45
		Total		13860

x Less than 1 percent

[ ] map unit

Notes:

1) The surfaces were measured with a "Kent" compensation planimeter on the field soil map (scale 1:25.000).
The measurements of the surfaces have an accuracy of about ± 5 hectares.

2) Soil associations.

3) Sub-soil associations, described in "Soils of the Great Konya Basin, Reconnaissance Survey, in press.

4) In the reconnaissance survey of the Konya Basin, the Limestone platform is included in a larger integrant landform-unit, called "Terraces" (Soils of the Great Konya Basin, Reconnaissance Survey, in press.).

5.4 THE SOILS.

This chapter describes systematically the soil associations, the soil series and the mapping units of the Erosion Camp Area. For general information about the soils the reader is referred to the general description, which describes briefly the soils of the soil association and precedes the description of the soil series and mapping units. After this, the soil series are first described and then the mapping units in these series. The description of complexes of soil series follows the reverse sequence.
Unless otherwise stated, the colors given describe the surface layer when dry and the underlying layers when moist.
Readers, who want detailed descriptions of characteristic soil profiles, as well as physical and chemical analyses, should see Appendix II.

The location and extent of the soils in the Erosion Camp Area are shown on the semi-detailed soil map (Appendix IV).
The map legend, the guide to the series and mapping units, the proportional extent and the absolute surface in hectares of each mapping unit are given in chapter 5.3.
In parentheses the legend also gives as much as possible the "sub-associations", to which the undermentioned soil series and mapping units belong in the larger integrant survey of the Konya Basin. (Soils of the Great Konya Basin, Reconnaissance Survey, in press.)

5.4.1 Series of the Aeolian sandplain soil association.

(Very deep, level to very steep, carbonatic soils and winnowed materials, underlain by lacustrine sediments, unit 1 in fig.2)

General description.
This association constitutes about 49% of the Erosion Camp Area. It is the largest one and it occurs in the southern and central part of the mapped area.
The topography ranges from level depressions to very steep dunes.
An indistinct dune-like landscape, which is level to undulating, occurs in the southern part of the surveyed area. It is characterized by very broad gently rounded dune ridges and nearly level broad valley-like depressions.
Originally this indistinct dune-like landscape had also occurred in the central and eastern part of the recorded area. Here, however, it had been transformed into an active dune landtype by the wind action.
The topography of this landtype ranges from level to very steep and the slopes are short. The active dunes are arranged in two

belts of mainly crescentic dunes or barchans in the central part and in one belt of mostly rounded sanddunes in the eastern part of the Erosion Camp Area. The dominant S.W. winds propel these different dunes very slowly as rollers to the basalt mountain "Andıklı Tepe" (see appendix I).

The soils of this association are unconsolidated Aeolian deposits on lacustrine sediments at a level, ranging from about 1000 meters to about 1010 meters or higher. The lacustrine deposits may be exposed at the surface in blowouts.

These soils are well drained to excessively drained, droughty, very deep, carbonatic, predominantly sandy soils or materials, sometimes loamy or clayey.

Their parent material is mainly a wind-deposit, reworked from underlying lacustrine sediments or in some places from underlying beach deposits.

These soils have not been subject to salinization.

The soils of this association are mapped in two complexes of soil series, in three soil phases and two miscellaneous land types.

The two complexes of soil series have been mainly recognized on basis of difference in mineralogical composition of the parent material. This because light gray, carbonatic, very fine sands lie in the south-western part of the surveyed area and their color become darker by the gradual increase of the content of dark colored coarser sand grains (mainly basalt sand) in the north-eastern direction.

Very pale brown sandy materials with very dark brown coarse sand and fine gravel are in the north eastern part of the area. In several places they are covered by a kind of "desert pavement", which counteracts the sand-drifting action of the wind.

A distinct line of demarcation between the light gray and the darker sand can not be indicated as the increase of the dark colored coarser sand is very regular in north-east direction.

Thus the boundaries between the light gray soils (Map units Dd. 1.1, Dd. 1.2 and Lp. 1.1) and the darker soils (Map units Dd. 3.1, Dd. 3.2 and Lp.2.1) are vague. They signalize a general difference in the mineralogical composition and properties of the several soils.

Komoba complex, stabilized sandy soils, low hummocky. (Map unit Dd.1.1).

The two soil series in this complex consist of somewhat excessively drained to excessively drained, very deep, level to undulating carbonatic soils on the Aeolian sand plain. They occur in an indistinct dune-like landscape. The soils of this complex belong to the most extensive map units of the Erosion Camp Area and make up about 19% of the total area.

They occur mainly in the southern part around the deserted village Komoba Y.

Of minor extent of this complex is an isolated area in the north central part.

The first soil series of this complex, called Komoba A series, are on the very broad gently rounded dune ridges and their gently sloping sides. They occupy about two third of the surface of this map unit.

The Komoba A soils are very deep, excessively drained, carbonatic sandy soils and are covered with a scarce steppe vegetation.

Dominant are Marrubium parviflorum (Tapir), Salvia cryptantha (Ada çay) and a few to very few Artemisia fragrans (Piren) occur. This plants grow often on low hummocks of fine sand that are scattered irregularly over the surface and range from about 10 cm to 80 cm in height.

The parent material is a wind deposit.

The surface layer, a light brownish gray fine and very fine sand with often fragments of shells, is about 10 to about 40 cm

thick. It is thinner in wind-blown areas and thicker where soil material from other areas has accumulated.
Below the surface layer is about 30 to 50 cm of fine sand, that in color and structure is transitional to the substratum.
The substratum is light gray to light brownish gray, loamy fine sand, often with hard to very hard consistence when dry by the presence of secundary lime accumulation. It is like a faint caliche layer. Very faint white calcareous spots are visible.
In this soils mostly no clear texture stratification occurs and the fragments of shells are mixed through the profile.

Detailed description.

A detailed description of a representative profile of Komoba A soils (map unit Dd.1.1) on an indistinct broad dune ridge is given in appendix II, Profile no.1.
These soils absorb water rapidly and release it readily.
The available moisture capacity is low. Plants may be damaged by lack of water during even a short period of drought.
The second soil series of this Komoba complex, called the Komoba B series, occur in the nearly level, wide, valley-like depressions. They occupy about one third of the surface of this map unit.
The Komoba B series are made up of very deep, somewhat excessively drained, carbonatic, sandy soils and are covered with a scarce steppe vegetation. Dominant are Salvia cryptantha (Ada çay), Marrubium parviflorum (Tapir) and very few Artemisia fragrans (Piren) occur. The vegetation occurs mostly on low hummocks of sand, that are scattered irregularly over the surface and range from 10 to 50 cm height.
The parent material is a carbonatic wind deposit on carbonatic lacustrine deposits.
The surface layer, a light brownish gray to light gray fine

and very fine sand with often fragments of shells, is about 20 to 60 cm thick. It is thinner in wind-blown areas and thicker where soil material from other areas has accumulated. In the lower part of the surface layer lime concentration is mostly visible as very faint white calcareous spots.
Below the surface layer is 20 to 40 cm of grayish brown to light brownish gray material that in texture is transitional to the substratum. Often the consistence is hard when dry by the presence of lime accumulation. In this caliche-like layer Krotovinas occur.
The substratum mostly ranges from light brownish gray to light gray clay loam to silty clay or clay. It is often stratified. Thin layers of sandy material and often entire shells (Dreissensia spec.) occur.

Detailed description.

A detailed description of a representative profile of Komoba B soils in a depression (map unit Dd.1.1) is given in Appendix II, profile 2.
These soils absorb water rapidly and release it readily. The available moisture capacity is also low, but slightly higher than that one of the Komoba A soils.
A few severely eroded areas and blowouts, too small to map separately are included in this map unit. Also included are too small areas with a thicker sandy solum, transitional between Komoba A soils and Komoba B soils.
The surface layer of the soils of Komoba complex contains very little organic matter.

Use and management.

Formerly all this unit was in native pasture and mainly sheeps and goats were grazed on it. The scarce steppe vegetation provided scant forage and had a limited value for grazing. At

the moment its chief value is to stabilize the soil material against further erosion and keep it from blowing on to Karapinar and other habitations. The erosion hazard is slight if a good cover of vegetation is maintained.
Presently these soils are idle land and natural return to climax vegetation is very slow. In the future when the vegetation cover will be in excellent condition, deferred grazing with a proper degree of use and uniform grazing seems to be possible. Control of blowouts is needed in some small areas.

Fig. 9 *(Şekil 9)*

Marrubium parviflorum on low hummocks of the soils of Komoba complex. On the background the broad dune ridge.

Komoba kompleksinin alçak tepeciklerinde "marrubium parviflorum" (Tapir) arka planda geniş kumlu siraları.

Komoba complex, sandy soils, winderoded phase (map unit Dd. 1.2)
These soils have a rougher surface, commonly a poorer vegetation and are more windblown than the soils of Komoba complex (map unit Dd.1.1.).
They occupy about 10% of the surveyed area and occur mainly in three large areas in the central part. An isolated area of

minor extent is in the north central part.
These soils are commonly bounded in the south and south-west by the soils of Komoba complex and are mostly between the Active Dune land and the Komoba complex.
This map unit consists of Komoba soils, which are intersperced with winderoded places, blowouts, high hummocky areas and sometimes with low shifting dunes.
The Komoba soils make up more than about 60% of this phase and are described under Komoba complex (map unit Dd.1.1).
The winderoded places have slightly lighter colored soils than the Komoba soils, as the surface soil has been winnowed or eroded and the supply of organic matter is lower.
The blowouts are generally result from destruction of vegetation probably caused by a too high intensity of grazing, by excessive trailing by livestock in early days and by winderosion. Here the surface- and the subsurface soil have been removed by wind. The caliche-like layer forms commonly a level floor of those shallow depressions. Also the fine lacustrine deposits may be at the surface. The edges of the blowouts may range from nearly level to very steep. The soil is mainly barren between some places with a poor steppe vegetation.
The high hummocky areas of accumulated sand are commonly adjacent to areas of removal. The high hummocks are up to 1 meter high and the low dunes are up to 2 meters or more high.
The properties of these soils are about the same as described for Komoba soils (map unit Dd.1.1) except for the winderosion, which is a great hazard, ranging from moderate to severe.

Use and management.
Formerly all this mapping unit was used for native pasture.
Because many places had not been grazed properly small blowouts and windblown areas are developed.
Most of this vegetation has very little value for grazing. Its

main value is to stabilize the soil material against further erosion. In several places a natural recovering with vegetation of small blowouts and winderoded places can be observed in these areas, which are now protected from grazing. Volunteer annuals and weedy plants gradually spread in from edges and stabilize the soil. After them native vegetation gradually reoccupies these places.
Seeding or planting of native plants on severely eroded spots may increase the recovering within a reasonable time.
Revegetation can also be hastened by mulching eroded areas with native hay that contains seeds.

Komoba complex, sandy soils, overblown phase, high hummocky (map unit Dd.1.3)
These soils are Komoba sandy soils on which significant amount of coarse textured material have been deposited by wind.
These soils make up about 3% of the surveyed area and occur mainly in the central part of the surveyed area. These overblown soils are commonly bounded in the south and south-west by the active duneland. They occur in the lee-side of this landtype.
The soils of this map unit are like Komoba soils, except for high hummocks up to 1,5 meters high and some low dunes up to 2 meters. The steppe vegetation consists of mainly Marrubium parviflorum (Tapir) and a few Astragalus microcephalus (Geven). It has been burried by fine sands and the hummocks are scattered irregularly over the surface.
These overblown soils absorb water rapidly and release it readily. The erosion hazard is severe in many places as the vegetation is buried. Only those plants remain alive, which grow upward vigorously.

Use and management.
Most of this scarse vegetation has very little value for

grazing. Its chief value is to arrest the sand, which is blown from the active dune land. The plants cause it to accumulate and to fixe it in this area. So, the vegetation keeps the sand from blowing on to more valuable soils nearby.

Active dune land. (map unit Dd. 2.1).
This miscellaneous landtype consists of an accumulation of light gray, Aeolian, shallow to very deep, loose, carbonatic (about 60 to about 80% $CaCO_3$ equiv.), coarse textured material and is mainly overlying a slightly hard, light gray to white coarse to fine textured mainly lacustrine deposits, which sometimes form the surface in areas between sandhills and in blowouts. Mostly very little or no natural vegetation occurs. This landtype makes up about 12% of the surveyed area and occurs mainly in the central part of the Erosion Camp Area. Two isolated areas of minor extent are in the south-western part, near Çardak Y.

Fig. 10 *(Şekil 10)*

A blowout near Çardak Y. The surface of the original soil, which is blown away, should reach to the shoulders of the man.

Çardak yakınında rüzgâr erezyonu. Rüzgâr tarafından aşındırılmış yüzey toprağının yüksekliği adamın omzuna kadardır.

This map unit consists mainly of drifting dunes. The blowouts are so numerous and are in such intricate association, that they are included.
The dunes vary much in size and shape, but are predominantly from 2 meters to 12 meters or more high. They occur in two irregular belts, that extend from the southwest central part of the surveyed area in north-eastern direction to the volcanic mountain "Andıklı Tepe".
The accumulated material seems to be originated from winnowed former Komoba soils and from windremoved material from blowouts, which became so numerous that the land altered in a real droughty sand desert-like area.
So the parent material is a wind deposit, consisting of well wind-sorted coarse textured material.
The sandhills in the southwestern side of the belts and in the two isolated areas near Çardak Y. are dominantly rounded dunes, mainly from 2 meters to 4 meters or more high.
The more the material seems to have been transported by the dominant south-western winds in north-eastern direction over the severely blown out surface, the more the dunes become higher and get a clearer crescentic shape. Often clear shaped barchans occur in the central part of the surveyed area near the volcanic mountain, predominantly from 2 meters to 12 meters or more high. (For a detailed description see appendix I).
These drifting dunes are slowly propelled by dominant south-western winds in about north-eastern direction. A few of them are blown on the edge of the volcanic mountain.
Personal observations in the field and on aerial photos of several years old, agree with informations of local people, who told that the dunes are moving very slowly in about north-eastern direction, for example about 5 meters a year (for other dune speeds in the world see appendix I).
Many of the dunes originated or enlarged during a former period

of overgrazing and over-gleaning of vegetation, suited for cooking and heating purposes. But some of these dunes seem to have been in existence long before that time. The dunes have a level to very steep topography with short slopes. Their surface is covered by asymmetrical ripples of a few cm high sometimes. They are made up of mainly very deep, excessively drained, carbonatic, light gray, stratified, fine and very fine sand. The texture layers in the profile vary from level to very steep. This depends of the position of the surface of the vertical section (profile) into the dune. They are mostly old slip-faces. (For an explicative description see appendix I). Fragments of shells occur throughout the profile and the coarse textured material has a single grain structure. No soil horizon has been developed.
No or very little scarse vegetation occurs.

Detailed description.
A detailed description of a representative profile of dune material is given in appendix II, profile 3.
A soil peel (a large monolith) has been made of this profile, which is a nice example of an Aeolian sediment without horizons. It has been presented to the Topraksu authorities in Konya on 30 September 1965.

Results of physical and chemical investigations are given in table 4 , Appendix II.
The permeability is very rapid and very little water runs off. The available water holding capacity and the natural fertility is very low. The erosion hazard is very severe.
Both, the numerous blowout floors and the blown out areas between the drifting dunes are mainly made up of coarse, Aeolian deposits or loamy to clayey lacustrine materials. This wind-eroded areas consist of very deep, level or nearly level, well

drained to somewhat excessively drained light gray or white, carbonatic, coarse textured material over fine textured deposits.
Very little or no vegetation occurs.
The surface layer, a light gray to white, sandy to loamy material, is about 25 to 40 cm thick. It is caliche-like, slightly hard when dry by lime concentration, which is often visible as very faint, white, calcareous spots, and very soft concretions. The structure near the surface is platy or in places tends to be massive. It is mostly overlying a subangular structure. Here often krotovinas and many earthen cocoons of insects occur.
The surface layer is resting on a substratum of material, ranging from mostly silty clay to clay. Sometimes thin layer of sand or often entire shells (Dreissensia spec.) occur. Here few fine distinct rust mottles and few black coatings of MnO_2 are visible.

Detailed description.

A detailed description of a representative profile of a wind eroded area between dunes is given in appendix II, profile 4, The permeability of this material will range from moderate to slow, depending on the caliche-like layer. The erosion hazard ranges from slight to moderate.

Use and Management.

This active dune land has no agricultural value. In windy days it causes large clouds of dust, which is whirled high in the air and is blown over the volcanic mountains. This dust taints the living-atmosphere of Karapınar and other lee-lying villages. It seems possible to stabilize the drifting sand of this land-type. After some botanical research it may be possible to

find some adapted species of native vegetation, which can be replanted or reseeded, starting on the windward side of the prevailing winds. The list of plants, given in Appendix III, may be useful in the search for plants, which are suitable to this purpose. Such a kind of revegetation is already engaged very slowly by the nature in for example few small eroded places of the Komoba soils, wind eroded phase (map unit Dd.1.2). At the center and wind-lee sides of this active dune land, windbreaks of reed have been established under guidance of the Topraksu authorities. In few places the dunes have been planted with different kinds of trees varieties and rye. These effords seem to be in an experimental stage.

