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# UNIQUE SPIT: KIZKUMU (MARMARIS / TURKEY)

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## ABSTRACT

*Mankind, amazed that he saw around some landforms, filled with feelings of awe and wonder. In fact, such forms are contained in extraordinary art and science of self is not always that we can see elements of topography. For that reason, so that startle people who are, surprise, shock, astonishment, amazement and curiosity are set in motion. A landform that forms similar feelings when it is seen here on the Aegean coast of Turkey, the Gulf of Hisarönü to lie down in the face yet extending on the Kızkumu Spit. The sand spit formed where longshore drift moves large amounts of sand and shingle along the coast, and where the coastline suddenly changes direction to leave a shallow, sheltered area of water. The cycle in regard geomorphologic, at the beginning, yet producing on the surface of the sea Kızkumu Spit and the water level remains under water during an oven 30 cm. The water in a sea of people in their period 420 meters long in an oven that is also flooded stretches of sand to walk on the path made in the sea floor without pressing towards her at this time because that gives the impression he wasn't. Kızkumu a very interesting and attractive place where featured in the sand is not the only situation. Here the mythological legend about the ancient city Bybassos daughter of the King is also legendary. That is why it is visited by thousands of tourists every year as a privileged element geomorphotourizm. Nevertheless, in the last decades, Kızkumu spit stayed under the human activities harm and scatter the sand on it.*

**KEYWORDS:** *Kızkumu, Spit, Geomorphotourism, Geomorphosite, Bybassos, Turkey*

## 1. INTRODUCTION

Rivers are particularly important to many coastal areas because they transport large volumes of sand and stones from farther inland to the sea. Much of this material eventually ends up on the beaches. Mining sand from the river removes material before it can reach the shoreline. Thus, river mining reduces the supply of sand to the beach. In the Hisarönü Gulf, rivers are blocked from entering the sea by sand bars, which are formed by wave action moving sand onto and along the beach. The river is then only able cut a channel through the beach to the sea during a storm or heavy rainfall. After the rain stops, the river mouth is closed naturally by a sand bar. However, even then, freshwater may continue to enter the sea by flowing through the sand beach. Sometimes, a concentration of freshwater forms a large pond behind the sand bar. These sand bars are often favoured places for sand extraction. The excuse is often given that a channel is required to improve drainage, but removing sand from the bar is the same as removing sand from the beach. Sometimes, the river mouth is diverted by a spit. A spit or sandspit is a deposition landform. Consisting of sand and stones and formed by wave action, the spit

is joined to the shore at one end only. It forms by the process of longshore transport (http://fastwindtoaim.blogspot.com.tr).

Waves approaching from a constant direction result in a longshore that moves the sand or stones along the beach face in one direction. The sand spit may grow across the mouth of the river, thereby diverting its path to the sea. River mouths are particularly dynamic areas (http://ihouse.hkedcity.net; http://pr2014.aaschool.ac.uk). They are shaped by waves, tidal and sea processes, and are also acted upon by river processes. Rivers may be influenced by tidal flows. As the tide rises, salt water flows into the river and mixes with the freshwater. This brackish water mixture may extend some considerable distance upstream. In essence while the beaches are pretty, there are a number of fascinating features in the trough (http://www.unesco.org).

An elegant slice of the Keçibükü coastline can be found at Kızkumu Spit (Figure 1). Sand and shingle being transported along the coast by longshore drift will, in time, reach an area where the water is sheltered and the waves lack energy, Orhaniye bay. The material may be temporarily deposited to form Keçibükü beach. Beaches are permanent features; however, their shape can be altered by waves every time the tide comes in goes out. Shingle beaches have a steeper gradient than sandy beaches (http://farm4.staticflickr.com). As spits are elongated deposits of sand or gravel, a spit will usually form at the mouth of a bay due to long shore current and beach drift (Urbano, 2011). Kızkumu spit curve inward towards the bay due to refraction of the waves around the mouth of the Orhaniye bay.

