

Overview of Valley Types Formed by Göksu River (Mersin, Southern Turkey)

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Received August 28, 2019; Accepted October 25, 2019

Abstract: There are various valley types in the rock groups formed from Ordovician to Miocene at the mouth of the Göksu River. Basement rocks in the area are composed of mainly low resistant Miocene mudstone-shale-marl and high resistant chalcarenites and an important or lesser amount of low resistant Ordovician metamorphic rocks; medium to high resistant Upper Devonian-Upper Cretaceous clastic and carbonate rocks. The types of valley with wide and gentle floor (broad valley) is dominant in the Langhian-Tortonian low resistant mudstone-shale-marl-clayey limestone in the Mut and surrounding area. These rock groups have cropped out in the undulated morphology and as low dipping strata. The deposition of the thick alluvial materials in the bottom of the Göksu River caused the developing of the many small-scale planes along the Göksu Valley. A canyon valley in 2.5 km long was also developed in the Miocene chalcarenites showing plentiful joints and strongly porous nature that were observed in the Evkaçiftliği and Kargıcak villages, in the central part of the study area. A very thin alluvial cover composed of pebbles-sands and muds was deposited at the bottom of the canyon. The valleys developed on the Paleozoic-Mesozoic clastic and carbonate rocks in the main valley of the Göksu River at the surrounding area of the Değirmendere and Karakaya villages in the western part of the Silifke are narrow floor, anticline and cutting through type valleys. Terrace deposits are clearly observed in the main valley slopes while recent alluvial materials deposited in the bottom of the valley are in the shape of narrow and thin strips. The meander valley types can distinctly be distinguished in the Langhian-Tortonian mudstones-shales-marls and very wide spread and very thick Holocene alluviums of the Göksu delta at the center of the Silifke and surrounding area in the eastern-south-eastern part of the study area.

Keywords: Valley types, broad valley, canyon valley, delta of the Göksu, Holocene alluviums.

Introduction

Göksu River arises from the east of the Söbüçimen Yayla in 2900 m altitude, which is in the Geyik Dağı mountain between Gündoğmuş and Hadim towns of the Central Taurides Orogenic Belt (Demirtaşlı, 1984; Özgül, 1984; Figure 1). It reaches to the Mediterranean Sea in the Silifke Delta after taking a 245 km long road in a hilly terrain, extending NW-SE direction. Mut and Silifke towns are important settlements in the Göksu River route. Valley forms, which are the subject of study, are ground down of the Göksu River. In this part of the river, broad-based-flat, meandering, canyon, with narrow floor, cutting through and anticline valley types and different geological-geomorphological formations and structures are observed (Russel, 1954; Whitten and Brooks, 1972; İzbirak, 1977, 1979; Ardos, 1994; Yağcımlar, 1996; Hugget, 2010; Lutgens and others, 2013; Poort and Carlos, 1992). Broad-based-flat and meandering valleys are predominantly seen in Mut area. This area is characterized by less rugged, flat over which partially flattened hills, ridges and shallow cover as broad valleys. Narrow-based, canyon, cutting through and anticline valleys are more common around the Silifke district showing more high relief. This field consists of hills and ridges that has been deeply split with Göksu main valley and its arm valleys.

Material and Method

The valleys in the ground down of the Göksu River have been studied in a detail. Stratigraphical and lithological properties of the rocks, which is hosting valleys, were carefully observed during the field works. Geometric dimensions, rock types and the position of strata (according to Roberts, 1989) in the

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valley slopes and valley floors were determined during the observational assessments. Scientific interpretation of the data from the study area has been done with this research. The valley types in the region were also distinguished based on the valley systematic. Important valley types in the study area and their characteristic properties will be present below as systematically.



Figure 1. Location map and Google Earth image of study area.

1. Valleys with wide and gentlement floor (broad valley): They were observed in rather Mut region. The valley floor wide is between 500-1000 m. Valley slope is about 10-12 degrees. Langhian-Serravalian formations are located in the valley slopes. This type of valley has been observed in the rather Mut region. The wide of valley floor is between 500-1000 m. These formations are ductile and less rigid layers interbedded claystone- shale and marl-clayey limestone. Average strike and dip values of the layers in area about N 70°W and 20-30°E directions (Figure 2). Slope aspects are to southward and to northward at the northern and southern parts of the Göksu valley, respectively. Miocene rocks in this area therefore show a synclinal structure. The thickness of the Holocene alluvium at the bottom of the valley floor and broad-based valley is about 30-35 m. These alluvial sediments are composed of mainly calcareous well-rounded gravel (20%), sand (10-15%) and silt to clay sized materials (65-70%).

