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APPLICATION OF SPACE PHOTOGRAPHS FOR GEOMORPHOLOGICAL STUDY: TAURUS MOUNTAINS, TURKEY

By

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APPLICATION OF SPACE PHOTOGRAPHS FOR GEOMORPHOLOGICAL STUDY: TAURUS MOUNTAINS, TURKEY

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INTRODUCTION

This paper concerns the potentialities of space photographs for the analysis of the geomorphology of an area, which has been mapped with detailed geological information. The area under discussion is the central part of the Taurus Mountains and the southern part of central Anatolia. This area will be analyzed and divided into geomorphological units. The major discussion concerns the function of the space photographs in the geomorphological study.

GEOGRAPHIC LOCATION

The area under study lies between 32° and 34° east longitude; bounded on the south by the Mediterranean Sea on the north by Tuz-Golu. The total area is approximately 60 000 square kilometers. The length is 300 kilometers, and the width is 200 kilometers. The area is known as the Anatolian Plateau and the Taurus Mountains. The maximum elevation is at the peak of Hasan Dag (3253 meters).

SOURCE MATERIAL

Two sources for the geomorphological research were used — geological maps and space photographs. The geological map[1] used (scale of 1:800,000) lacks any structural information; but it has a very detailed delineation of the geological formation, mainly according to the age and, in some cases, according to the lithology. The subdivisions are as follows.

1. The Paleozoic has been divided into 11 subdivisions.

2. The Mesozoic has been divided into 13 subdivisions.

3. The Tertiary has been divided into 13 subdivisions.

4. The Quaternary has been divided into three subdivisions.

5. The igneous and volcanic formations have been divided into eight subdivisions.

The contour lines are separated by 500-meter intervals. The delineation of the geological formation is extremely refined because some cases exist where time relicts of outcrops, with less than 1-kilometer cross section, were mapped.

A mosaic photograph of the area under discussion is shown in figure 1; a stereogram photograph of the same area is shown in figure 2. The photographs were taken in the 85th orbit of Gemini V on August 27, 1965, at 05:26 g.e.t. The photographs were taken with the 80-millimeter Hasselblad camera (model 500C, f:2.8). Ektachrome and Anscochrome films were used. The distance from earth was between 100 miles (perigee) and 215 miles (apogee). The photographs are oblique.

GEOMORPHOLOGICAL ANALYSIS OF THE AREA

The geological map does not indicate any definite subdivision of the area into geomorphological units. The map indicates that the area is subdivided into a northern part, a compact plateau, a southern part, a dissected plateau, and a northwest-southeast-trended mountain strip in

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[1]Turkiye Jeolojik Hartasi, iv-Konya Paftasi, published in Ankara, Turkey, 1944. More detailed geological and geographical studies have been made by Madan Totkik ve Arama Enstitusu, Ankara, by Istanbul University, and by Ankara University, but that information was not available to the author.