## 2. OBJECTIVES

It's a perfect beach walk offering 420 meters of easy walking with spectacular views. It is the world's most attractive natural sand spit. As the entire spit is also part of the Kocapınar delta, there is a large quantity of marine life. It is home to an abundance of bird and plant life, and also minerals that wash up after storms. The Kızkumu spit is high in value of geomorphosit with the appearance of statues having been formed through natural accumulation by wave, tide and current. These are all sand, clay, and silt and they are all tourist attractions (Coratza and Giusti, 2002; Coratza and Giusti, 2005). The Earth's geomorphological wonders have always fascinated people and many form the basis for protected areas and World Heritage Sites (Ekinci and Doğaner, 2014; Black, 1988; Cavallin etc., 1994; Gray, 2004a; Gray, 2004b; Panizza, 2001.). Yet it was determined that this important geomorphotourism zone has experienced human ruination in the recent past. The sand spit and lithologic formations have been crushed by walking on this zone, which is supposed to be protected. These geographical formations already experience a constant level of erosion due to the effects of the wind, waves, and tides which formed them. Kızkumu spit has not been examined yet in details in terms of geomorphology and tourism. In this research the aim is initially to reveal the formation of this zone in terms of geomorphology and to determine its scientific value. Secondly, to present its potential within the context of geomorphotourism and to analyses it's cultural, and economic values.

## 3. METHODOLOGY

Primarily content analysis of the written and visual documentation was conducted of the Kızkumu spit. Location, landforms information, specifications, pattern of ditribution, the destruction of the surrounding settlements, land use have been identified during land exscursion. So content knowledge development via fieldwork excursions. Maps are prepared using satellite imagery and topographic map sheets.

## 4. GEOGRAPHICAL AREA

The Kızkumu Spit, and the surrounding Hisarönü gulf located on the southwest tip of Anatolia nearly 25 km away from the Marmaris, in the Aegean region, constitutes the subject of this study. The Kızkumu Spit lies along the Orhaniye bay which is an extension of The Hisarönü gulf (Aegean Sea) and is the most accessible part of the Hisarönü gulf (Figure 2).

The Kızkumu spit is a narrow finger from 10 to 30 meters wide of orangery sand, and gravel nearly 420 m in length, shaped from materials eroded by the Kocapınar stream throughout its watershed which then accumulate in the delta and are than carried south into the Orhaniye bay by shore currents. Kızkumu spit is jutting out into the Orhaniye bay on the western edge of the Kayabaşı. It separates Orhaniye bay (Figure 3).

## 5. RESULTS

Two main results were reached. Firstly, it is jeomoroflojik properties. Geomorphological features will be studied in under two sub-titles the effected factors and geomorphological formation and development will be discussed. Secondly, cultural values, spatial use and environmental problems.

### 5.1. EFFECTED FACTORS ON FORMATION OF KIZKUMU SPIT

There are some affected factors on the spit. The shape of coast is controlled by tectonic forces, structure, topography, eustatic changes, rivers, winds, waves, tides, currents, meteorological conditions, and bio factors. A variety of processes have played parts in the formation and configuration of the Kızkumu spit: One of these is without doubt, the location of channels which dispersed the material carried by the Kocapınar stream in land area which makes up its 12 square kilometer catchment area (Figure 4). The

Kocapınar, the stream in the east, starts its journey to the Hisarönü gulf from the highest point of Eren Mountain (842 m). It flows from the Eren Mountain about 6 km through its valley into the Hisarönü gulf of part of the Aegean Sea.

There are Lycian nappes are located in the base of the rocks.Lycian napa is represented by Marmaris ophiolite Napa in the region. There are limestone, cherty limestone, chert, talus, basalt, peridodite, mélange, and alluvium in the Hisarönü gulf basin (Çörekçioğlu et. all, 1997; Ercan, et. all, 1981; Erdem, et. all., 1997). The Kocapınar Stream Basin is surrounded by pelagic, cherty limestone and its connection with the coastal area is secured by the Lower Kocapınar valley, the structural formation of which began towards the end of Mesosoic. Outcrops of ultrabasic rocks surround the northeast of the Orhaniye Gulf (Ersoy, 1991; Ersoy, 1993). Again the coast is composed of sand and gravel formed by the breakdown of rocks such as peridotite (Figure 5).