2. Meandering valleys: This type valley can also be seen around the Silifke although it is common in Mut region. The valley floors are 300-500 m wide. Meandering valleys were predominantly formed in the Middle Miocene rocks. The dips of slope in alluvium side, are between 10 and 12 degrees while in the autochthonous rock side, ranges from 20 to 25 degrees. The strikes of the layers are in variable directions in the valley slopes and the dips of the strata are also between 20 and 25 degrees (Figures 3, 4). Valley bottoms were filled with alluvium in the 10-15 m thick. 55-60% of these deposits are mostly well-rounded limestone gravel and sand, while 40-45% is made up of silt and clay sized materials.

3. Canyon valleys: Important canyon of the region is southwest of the village of Kargıcak and Evkafçiftliği of the Silifke towns. This canyon was developed in the Middle Miocene aged, medium-thick bedded, abundant fractured and strongly rigid clastic limestone. Here the wide of the valley floor is 40-50 m, and they have 90-100 m altitude and steep slopes. Strike and dip values of the strata

on the edge of the canyon is close to N 30-40 W/20NE position. The canyon in this region continues nearly 2,5 km NNW-SSE direction (Figure 5).

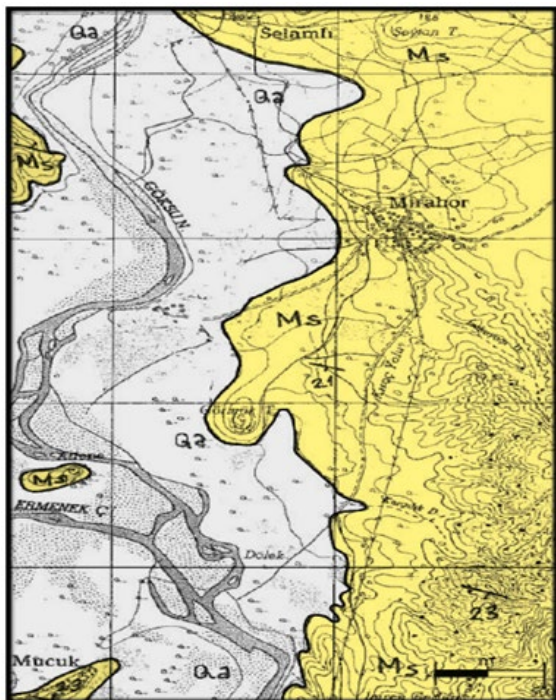


Figure 2. Broad valley and simplified geological map of the Suçatı village of Mut (Ms: Miocene aged claystone-shale and marls, Qa: Quaternary alluviums. The scale line is 500 m and geological map was modified from Akarsu, 1960 and Niehof, 1960).

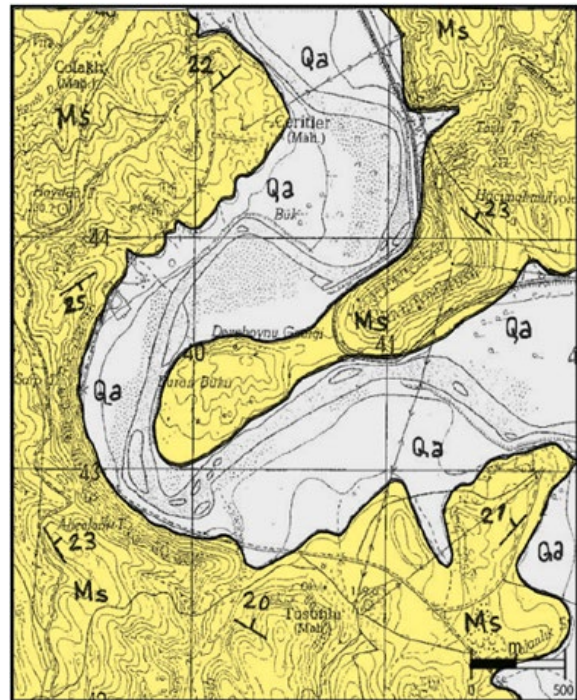


Figure 3 Meandering valley and simplified geological map of the Köseleri village of Mut (Ms: Miocene aged claystone-shale and marls, Qa: Quaternary alluviums. The scale line is 500 m and geological map was modified from Akarsu, 1960 and Niehof, 1960).