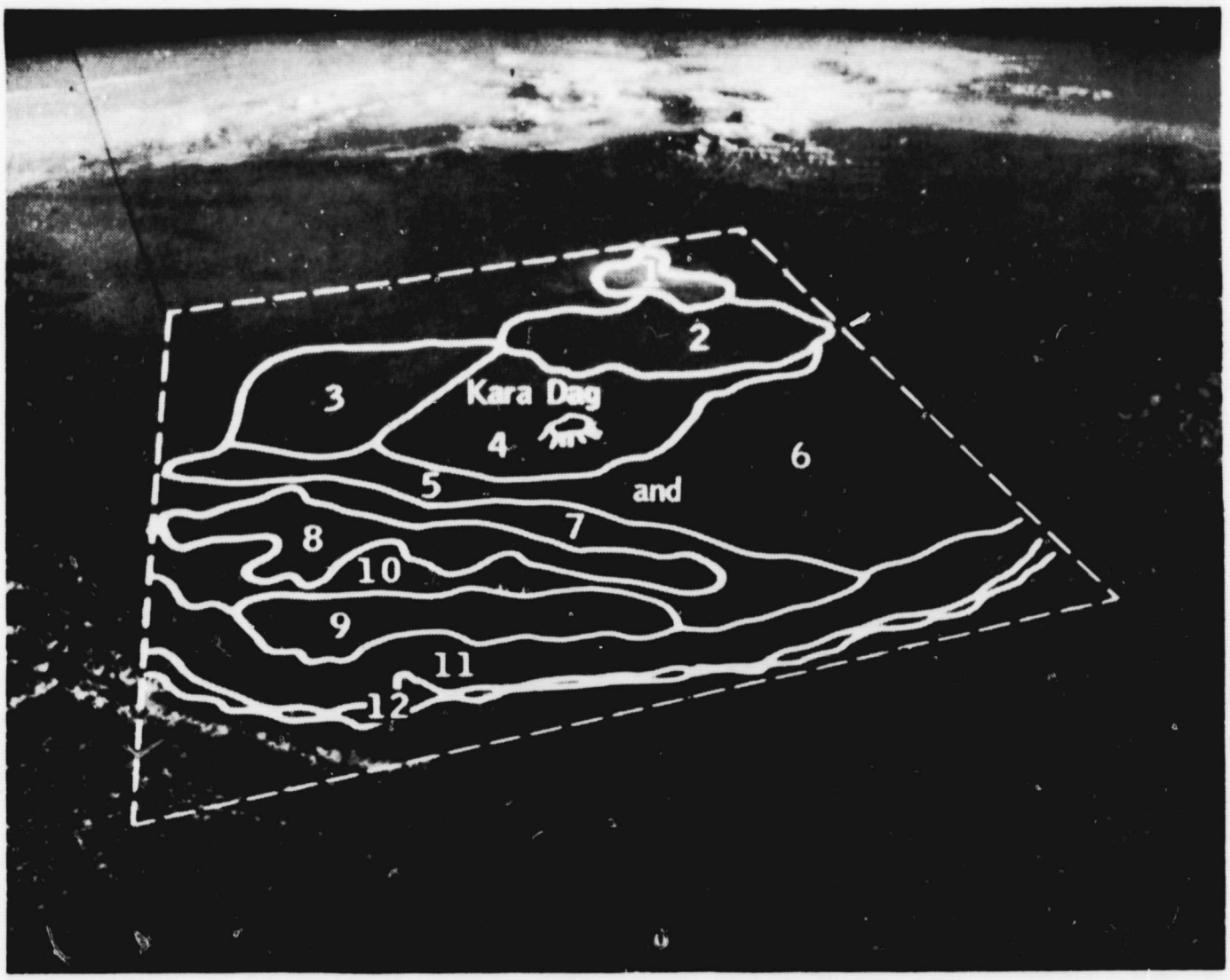

Figure 1.- Mosaic of Anatolian Plateau, the Taurus Mountains, and the delineation of the subgeomorphological regions (Gemini V mission photographs NASA-S-65-45500/1, black and white).