Tectonic movements in the area occur mostly along faults (Dirik et. all, 2003; Taymaz, et. all., 1991). Faults also extending in the structural direction have formed at places where folding processes have been the most intense (Görür, et. all., 1995). Such processes occurred at the end of Oligocene with resulting structural forms indicate that the Hisarönü gulf and Koca River Valley has a graben character. The gulf of Hisarönü, which is located in the Aegean Extensional Zone of Turkey. This gulf takes place within the regional extensional tectonic regime in N-S directions. The extension of Western Aegean in N-S directions has also formed many other grabens which are perpendicular to grabens in E-W directions.

Again, this fill was not only the result of fluvial processes but also marine conditions (Yeşilyurt and TAner, 2002). Likewise fossils and silt deposits found under the present surficial cover indicate that the Flandr Transgression most probably also occupied the river valleys and bays. A significant amount of submarine sand found at the mouth of the Kocapınar stream Valley and is situated on the shelf have began to form with the Flandr Transgression (Kayan, 1988, Kurt, et. all., 1999; Lambeck, K., 1995). The submarine sand deposition could also be formed during the Flandr Transgression. The present delta of Kocapınar stream develops on the old submarine delta. During its evolution period, frequent directional changes have occured, results of progradational activities (Kaşer, 2004; Kaşer 2010).

The bathymetrical map shows continuation of the Kızkumu Spit up to -5 meters in the off shore part of the delta (Figure 6). The Kız kumu spit is located on this level. The present delta of the Koca River projects toward the Hisarönü gulf (Aegean Sea) from under the water as well. This submarine delta terminates at a depth of -10 meters with a fore part having an inclination of 5°. Isobaths on the near shelf show a parallel extension to the shore in its general outlines. But their extension change direction as the distance from the shore increases. There are marine processes as an affected factor on coastal topography. Besides destructive and transporting activities waves have some positive effects too. Waves are generated by winds that blow over the surface of sea. However, the effects of waves on advancement of the spit is great. The destructive and constructive power of waves increases in direct proportion to their periods and lengths. For such an evaluation, waves were classified according to some wave-length, and frequencies acquired at each wavelength. Also, probability calculations were made on periodic characteristics of waves during different seasons (DMİ, 2016). Hence, percentages of wavelengths exceeding 1,25 meters, calculated monthly for each year were later calculated as seasonal percentages and their periods being found too (Figure 7).

Wavelengths and periods of waves have great effects on coastal erosion and deposition. Wave period was 2.7 seconds (Figure 8). Probability of destruction of delta increases during winter months, and it is the least in spring. However, the Kcapınar stream reaches its maximum discharge rate during spring when the destructive effects of waves are at their lowest level, resulting in advancement of the delta during this period. So the development of the spit is decreased during these periods.

The formation of deltas and spits are also associated with tides. Tides are due to the gravitational attraction of moon and to a lesser extent, the sun on the Earth. Because the moon is closer to the Earth than the sun, it has a larger effect and causes the Earth to bulge toward the moon. At the same time, a bulge occurs on the opposite side of the Earth due to inertial forces. These bulges remain stationary while the Earth rotates. These tidal bulges result in a rhythmic rise and fall of the ocean surface, which is not noticeable to someone on a boat at sea, but is magnified along the coasts. Usually there are two high tides and two low tides each day, and thus a variation in sea level as the tidal bulge passes through each point on the Earth's surface. Tidal amplitude is the elevation of tidal high water above mean sea level. However, the range of such tidal activities on the shores of the Hisarönü gulf is nearly 5 centimeters (Figure 9). Hence, such activities do not effect delta and spit development much in our study area. Nevertheless, the small submarine sand occuring on Kızkumu spit is probably the result of tidal sand deposition.