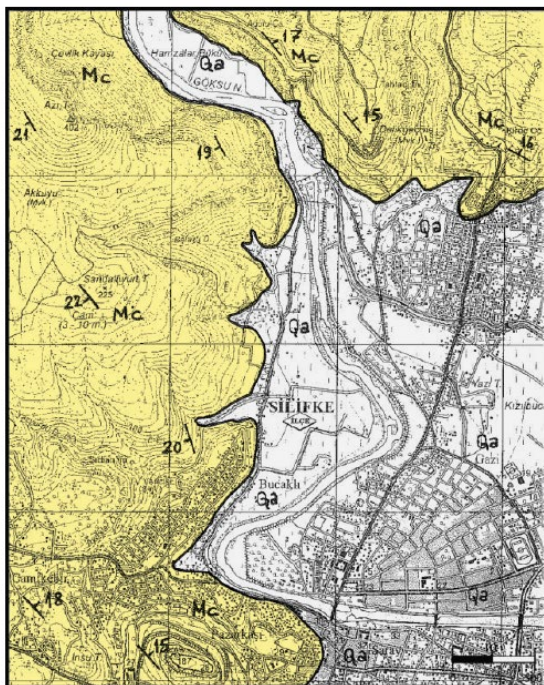


Figure 4. Meandering valley and simplified geological map of the Silifke city centre (M: Miocene aged claystone-shale and marls, Qa: Quaternary alluviums. The scale line is 500 m and geological map was modified from Gökten, 1976).

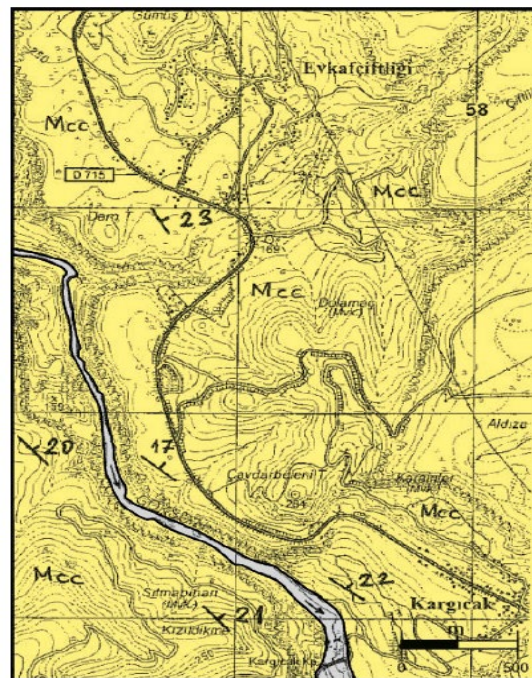


Figure 5. Canyon valley form and simplified geological map of the Kargıcak village of Silifke (Mcc: Miocene aged clastic limestones, Qa: Quaternary alluviums. The scale line is 500 m and geological maps were modified from Akarsu, 1960 and Niehof, 1960).

4. Cutting through valleys: Göksu River between Bilalli distric and Meteris gap passes through a narrow chute of Jurassic-Cretaceous recrystallized limestone showing medium-thick bedded, intense jointed and extremely high strength. In this part, the wide of the valley bottom is 30-35 m. Also inclinations of the slopes are 60-65 degrees. Development of the valley floor is unqualified and in the bottom of the valley, recent sand and gravel deposits with 0,5-1 m thickness can be seen. The valley floor of the splitting valley expands towards both the upstream and the downstream and it takes a similar position to narrow based valley (Figure 7).

5. Anticline valleys: Göksu River flows along the axis of an anticline that is trending E-W in the east of the study area near Bademhayat and Ekşiler villages. Here it cut Upper Devonian-Carboniferous rocks. In this part of the valley floor width is 200-300 m. The valley bottom is covered by alluvial deposits with 5-10 m thickness. This recent cover materials consist of gravels and sands that were well rounded and are in predominantly limestone-dolomite-quartzite composition. There are fossiliferous limestone-dolomite-shale-quartzite layers cropped out on the slopes of valley. In the northern parts of the anticlinal axis, strike and dip of the layers are N 40-50 W/ 50 NE, and also in the southern parts of N 35-40' W / 45' SW (Figure 8).

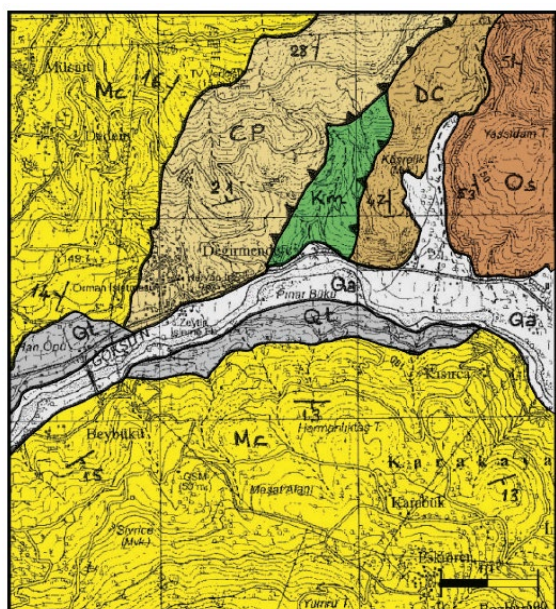


Figure 6. Narrow floor valley form and simplified geological map of the surrounding area (Os: Ordovician schist, DC: Devonian and Carboniferous detritics and carbonates, CP: Carboniferous and Permian sediments, JK: Jurassic-Cretaceous carbonates, Km: Upper Cretaceous ophiolitic melange, Mc: Miocene carbonates, Qt: Quaternary talus, Qa: Quaternary alluviums. The scale line is 500 m and geological map was modified from Turan, 1997 and Turan and others, 2005).