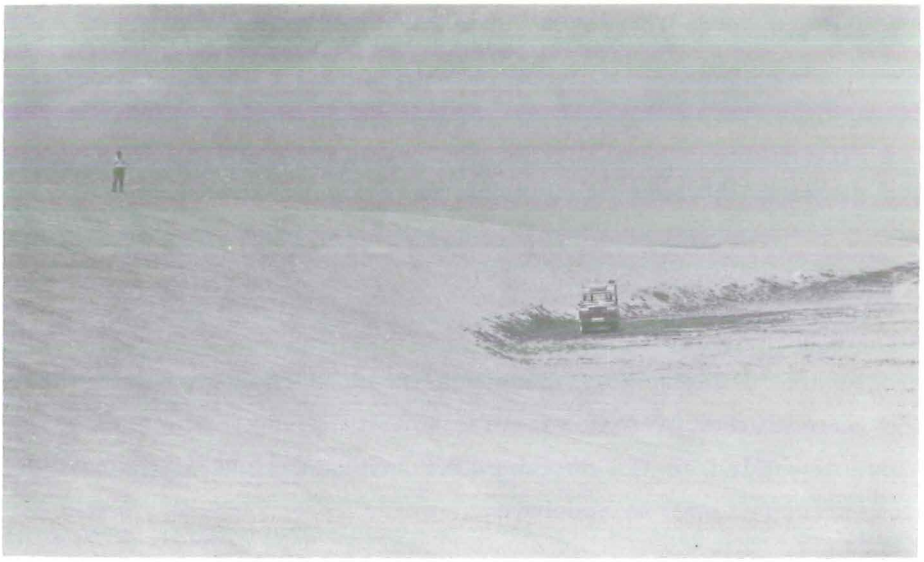


Fig. 11 *(Şekil 11)*
The concave side of a barchan dune.
"Barchan" kumulunun konkav yüzü.

Günağılı complex, stabilized dark sandy soils, low hummocky.
(map unit Dd 3.1)
The two soil series in this complex consist of somewhat excessively drained to excessively drained, mostly very deep, level

to undulating, calcareous soil on the Aeolian sandplain. They occur in an indistinct dune-like landscape. The soils of this complex make up about 3% of the total area and are named after a little rocky hill "Günağılı Tepe". They occur in two oblong areas in the eastern part of the surveyed area.

The first soil series of this complex, called Günağılı-A series are on the broad gently rounded ridges and on the gently sloping sides. They occupy about three quart of the surface of this map unit.

The Günağılı-A soils are very deep, excessively drained, calcareous, coarse textured and are covered with a scarce steppe vegetation. This vegetation is more scanty than that of the Komoba soils. Dominant is Marrubium parviflorum (Tapir) and a few Artemisia fragrans (Piren) occurs.

These plants grow often on low hummocks of fine sand, which are scattered irregularly over the surface, ranging from 10 to 60 cm in height. The hummocks are less numerous than on the Komoba soils (map unit Dd.1.1).

The parent material is mainly a windreworked beach- and lacustrine deposit. In several places, however, the original deposits are at the surface or may be mixed with the wind-deposits. They are chiefly derived from basalt, tuff and limestone. Light colored calcareous material and black and brown coarse textured basalt grains, which occur in a higher content than in the Komoba soils, give a salt-and-pepper effect to this material.

In places the surface is covered with winnowed, dark colored, very coarse sand and fine gravel, which tends to protect the landsurface against winderosion.

The dry surface layer, a light yellowish brown, calcareous fine sand, is 50 to 75 cm thick. It is thinner in wind-blown areas and thicker where soil material from other areas has accumulated. This layer consists of scattered rounded basalt

fine gravel and of fragments of shells and is very low in organic matter. Single grain structure occurs and the consistence is loose when dry.
The surface layer rests on a substratum of yellowish brown very fine sand. The sand and gravel are finer than those of the surface layer and fragments of shells occur. No distinct stratification occurs and the consistency is soft to loose, and in places firm because of slight cementation by lime.

Detailed description.
A detailed description of a representative profile of Günagili A soils on a broad ridge is given in appendix II, profile 5. These soils absorb water rapidly and release it readily. They are droughty because of low available moisture capacity. The second soil series of this Günağılı complex, called Günagili-B series, occur in the nearly level depressions. They occupy less than one quart of the surface of this map unit.

The Günağılı-B soils are made up of very deep, somewhat excessively drained, calcareous, coarse to fine textured soils. They carry the same scarse vegetation, as the Günağılı-A soils, which have already been described.
The parent material was mainly a wind-reworked lacustrine deposit or in some places a wind-reworked beach deposit. These different deposits may be also mixed with the originally alluvial deposits.
The dry surface layer, a light yellowish brown, fine sand with dark rounded fine gravel and fragments of shells, is about 20 to 50 cm thick. It is thinner in wind-blown areas and thicker where soil material from other areas has accumulated.
Below the surface layer is 20 to 35 cm of very pale brown material that is transitional in texture to the substratum. Often the consistence is slightly hard when dry by slight lime

cementation, which is often visible as very faint, white, calcareous stains.
The substratum ranges from mostly very pale brown loam to silty clay loam. Thin layers of entire shells (Dreissensia spe.) may occur.
Some small areas with basalt bedrock exposure and with very shallow and shallow, coarse textured soil, overlying basalt bedrock are included in this map unit. Also included are a few small blowouts and small areas with a thicker coarse textured solum, that integrades between the Günağılı-A soils and the Günağılı-B soils.
The properties of the soils of this map unit are approximately similar to those of Komoba complex, stabilized sandy soils, (map unit Dd.1.1), except the erosion hazard. These soils are somewhat less susceptible to blowing than the Komoba soils (map unit Dd 1.1).

Use and management.
All this mapping unit is covered by native vegetation, which is poorer than that one of the Komoba soils (map unit Dd 1.1). The management of these soils is about the same as for Komoba soils (map unit Dd 1.1).

Günağılı complex, dark sandy soils, winderoded phase. (map unit Dd 3.2)
These soils have a rougher surface, a poorer vegetation and are more windblown than the soils of Günağılı complex (map unit Dd 3.1). They occupy about 0,7 % of the total surveyed area and occur in one oblong area and in two areas of minor extent in the eastern part. This map unit consists mainly of Günagili soils, which are intricately mixed with winderoded places, blowouts, adjacent high hummocky areas and some low drifting dunes. The Günagili soils make up more than about 60%

of this phase and are similar to those described for the Günagili complex (map unit Dd.3.1).
In many winderoded places the surface layer is severely eroded. The blowouts are mostly small, nearly barren, shallow depressions, where a winnowed coarse textured material and an accumulation of fine dark pebbles tend to protect the level or nearly level floor.
A caliche-like layer may also form the relatively wind resistant layer in the blowouts.
Adjacent to the blowouts areas with higher hummocks occur. They are commonly less numerous and lower than in the winderoded Komoba soils (map unit Dd 1.2).
The low dunes are up to 2 meters or higher. These soils absorb water rapidly and release it readily. The available moisture capacity is also low.
These soils are somewhat less susceptible to blowing than the winderoded Komoba soils by the influence of the presence of local desertpavement-like material on the surface. The erosion hazard is still moderate.

Use and management.
All of these soils have been former grazing land. Last years livestock has been excluded and now it is idle land. The management is the same as described for the winderoded Komoba soils (map unit Dd 1.2).
Some places show signs of natural revegetation.

Dark active duneland (map unit Dd. 4.1)
This miscellaneous landtype consists of an accumulation of very pale brown, Aeolian, shallow to very deep, loose, calcareous, coarse textured material and is mainly overlying slightly hard, light gray to white (10 YR 8/2), coarse to fine textured, mainly beach or lacustrine deposits.

This beach or lacustrine substratum forms in some places the surface in areas between dunes and in blowouts.
There is very little or no natural vegetation.
This dark colored landtype occupies about 2% of the surface of the surveyed area and occurs in one oblong area and two areas of minor extent in the eastern part of the Erosion Camp Area.
It consists mainly of drifting dunes and blowouts are so numerous and so intricately mixed, that they are included.
The drifting dunes vary in size and shape, but are predominantly 2 to 6 meters or more high. They are dominantly rounded sand-hills and occur mainly in one oblong belt, that extends from the northwest of Vahapobası Y. to the volcanic mountain "Andıklı Tepe". Mainly in the north-east side some crescentic dunes or barchans occur.
The accumulated material appears to be originated from winnowed former Günağılı soils and from windremoved material from blowouts, which became so numerous, that the land altered in a droughty, dark, sanddesert-like area.
Thus the parent material is mainly a winddeposit, consisting of a well windsorted coarse textured material.
In some places the parent material may be a coarse textured beach deposit with fine gravel and in depressions a fine textured lacustrine deposit.
The dark dunes, which are commonly lower than those in the western part have a level to very steep topography with short slopes. They are made up of excessively drained, very deep, calcareous, very pale brown, fine sand. The light colored calcareous particles and the black and brown basalt grains give a salt-and-pepper effect to this material. Fine basalt pebbles and common fragments of shells occur throughout the profile.
The material is structureless single grain and its consistence is loose when dry.
On the surface are often asymmetrical ripples of a few cm's high.

The lee slope is steeper than the windward one. Often a kind of discontinuous thin desert pavement occurs, compound of fine dark basalt gravel and dark basalt coarse sand.

Detailed description. A detailed description of a representative profile of dune material is given in Appendix II, profile 6.

The dune sands are very permeable and very little water runs off. The available water holding capacity and the natural fertility is very low. This dark active dune land is somewhat less susceptible to blowing than the active dune land (map unit Dd 2.1) but the winderosion is still a severe hazard.

Both, the numerous level to nearly level blowout floors and the severely winderoded troughs between the dunes are made up of very deep, well drained to somewhat excessively drained, carbonatic to calcareous, light-gray (10 YR 7/2) to white, fine sand with some dark fine basalt gravel and very coarse sand. It has a salt-and-pepper effect.

The surface layer is commonly fine sand and is 20 to 60 cm thick. The material has a massive structure and the consistence is slightly hard, when dry by the concentration of lime. It is a caliche-like layer.

The material, underlying the surface layer, ranges from loam to silty clay loam or clay, in some places stratified with shell layers (Dreissensia spec.) or with thin sandy layers. Few fine rust mottles occur. The run-off is slow and permeability ranges from slow to moderate and depends of the development of the caliche-like layer. The hazard of winderosion is slight. The natural fertility is very low.

Use and management.

All this dark active dune land has no agricultural value and it is idle land. In windy days it produces dust, but less than the active dune land (map unit Dd 2.1). This landtype must be managed like active dune land.

5.4.2 Series of the lacustrine plain soil association.

(very deep, level to nearly level, carbonatic soils, underlain by clastic lacustrine sediments, unit 2 in fig. 2).

General description.

This association constitutes about 29% of the Erosion Camp Area. It occurs throughout this area. The largest single area is in the north and three other areas in the south and east.
The topography is predominantly level but may be nearly level to gently undulating in some places.
The soils of this association are unconsolidated lacustrine sediments at a level ranging from about 998 to about 1003 m. In many places this sediment is overlain by a relatively thin layer of Aeolian sandy material.
The Kındam soils are the most extensive of this association and occur in the north. They are very deep, level to nearly level and may be in places gently undulating.
The surface soil and sometimes also the subsurface soil are sandy materials, which overlie commonly a stratified clayey, loamy and sandy lacustrine subsoil.
Of minor extent in the association are the Karafakı soils, which are very deep, well drained, level soils. They are underlain by a clayey subsoil. In mapping it was possible to separate the Karafakı series into two groups of soiltypes on base of the texture of the surface layer and into two phases. The content of dark colored sand and gravel increases very regular in south-eastern direction.
The Kayırlıkaşı series of this association has been recognized in the eastern part of the area on basis of the important content of dark colored gravel and coarse sand and of the presence of a discontinous dark desert pavement, which counteracts the winderosion. In this soil series no or very weak ex-

pressed layers with lime accumulation and with gypsum accumulation occur,unlike in the other series of this association,which commonly show layers with lime accumulation overlying a layer with gypsum accumulation.
As the increase of the content of dark colored coarse material is very regular, the boundary of the Kayırlıkaşı soils with the other mapping units can not clearly be indicated in the field and so it is a general boundary.
More than 90% of this association is idle land. A minor extent is cultivated. The ancient tracks, radiate from the villages and are relatively straight. They are characterised by a smooth cut in the level terrain. A hard caliche-like layer forms often the surface of the tracks.

Karafakı series.

Soils of the Karafakı series are level to nearly level, very deep, well drained, carbonatic, sandy and clayey soils, They are mainly located in the northwestern part of the surveyed area. One area of minor extent occurs in the south-eastern part. About half of these soils are cultivated. The vegetation on idle land ranges from a vegetation relatively poor in number of plantspecies on former grazing land to a vegetation which consists of a relatively great number of plantspecies near arable land.
The parent material is a fine textured, carbonatic, clastic, lacustrine deposit.
The dry surface layer is light gray to white and ranges from very fine sand to silty clay loam. It varies from 15 cm to 50 cm in thickness, but it averages between 25 and 35 cm. The surface of the not plowed clayey soils are mostly formed by a crust, which often overlies a fine granular or weak platy structure.
Below the surface layer is a 20 to 40 cm of material, that

mostly is transitional to the substratum. The texture ranges from clay loam to silty clay or clay. In few places the material has been altered and a very weakly expressed horizon between A and C occurs, that tends to be a cambic B horizon. Krotovinas may occur here.
Also below the surface layer an accumulation of carbonates occurs. This caliche-like layer ranges from about 20 cm to 40 cm in thickness. The depth of the upper boundary of this layer ranges from 20 to 40 cm. It may be a A_3ca, a AC_{ca}, a C_{ca} and in places a B_{2ca} and its development ranges from medium to prominent. In some places a weak calcic horizon occurs.
The substratum is light brownish gray and the texture ranges from silt loam to clay and has an angular structure. Faint thin layers of fragments or of entire shells (Dreissensia spec.) may occur. In places a compound prismatic structure occurs. Generally an accumulation of gypsum occurs as veins of very fine gypsum cristals or as distinct gypsum cristals or both. The depth of the upper boundary of this C_{cs} horizon ranges from 60 to 100 cm. and its development ranges from weak to prominent. In places a well developed gypsic horizon occurs and its thickness ranges from 30 to 60 cm.

Detailed description.
A detailed description of a profile with well developed horizons is given in Appendix II, profile no. 7. A soil peel of this profile has been made and was offered to the Topraksu authorities.
Results of chemical investigations are given in table 5, Appendix II. The soils of this soil series could be mapped in two groups of soil types, according to the differences in texture of the surface layer of the soils and in two phases, according to the presence of low sandhills, which cover these soils.

Karafakı clayey soils. (map unit Lm 4.1)

These soils have layers like those described for the series, except the surface layer, which is chiefly clayey but may be loamy in places.
The surface layer ranges from light gray loam to silty clay loam.The surface of a not plowed soil often has a crust, overlying a granular or weak platy soil structure. Mostly the layers with lime accumulation (ca) and with gypsum accumulation (cs) have resp. moderate and strong horizon differentiations.
These soils are mapped in one area in the northwestern part of the Erosion Camp Area, and make up about 3% of the total area. They occur in the lowest part of the area at a level from 999 to 1000 meters.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 8,
These soils take in water readily and it moves through the profile at a moderate rate.
Nevertheless, in places water accumulates in small amounts in low spots, following a heavy rain or rapid melting snow.
These soils are easy to work but they clod, if worked too wet or too dry. When the soil dries up, a crust will form, that sometimes causes the stand of crops to be poor. The winderosion hazard is slight to moderate if the soils are cultivated.
A few areas, which have surface layers with a texture ranging from fine sand to loam, are included in this map unit. They have often been verges of former tracks, where vegetation had caught blowing sand. Also included are isolated low sandhills.
Idle land on these clayey soils has a vegetation, rich in plant-species. All the plants, mentioned on page 40, occur in this area on the clayey soils.

Use and management.

These soils are mainly used to grow wheat, rye, barley under dry farming system.

The fields are rectangular and are arranged in strips, about 50 meters broad. Here dry farming practices are applied in a wind strip cropping system. A few numbers of windbreaks are scattered over the field.

Karafakı clayey soils, phase with few to common low sandhills.

(map unit Lm 4.2)

On these clayey soils are few to common low sandhills. These are about 0,30 to about 1 meter or more high and 3 to about 6 meters across.

These low sandhills cover 10 to about 50% of the area mapped as this unit. They are made up of fine to very fine sandy material and appear to be a wind-deposit.

Below and between these low sandhills, Karafakı clayey soils occur, with a profile as described for the series, but the thickness of its surface layer is more variable.

The ca layer and the cs layer are commonly weakly expressed.

These soils are distributed in four areas in the northern part of the Erosion Camp Area, and they adjoin to the Kındam soils.

They make up about 1% of the surveyed area.

The soils are well drained and have a moderate permeability above the clayey material and a slow one in it.

The erosion hazard of these soils under vegetation is slight and moderate if cultivated.

Use and management.