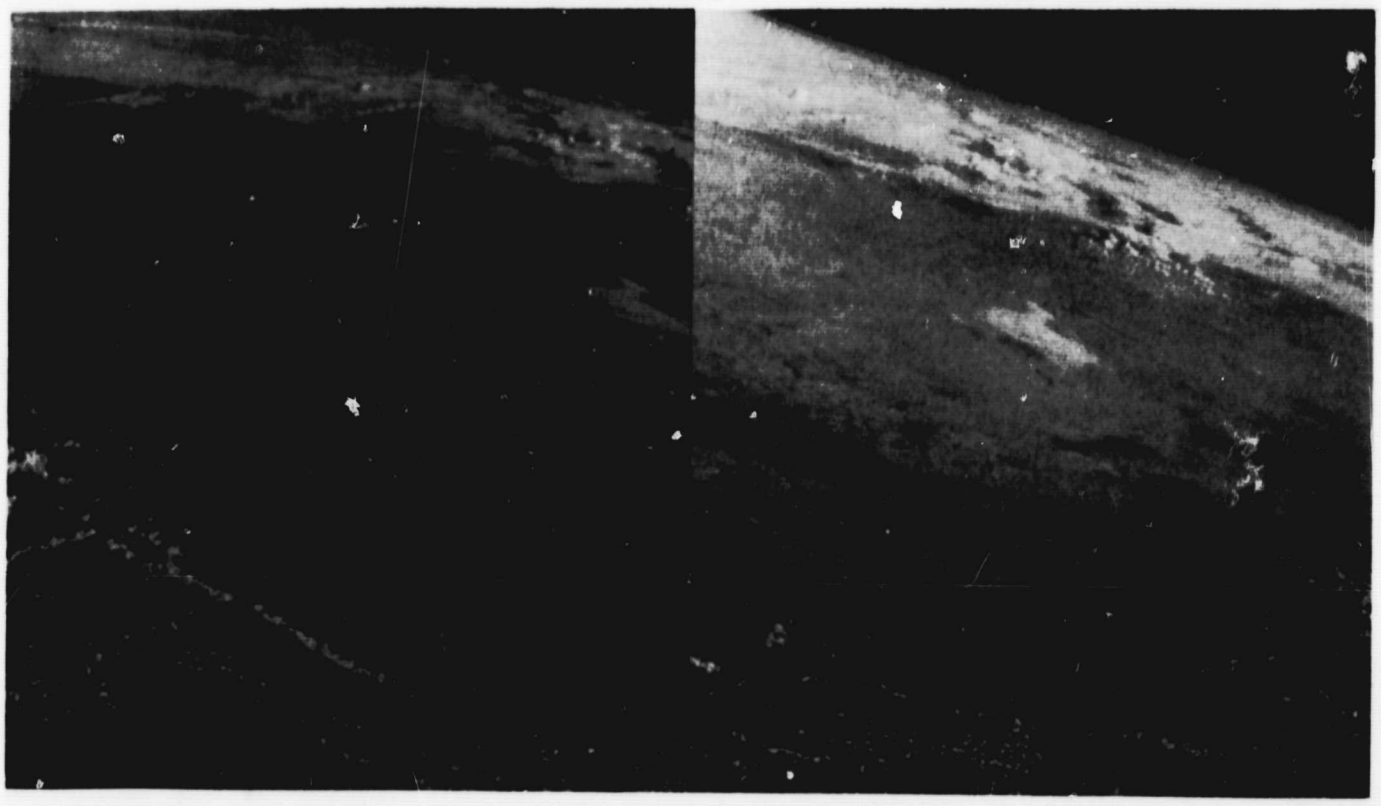

Figure 2.- Stereogram of Anatolain Plateau and the Taurus Mountains (Gemini V mission photographs NASA-S-65-45555/6, color).

the southwest. Any further subdivision is possible only on the basis of speculation, without any evident justification. By the application of the space photographs, it is suggested that the area should be subdivided into the following subgeomorphological units.

1. Tuz-Golu (Tuz Lake)
2. Lacustric Plain
3. Konya Ovasi
4. Kara Ovasi
5. Alaca-Buzlu mountain strip
6. Bu Ergi Plateau
7. Trough
8. Mahra Plateau
9. Kizil Plateau
10. Goksu Valley
11. Southern slopes
12. Coastline and the alluvial fans.

Tuz-Golu (Tuz Lake) is a salt lake which is located 300 kilometers from the southern coast at an elevation of 900 meters. The dimensions of the lake are approximately 40 by 80 kilometers; thus, the lake can be seen readily from the space photographs. It is obvious from the space photographs that the lake has two basins, a small northern basin and a large southern basin. This information is available from the geological map and the space photographs, but only the space photographs indicate that the southern basin has a salt concentration which is not homogeneous. The photographs also offer some solution as to what factors determine the shape of the lake. Structural lines seem to shape the southwestern side and the northeastern side, along which rock outcrops can be seen. This hypothesis requires ground-truth verification.

The huge Lacustric Plain can be seen better on the geological map than on the space photographs. The plain extends from the lake toward the south approximately 100 kilometers. The boundaries of the plain are lithological on the map, but the boundaries are seen as morphological on the space photographs. The surface of the terrain elevates gradually

toward the south and elevates suddenly toward the southwest and southeast. This landform information is lost on the map.