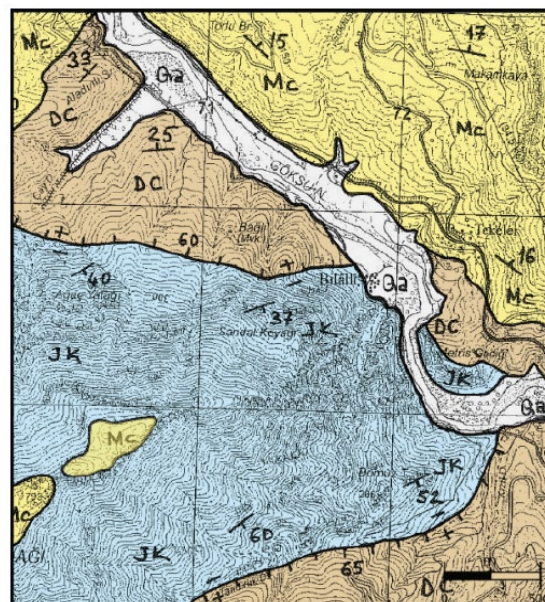


Figure 7. Cutting through and narrow floor valleys forms and simplified geological map of the Değirmende village of Silifke (DC: Devonian and Carboniferous detritics and carbonates, JK: Jurassic-Cretaceous carbonates, Mc: Miocene carbonates, Qa: Quaternary alluviums. The scale line is 500 m and geological map was modified from Turan, 1997 and Turan and others, 2005).

Conclusions:

Main type valleys observed in the valley of the Göksu River between Mut and Silifke towns have been identified by this study

1. Geometric shapes of the valleys located along the Göksu River and their dimensions were determined.
2. Lithology types and stratigraphic levels of the formations, in which the valleys in the area were developed, have been explained.
3. Information on the position of the layers in the formation of the valley (strike and dip values) were given.

4. Data about the width, thickness, particle size and composition of the recent alluvial materials on the bottom of the valleys were presented in the study.

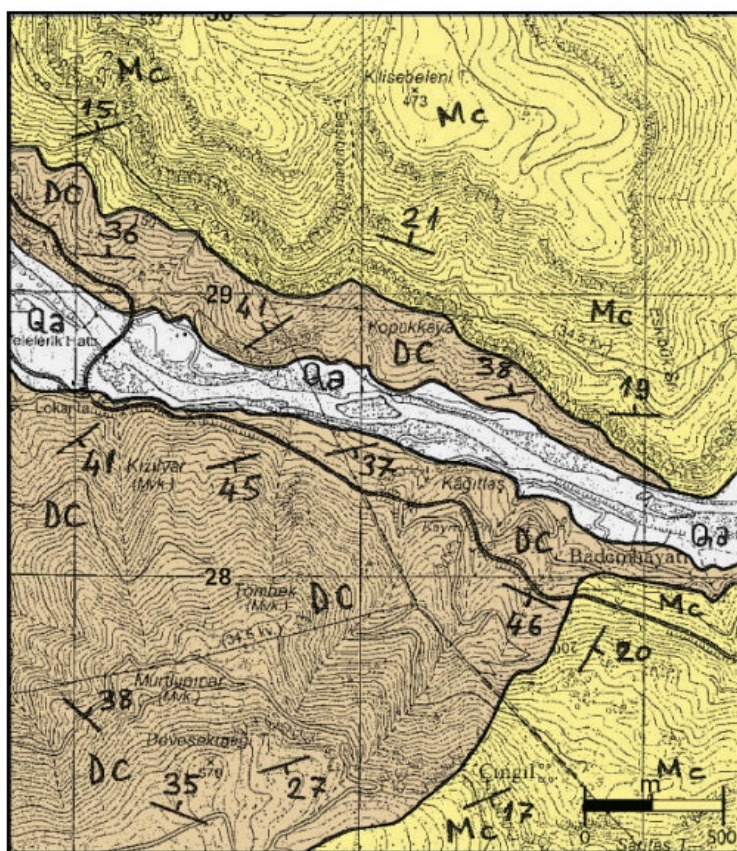


Figure 8. Anticline valley form and simplified geological map surrounding area (DC: Devonian and Carboniferous detritics and carbonates, Mc: Miocene carbonates, Qa: Quaternary alluviums. The scale line is 500 m and geological map was modified from Turan, 1997 and Turan and others, 2005).

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