These soils are used for cultivation of crops (mainly wheat and rye) on several places of this mapping unit in the same way as the Karafaki clayey soils. The winderosion is a hazard,

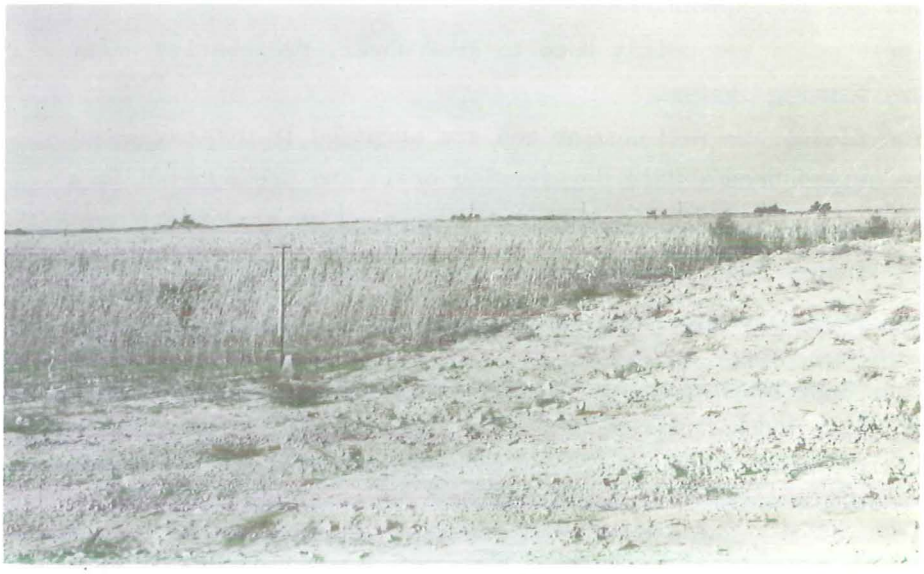


Fig. 12 *(Şekil 12)*

Dry farming on Karafakı clayey soils, phase with few to common low sand-hills. To the right at the back of the spade lies a low sand-hill.

Karafakı killi topraklarında kuru zıraat, az çok alçak kum tepesi görünüşlü. Sağdor kazmanin arka tarafirda alçak bir kum tepesi uzanmaktadir.

mainly on the low sandhills, if the protecting vegetation has been plowed up.

In idle land these low sandhills are stabilized, commonly by a cover of steppe vegetation, in which Alhagi camelorum (Yandak) is dominant. They form striking small, green elevations in the field and are often attractive residences for Citellus spec. (Terra farla). These rodents mix by burrowing the coarse textured low sandhill material with the clayey substratum. They visit daily the arable land for feeding.

Karafakı sandy soils, phase with common to many low sandhills. (map unit Lm 4.3).

The soils of this map unit have common to many low sandhills.

They are 0,30 to about 1 meter high and 3 to about 12 meters across. These low sandhills cover about 50 to 100% of the surface. They are made up of fine sand to loamy very fine sand, which is probably accumulated at the base of the plants by the action of winds.
Between and mainly below these low sandhills are the Karafakı clayey soils. They have layers like those described for the series, but the thickness of their surface layer is more variable. The layer with lime accumulation (ca) and the layer with gypsum accumulation are commonly weaker expressed, than those described for the series. The homogenization is relatively high by activities of rodents (Citellus).
The soils of this mapping unit make up about 2% of the Erosion Camp Area and occur in the northern part of the area surveyed. This map unit is transitional between the Karafakı clayey soils and the Kındam soils.
These well drained soils have a very slow runoff in periods of normal rainfall and the permeability is moderate above the clayey material and slow in it. Winderosion is moderate to severe if cultivated and slight if covered by vegetation.

Use and management.
These soils are mainly in idle land and are covered by mainly Alhagi camelorum (Yandak). Many rodents (mainly Citellus spec.) live in the sandhills and mix the sandy surface soil and subsurface soil with the subsoil. From there they collect their food on the arable fields.

Karafakı sandy soils (map unit Lm 4.4).
These soils have layers similar to those described for the series, but the surface layer is coarser textured and thinner. The dry surface layer ranges from light gray fine sand to fine sandy loam. In the past wind action, has deposed sandy material

at the base of the plants. This surface layer ranges from 10 to 20 cm in thickness.

Below the surface layer there are layers with lime accumulation (ca) and with gypsum accumulation (cs)which are weakly to moderately expressed in the clayey subsurface soil and substratum.

Some soils of this map unit, which occur in the south-eastern part of the surveyed area, may have locally thin to thick layers of dark ashy sand in the substratum (chiefly in the areas in the south of the mountain "Meke dağ").

Also in this part the ca and cs layers may be very weakly expressed or even may be absent in several places.

The soils grouped in this map unit make up about 2% of the Erosion Camp Area.

Low, isolated, stabilized sandhills are included in this mapunit. This unit may also include areas of Karafakı clayey soils too small in size to show them separately on the soil map at the scale used in this report.

Nearly all these soils were former grazing land and the vegetation has a relative small number of plantspecies. In this steppevegetation Marrubium parviflorum (Tapir) and Bromus species (Ipelek) are dominant and in places Peganum harmala (Üzerlik) and Alhagi camelorum (Yandak) occur. The soils have a slight erosion hazard under native vegetation. They have about the same properties as described in Karafakı clayey soils, but they are more susceptible to wind-erosion if cultivated.

Use and management.

Nearly all this map unit is idle land. In few places the soils are recently reclaimed and cultivated. Here can be observed, that tillage increases the hazard of winderosion.

Kındam series.

The Kındam series are level to nearly level and gently sloping

in few places, very deep, well- and somewhat excessively drained soils, which are carbonatic. The soils of this map unit are the most extensive in the Erosion Camp Area. They are distributed throughout the Erosion Camp Area and occur in the southern, the south-eastern, the central and the northern part of the area surveyed around Kındam Yayla.

A steppe vegetation occurs in which Marrubium parviflorum (Tapir) and in places also Bromus spec. (Ipelek) are dominant.

The carbonatic parent material is mainly sandy, overlying stratified loamy or clayey material. The surface soil may be reworked and sorted by windaction or blown from other areas.

The dry surface layer is light brownish gray to light gray and ranges from fine sand to fine sandy loam. It ranges from 10 to 40 cm in thickness, but it averages between 20 and 30 cm. The structure is commonly weak platy or massive. The surface is mostly billowy and very low hummocks may occur, which are scattered irregularly over the surface. They range from about 10 to 50 cm in height. Sandy material is often accumulated at the base of plants.

Below the surface layer there is a 20 to 65 cm material, that is transitional to the substratum. Its texture ranges from fine sand to silty clay or clay.

In this transitional layer an accumulation of carbonates occurs (ca) and forms a caliche-like layer. The depth of the upper boundary ranges from 15 to about 35 cm. It may be a weak expressed A_3ca, AC ca or a C ca and has commonly a white color.

The substratum is light gray to light brownish gray and is commonly stratified sandy, loamy and clayey material, layers of entire shells (Dreissensia spec.) may occur (for example in the south-west of Kındam Y.).

In the substratum a layer with an accumulation of gypsum occurs (cs). It is visible as white powder in cracks, as white spots and as powdery pockets. The upper limit of this weakly expressed

cs layer ranges from 70 to 110 cm in depth.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 9.

Kındam sandy soils (map unit Lp 1.1)
These soils have layers similar to those described for the series. It makes up about 19% of the Erosion Camp Area.

Included with this soil in mapping are small areas of Komoba soils and Karafakı soils, too small in size to show them separately on the map at this scale. Also included are low sandhills, which are covered with a vegetation, consisting mainly of Alhagi camelorum (Yandak). They are striking green places in the landscape.
These soils take in water readily and it moves through the profile at a moderate rate.
The winderosion hazard is slight under vegetation and severe under cultivation.

Use and management.
Formerly all these soils were in native pasture. After placing the fences, it was idle land. In some places this soil has just been reclaimed for irrigated cultivation. The winderosion hazard is severe there. In the future when the vegetation cover of the idle land will be in excellent condition, deferred grazing with a proper degree of use and uniform grazing seems to be possible.

Kayırlıkaşı series.
The Kayırlıkası series consist of level, very deep, well drained, carbonatic, gravelly sandy soils. They occur in one

area in the eastern part of the area surveyed, near the elevation called Kayırlıkaşı.
The scarse native steppe vegetation consists chiefly of Peganum harmala (Üzerlik), but about more than 50% of the soil-surface is barren.
The parent material consists of waterworn gravel and coarse sand, derived from dark colored basalt, andesiet, ash and limestone. It is overlying lacustrine, loamy and clayey material. It is an offshore sediment, deposited in the pleistocene lake near coarse sandy and gravelly beaches.
The dry surface layer is gray (10 YR 5,5/1) gravelly coarse sand. The light colored calcareous sandy material and the black and brown basalt and ash grains give a salt-and-pepper effect. The structure is massive and the soil is soft or loose.
It ranges from 30 to 50 cm in thickness. The surface is commonly covered by asymmetrical ripples, which are commonly a few cm to about 8 cm high. In places a discontinuous desert pavement occurs.
Below the surface layer one finds commonly a transitional layer, 20 to 30 cm thick, consisting of a gravelly sandy material. It has a weak subangular structure and it is hard.
The substratum is light gray to very pale brown, loamy or fine textured material and is very hard. It has an angular, blocky structure.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 10.
The soils of the Kayirlikasi series are somewhat darker than the Kındam soils, which have less dark colored coarse textured material from volcanic origin. A ca and cs layer do not occur in this soils.

Kayırlıkaşı dark gravelly sandy soils (map unit Lp 2.1)
This map unit has layers similar to those described for the series and makes up about 1% of the area surveyed.
Included in this map unit are small areas of Kındam soils and Kartan gravelly sandy soils.
These well drained soils are low in fertility. They are calcareous throughout the profile. Surface runoff is slow. Permeability is moderate. These soils are somewhat less susceptible to blowing than the Karafaki clayey soils, because of the desert pavement, but the erosion hazard is still slight to moderate.

Use and management.
Formerly all of this soil was in poor pasture. Now grazing is limited by fences and it will be idle land. The natural revegetation is very slow.

5.4.3 Series of the volcanic mountain soil association.

(Shallow to very deep, nearly level to moderately steep, gravelly sandy soils and barren dark rock land (Unit 3 in fig.2)

General description.
This association occupies about 18% of the Erosion Camp Area. It mainly occurs in the northeastern part of the surveyed area and an area of minor extent is in the southeastern part near "Meke dag".
The topography ranges from nearly level to very steep.
This association mainly consists of a volcanic mountain, in which the Andıklı Tepe is the highest summit. In pleistocene times this mountain was almost entirely enclosed by a lake. There was only land at its eastern side.

Hence, the mountain is on 3 sides surrounded by beach deposits. After the lake had dried up, the wind action reworked this sediment, mainly in the south. In several places Aeolian deposits had been formed.
The level of the association ranges from about 1005 m around the mountain to about 1120 m on the top of the Andıklı Tepe.
The miscellaneous landtype "basalt rock land", is a rough barren droughty land with very little value for grazing. A steep escarpment forms the southern boundary of this largest map unit in this association.
The Kartan soils occur mostly around this volcanic mountain and adjoin the rock land. The soils of this series are nearly level to sloping and the texture mostly ranges from gravelly coarse textured beach deposits to dark water worn gravel.
Of minor extent in this association are the Andıklı soils, which range from shallow to very deep and are angular cobbly sandy soils.
Formerly almost the whole association was in pasture, but now it is idle land. Small areas are planted with young trees.

Andıklı series.
The Andıklı series has shallow to very deep, somewhat excessively drained, gently sloping to moderate steep, calcareous, sandy soils. They occur in the volcanic mountain at a level, ranging from 1060 to 1100 meters on the southeast slopes of the mountain "Andıklı Tepe".
A scarce vegetation occurs, but in many places the soil surface is barren.
The parent material consists of coarse and medium textured material, wheathered from dark volcanic ash and basalt. In several places it may be mixed with calcareous wind deposits, blown from the sand plain.
The surface soil is light brownish gray to pale brown. Its

texture ranges from coarse sand to sandy loam. In several places the bedrock occurs at depths, that range from moderately deep to deep. The soils have predominantly a single grain structure. In places the subsurface soil and subsoil consist of material, that ranges from coarse sand to sandy loam.

Andıklı angular cobbly sandy soils. (map unit Mv 1.1)
The profile of this soil is like the one described for the series. Angular cobbly stones are throughout the profile and interfere with tillage, but do not make tillage of intertilled crops impracticable. This map unit is the smallest one and makes up less than 0,2% of the Erosion Camp Area.
Mapped with this soil are small areas of exposures of barren bedrock.
The runoff is slow to medium and depends on the slopes and the intensity of rainfall. Winderosion is a hazard.

Use and management.
This soil has been used as cultivated land in dry farming system. This area is difficult to reach, because the tracks, which lead to it, are sometimes steep and narrow between the basalt rocks.

Kartan series.
The soils of the Kartan series are nearly level to sloping, very deep, somewhat excessively to excessively drained, calcareous, coarse and moderately coarse textured soils.
They are distributed in the northern and eastern part of the area surveyed. They are adjacent to the basalt rock land and are named to the two peaks "Büyük Kartan Tepe" and "Kücük Kartan Tepe".
Formerly all this soil was in native pasture and now it is covered by a steppe vegetation, in which commonly Marrubium

parviflorum (Tapir) is dominant and in places Alhagi camelorum (Yandak), Peganum harmale (Üzerlik), Bromus spec. and Artemisia fragrans (Piren) occur.

The parent material seems to be either a beach deposit or a sediment deposited as spits in the former pleistocene lake. In places at a level higher than about 1015 meters it may be volcanic ash and these sediments may have been sorted by windaction in more recent times. The texture ranges from gravel to gravelly coarse or moderately coarse with gravel. The waterworn pebbles are rounded and this material is derived mainly from basalt and volcanic ash. Fragments of shells are commonly throughout the profile and in many places layers of broken shells occur at different depths in the substratum. The level of this soils ranges from 1005 to 1015 meters. The dry surface layer is commonly pale brown to very pale brown or sometimes light gray. Its texture ranges from fine gravelly sand to sandy loam, which contains rounded fine gravel. Its thickness ranges from 10 to 30 cm. Below the surface layer there is commonly 30 to 55 cm of material transitional to the substratum, which ranges from fine gravelly sandy to sandy material with rounded gravel. Many of the pebbles are coated with lime, mainly on their lower sides. The substratum is waterworn fine gravel. Here also many of the pebbles are coated with lime, mainly on their lower side and have often lime pendants. In places the upper side of the substratum may be weakly cemented with lime. Layers of fragments of shells often occur in the substratum.

Detailed description.

A detailed description of a representative profile is given in Appendix II, profile 11.

Kartan gravelly sandy soils (map unit Mv 2.1)

These soils have gravelly layers similar to those described for

the series and make up about 3% of the Erosion Camp Area. Small areas of Komoba soils, Karafakı soils and Andıklı soils are included with these soils. Also included are very small exposures of barren bedrock and a small area in the north of Kındam, where this coarse textured soil with gravel is gradually thinning out over the lacustrine clayey subsoil and lies as a small ridge in the landscape.
These somewhat excessively to excessively drained soils have a rapid permeability. Surface runoff is mostly slow. Fine roots penetrate very deeply. The available water capacity and the fertility are low. Wind erosion is a slight hazard under vegetation.

Use and management.
These soils seem not suitable for cultivation and they have little value as range land. Some places have been planted with trees.
However the substratum may be in few places a source of gravel, which can be used, for example, for road construction.

Basalt rock land. (map unit Mv 3.1)
This miscellaneous landtype consists of rough, rocky areas, where basalt outcrops and loose fragments of mainly basalt are on the surface.
Between the rock outcrop, which consists of barren basalt blocks, characterized by relatively smooth surfaces and sharp angular blocks, are shallow and in some places very deep sandy soils commonly in the depressions. They may be volcanic ash and coarse textured winddeposits. The slopes range from gently sloping to very steep.
These soils are covered with a sparse steppe vegetation, in which Marrubium parviflorum (Tapir) is dominant and a few

Artemisia fragrans (Piren) occur.
This landtype, which makes up about 14% of the Erosion Camp Area, is located in the northeastern part of the area surveyed. It also occurs in a very small extent in the south-eastern part near the mountain Meke dagi.
The outcrop of basalt and loose fragments of mainly basalt, covers from 25 to 70% of the surface. In the south of this landtype the basalt rocks show a curious arrangement (parts of eroded ring-dikes), which is described in chapter 2-3, sub 3.
The boundary of this landtype in the south is formed by a steep escarpment. The small area near the Meke dagi has less rock outcrop.
Some small areas of Andıklı soils, Kartan soils and Kındam soils were mapped with this landtype. Also included are small areas of Active dune land in the southern part of this landtype. There black rocks stand out against the light gray drifting sands.
The material of this landtype is calcareous and its natural fertility and content of organic matter are very low. Surface run off on the basalt blocks is rapid to very rapid. The infiltration and the permeability are rapid on the sandy soil. The available moisture capacity is very low.

Use and management.
Formerly the basalt rock land was in poor pasture but now it is idle land. It is not suited for cultivation of crops or pasture, because of its high content of rock, its shallow rootzone and and its low available moisture capacity. This landtype is protecting the town Karapinar against the drifting sand of the Active dune land.
Some areas between the rock outcrop have been planted with trees by Topraksu.

5.4.4 Series of the Limestone platform soil association.

(shallow to very deep, nearly level to moderately steep, angular cobbly sandy soils, gravelly sandy soils and sandy soils, overlying limestone bedrock or in places lacustrine or beach deposits, unit 4 in fig.2).

General description.

This association makes up about 4% of the Erosion Camp Area. It occurs in the northwestern part.