Surface sea currents are the result of the drift of the water's surface due to drag by wind. Thus, surface currents generally follow the same patterns as atmospheric circulation with the exception that atmospheric currents continue over the land surface while sea surface currents are deflected by the land. The forming and destroying

effects of coastal currents reach their maximum level at the beaches, and Kocapınar stream delta shores which are sedimentation areas of loose material. Currents entering the Aegean Sea from off the shores of the Kayabaşı foreland advance in an eastern direction (DMİ, 2016). But this is a current of a very general occurence and its effects on the Hisarönü Gulf and Kızkumu spit is very questionable. However, as coastal currents form by the effects of winds which form waves, studies on monthly wind roses, wind frequencies, and wave periods can supply information on these currents. The following results are obtained from the monthly wind rose diagrams in the Marine Atlas (DMİ, 2016). Hence, winds blowing from the north, west and northwest are dominant for a greater part of the year. Almost continuous northerly and northwesterly winds push surface waters offshore, which are compensated by waters from the deeper parts to the south and southeast. Existence of submarine ridges and spits developing from north to south points to the presence of such a current. Also winds blowing parallel or head-on to the shores occur during most of the year. However, territorial landforms potentially affect the wind's direction. Winds are channeled through the valley and depressions. The wind direction is from northwest to sotheast in Kızkumu and the surrounding area (Figure 10). Average annual wind speed of 4.5 m/sec were recorded. Coastal currents formed by such winds would have destructive effects at the coast, preventing its development to a great extent (http://www.ezg.com.tr/). This is also the period when discharge and load rates of river is the highest. Hence, an equilibrium will commence between such destructive activities and sedimentation. On the other hand, wind systems and related currents have positive effects on the formation of the Kızkumu spit.

## 5.2. GEOMORPHOLOGICAL FORMATION OF KIZKUMU SPIT

Kızkumu spit formed from radiolarite, chert, limestone sand and gravel. The gravels are sharp and angular. The spit is known for its orangery sand. These iron oxide-colored sands were brought to the region nearly 10,000 years ago by currents and beach drift, from as far as the Kocapınar stream delta. The Kocapınar, the stream in northeast of the Hisarönü gulf, starts its journey high in the Eren Mountain (842 m). It flows from the Eren Mountain about 6 km through its valley into the Hisarönü gulf of part of Aegean Sea. The Kocapınar carries some quantities of silt, clay, sand and gravel into the Aegean Sea. So a percentage of the material forming the beaches comes from the Kocapınar Stream. During the last ten thousand years, the Kocapınar Stream deposited sediment over the Kocapınar stream delta, covering an area of about 1.1 kilometers wide and 650 meters long.

The Kızkumu spit is a permanent landform resulting from marine deposition. It is a long, narrow accumulation of sand or shingle, with one end attached to the land, and the other projecting at a narrow angle either into the Orhaniye bay or across a river estuary. Kızkumu spits have a hooked or curved end.

The Kızkumu spit formed where longshore drift moves large amounts of sand and shingle along the coast, and where the coastline suddenly changes direction to leave a shallow, sheltered area of water. One of the realities of living in a coastal area, and especially near a beach, is that the sand which makes up a beach actually "migrates". This is called littoral drift or longshore transport. This is known since most waves arrive at the shoreline at an angle even after refraction (http://ihouse.hkedcity.net). Such waves have a velocity oriented in the direction perpendicular to the wave crests (Vw), but this velocity can be resolved into a component perpendicular to the shore (Vp) and a component parallel to the shore (VL) (http://earthsci.org/education). The component parallel to the shore can move sediment and is called the longshore current (Figure 11). As it is also known, beach drift is due to waves approaching at angles to the beach, but retreating perpendicular to the shore line. This results in the swash of the incoming wave moving the sand up the beach in a direction perpendicular to the incoming wave crests and the backwash moving the sand down the beach perpendicular to the shoreline (http://earthsci.org/education). Thus, with successive waves, the sand will move along a zigzag path along the beach.