The Konya Ovasi is an internal basin which is surrounded on three sides by elevated terrain. The space photographs indicate that this basin is surrounded completely and that it would be better to limit the extent of the basin eastward. The real landform boundary is the upper branches of Carsamba Suyu, (Carsamba stream). Also, the space photographs indicate that part of the boundaries of the basin are structural straight lines. In the north, Boz Dag (1544 meters) overlooks that line. Both the geological map and the space photographs indicate that volcanic rocks and tuffs are important landmarks in the western side of this basin.

The Kara Ovasi is separated by a ridge from the previously mentioned basin. The ridge is not represented on the geological map. In this area, some landforms are dominant in the landscape. By far, volcano Kara Dag is the most important in landscape; it stands out on the geological map and in the space photographs. Also, a nearby lake is an important landmark. Although the upper branches appear on the geological map, the space photographs indicate, in a more effective way, that this stream is transversal, deeply cut into the terrain. The valley of the stream appears to have a gorge form.

The Alaca-Buzlu mountain strip has a width of approximately 20 to 25 kilometers and a length of 150 kilometers. By using only the geological map, it is hard to describe the morphology, although it is obvious that the northern part consists of volcanic rocks, that the central part consists of Mesozoic and partly Paleozoic rock formations, and that the southern part consists of Tertiary rock formation. The space photographs help to define the morphology. The northern and southern parts are compact plateaus, but the central part is a rough dissected mountain. The southern plateau, as can be seen readily on the space photographs, extends to the Mediterranean Sea and consists of Miocene Limestone rock formation. The Miocene Limestone rock formation can be inferred from the geological map; but, this plateau has precipitous edges toward the southwest, south, and southeast which can be obtained from the space photographs only. This fact is vividly illustrated by the space photographs under study.

The trough is a deep valley which extends along the southwest mountainous strip. The direction of the axis of the trough is northwest southeast, which can be seen readily on the geological map and the space photographs. But, again, details as to the landform features (especially the length) can be obtained more accurately from the space photographs. The space photographs also might possibly suggest a solution as to the origin of Sugla Golu Lake and Beysehir Golu Lake, both of which are over 1000 meters above sea level in the bottom of the trough.

The Mahra Plateau is the northern part of a plateau dissected by the Goksu Cayi stream, which culminates to 1390 meters at Mahara Dag. The plateau is extensively dissected in the northern part, where a huge erosional circe has developed. In the geometric center, a stream has cut a deep gorge in the plateau, which is the southwestern branch of the Goksu Cayi. Toward the southeast, it is less dissected and looks like a solid plateau.

The Kizil Plateau is the southern part of the plateau which is dissected by the Goksu Cayi and culminates to 2257 meters above sea level at Kizil Dag. This plateau is solid and flat in the western side and is dissected in the eastern edge, as can be seen from the geological map and from the space photographs. Additional important information supplied by the space photographs is that the plateau has sharp edges and precipitous cliffs around three sides. The space photographs vividly illustrate that the Miocene deposits rest unconformably on the earlier formations. This information could not be extrapolated from the map.

The Goksu Valley is the gap between the previously mentioned plateaus. The valley has partly a gorge form and partly a canyon form. The walls are steep, and the bottom of the stream has cut deeply into the plateau formation. The fan-shaped outlet of this stream into the sea can be seen readily on both the geological map and the space photographs; but the map deviates somewhat from the real shape of the plain near Silifke.

The southern slopes are the most obvious element on the space photographs and the less impressive feature on the geological map. The space photographs readily indicate the reason for the lack of a coastal plain; this information cannot be obtained from the geological map.

The coastline and the alluvial fans are obvious landforms on the space photographs, which demonstrate the extent to which the map is generalized. Also, these landform elements explain the limited number of settlements along the coast.

CONCLUSIONS

The following conclusions were drawn as a result of this study.

1. It seems that such a refined landform classification could not be achieved only by the geological map.

2. For the interpretation and classification of huge areas, hundreds of aerial photographs are needed; and still, a general idea could not have been obtained from them. Therefore, space photographs are preferable.

3. On the other hand, various morphological regions can be delineated on the space photographs, but the space photographs cannot describe accurately the specific features without the geological map.

4. The comparison of the landform features on the space photographs with the information on the geological map indicates that space photography might help to eliminate mistakes in geological mapping, because in many cases in this study, the geological map deviated from the features outlined on the space photographs.

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