Soils of this association are located:

1) on the Limestone platform and

2) in the fringe areas at sides of this platform.

ad. 1. The surface of the Limestone platform slopes downward in eastern and southeastern direction. In some places it is dissected by several gullies, which mainly drain away the concentrated run-off water in southeastern and partly in eastern direction onto the lacustrine plain. The level ranges from about 1050 meters near Apakkaş Tepe to about 1020 meters at the edge of the platform, for example near Apak Y.

ad. 2. The fringe areas consist of nearly level to gently sloping areas in the southeastern part of the platform and of a very steep escarpment and sloping or nearly level concave escarpment-footslopes at the eastern side of the platform. Included in this association are areas of which the surface layer consists of material, derived from the limestone platform and which is thinning out on the lacustrine plain.

Apak soils occur on the Limestone platform and are the highest soils of this association. They are moderately deep to very deep, angular cobbly, well drained soils over limestone.

The Karataş soils occur in the fringe area at the south-eastern side of the Limestone platform. They are very deep, gravelly sandy or sandy soils.

The Ecelertolu soils are located mainly on the footslopes of the escarpment. These nearly level to moderately steep, very deep, angular cobbly sandy soils and sandy soils are mapped in a complex with other soils.
One part of this association is cultivated in dry farming system and an other part is idle land, but was in native pasture formerly.

Apak series.
The Apak series consist of gently sloping, moderately deep and very deep, somewhat excessively drained, angular cobbly, carbonatic sandy soils.
They are only in one area in the western part of the surveyed area, southward from the village Apak Y.
Almost all this soil is cultivated. Some weeds occur of which Peganum harmala (Üzerlik) is mostly dominant.
The parent material is weathered from limestone. The level ranges from about 1020 to about 1025 meters.
The dry surface layer is very pale brown (10 YR 7/3) to light gray (10 YR 7/2) and the texture ranges from angular cobbly sand to angular cobbly sandy loam. It ranges from 10 to 25 cm in thickness and it has a weak subangular structure if cultivated and a weak platy structure when it is idle land.
Below the surface layer is a 20 to 40 cm of material, that is transitional to the substratum in most cases. Its texture ranges from angular cobbly sand to angular cobbly loam. The amount of angular cobblestones in the soil ranges from 20 to about 60% and the structure of the soil is subangular.
The substratum is white (10 YR 8/2) or very pale brown (10 YR 8/3) and its texture ranges from angular cobbly sand to angular cobbly loam. It overlies limestone bedrock, which occurs at different depths.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 12.

Apak angular cobbly sandy soils (map unit Tp 1.1)
The soils have layers similar to those described for the series and make up about 0,4% of the Erosion Camp Area. The amount of angular cobbly stones of the surface soil shows important differences. On arable land these angular cobble stones are often plowed up and removed by the farmers. In places the profile may be truncated and a few very small areas of limestone outcrop are included in this mapunit.
These somewhat excessively drained soils have a rapid permeability. Surface run-off ranges from slow to rapid and depends on the slope gradient, the intensity of rainfall and the depth of the bedrock.

Use and management.
These soils are chiefly arable land. Small grains are cultivated in dry farming system and the angular cobble stones are a handicap in tillage.

Karataş series.
The Karataş series are commonly nearly level, in places gently sloping, mostly very deep, in places moderately deep to shallow, somewhat excessively drained, carbonatic, coarse and moderately coarse textured soils.
They occur in three mapping units in the western part of the surveyed area, westward from the deserted village Karataş Y.
The largest part of this soil is cultivated.
The parent material seems to be either a beach deposit or a sediment deposited as spits and flats in the former pleistocene lake. It ranges from light colored calcareous gravel to

gravelly coarse textured soils or moderate coarse textured soils. The waterworn pebbles are rounded and this material is derived from mainly limestone. It overlies either hard limestone, or in places soft chalky lime. Going downward onto the lacustrine plain this coarse material is thinning out over lacustrine loamy and clayey deposits.
The level ranges from about 1005 to 1015 meters.
The dry surface layer is commonly very pale brown (10 YR 7/3) or pale brown. Its texture ranges from gravelly sand to sandy loam, which contains rounded gravel. In thickness it ranges from 20 to 30 cm and has commonly a subangular structure.
Below the surface layer is commonly 30 to 50 cm of material, that ranges from gravelly sand to sandy loam.
The substratum is commonly white gravel or gravelly coarse textured material or sandy material with rounded pebbles. It is stratified and there are commonly many fragments of shells throughout the profile. Even layers of shells may occur in the subsoil. The upperside of the substratum may be weakly to strongly cemented by secundary lime. The pebbles have commonly lime pendants at their lower sides.

Karataş gravelly sandy soils (map unit Tp 2.1)
These soils have layers like those described for the series and they make up about 1% of the Erosion Camp Area.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 13.
Included with this map unit are small areas of shallow to moderately deep Karataş gravelly sandy soils, underlain by a lacustrine substratum or by hard limestone bedrock. Also included are small exposures of level limestone bedrock. In places the substratum appears at the surface as result of very

local water erosion.
This somewhat excessively drained soil has a rapid permeability. Surface runoff ranges from slow to moderate and depends on the slope gradient, intensity of rainfall and the depth of the bedrock. Winderosion is under vegetation, a slight hazard.

Use and management.
The largest part of this map unit is cultivated in dry farming system. Wheat, rye and other small grains are cropped mainly according wind strip cropping principles.
A small part is idle land. In some places the substratum can be a source of gravel, that can be used for example for improving tracks.

Karataş sandy soils (map unit Tp 2.2)
These soils have layers, which are coarse textured with some gravel and which are similar to those described for the series. They occupy less than 1% of the Erosion Camp Area.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 14.
As the Karataş sandy soils are thinning out over lacustrine deposits, few areas with a clayey substratum are included in this map unit. Also included are small areas of Kindam soils and small areas, where the surface soil has been reworked by wind.
These somewhat excessively drained soils take in water readily. The water moves through the profile at a moderate rate. The fertility is low and the winderosion is a slight to moderate hazard if cultivated. Water erosion is not a hazard.

Use and management.
One small part of this map unit is cultivated, according wind

strip cropping principles. Small grains are cropped in dry farming system.
The largest part of this map unit is idle land. In the future when the vegetation cover on the idle land may be in excellent conditions, deferred grazing with a proper degree of use and uniform grazing seems to be possible.

Ecelertolu series.
The Ecelertolu soil series consist of moderately steep to nearly level, very deep, somewhat excessively drained to well drained, carbonatic, chiefly coarse and moderately coarse textured soils.
They occur in two map units in the northwestern part of the surveyed area and are near the deserted village "Ecelertolu Y.". They lie mainly on the footslopes and colluvial small fans of the escarpment of the Apak limestone platform.
A small area is on the sloping part of the edge of this limestone platform.
One part of this soil is cultivated and another part is idle land, which was former grazing land. The dominant plantspecies is Peganum harmala (Üzerlik).
The parent material seems to be mainly colluvial material, which in places overlies abrasion angular cobbly deposits or lacustrine deposits in some lower places.
The level ranges from about 1020 to 1005 meters.
The dry surface layer is very pale brown to light gray and the texture ranges from angular cobbly sand to angular cobbly sandy loam or from sand to sandy loam, with some angular cobble stones. Its thickness ranges from 15 to 35 cm. The structure is commonly weak platy on soils of idle land and subangular in soils of cultivated land.
Below the surface layer is a 50 to 80 cm of material, that in texture ranges from sand to sandy loam. The structure may be

granular or angular blocky.
The substratum is a lacustrine sandy or loamy sediment, which is often stratified and contains layers of shells.
Calcareous angular cobblestones and sometimes pebbles occur throughout the profile and may cover the soil in a significant amount in several places.

Detailed description.
A detailed description of a representative profile is given in Appendix II, profile 15.

Ecelertolu complex, angular cobbly sandy soils. (map unit Tp 3.1)
This complex consists of Ecelertolu angular cobbly sandy soils, Apak angular cobbly sandy soils and areas in which limestone bedrock is overlain by shallow to moderately deep soil material. In few places gullies occur on the sloping concave slopes below the escarpment. This map unit occupies about 0,3% of the Erosion Camp Area.
Ecelertolu angular cobbly sandy soils make up the largest part of this complex and have layers similar to those described for the series.
The degree of stoniness varies greatly. The calcareous angular cobble stones occupy about 0,01 to about 10% of the surface in areas near the escarpment, which were formerly in native pasture and are now idle land. These angular cobble stones on and in these soils have mainly been washed from the limestone platform and from the escarpment onto these soils or may have been deposited by the abrasion action along the escarpment in the former pleistocene lake. The stoniness on arable land is less because the stones have been removed. In several places some pebbles occur in the soil.
The Apak angular cobbly sandy soils make up an important part

of this complex. They occur mainly on those sloping footslopes of the excarpment, which are fenced in the Erosion Camp Area. These soils have layers similar to those described for the series, except for the surface soil, which may be eroded or burried in several places.
These shallow to moderately deep soils are overlying hard limestone bedrock or sometimes soft chalky-like material. During or after a period of heavy rains the areas which catch water from the gullies of the limestone platform above are flooded for a short time. This run off ranges from slow to moderate on these chiefly somewhat excessively drained soils, which are subject to watererosion. Winderosion is a slight hazard on cultivated land.

Use and management.
A part of these soils is idle land, but has been in native pasture formerly. They are mainly covered with Peganum harmala (Üzerlik). Another part is cultivated and wind strip cropping principles are put into practice in few places. Small grains like wheat and rye are cultivated in dry farming system. It seems that the yields on these soils are somewhat higher than the average yield in the plain, as the crops can profit by water, coming from the Apak platform.

Ecelertolu complex, sandy soils. (map unit Tp 3.2)
This map unit occurs between Ecelertolu complex, angular cobbly sandy soils (map unit Tp 3.1) and the Karafakı clayey soils (map unit Lm 4.1) and is a transitional map unit.
It makes up about 1% of the Erosion Camp Area.
This complex consists mainly of Ecelertolu sandy soils and Karafakı clayey soils.
The Ecelertolu sandy soils have layers similar to those described for the series. They also contain angular cobble stones

and sometimes gravel, but less than the Ecelertolu angular cobble sandy soils.
In some places the Ecelertolu sandy soils are thinning out in eastern direction over a substratum like that, described for the Karafakı series. Included with this map unit are small areas of soils disturbed by man along the track from Apak Y. to Ecelertolu Y., which probably have been a very ancient small canal or track. In several places angular cobble stones have been removed from the surface soil.
These nearly level soils are mostly well drained. Surface runoff is slow and the permeability is moderate in the sandy surface and subsurface soil and slower in the substratum. Nevertheless water may accumulate in small amounts in low spots for short periods, following a heavy rain or rapid melting snow. The water is coming from the Limestone platform. Watererosion is no problem and winderosion is a slight to moderate hazard in cultivated areas and is a slight hazard in idle land.

Use and management.
Some areas of this map unit are cultivated in dry farming system.
In the Topraksu area, wind strip cropping is put in practice. The fields are about 50 meters wide and the long sides have different dimensions and are parallel to a E-W direction. Many areas of this map unit are idle land and have been grazing land formerly. They are mainly covered with Peganum harmala (Üzerlik)

5.4.5 Man disturbed land.

General description.
These miscellaneous landtypes consist of areas in which human life and commonly also livestock had been concentrated for

long times. These many small areas occur in and around the villages or in aboriginal living places and make up about 0,7% of the Erosion Camp Area.
The vegetation of these two landtypes has been overgrazed, damaged by trampling and the land has been eroded around wells. Mud and sundried bricks have been fabricated around the village centre and has been used for mudhouses and other mudbuildings. Even large stones have been brought from far and rubbish has been burried.
The soils have been so altered that their normal soil characteristics are destroyed.
This landtype has been mapped in two map units.

Recent man disturbed land. (map unit U 1)
The areas of this landtype are in and around villages in the Erosion Camp Area. Now these villages are deserted, except Kındam Y. (see chapter 2.1).
These areas are level or nearly level and consist of very deep carbonatic soil materials, mixed with ashes, bones, potsherds, charcoal and, in places, stones.
All the areas are idle land and in places a steppe vegetation occur, in which Peganum harmala (Üzerlik) is dominant.

Ancient man disturbed land. (map unit U 2)
This map unit consists of very old living places. The mudhouses have been destroyed and only low ruins occur. They are sites of aboriginal human homes, large enough to map.
They consist of mixtures of soil materials, ashes, charcoal, artifacts, bones and in places stones.
This landtype consists of level or nearly level areas with very deep, carbonatic soil materials. All these areas are idle land and they are commonly covered with a steppe vegetation, in which Peganum harmala (Üzerlik) is dominant.

6 Classification of soils

The soils of the Erosion Camp Area have been grouped according to two classification systems:

1) The new comprehensive system of the Soil Survey Staff of the U.S. Department of Agriculture (7th Approximation)
2) The U.S. Soil Classification (Soils and Man 1938 et al)

6.1 SOIL CLASSIFICATION ACCORDING TO THE 7th APPROXIMATION.

This new soil classification system is used in the Konya Project and its advantages are discussed in the Preliminary Report, no. 1, chapter 6, para 6.1.
The following list shows the preliminary classification of the soils of the Erosion Camp Area.
a) Orthic Psammustents occur in Komoba A series, Günağili A series, Kındam series, Kayırlıkaşı series, Kartan series, Apak series and Karataş series.
b) Orthustentic Psammustents occur in Komoba B series, and Karatas series.
c) Calcorthids occur in Karafakı series.
d) Orthic Camborthids occur in Ecelertolu series.
e) Not considered as soils, (not-soils) occur in the active dune land and dark active dune land.
Each of the great groups or subgroups is discussed in the

following paragraphs.

sub a - Most of the soil series in the Erosion Camp Area seem to lack diagnostic horizons, except an ochric epipedon and thus belong to the order of Entisols. These usually dry soils belong to the suborder of Ustents. The great group is Psammustent, because the soils are coarse textured. The subgroup of Orthic Psammustents includes the soils with coarse textures to depths of 75 cm or more and with more than 5% of the sand fraction, that is not quartz, tourmaline, zircon, rutile, or similar minerals. An accumulation of secondary lime can be observed as mycelia, powdery pockets, white spots or very soft concretions in the Komoba series, Karataş series and Kındam series or as lime pendants in the Karatas series and Kartan series. These Orthic Psammustents occur in the Aeolian sandplain, the limestone platform and the volcanic mountains.

sub b - This subgroup is considered to integrade toward the great group of Orthustents and includes the Psammustents, which have textures finer than loamy fine sand within 50 cm. Redistribution of carbonates can be observed as seggregations of lime in mycelia, powdery pockets and generally a weak ca horizon occurs. Orthustentic Psammustents occur in the Aeolian sand plain, the Lacustrine plain and at the edge of the Limestone platform.

sub c - The Karafakı series have the best developed horizons in the Erosion Camp Area. They have an ochric epipedon and a gypsic horizon. These usually dry soils belong to the order of Aridisoils and to the suborder of the Orthids, because they have no argillic or natric horizon or duripan.

The gypsic horizon puts these carbonatic soils in the Great Group of Calcorthids. They have a conductivity of the saturation extract more than 1 millimho per cm at 25°C (see table 5, Appendix II).

In these soils part of lime and gypsum have been removed from

the surface soil by percolating water and deposited in a lower layer designated as respectively a ca-horizon and a cs-horizon.
The secundary lime can be observed as lime mycelia, powdery pockets or sometimes as very soft concretions and the ca horizon is moderate or well developed. Locally a weak calcic horizon occurs at such a depth, that these carbonatic soils are classed as an Orthic Calcorthid (profile 7, Appendix II).
The cs horizon underlies the layer accumulated with lime and the gypsum can be seen as cristals or powder, embedded in soft lime.
The Calcorthids occur in the lacustrine plain.
sub d - Several soils in the Erosion Camp Area have been wind-eroded or may be burried by colluvial deposits. These usually dry soils, having an ochric epipedon, belong to the order of Aridisols. Their cambic horizon puts them into the suborder of Orthids. These soils are classed with the subgroup of Orthic Camborthids, because it is considered that the weak to moderate developed ca horizon does not reach the criteria of a calcic horizon.
The secundary lime can be seen as white seggregation or soft white concretions.
These soils occur locally throughout the Erosion Camp Area, except in the volcanic mountains.
sub e - The shifting sands, etc. are not included in this soil classification system. If the surface of the land has no vegetation, it is considered that the land has no soil.

6.2 SOIL CLASSIFICATION ACCORDING TO THE U.S.CLASSIFICATION (Soils and Man 1938 et al.)

A great soil group consists of soils, which are similar in

several fundamental characteristics. They have the same kind and number of horizons, although corresponding horizons are not necessarily of the same thickness or expressed with the same degree of clarity. In some characteristics the soils of any given group may differ considerably. Many soils have some of the significant characteristics of more than one great soil group and are called intergrades. This soil classification system has been developed since long times. The following list shows the tentative classification of the soils, according to orders, suborders and great soil groups. Approximate equivalents according to the 7th Approximation are given too.

	Profile no. [a]	*According to 7th Approx.*
Azonal order		
Alluvial soils occur in : Kayırlıkaşı series	10	Orthic Psammustent
Alluvial soils (intergrading to Calcisols), occur in:		
Karataş series	13	Orthic Psammustent
" "	14	Orthustentic Psammustent
Ecelertolu series	15	Orthic Camborthid
Kartan series	11	Orthic Psammustent
Alluvial soils (intergrading to Regosols), occur in :		
Günağılı A series	5	Orthic Psammustent

	Profile no	*According 7th Approx.*
Regosols (includes Dry Sands), occur in : Active dune land	3	Not considered as soil
Dark active dune land	6	Not considered as soil
Regosols (intergrading to Calcisols) occur in:		
Komoba A series	1	Orthic Psammustent
Komoba B series	2	Orthustentic Psammustent
Kındam series	9	Orthic Psammustent
Lithosols, occur in :		
Apak series	12	Orthic Psammustent
Intrazonal order		
Calcimorphic suborder		
Calcisols occur in :		
Karafakı series	8	Calcorthid
Calcisols (truncated), occur in : Blown-out Active dune land	4	Not considered as soil
Calcisols (intergrading to Sierozem) occur in :		
Karafakı series	7	Orthic Calcorthid

a) Detailed profile descriptions are given in Appendix II.