In the figure 12 line X to Y marks the position of the Hisarönü Gulf coastline (Figure 12).

The dominant wave direction is from northwest to southeast in the Hisaronu Gulf. As the fetch and prevailing winds are from the northwest to southeast, material will be moved eastwards along the coast by long shore drift, in other words prevailing winds bring waves in at an angle so material is moved along beach in zig-zag way. Sand, clay, and gravel movement occurs due to swash and backswash. Actually material from Longshore Drift builds up the beach. There are waves moving towards the shore to the Orhaniye Bay not perpendicular direction, so that an angle corresponds to the diagonal. Oblique waves lapping the shore, gravel and sand from the back, pushing southeast direction and spread; thus providing the formation of Kızkumu Spit.

Change in shape of headland. Waves break on the Kayabaşı headland and accumulation starts from the nose of the hill to the south. After headland X the direction of the original coastline changes and larger material is deposited in water sheltered by the headland (B). Material deposited in nearly 5 meters in shallow, calm water, to form

the Kızkumu spit. Further deposition of finer material (sand) enables the feature to build up slowly to sea-level (C) and to extend its length (D). Occasionally the wind changes its direction (e.g. comes from the west). Short term change in wind and wave direction. Kızkumu spit curved with the change in wind direction. This in turn causes the waves to alter their direction (e.g. approach from the south east. During this time some material at the end of the spit may be pushed inland to form a curved end (E) (Figure 13). When the wind returns to its usual direction the spit resumes its growth eastwards (F). Spits become permanent when sand is blown up the beach, by the prevailing wind, to form sand-dunes. A salt marsh is likely to develop in the sheltered water behind the spit. There is no wave action behind Kızkumu spit. Here salt marshes formed behind spit in this low energy zone. The lagoon is an ongoing formation process between the mainland and Kızkumu spit. The spit is unable to grow across the estuary as the river current carries material out to sea. Kızkumu spit is stopped from growing any further due to the river outlet removing material. Nevertheless, the spit may grow across the bay to form a bar (Figure 14).

## 5.3. CULTURAL ENVIRONMENTAL VALUES IN KIZKUMU SPIT AND IT'S HINTERLAND

The most important cultural ruin around Keçibük bay belongs to *Bybassos* city (Held et.all. 2007; Held et.all., 2008). The ruins are located between Asar Hill, Oyuklu Hill in the north and the bridge which connects both of them. It was ruled over by Rhodes in 408 B.C, just like other cities in the peninsula (Cook and Plommer, 1996). It was founded as a port city and it is covered by alluvion deposit. It kept its commerce within Rhodes State and Rhodes Island. Hemithia Holy Place is located in the place which is in the east of Orhaniye village. There is a habitation called *Kastabos* which is close to the holy place. This place had attracted attention of the tourists who came from nearby cities and far away there are ruins of a Byzantian castle on the island. There are ruins of Byzantian period in marina's surroundings. Kızkumu has metioned in mythology as well. The legend is about the daughter of Bybassos's King. The legend has it that the princess doesn't know how to swim and she spills the sand on her skirt and form Kızkumu. Therefore, there is a 1, 5 mt. statue of a white mermaid where spit starts and ends. Mythology attracts tourism and the story draws attention here (Doğaner, 1999).

The peninsula, after Byzantians, was taken over by Menteseogullari and Ottoman Empire. The habitation in Bozburun peninsula is neighborhoods which have villages because of the surface features. The neighborhoods don't have village characteristics, they do agriculture but they are connected to each other and become a village. Orhaniye village is located in 1.5 mt inside from the beach. Keçibük neighborhood is located in the steeps which are closer to the beach. Hisarönü gulf has taken its name after Hisarönü village which is in the north east of the gulf. It consists of three neighborhoods. Thanks to tourism, Hisarönü village has expanded to the beach. When the metropolitan municipality took away the status of village, Orhaniye village has become a neighborhood dependent to Marmaris.