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Appendix I

Some phenomena of the Active dune land.

One of the most important tasks of Topraksu is to stabilize the drifting sand in the Erosion Camp Area.
The following details may be useful. They are obtained from the literature, from personal observations and from informations of local people. Much local information has been gathered by our Turkish colleague, Mr. Celal Karakus from people, living in the villages around the Erosion Camp Area.

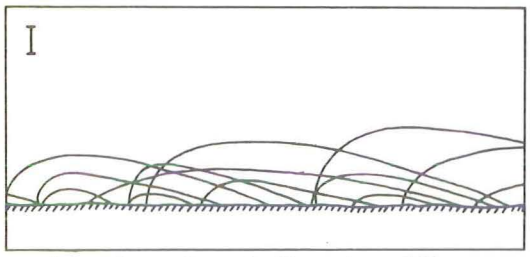
Ia. *The development of the desert-like Active dune land.*

According to local information dunes have existed in the Erosion Camp Area since time immemorial. Formerly, however, only a few dunes occured and they were covered with a scant vegetation of mainly Artemisia species (Piren).
Formerly a small number of herds, consisting of sheeps and goats, were grazed around in this almost stabilized sandy land and the animals passed the night in enclosed spaces.
The largest part of the population lived on the products of these animals. Even their excrements were collected and were used for the fires, necessary for cooking and for heating the mud-huts during the cold winter.
However, since about 1945 the population has increased regularly as the state of public health gradually improved, The logical consequence of this development was the increase of the livestock and more herds were grazed on the same area.

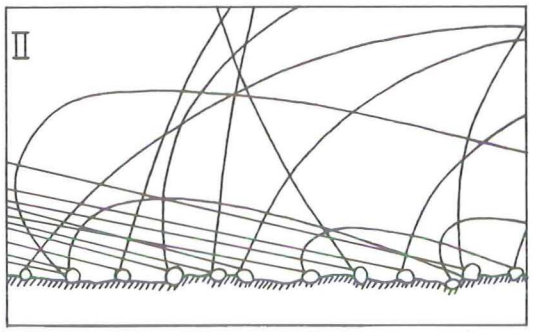
In a period around the years 1952 and 1953 the rate of increase of the population has been relatively high. In that time a few hundred refugees mainly from Bulgaria, have been sheltered in Karapınar (cöcmen evleri). Mainly in the beginning this group of men had very little personal properties or livestock. They had to go in the fields for picking woody plants on an intensive way, because they needed fuel for cooking and for heating their houses.
Thus the protective vegetation cover of the sandy soils have been damaged seriously over large areas, mainly by picking woody plants, by overgrazing and trampling.
According the informations it seems that the two successive very dry years 1956 (with an annual precipitation of 198 mm) and 1957 (with an annual precipitation of 207 mm) have seriously hurt the vegetation as well.
The wind got more and more hold on the barren sandy soils of the Erosion Camp Area and the sand started to drift over larger extents. So, several parts altered in a desert-like area.

I b. *The effects of the wind in the Erosion Camp Area.*
When the wind blows over the Erosion Camp Area, it produces a mist consisting of both dust and sand particles.
The nature of the movement of particles by the wind in deserts has been closely investigated by Bagnold (1954), who distinguished three types of movement: suspension, saltation and surface creep. Only very fine particles, those with diameters less than about 0,2 mm, are carried in suspension by the winds, normally found at the surface of the earth.
Saltation is most significant in understanding the erosive action of sand. In a turbulant flow of air near the surface local upward currents may lift a sandgrain. As it falls it is moved in the general wind direction. Thus the path, taken by a moving grain, consists of a short, near vertical ascent and a

FIGURE *ŞEKIL* 13

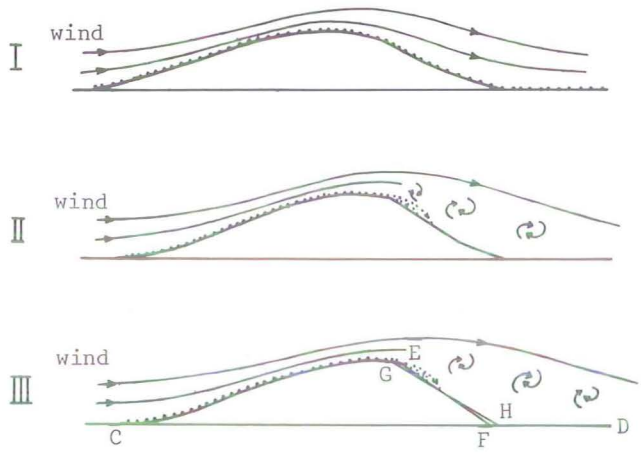


A sand surface (after Bagnold)
Kumluk yüzey (Bagnold dan)



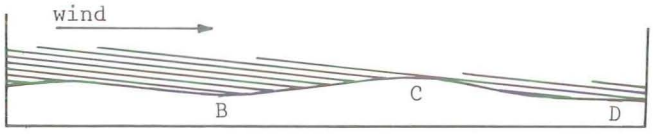
A pebble surface (after Bagnold)
Gakıllık yuzey (Bagnold dan)

FIGURE *ŞEKIL* 14



Formation of a slip-face on a barchan dune
(for explanation see text) (after Bagnold)
Barchan humulda kaymıs yüzey formasyonu
(izahat icin metne bak) (Bagnold dan)

FIGURE *ŞEKIL* 15



Formation of sand ripples (for explanation see text) (after Bagnold)
Kum dalgacıklarının (izahat icin metne bak) (Bagnold dan)

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longer sloping fall (fig.13.I.). When it strikes the surface, it may either rebound, thus repeating its motion, or it may start saltation of another sand grain by impact. The height attained by sand grains undergoing saltation depends on the velocity of the grains and thus basically upon wind velocity and on the nature of the surface. On pebble surfaces saltation is noticeably higher than on sand surfaces (fig.13.II), but even on these surfaces grains undergoing saltation rarely reach more than 1,80 meters above the surface. The energy of the falling grains may not be absorbed in rebounding or in starting saltation by impact, but may be used in disturbing a number of grains, which are driven forward for a short distance on the surface. At low wind velocities the jerky movement of these grains may be observed, but as the wind velocity increases this appears to change into a steady forward creep of the surface grains. This surface creep merges into very low saltation.
Thus it may be seen, that the only grains actually suspended in the air are the very fine ones. The upper parts of the sandstorms, which may rise very high into the air are composed solely of dust and sand movement takes place only very near the ground level. When the dust-laden wind meets an obstacle, the dust particles rarely strike the obstacles as they are diverted around it in the general air flow and so exert little or no erosive effect. The sandgrains, however, are confined to a layer very near to the surface and thus their erosive effect is very limited in vertical extent, while surface creep can obviously affect only an extremely limited vertical range. The work of wind erosion is therefore very limited.
Also the process of the deflation or removal by the wind of the fine products of weathering and fine textured deposits have been observed mainly in the eastern part of the Erosion Camp Area. On the sandy surface the wind removes the finer products in suspension and may shift the sand by saltation and surface

creep, thus leaving a surface of gravel.
These deflation surfaces have been given a variety of names: desert pavement, erosion pavement, etc. In this report the name desert pavement is used.
Probably of greater importance than the erosion produced by winds are the forms of the winddeposits in the Erosion Camp Area.
Two types of individual sand dunes can be distinguished in the surveyed area, namely: rounded sanddunes and crescentic sand dunes or barchans (see chapter 2-3, sub 1 B).
The rounded dunes have a rounded shape (see fig. 14-I). Their height ranges from about 2 to 4 meters and they occur mainly in the southwestern parts of the several belts (map unit Dd 2.1) and in large blowouts.
The barchans have a crescentic shape with two horns (fig.14-III an IV) and occur mainly in the north-eastern parts of the several belts in the Active dune land. (map unit Dd 2.1).
They are about 2 to 12 meters high. Their average southwestern (windward) slope is about 10^{o} and a pattern of small ridges of few centimeters apart, which form and reform, occur on the surface. The very steep north-eastern (lee side) slope is about 30^{o}.
The dunes are built up of stratified sandy material. The texture layers are mostly thin and are often parallel to the surface of the slip-face. The texture of the sand deposits of a barchan is given in Appendix II, Table 4.
The horns consist of somewhat coarser sand than the mass of their dune and point mainly to about the north east.
Almost all the dunes rest on a caliche-like layer, which has some resistance to the wind erosion (see chapter 2-3, sub 1B).
The dune surface has often sand ripples of a few cm high. A barchan dune will tend to form from a mound of sand, the development envisaged by Bagnold being as follows.

In crosssection (fig. 14-I) the greatest effect of the wind will be felt on the wind-ward slope of a mound of sand, and will lead to a pronounced movement of sand grains to the crest. Just beyond the crest they will tend to accumulate, for the effect of the wind is felt less here.
Accumulation at the top of the lee-slope leads to a steepening at that slope (fig. 14-II), and hence to a decrease of the wind effect on it. The steepening of the lee-slope by accumulation at the top goes on until the angle of the rest of the material is exceeded (E-F in fig. 14-III), when shearing takes place along a slightly less steep surface (G-H in fig.14-III). Thus, the slip face of the barchan advances by a process of oversteeping and shearing. The flanks of the original mound of sand advance more rapidly than the centre for the rate of advance is inversely proportional to the height of the slip face. In this way the crescentic barchan form is developed. The wings advance until they are very much in the shelter of the mainmass of the dune, where the sand flow is less and their rate of advance is retarded.
The coarse sand particles cannot be blown by wind over the windward side till the crest of the barchan dune and turn off to the wings and form the coarser textured horns (Tricart and Mainguet, 1965).
According Bagnold (1954) the barchan dune is formed when the wind is nearly uni-directional. It is orientated with the horns downwind.
The rate of advance of single isolated barchans varies much in several parts of the world.
Beadnell gives figures for a period of a year for the movement of five barchans of different heights in a desert area (Kharga Oasis Egypt).

Dune	Height in meters	Total advance in meters/a year
a	20	10,9
b	17	10,8
c	11	16,2
d	10,5	18,8
e	4	18,4

Buringh (1960) has calculated average dune speeds of 20 meters a year for drifting dunes in Irak over longer periods. He used therefore two series of aerial photographs. The second series was taken of the same dune land, several years after the first one.

Personal observation in the field and on the aerial photographs of many years old agree with informations of local people, who told, that the dunes moved very slowly, mainly in north-eastern direction, for example about 5 meters a year.

A phenomenon which may counteracts the absolute rate of advance of the dunes in north-eastern direction, is observed in the Erosion Camp Area. During the period of this survey, the wind had blown from the reverse direction of the dominant winds for about two weeks. In that time small crescentic dunes had been formed by north-eastern winds on the top of a few large barchans. A new small slip-face was formed, facing to the other side, namely to the south-west.

The forms of the different dunes are often obscured. The front-side of several dunes catches up the beginning of the backs of the preceding ones, as the dunes have different speeds. Other barchan dunes may touch each other by their horns and so they occur in colonies in several places. Local rocky obstacles may obscure the forms of the individual dunes too.

Also the formation of ripples, which cover the sandy surface in many places, are intensively studied by Bagnold (1954).

The formation of sand ripples is closely connected with the process of saltation. If a surface with chance irregularities is imagined (fig.15) on to which grains are being driven by saltation, it is obvious that the frequency of bombardement by sand grains will be greater on the slight slopes, facing the wind (B-C., fig. 15), than on slopes facing away from the wind (C-D, fig. 15). Thus on B-C the rate of arrival of the sand grains and the surface creep will be greater than on the reverse slope (C-D). In fact material will be arriving at C faster than it can be removed.

Similarly in an hollow such as B the sandgrains are being driven faster towards C than they are arriving, thus accentuating the hollow.

As all sand surfaces process change irregularities, even though they may be only on the magnitude of a few sandgrains, there is a natural tendency for ripples to form. The wave length of such ripples varies with the strength of the wind, which controls the distance travelled by each grain during saltation.

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Appendix II

Detailed descriptions of profiles.

Profile no.1.

Soil series: Komoba A series.Map unit: Dd.1.1. Survey no.: P53.

Area : Plain of Karapınar, Great Konya Basin, Central Anatolia, Turkey.

Location : 1.5 km westward from Girginli Y., near the fence. (43,8 longitude, 58,7 latitude).

Elevation : 1005 m.

Physiography : Aeolian sandplain.

Topography : Subnormal relief.

Parent material : Aeolian, carbonatic, sandy deposits.

Drainage condition : Excessively drained.

Groundwater : ca. 20 m. Salinity : Free of excess of salt.

Moisture : 0-40 cm dry, 40-150 cm moist.

Landuse : Idle land.

Rootdistribution : Plentiful fine roots down to ca. 40 cm.

Biological activity : 1 Krotovina at ca. 140 cm and small tubular holes (1 cm diameter) of insects.

Vegetation : Marrubium parviflorum (Tapir) on hummocks (< 80 cm high).

Profile description.

A1 0-20 cm.Grayish brown (2,5 Y 5/2) fine sand,light brownish gray (2,5 Y 6/2), when dry. Carbonatic and common fine fragments of shells. No distinct stratification. Single grain and weak, coarse, subangular blocky structure. Loose

to soft when dry, loose to very friable when moist non-plastic, non-sticky. Few macro-, common mesopores. Plentiful fine roots. Clear, smooth boundary.

AC 20-67 cm. Grayish brown (2,5 Y 5/2) fine sand, light brownish gray (2,5 Y 6,4/2) when dry. Carbonatic and common fine fragments of shells. No distinct stratification. Moderate, coarse, subangular, blocky structure. Slightly hard, friable, non-plastic, non-sticky. Few macro-, common mesopores. Plentiful fine roots in the upper part, decreasing downward. Gradual smooth boundary.

Cca 67-150 cm. Light brownish gray to light gray (2,5 Y 6,5/2) loamy fine sand, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Weak and moderate, coarse angular blocky structure. Hard to very hard, firm, slightly plastic, slightly sticky. Common macro-, common mesopores. One crack of 10 mm filled up with fine sandy soil, probably from the surface with fine fragments of shells. Segregation of lime in few medium and coarse, faint, white, soft concretions. 1 Krotovina at 140 cm.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile no. 2.
Soil series : Komoba B series. Map unit : Dd.1.1. Survey no.: P45a.
Area : Plain of Karapinar, Great Konya Basin, Central Anatolia, Turkey.
Location: 1,5 km N.E. ward from Çardak Y., ca.5 m northward

from the fence (40,2 longitude, 62 latitude).

Elevation : 1002 m.

Physiography : Aeolian sandplain.

Topography : Subnormal relief.

Slope : Undulating.

Parent material : Aeolian carbonatic, sandy deposits on lacustrine, carbonatic, loamy and clayey deposits.

Drainage : Somewhat excessively drained.

Groundwater : ca. 15 m. Salinity : Free of excess of salt.

Moisture : 0-40 cm dry, 40-150 cm moist.

Landuse : Idle land.

Biological activity : Krotovinas.

Rootdistribution : 0-40 cm abundant fine roots.

Vegetation : Marrubium parviflorum (Tapir) on low hummocks (< 50 cm high).

Profile description:

A 11 0-37 cm. Grayish brown (2,5 Y 5/2) very fine sand with fine fragments of shells, light brownish gray to gray (2,5 Y 6,5/2) when dry. No distinct stratification. Carbonatic. Single grain and weak, very coarse subangular blocky structure. Soft and loose when dry, loose when moist, non-plastic, non-sticky. Few macro-, common mesopores, abundant fine roots. Gradual smooth boundary.

A 12ca 37-58 cm. Grayish brown to light brownish gray (2,5 Y 5,5/2) very fine sand, light gray (2,5 Y 7/2) when dry. Carbonatic. No distinct stratification. Weak and moderate coarse subangular blocky structure. Soft, very friable, non-plastic, non-sticky. Common macro-, many mesopores. Few, fine roots. Common Krotovinas. Segregation of lime in few and common medium and coarse faint white (2,5 Y 8/2) soft concretions. Abrupt, irregular boundary.

AC 58-80 cm. Grayish brown to light brownish gray (2,5 Y 6,5/2) silt loam, white (2,5 Y 8/0-2) when dry. Carbonatic. Moderate coarse, angular blocky structure. Hard, friable, slightly plastic, slightly sticky. Few macro-, common mesopores. Many Krotovinas. Abrupt, wavy boundary.

C 80-150 cm. Light brownish gray to light gray (2,5 Y 6,5/2) silty clay, white (2,5 Y 8/2) when dry. Carbonatic. Moderate coarse angular blocky structure. Slightly hard to hard, firm, plastic, sticky. Common macro-, common mesopores. Prominent shell layer (Dreissensia spec.) at 110 cm.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthustentic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile 3. Soil peel no. 65 - 3.
Landtype : Active dune land. Map unit : Dd 2.1. Survey no. P44.
Area : Plain of Karapınar, Great Konya Basin, Central Anatolia, Turkye.
Location : At the end of the N.S. maintrack, 5 km southward of Kındam Y. on a barchan dune at the windward side. Profile perpendicular on the crest line of the barchan. (44 longitude, 66,4 latitude).
Elevation : 1005 m.
Physiography : Aeolian sandplain, active dunes.
Topography : Subnormal relief.
Slope : Moderately steep, short slope.
Landuse : Waste land.

Parent material : Carbonatic Aeolian sand.
Drainage condition : Excessively drained.
Salinity : Free of salt excess.
Groundwater : ca. 20 m. Permeability : Rapid.
Moisture : 0-70 dry, 70-170 moist.
Root distribution : no roots.
Erosion : Severaly overblown land.
Vegetation : None.

Profile description. (see Fig. 16) :

C 1 0-0,5 cm. Light brownish gray (10 YR 6/2) sand, light gray (10 YR 7/2) when dry. Carbonatic. (less than 95% quartz). Single grain structure. Loose when dry, loose when moist, non-plastic, non-sticky. On the dune-surface much shell fragments and coarse sand. Very few macro-, many mesopores. Abrupt, smooth boundary.

C 2 0,5-70 cm. Light brownish gray (10 YR 6/2) fine sand, light gray (10 YR 7/2) when dry. Carbonatic (less than 95% quartz). Stratified. The texture layers make an angle of 20^{o}-30^{o} with a horizontal plane. Single grain. Loose when dry, loose when moist, non-plastic. non-sticky. Very few macro-, many mesopores. Diffuse smooth boundary.

C 3 70-165 cm. Light brownish gray (10 YR 6/2) fine sand, light gray (10 YR 7/2) when dry. Carbonatic. Moist and stratified. Other properties are the same as in C 2.

Soil Classification : Not considered as soil (not-soil).
Described by : A.F. Groneman.
Date : June 1965.

Figure 16

Profile *Profil* no.3

Soil Peel no.65-3

Toprak kabuğu

Land type :

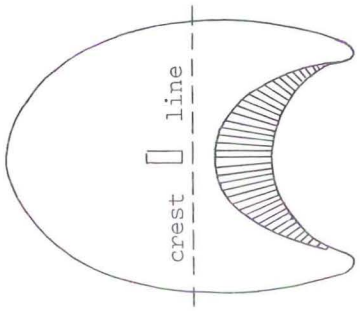
Active dune land.

Map unit : Dd 2.1.

Remarks :

The profile is perpendicular on the crest line and is at the windward side of a barchan.

Carbonatic. (ca 77% $CaCO_3$ equiv.) stratified fine sand. The texture layers make angles, ranging from about 20^{o} to 30^{o} with a horizontal plain. The white spots are fragments of shells.



Barchan (Upperview)

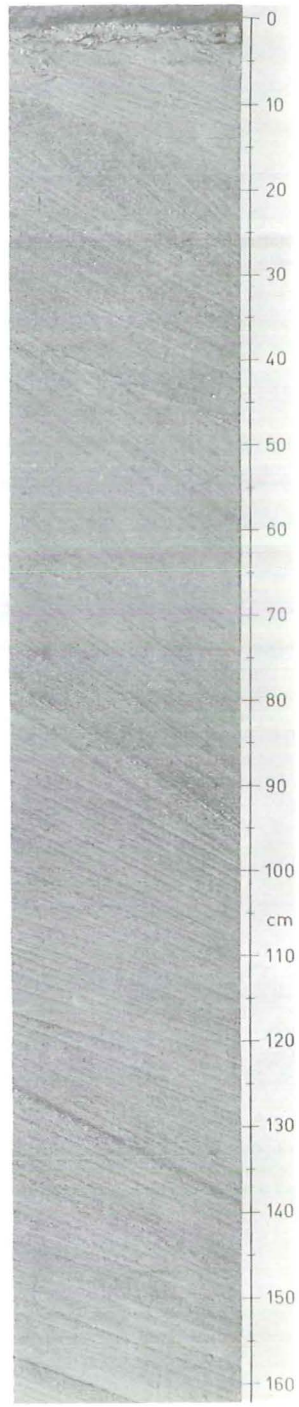


Table 4

Profile no.3. Soil Peel no. 65-3.

(a)

Horizon	Depth cm	> 420μ	300 - 420	210 - 300	150 - 210	105 - 150	75 - 105	50 - 75	32 - 50	16 - 32	8 - 16	2 - 8	< 2μ	$CaCO_3$ in % equivalent
C1	0-0,5	22.2	10.4	8.3	9.2	16.7	12.4	6.6	4.3	1.4	1.4	1.4	5.7	76.5
(b)		18.0	10.1	9.3	12.1	20.8	15.0	5.5	2.0	0.3	0.5	1.7	4.7	
C2	0,5-70	1.0	3.3	6.7	11.3	22.7	15.1	5.8	4.3	1.8	2.4	1.2	24.4	77.7
(b)		0.7	2.7	8.3	17.7	34.8	19.9	5.4	1.2	0.7	0.5	1.3	6.8	
C3	70-170	2.0	6.0	12.6	15.7	20.1	9.9	3.9	2.4	1.2	1.8	4.2	20.2	78.3
(b)		1.9	6.2	16.9	24.8	27.8	11.0	2.6	0.7	0.3	0.8	1.8	5.2	

		Moisture in % at satur.	pH of sat. paste (c)	E.C. in mmhos per cm, 25°C (d)	C.E.C. (e)
-	-	20	7.8	0.45	2
-	-	23	7.6	0.50	3
-	-	24	7.8	0.51	3

(a) Particle size distribution and $CaCO_3$% are determined in Wageningen. Texture with pipette method. Dispersion with sodium hexamethaphosphate. $CaCO_3$ removed with HCl. Organic matter removed with H_2O_2. (x)

(b) Without removal of $CaCO_3$.(c) Glass electrode, using saturated soil paste.

(d) Wheatstone bridge, using saturation extract. (e) Na+ saturation (pH 8,2) displacement with 1n. ammoniumacetate and determination of Na+ displaced with Lange flame spectrometer.

(x) The other analyses are made in Ankara, according methods, described in Handbook no.60 U.S.D. of A. (1954).

Profile no.4.

Landtype : Active dune land. Map unit : Dd 2.1. Survey no.P45.

Area : Plain of Karapınar, Great Konya Basin, Central Anatolia, Turkey.

Location : At the end of the N-S. maintrack, 5 km southward of Kındam Y., between two crescentic dunes (barchans) (43,9 latitude, 66,4 longitude).

Physiography : Aeolian sandplain. Active dunes.

Topography : Flat to subnormal relief. Slope : level.

Landuse : Waste land.

Parent material : Carbonatic lacustrine sandy to clayey deposits.

Drainage condition : Well drained. Salinity : Free of excess of salt.

Groundwater : 15 m. Moisture : 0-10 dry, 10-150 cm moist.

Erosion : Severely blown out land.

Stoniness : no stones, class 0.

Root distribution : No roots.

Biological activity : Many Krotovinas and many cocoons of insects.

Vegetation : none.

Profile description :

B 31 0-1 cm. Crust of grayish brown to light brownish gray (2,5 Y 5,5/2) fine sand, white to light gray (2,5 Y 7,5/2) when dry. Carbonatic. Massive. Slightly hard, friable, slightly plastic, slightly sticky. Few macro-, few mesopores. On the surface of the crust occur common old cocoons and few fragments of pottery and obsidian implements.

B 32 ca 1-9 cm. Grayish brown to light brownish gray (2,5 Y 5,5/2) loamy fine sand, white to light gray (2,5 Y 7,5/2) when dry. Carbonatic. Weak, coarse and medium, subangular

blocky structure. Slightly hard, firm, slightly plastic, slightly sticky. Few macro-, many mesopores. Many old cocoons of insects and common Krotovinas. Canals and casts. Segregation of lime in common, medium and coarse faint white soft concretions. Abrupt irregular boundary.

B 33 ca 9-36 cm. Light gray (2,5 Y 7/2) silty clay loam, white (2,5 Y 8/2) when dry. Carbonatic. Moderate coarse sub-angular blocky structure. Slightly hard, firm, plastic, sticky. Few macro-, many mesopores. Segregation of lime in few medium and coarse, faint, white, soft lime-concretions. Abrupt, smooth boundary.

C 36-150 cm. Light gray (2,5 Y 7/2) silty clay, white (2,5 Y 8/0-2) when dry. Carbonatic. Moderate, coarse, angular blocky structure. Slightly hard, firm, plastic, sticky. Many macro-, many mesopores. Few fine distinct rust mottles. Few black coatings of Manganese oxide on the surface of structure elements.

Soil classification :Not considered as soil (not-soil).
Described by : A.F. Groneman.
Date : June 1965.

Profile no.5.
Soil series : Günağılı A series. Map unit : Dd.3.1.
Survey no. P55.
Area : Plain of Karapınar, Great Konya Basin, Central Anatolia, Turkey.
Location : 1,5 km N.N.W.-ward from Vahapobası Y, near the fence (65,6 latitude, 48,8 longitude).
Elevation : 1002 m.
Physiography : Aeolian sandplain.

Topography : Subnormal relief.
Slope : Level to undulating.
Parent material : Aeolian volcanic calcareous, sandy deposits
Drainage condition : Somewhat excessively drained.
Groundwater : ca. 20 m.
Salinity : Free of excess of salt.
Moisture : 0-50 cm dry, 50-120 cm moist.
Landuse : idle land.
Root distribution : Few fine roots down to 50 cm.
Biological activity : No Krotovinas or cocoons.
Vegetation : Marrubium parviflorum (Tapir) on low hummocks and few Artemisia scoparia (Piren).

Profile description :

A 1 0-70 cm. Yellowish brown (10 YR 5/4) fine basalt sand, light yellowish brown (10 YR 6/4) when dry. Calcareous. Some black fine basalt gravel and common fragments of shells. No distinct stratification. Single grain structure. Loose when dry, loose when moist, non-plastic, non-sticky. Common macro-, many mesopores. Fine fine roots. Diffuse, smooth boundary.

C 70-120 cm. Yellowish brown (10 YR 5/4) very fine sand, light yellowish brown (10 YR 6/4) when dry. Calcareous, some very coarse sandgrains and common fragments of shells. No distinct stratification. Massive and single grain. Loose to soft when dry, loose when moist, non-plastic non-sticky. Few macro-, common mesopores.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile no. 6.

Landtype : Dark active dune land. Map unit : Dd.4.1.
Survey no. P54.

Area : Karapınar, Great Konya Basin, Central Anatolia, Turkey.

Location : 2 km N.W.-ward from Vahapobası Y. On the top of a rounded dune (48,4 longitude, 65,6 latitude).

Elevation : 1004 m.

Physiography : Aeolian sandplain, active dunes.

Topography : Subnormal relief.

Slope : Level to rolling.

Parent material : Aeolian sandy deposits, local dark volcanic sand.

Drainage condition : Excessively drained.

Groundwater : ca. 20 m.

Salinity : Free of excess of salt.

Moisture : 0-45 cm dry. Permeability : rapid.

Landuse : waste land.

Root distribution : no roots.

Biological activity : none.

Vegetation : none.

Profile description :

C 1 0-46 cm. Light yellowish brown (10 YR 6/4) fine sand, very pale brown (10 YR 7/4) when dry. Calcareous, some dark rounded volcanic fine gravel and common fragments of shells. Quartz less than 95%. No distinct stratification. Single grain structure. Loose when dry, loose when moist, non-plastic, non-sticky. On the surface a discontinuous thin desert pavement of dark volcanic coarse sand and dark volcanic rounded fine gravel. Very few macro-, many mesopores. No roots. Diffuse smooth boundary.

C 2 46-60 cm. Light yellowish brown (10 YR 6/4) fine sand,

very pale brown (10 YR 7/4) when dry. Calcareous, Some dark volcanic rounded fine pebbles and common fragments of shells. Quartz less than 95%. No distinct stratification. Massive. Loose when dry, loose when moist, non-plastic, non-sticky. Very few macro-, many mesopores.

Soil classification : Not considered as soil (not-soil).
Described by : A.F. Groneman.
Date : June 1965.

Profile no.7. Soil Peel no. 65-2.
Soil series : Karafakı series. Map unit : Lm 4.1.
Survey no : P12.
Area : Karapınar, Great Konya Basin, Central Anatolia, Turkey.
Location : 5 km westward from Karapinar and 500 m. southward from the highway (43,1 longitude, 74 latitude).
Elevation : 1000 m.
Physiography : Lacustrine plain.
Topography : flat Slope : level
Landuse : Idle land near arable land, dry farmed.
Parent material : Carbonatic lacustrine loamy and clayey deposits.
Drainage condition : Moderately well drained to well drained.
Groundwater : ca. 8 m.
Moisture : 0-50 cm dry, 50-70 cm moderately dry, 70-170 cm moist
Root distribution : 0-72 cm plentiful roots, 72-130 cm very few old roots.
Vegetation : Predominantly Alhagi camelorum and Glaucium corniculatum. Some Adonis flammea.

Profile description :

A 11 0-3 cm. Light brownish gray (2,5 Y 6/2) loam, light gray (2,5 Y 7,5/2) when dry. Carbonatic. Strong, very fine, granular structure and few shell fragments under a soft crust of about 0,5 cm thick. Slightly hard, very firm, slightly plastic, slightly sticky to sticky. Many macro-, many mesopores. Abrupt smooth boundary.

A 12 3-32 cm. Light brownish gray (2,5 Y 5,5/2) silty clay loam light gray (2,5 Y 7/2) when dry, Carbonatic. Compound, weak subangular blocky and moderate medium granular structure. Slightly hard, friable, plastic, sticky. Common macro-, common mesopores. Very few roots decomposed in clear moder and round excrements of one mm diameter. Common cocoons of about 1 cm diameter and many round earthen excrements of 1 mm diameter. Clear, irregular boundary.

II B2 ca 32-53 cm. White (2,5 Y 7,5/2) silty clay, white (2,5 Y 8/2) when dry. Strong medium subangular blocky structure. Slightly hard to hard, very firm, plastic, sticky. Carbonatic. Common macro-, common mesopores. Common medium and coarse, distinct segregation of lime with clear boundaries, white (2,5 Y 8/0-2) when dry. Few, soft, coarse, rounded concretions of lime. Gradual irregular boundary.

II C1 53-75 cm. Light brownish gray (2,5 Y 6,5/2) silty clay white (2,5 Y 7,5/2) when dry. Carbonatic. Strong medium subangular blocky structure. Slightly hard, very firm slightly plastic, sticky. Few macro-, common mesopores. 1 Krotovina at 70 cm and 8 cm diameter. Few roots of Alhagi camelorum. Clear, smooth boundary.

II C2 cs 75-142 cm. Light brownish gray (2,5 Y 6/2) clay, white (2,5 Y 8/2) when dry. Carbonatic. Moderate, medium angular blocky structure. Very hard, very firm, slightly

plastic and sticky. Few fine distinct rust mottles (5 YR 5/8). Many gypsum veins and pseudomycelium, many gypsum cristals embedded in soft lime and few soft rounded medium clusters of gypsum cristals. Very few macro-, very few mesopores. Some black (2,5 YR 2/0) coatings of manganeseoxide on the elements and on the surface of the macropores. Few shell-fragments. Gradual, smooth boundary.

II C3 cs 142-165 cm. Light gray (2,5 Y 7/2) clay white (2,5 Y 7,5/2) when dry. Carbonatic. Compound strong wedge shaped and with parallelepiped natural structural elements with a strong medium angular blocky structure. Extremely hard, extremely firm, plastic, sticky to very sticky. Very few macro-, very few mesopores. Common gypsum and lime pseudomycelia and few gypsum cristals. Few shell fragments. Black (2,5 YR 2/0) coatings of manganese oxyde on the structure elements.

Diagnostic horizons : Ochric epipedon
Cambic horizon
Gypsic horizon
Calcic horizon

Soil classification : Orthic Calcorthid.

Described by : A.F. Groneman.

Date : 29-5-1965.

Figure 17

Profile *Profil* no.7

Soil Peel

Toprak kabuğu no.65-2

Soil series :

Karafakı series

Map unit :

Lm.4.1.

Remarks :

1. Carbonatic (ca.54% $CaCO_3$ equiv.) loamy and clayey lacustrine deposits.
2. Weak calcic horizon between 32 and 53 cm. with white soft, coarse rounded concretions of lime.
3. Strongly developed gypsic horizon between 75 and 142 cm.
4. Structure of parallelepiped natural structural elements below 142 cm.

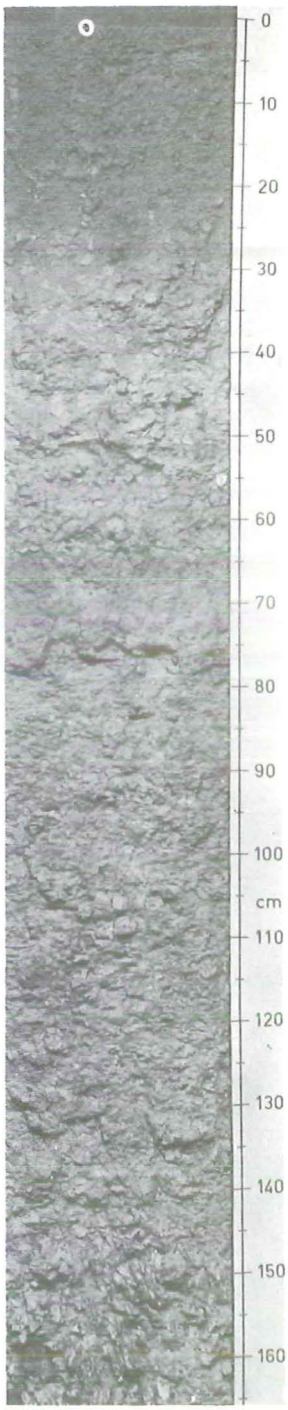


Table 5

Profile no.: 7. Soil peel no.: 65-2

(a)

Horizon	Depth cm.		Particle size distribution in mu												
		>420 µ	300 - 420	210 - 300	150 - 210	105 - 150	75 - 105	50 - 75	32 - 50	16 - 32	8 - 16	2 - 8	<2µ	< 2 / <16	$CaCO_3$ in % equiv.
A11	0-3	(a) 0.2	0.6	1.4	2.1	3.8	4.2	4.5	6.9	6.5	2.0	17.1	50.7		53.4
		(b) 1.3	2.1	3.4	4.7	6.8	7.4	7.9	11.9	9.1	4.5	17.8	23.1	0.51	
A12	3-32	(a) 0.2	0.3	0.6	1.0	1.5	1.7	2.0	11.3	2.0	5.2	9.7	64.5		54.5
		(b) 0.9	0.9	1.4	2.0	2.8	3.1	3.5	9.9	6.6	9.6	24.1	35.2	0.51	
II B2 ca	32-53						(a)	3.9	3.7	3.2	8.5	11.1	69.6		58.4
							(b)	7.0	3.8	7.4	9.4	28.0	44.4	0.54	
II C1	53-75						(a)	1.5	5.5	7.3	8.0	21.4	56.3		54.0
							(b)	2.4	5.2	8.6	10.1	27.7	46.0	0.55	
II C2 cs	75-142							3.8	3.6	2.4	9.5	14.3	66.4		48.0
							(c)	- -	- -	- -	- -	- -	- -		
II C3	142-165							4.2	3.4	4.0	9.4	14.8	64.2		52.3
							(c)	- -	- -	- -	- -	- -	- -		

Table 5. Continued.

Horizon	Depth cm.	H_2O in % at satur.	pH of sat. paste (d)	E.C. in mmhos per cm, 25°C of sat. extr. (e)	C.E.C. (f)
A 11	0-3	70	7.9	0.9	10.8
A 12	3-32	74	8.0	1.1	11.6
II B2 ca	32-53	76	8.3	1.2	12.8
II C1	53-75	83	8.2	1.1	12.4
II C2 cs	75-142	82	7.7	1.7	10.3
II C3	142-165	86	7.9	2.8	12.7

(a) Particle size distribution and $CaCO_3$ % are determined in Wageningen. Texture with pipette method. Dispersion with sodium hexamethaphosphate. $CaCO_3$ removed with HCl. Organic matter removed with H_2O_2. The other analyses are made in Ankara, according methods, described in Handbook no.60 U.S.D. of A. (b) Without HCl treatment.

(c) Particle size distribution without HCl treatment not reported. Samples gave indication of flocculation from gypsum.

(d) Glass electrode, using saturated soil paste. (e) Wheatstone bridge, using saturation extract.

(f) Na^+ saturation (pH 8,2) displacement with 1n. ammoniumacetate and determination of Na^+ displaced with Lange flame spectrophotometer.

Profile no.8.

Soil series : Karafakı series. Map unit : Lm 4.1. Survey no.P59.

Area : Karapınar, Great Konya Basin, Central Anatolia, Turkey.

Location : 1 km S.E.-ward from Ecelertolu Y. (72,5 latitude, 42,5 longitude).

Elevation : 999 m.

Physiography : Lacustrine plain.

Topography : Subnormal relief.

Slope : level.

Parent material : Carbonatic, lacustrine, loamy and clayey deposits.

Landuse : Arable land. Dry farming. Wheat, rye.

Groundwaterdepth : ca. 10 m.

Drainage condition : Well drained.

Irrigation : none.

Stoniness : 0.

Human activity : Plowing.

Biological activity : 4 Krotovinas (10 cm diameter) and ancient cocoons (1 cm diameter).

Root distribution : 0-70 cm plentiful roots.

Vegetation : Some stubbles of rye.

Profile description :

Ap 0-12 cm. Gray brown to light brownish gray (2,5 Y 5,5/2) silt loam, light gray to white (2,5 Y 7,5/2) when dry. Weak, very thick platy structure, breaking to very fine granular structure. Carbonatic. Soft, very friable slightly plastic, slightly sticky. Few macro-, few meso-pores. Gradual smooth boundary.

A1 12-25 cm. Gray brown to light brownish gray (2,5 Y 5,5/2) silty clay loam, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Moderate, medium, granular structure. slightly hard, friable, plastic, slightly sticky to

sticky. Few macro-, common mesopores. Few roots are decomposed to moder. Gradual, smooth boundary.

A3ca 25-56 cm. Light brownish gray to light gray (2,5 Y 6,5/2) clay, white (2,5 Y 8/0-2) when dry. Carbonatic. Moderate fine, subangular blocky structure. Slightly hard to hard, firm, plastic, sticky. Few macro-, many mesopores. Stains of white segregations of lime. Few roots decomposed to moder. Diffuse, smooth boundary.

AC 56-92 cm. Light brownish gray to light gray (2,5 Y 6,5/2) silty clay, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Moderate, fine, subangular blocky structure. Hard to slightly hard, firm, plastic, sticky. Few macro-, common mesopores. Clear, smooth boundary.

C1cs 92-127 cm. Light brownish gray to light gray (2,5 Y 6,5/2) clay, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Moderate and strong, fine, angular, blocky structure. Hard to slightly hard, firm, plastic, sticky. Very few macro-, few mesopores. Veins with gypsum powder and spots of white segregation of lime. Fragments of shells. Common and few fine distinct rust mottles. Diffuse, smooth boundary.

C2 127-150 cm. Light brownish gray to light gray (2,5 Y 6,5/2) clay,light gray to white (2,5 Y 7,5/2) when dry Carbonatic. Same structure and consistency as in C1cs. Very few macro-, few mesopores. Common, fine, distinct rustmottles. Few gypsum powder and fragments of shells. Few segregation of lime.

Diagnostic horizons : Ochric epipedon, gypsic horizon.

Soil classification : Calcorthid.

Described by : A.F. Groneman.

Date : June 1965.

Profile no. 9.

Soil series : Kındam series. Map unit : Lp 1.1. Survey no.P37.

Area : Plain of Karapınar, Great Konya Basin, Central Anatolia Turkey.

Location : 600 m N.W. of Kındam Y. (72,3 latitude, 44,6 longitude).

Elevation : 999 m.

Physiography : Lacustrine plain.

Topography : Subnormal relief. Slope : level to nearly level.

Parent material : Wind reworked deposits on lacustrine deposits.

Landuse : Idle land (formerly in native pasture).

Groundwater depth : ca. 15 m. Stoniness : 0.

Drainage condition : somewhat excessively drained.

Irrigation : none. Human activity : none.

Biological activity : 4 Krotovinas.

Root distribution : 0-40 cm plentiful fine roots, decreasing downward.

Vegetation : Marrubium parviflorum on low hummocks of < 50 cm high.

Profile description :

A1 0-30 cm. Grayish brown to light brownish gray (2,5 Y 5,5/2) fine sand to very fine sand, light brownish gray to light gray (2,5 Y 6,5/2) when dry. Carbonatic. Very weak, very thick, platy structure. Soft, very friable, slightly plastic, non-sticky. Few macro-, common mesopores. Diffuse smooth boundary.

ACca 30-90 cm. Light gray (2,5 Y 7/2) fine sand to very fine sand, white (2,5 Y 8/2) when dry. Carbonatic. Moderately, weak, fine, subangular blocky structure. Slightly hard, friable, slightly plastic, slightly sticky. Few macro-, common mesopores. White, very faint spots of lime. Clear

smooth boundary.

C1 90-115 cm. Light brownish gray to light gray (2,5 Y 6,5/2) silt loam, white to light gray (2,5 Y 7,5/2) when dry. Carbonatic. Moderate, coarse, subangular blocky structure. Slightly hard, very firm, plastic, sticky, Many macro-, many mesopores. Clear, smooth boundary.

C2 115-143 cm. Light brownish gray to light gray (2,5 Y 6,5/2) stratified fine sand and silt loam, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Moderately weak, fine and coarse, subangular blocky structure. Slightly hard, very firm, plastic sticky. Few macro-, common mesopores. Clear smooth boundary.

C3cs 143-165 cm.Light brownish gray to light gray(2,5 Y 6,5/2) stratified fine sand and silt loam, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Same structure and consistence as C2. Very few macro-, few mesopores. Veins of gypsum powder and lime. Clear smooth boundary.

C4 > 165 cm. Light brownish gray to light gray (2,5 Y 6,5/2) silty clay loam, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Compound weak, very coarse prismatic and moderate strong, coarse, angular blocky structure. Hard, firm, plastic, sticky. Few fine distinct rust mottles. Faint veins of white gypsum and lime in pockets and on cracks.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthic Psammustent,
Described by : A.F. Groneman.
Date : June 1965.

Profile no. 10.
Soil series : Kayırlıkaşı series. Map unit : Lp 2.1.

Survey no. P13.

Area : Karapınar, Great Konya Plain, Central Anatolia, Turkey.

Location : 2,5 km N.E.-ward from Vahapobasi Y. (Latitude 66,6, longitude 50,8).

Elevation : 1000 m.

Physiography : Lacustrine plain, Slope : level.

Topography : Subnormal relief.

Parent material : Lacustrine deposits, derived from volcanic ash, sand and gravel.

Landuse : Poor native pasture.

Groundwater depth : ca. 10 m.

Drainage condition : Well drained.

Irrigation : none.

Human activity : none. Salinity : Free of excess of salt.

Biological activity : Krotovinas.

Root distribution : 0-50 plentiful fine roots, decreasing downward.

Vegetation : Peganum harmala (Üzerlik).

Profile description.

A1 0-50 cm. Dark grayish brown to grayish brown (10 YR 4,5/2) gravelly coarse sand, grayish brown to light brownish gray (10 YR 5,5/1) when dry. Calcareous. Dark brown to black rounded pebbles. Structureless and massive. Loose to soft, when dry, loose to very friable when moist, slightly plastic, slightly sticky. Common macro-, common mesopores. Few Krotovinas. Asymmetrical ripples on the surface up to about 8 cm high. Locally desert pavement occurs. Abrupt, irregular boundary.

AC 50-72 cm. Pale brown (10 YR 6/3) gravelly loamy sand, white (10 YR 8/2) when dry. Calcareous. Weak, medium, subangular blocky structure. Hard, firm, plastic, slightly sticky. In the lower side few fine distinct rust

mottles. Few Krotovinas. Clear, irregular boundary.

C1 72-150 cm. Very pale brown (10 YR 7/3) silt loam to silty clay loam, white (10 YR 8/2) when dry. Calcareous. Moderate, coarse, angular blocky structure. Very hard, very firm, very plastic, sticky to very sticky. Few, fine, faint and distinct rust mottles.

Diagnostic horizons : Ochric epipedon.
Soil classification : Orthic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile no. 11.
Soil series : Kartan series. Map unit : Mv 2.1. Survey no.P51.
Area : Karapınar, Great Konya Basin, Central Anatolia, Turkey.
Location : 1,5 km N.E.-ward from Kindam Y., (latitude 72,7, longitude 46,5).
Elevation : ca. 1010 m.
Physiography : Ancient beach, adjoining Rockland.
Topography : Subnormal relief. Slope : Gently sloping.
Parent material : Gravelly beach deposits at the edge of the volcanic mountains.
Landuse : Idle land.
Groundwater depth : ca. 20 m.
Drainage conditions : Somewhat excessively drained.
Irrigation : none. Salinity : No salt efflorescence.
Human activity : none.
Biological activity : 2 Krotovinas and ancient cocoons.
Root distribution : 0-80 cm plentiful fine roots.
Vegetation : Marrubium parviflorum.(Tapir).

Profile description :

A1 0-12 cm. Dark brown to brown (10 YR 4,5/3) fine gravelly

loamy sand, pale brown to very pale brown (10 YR 6,5/3) when dry. Calcareous. Dark brown, rounded fine pebbles. weak, thick, platy structure. Soft, very friable, slightly plastic to non-plastic, slightly sticky to non-sticky. Common macro-, many mesopores. Clear, smooth boundary.

AC 12-59 cm. Grayish brown to light brownish gray (10 YR 5,5/3) fine gravelly loamy sand, very pale brown (10 YR 7/3) when dry. Calcareous. Waterworn, dark brown pebbles and fragments of shells. Weak, coarse, subangular blocky structure. Soft, very friable, slightly plastic to non-plastic, slightly sticky to non-sticky. Many macro-, many mesopores. 2 Krotovinas. Diffuse, smooth boundary.

C1ca 59-103 cm. Pale brown (10 YR 6/3) fine gravelly loamy sand, very pale brown (10 YR 7,5/3) when dry. Calcareous, Waterworn pebbles, coated with lime, have lime pendants at their lower side. Weak and moderate, coarse subangular blocky structure. Slightly hard to soft, friable, slightly plastic, slightly sticky. Few macro-, common mesopores. Clear wavy boundary.

C2ca 103-115 cm. Pale brown (10 YR 6/3) fine gravel, very pale brown (10 YR 7,5/3) when dry. Between the waterworn black fine pebbles occur loamy material and much fragments of shells. Pebbles are coated with lime and have lime pendants. Weakly cemented. Hard and slightly hard, friable, non-plastic and non-sticky. Few macro-, few mesopores. Gradual wavy boundary.

C3 115-150 cm. Pale brown (10 YR 6/3) fine gravel, very pale brown (10 YR 7,5/3) when dry. Thin layers of loamy sand and thin layers of fragments of shells occur. Single grain. Loose when dry, loose when moist, non-plastic, non-sticky. Few macro-, common mesopores.

Diagnostic horizon : Ochric epipedon.

Soil classification : Orthic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile no. 12.
Soil series : Apak series. Map unit : Tp 1.1. Survey no. P40.
Area : Plain of Karapınar, Great Konya Plain, Central Anatolia, Turkey.
Location : 1,8 km S.-ward from Apak Y (68,9 latitude, 41 longitude).
Elevation : 1025 m.
Physiography : Limestone platform.
Topography : Subnormal relief. Slope : Gently sloping.
Parent material : Residuum of hard and soft limestone.
Landuse : Fallow arable land. Dry farming. Rye, wheat.
Groundwater depth : ca. 40 m.
Drainage condition : Somewhat excessively drained.
Irrigation : none. Salinity : no efflorescence of salts.
Human activity : Plowing and angular cobble stones are removed from the surface soil.
Biological activity : No Krotovinas.
Root distribution : 0-40 cm Few roots, decreasing downward.
Vegetation : Few Peganum harmala and few thistles.

Profile description :
Ap 0-20 cm. Brown to pale brown (10 YR 5,5/3) angular cobbly sand, very pale brown (10 YR 7/3) when dry, Carbonatic. Single grain and very weak, very fine sub-angular blocky structure. Soft, very friable non-plastic non-sticky. Few macro-, common mesopores. Clear, smooth boundary.

AC 20-50 cm. Pale brown to very pale brown (10 YR 6,5/3) angular cobbly loamy sand, very pale brown (10 YR 8/3) when dry. 40% of the horizon is occupied by calcareous, angular cobble stones. Carbonatic. Weak, very fine subangular structure. Soft to slightly hard, very friable non-plastic, non-sticky. Few macro-, few mesopores. Gradual, wavy boundary.

C1 50-150 cm. Very pale brown (10 YR 8/3) and white (10 YR 8/2) sand and soft chalky limestone, white (10 YR 8/0) when dry. 60% of the material are angular cobblestones of hard limestone. Carbonatic. Weak, medium, angular blocky structure. Hard, firm non-plastic, non-sticky. Very few macro-, few mesopores. Gradual, wavy boundary > 150 cm. Limestone bedrock.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile no. 13.
Soil series : Karataş series. Survey nr.P30. Map unit : Tp 2.1.
Area : Plain of Karapınar, Great Konya Basin, Central Anatolia, Turkey.
Location : 700 m S.S.E.-wards from Apak Y.
Coordinates : 41,4 longitude, 70,1 latitude.
Elevation : 1014 m.
Physiography : Ancient beach at the edge of the limestone-platform.
Topography : Subnormal relief. Slope : nearly level.
Parent material : Carbonatic gravelly beach deposits.

Drainage condition : Somewhat excessively drained.
Groundwater : ca. 20 m. Salinity : Free of excess of salt.
Irrigation : none. Stoniness : Class 0.
Landuse : Arable land, dry farming (rye, wheat), fallow.
Rootdistribution : 0 - 50 cm plentiful roots, decreasing downward.
Biological activity : Krotovinas and cocoons of insects and rounded earthy casts of ca. 2 mm diam.
Human activity : Plowing.

Profile description :

Ap 0-20 cm. Brown (10 YR 5/3) finely gravelly, fine sand with shellfragments, pale brown to very pale brown (10 YR 6,5/3) when dry. Rounded limestone pebbles. Weak very fine, subangular blocky structure. Carbonatic. Soft, very friable, slightly plastic, non-sticky. Many macro-, many mesopores. Clear smooth boundary.

A1 20-65 cm. Brown (10 YR 5/3) gravelly, loamy fine sand with shell fragments, pale brown to very pale brown (10 YR 6,5/3) when dry. Rounded pebbles. Carbonatic. Weak, fine subangular blocky structure. Slightly hard, friable, slightly plastic, non-sticky to slightly sticky. Clear, wavy boundary.

II C1 m ca 65-75 cm. White (10 YR 8/2) finely gravel. Very thick and thick, platy structure. Carbonatic. Weakly and strongly cemented. The diameter of the rounded pebbles is mostly about 2 cm and lime pendants are below the pebbles. Shellfragments. Clear smooth boundary.

II C2 75-150 cm. Stratified white (10 YR 8/2) finely gravel. Rounded limestone pebbles. Massive. Shellfragments.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthic Psammustent.

Described by : A.F. Groneman.
Date : June 1965.

Profile no. 14.

Soil series : Karataş. Map unit : Tp 2.2. Survey no.: P50.
Area : Plain of Karapınar, Great Konya Basin, Central Anatolia, Turkey.
Location : 600 m northwest-ward from Karataş (42,4 longitude, 69,3 latitude).
Elevation : 1008 m.
Physiography : Ancient beach at the edge of the limestone platform.
Topography : Subnormal relief. Slope : Gently sloping.
Parent material : Sandy beach deposits.
Landuse : Arable land. Dry farming (wheat, rye).
Groundwater depth : ca. 20 m.
Drainage condition : Somewhat excessively drained.
Irrigation : none. Human activity : Plowing.
Biological activity : No Krotovinas.
Rootdistribution : 0-50 cm few fine roots.
Vegetation : Wheat.

Profile description :

Ap 0-15 cm. Pale brown (10 YR 6/3) loamy sand, very pale brown (10 YR 7/3) when dry. Some rounded finely pebbles. Carbonatic. Very weak, medium, subangular blocky structure and single grain. Soft and loose when dry, very friable, non-plastic, non-sticky. Few macro-, common mesopores. Clear wavy boundary.

A1 15-30 cm. Pale brown (10 YR 6/3) loamy sand, very pale brown (10 YR 7/3) when dry. Some rounded finely pebbles

and few fragments of shells. Carbonatic. Weak, medium, subangular blocky structure. Soft, very friable, non-plastic, non-sticky. Few macro-, common mesopores. Gradual, smooth boundary.

C1 ca 30-80 cm. Light brownish gray to light gray (10 YR 6,5/2) sandy loam, white (10 YR 8/2) when dry. Some finely rounded pebbles, and fragments of shells. Carbonatic. Moderate, medium, subangular blocky structure. Slightly hard to hard, friable, slightly plastic, non-sticky. White (10 YR 8/0-2) segregation of lime. Few macro-, common mesopores. Clear, smooth boundary.

C2 80-150 cm. Pale brown to very pale brown (10 YR 6,5/3) stratified sand and sandy loam very pale brown (10 YR 8/3) when dry. Some rounded pebbles and fragments of shells. Carbonatic. Single grain. Loose when dry. Loose when moist, non-plastic, non-sticky.

Diagnostic horizon : Ochric epipedon.
Soil classification : Orthustentic Psammustent.
Described by : A.F. Groneman.
Date : June 1965.

Profile no.15.
Soil series : Ecelertolu series. Map unit : Tp 3.1.
Survey no. P36.
Area : Karapınar, Great Konya Basin, Central Anatolia, Turkey.
Location : 500 m northward from Apak Y. 20 m westward from the fence. (41 longitude, 71,5 latitude).
Elevation : ca. 1008 m.
Physiography : At the footslope of the escarpment of the limestone platform.

Topography : Subnormal relief. Slope : Gently sloping.
Parent material : Colluvium from the limestone platform over abrasion deposits.
Drainage condition : Somewhat excessively drained.
Irrigation : None. Stoniness : class 3.
Groundwater depth : ca. 25 m.
Landuse : native pasture.
Biological activity : Many old cocoons, casts of insects and few channels.
Rootdistribution : Plentiful roots, decreasing to 115 cm.
Vegetation : Peganum harmala. (Üzerlik).

Profile description :

A11 0-12 cm. Brown to pale brown (10 YR 5,5/3), loamy coarse sand with calcareous pebbles and calcareous angular cobblestones, very pale brown (10 YR 7,5/3) when dry. Weak, thin, platy structure. Soft, very friable, non-plastic, non-sticky. Few macro-, common mesopores. Abrupt, smooth boundary.

A12 12-20 cm. Brown to pale brown (10 YR 5,5/3) loamy coarse sand with calcareous finely pebbles and calcareous angular cobblestones, very pale brown (10 YR 7,5/3) when dry. Weak and moderate, coarse, angular blocky structure. Slightly hard, very friable, non-plastic, non-sticky. Few macro-, common mesopores. Plentiful roots. Clear wavy boundary.

B21 20-60 cm. Light brownish gray to light gray (10 YR 6,5/2) very fine sandy loam, light gray to white (10 YR 7,5/2) when dry. Carbonatic. Moderate, medium, granular structure. Many cocoons and few channels and rounded earthen casts of < 1 mm diameter. Plentiful roots. Slightly hard, friable, slightly plastic, non-sticky. Many macro-, many mesopores. Abrupt, irregular boundary.

II B22 60-90 cm. Light brownish gray to light gray (10 YR 6,5/2) very fine sandy loam, light gray to white (10 YR 8/2) when dry. Carbonatic. Moderate, coarse subangular blocky structure. Hard to slightly hard, friable to firm, slightly plastic, slightly sticky. White (2,5 Y 8/0-2) common coarse faint lime segregations. Few macro-, common mesopores. Few roots. Gradual wavy boundary.

Ca

II C1 90-115 cm. Light brownish gray (2,5 Y 6/2) loam, light gray to white (2,5 Y 7,5/2) when dry. Carbonatic. Moderate coarse, angular blocky structure. Hard, firm, plastic, slightly sticky. Few macro-, common mesopores. Very few roots. Abrupt irregular boundary.

II C2 115-200 cm. Light brownish gray to light gray (2,5 Y 6,5/2) very fine stratified sand, white (2,5 Y 7,5/2) when dry. Carbonatic. Layers of shells and shell-fragments. Massive. Slightly hard, very friable, non-plastic, non-sticky. Very few macro-, few mesopores. Few, fine and medium distinct rust mottles.

Diagnostic horizons : Ochric epipedon.
Cambic horizon.

Soil classification : Orthic Canborthid.

Described by : A.F. Groneman.

Date : June 1965.

Appendix III

Plants, which may occur in the Great Konya Basin, listed by ZHUKOVSKY, P. and H. BIRAND.

Androsace maxima, Alyssum desertorum, Salicornia herbacea, Triglochin maritima, Kochia prostrata, Frankenia sp., Antriplex sp., Helocharis sp., Statice sp..
Bromus tectorum, B. scoparius, Poa bulbosa, Agropyron orientale, Elymus caput medusae, Festuca ovina, Xeranthemum orientale, Scabiosa anatolica, Centaurea depressa, C. mixta, C.solstitialis Stachys lavandulaefolia, Linum anatolicum, L. flavum, Helianthemum salicifolium, Saponaria prostata, Astragalus atropurpureus, A. collinus, Anchusa hybrida, Salvia ceratophylla S. syriaca, Alyssum murale, A. campestre, A. strictum, A. tortuosum, Anthemis montana, A. widemanniana, Valerianella vesicaria, Rochelia stellulata, Adonis flammea, Zizyphora tenior, Camelina sp., Achillea santolina, Androsace maxima, Hypecoum procumbens, Moltkia coerulea, Wiedemannia orientalis, Galium coronatum, Roemeria hybrida, Crocus sp., Gagea sp., Muscari sp., Ornithogalum sp., Ranunculus türleri, Matthiola oxyceras, v.s..
Thymus squarrosus, Artemisia fragrans, Salvia cryptantha, Noea spinosissima, Frankenia sp..
Senecio vernalis, Veronica multifida, Geranium tuberosum, Anchusa hybrida, Ajuga chia, Scorzonera mollis, Salvia syriaca Cephalaria syriaca, Onosma asperum, Lepidium draba, Sisymbrium

altissimum, Thlaspi perfoliatum, Cirsium acarna, Xanthium spinosum, Onopordum acanthium, Beta trigyna, Ranunculus cuneatus, Boreava orientalis, Hordeum murinum, Hyoscyamus niger, Carduus nevileri v.s..

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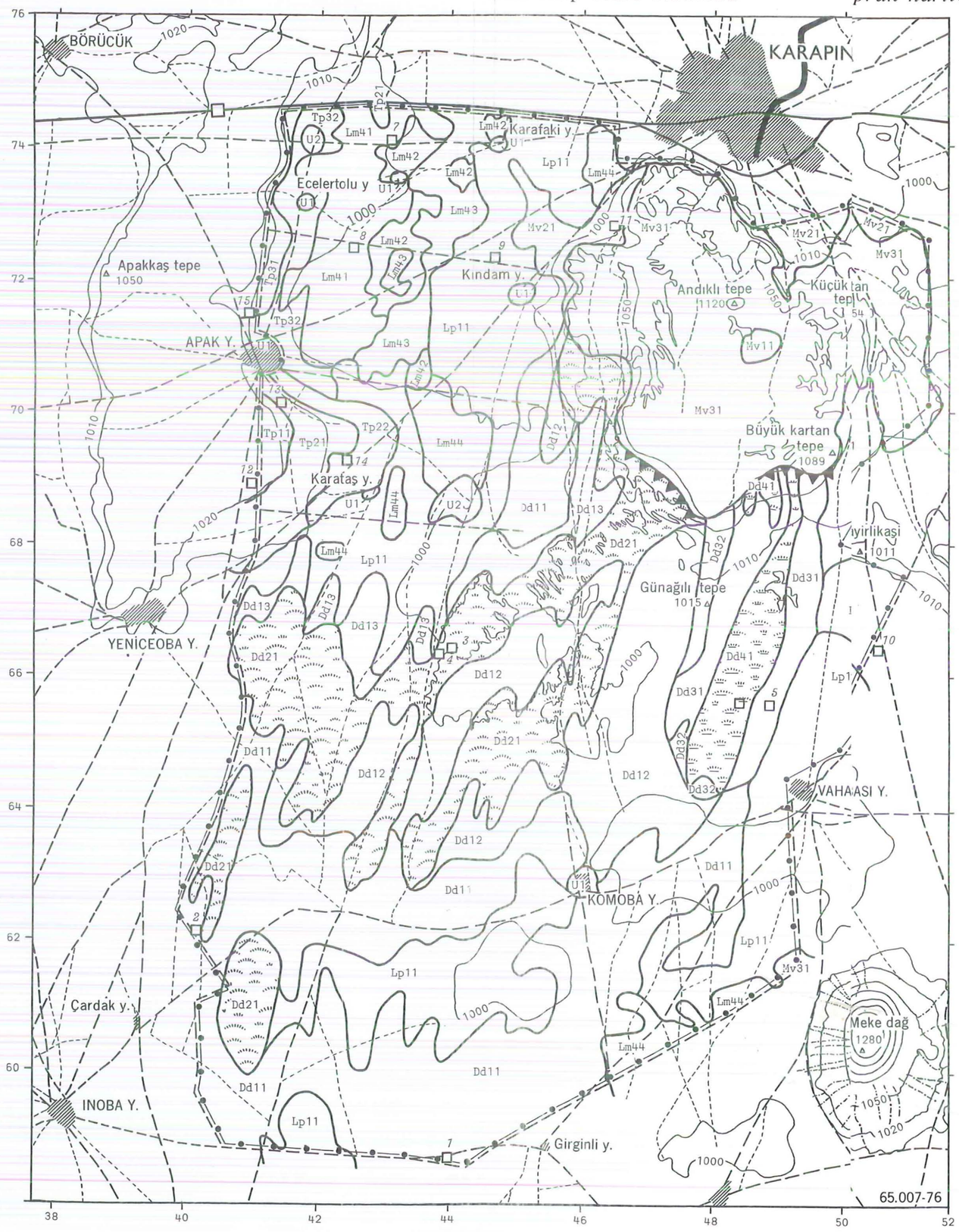
TOPRAKSU WIND EROSION CONTROL CAMP AREA

Soil map scale 1:50.000

TOPRAKSU RÜZGÂR EROZYONU KONTROLU ÇIFTÇI EĞİTİM KAMPI

Toprak haritası ölçek 1:50.000



LEGEND *LEJAND*

D AEOLIAN SANDPLAIN
RÜZGARLARLA MEYDANA GELEN KUMLU SAHA

Dd Shifting and stabilized sand dunes
Bir yerden taşınarak başka bir yere yerleşmiş ve oturmuş kum tepeleri

Dd.1 Komoba A and B series
Komoba A ve B serileri

- Dd.1.1 Komoba complex, stabilized sandy soils, low hummocky
  Komoba kompleksi, stabilize kumlu topraklar, küçük dalgalı
- Dd.1.2 Komoba complex, sandy soils, wind eroded phase
  Komoba kompleksi, rüzgarlarla aşınarak meydana gelmiş kumlu topraklar fazı
- Dd.1.3 Komoba complex, sandy soils, overblown phase, high hummocky
  Komoba kompleksi, kumlu topraklar, örtülü faz, yüksek dalgalı
- Dd.2.1 Active dune land
  aktif kumlu saha

Dd.3 Gunagili A and B series
Gunagili A ve B serileri

- Dd.3.1 Gunagili complex, stabilized dark sandy soils, low hummocky
  Gunagili kompleksi, stabilize koyu renkli kumlu topraklar, alçak dalgalı
- Dd.3.2 Gunagili complex, dark sandy soils, wind eroded phase
  Gunagili kompleksi, koyu renkli kumlu topraklar, rüzgar erozyonuna uğramış fazı
- Dd.4.1 Dark active dune land
  Koyu renkli aktif kumlu saha

L LACUSTRINE PLAIN
GÖLLERDEN HASIL OLAN SAHA

Lm Marl soils
Kireçli topraklar

Lm.4 Karafaki series
Karafakı serisi

- Lm.4.1 Karafaki clayey soils
  Karafakı killi toprakları
- Lm.4.2 Karafaki clayey soils, phase with few to common low sandhills
  Bazı yerlerde umumiyetle alçak kum tepecikleri bulunan karafakı killi topraklar
- Lm.4.3 Karafaki sandy soils, phase with common to many low sandhills
  Karafakı kumlu toprakları, genellikle çok alçak kumtepeleri bulunan fazı
- Lm.4.4 Karafaki sandy soils
  Karafakı kum toprakları

Lp Soils of the sandplain
Kum ovasının toprakları

Lp.1 Kindam series
Kindam serisi

- Lp.1.1 Kindam sandy soils
  Kindam kumlu toprakları

Lp.2 Kayırlıkası series
Kayırlıkası serisi

- Lp.2.1 Kayırlıkası dark gravelly sandy soils
  Kayırlıkası koyu çakıllı kumlu topraklar

Mv VOLCANIC MOUNTAINS
VOLKANİK DAĞLAR

Mv Soils of volcanic mountains and hills
Volkanik dağların ve tepelerin toprakları

Mv.1 Andıklı series
Andıklı serisi

- Mv.1.1 Andikli angular cobbly sandy soils
  İçinde büyük köşeli taşlı kumlu topraklar

Mv.2 Kartan series
Kartan serisi

- Mv.2.1 Kartan gravelly sandy soils
  Kartan çakıllı kumlu topraklar
- Mv.3.1 Basalt rock land
  Bazalt kayalarʼdan meydana gelmiş arazi

T LIMESTONE PLATFORM (TERRACES.4)
KİREÇ TAŞINDAN MEYDANA GELEN PLATFORM

Tp Soils of flat terraces
Düz teras toprakları

Tp.1 Apak series
Apak serisi

- Tp.1.1 Apak angular cobbly sandy soils
  Apak köşeli iri taşlı kumlu topraklar

Tp.2 Karataş series
Karataş serisi

- Tp.2.1 Karataş gravelly sandy soils
  Karataş çakıllı kumlu topraklar
- Tp.2.2 Karataş sandy soils
  Karataş kumlu topraklar

Tp.3 Ecelertolu series
Ecelertolu serisi

- Tp.3.1 Ecelertolu complex, angular cobbly sandy soils
  Ecelertolu köşeli taşlı kumlu topraklar
- Tp.3.2 Ecelertolu complex, sandy soils
  Ecelertolu kompleksi, kumlu topraklar

U MAN DISTURBED LAND
İNSANIN MÜDAHALE ETTİĞİ ARAZİ.

- U.1 Recent man disturbed land.
  Yakın zamanda insanın müdahale ettiği arazi.
- U.2 Ancient man disturbed land.
  Geçmişte insanın müdahale ettiği arazi.

Main road (asphalt)
Esas yol (asphalt)

Track
Tali yol-'iz

Drainage canal
Drenaj (boşaltma) kanalı

Gully
Sel yatağı

Fence and boundary of the Erosion Camp Area
Erozyon kamp sahasının hudutları ve çitleri

Escarpment
Dik meyil

1000 Contour Line (meters above sea level)
Tesviye çizgisi (yükseklik çizgisi)

Town or village
Kasaba veya köy

Described soil profile (Report, Append. II)
Tasnif edilmiş toprak profili (Rapor, EK. II)

Boundary of the map unit
Harita ünite hududu

Konya project *Konya projesi*

soil survey 1965 by A.F.Groneman — Agricultural University Wageningen Holland

A.F.Groneman tarafından yapılmıştır — *Devlet Ziraat Üniversitesi Wageningen Hollanda*