The fields are served for agriculture in Orhaniye village. It has appropriate soil for olive, fig, thyme, almond, citrus trees and grapes. Means of living of the villagers are agriculture, fishing and beekeeplig. However, tourism has become the most important means of living thanks to recreation. The oils which are extracted from healing herbs among forestry productions has been a new market. The water and oil of thyme, hellebore, bay, watermelon, eucalyptus, sage and gale are extracted.

Another function of Orhaniye village is recreation and tourism. Daily tours are organized as it is near Marmaris. These tours are trekking or jeep safari. Daily tours donot require many buildings, places like cafes are enough. Before tourism, Orhaniye bay has yachting tourism. Little piers and restaurants are built for yachters. A marina has been built for yachter to enable them to stay longer. Two motels were built in the eastern coast in 1986, in 1990 a motel was built as well. This bay was ignored because the priority was given to the bays such as Turunç, İçmeler.

New pursuits of coastal tourism have started coastal tourism in Orhaniye Bay. However, the touristic buildings are not for mass tourism but as motels. Accommodation facilities are located on the north side of the bay, Keçibük district. Apart from three of accommodation facilities, seven of them have been designed as bungalow type rooms. There are 113 rooms in the facilities in total. Since the bay is natural protected area, only these kinds of buildings are allowed. There are docks for yachts and 1 accommodation facility on the south side of the bay. The most favorite recreational activities which are done by residents are sun-bathing and swimming. That is why motels have carried out some environmental regulations.

## 5.4. DEGRADATIONAL FACTORS AND PROCESSES THAT AFFECT KIZKUMU SPIT

The importance of the geography increases according to the uniqueness around region, country and world. The prominent feature of Kızkumu is that tourists can observe while the spit sinks and rises above the sea. Kızkumu spit stays under the sea until noon and afternoon it rises which can be observed during the process. As it stays under the see until noon, tourists can actualize the phenomenon of "walking on the sea". This renders Kızkumu a very interesting and attractive place. Nevertheless, in the last 10 years, Kızkumu spit

stayed under the sea which shows that human activities harm and scatter the sand on it. The factors that affect the spit are the natural changes of the flow of the bay, the changes in the underwater flora, the tourists who walk on it and decrease of the sand which is carried towards the spit. Pulling of the seaweed and the marina that was established on the entryway of the bay put pressure to spit.

There is very sensitive, endemic and biotope seaweed which is called "*PosidoniaOceanica*". (Okuş ve Yüksek, 2007: 44). *Posidonia Oceanica* has a role in many important things such as oxygenation of water, providing source of nutrition, creating living and reproduction area, cleaning sea water and preventing erosion. It got under protection according to "Protection of Mediterranean against Pollution" agreement which was signed in Barcelona. Turkey became the party of this agreement on 2002. The importance of this plant is that it holds the sands around the spit and prevents the spread of the sand. Nonetheless, people who walk on the spit, facilities which pull of this plant to clean the sea and the anchors of yachts have decreased the volume of this plant which has increased the erosion around the spit and led the seaweed to go into deep of the sea. Consequently, spit does not rise above the sea afternoon with reciprocation. You can see it only when the level of the sea rises significantly.

Orhaniye Bay, which includes Kızkumu spit, is under the effect of one of the tourism centers, Marmaris. It has a short connection to Marmaris through a motorway. The tourists who are excursionist from Marmaris, accommodate in the hotels on the coast, and come there by yachts walk on the spit. These steps on the spit cause the soils scattering around and decrease the spit level.

The installations on the coast are the docks for the yachts and a marina on the bay. The installations avoid reaching the material comes via the bays to the spit. Particularly, the stone docks are important obstacles about this subject. In 1988, a marina that has 30 yacht capacities was built on the east of the bay, its capacity increased. Now, it has 250 yachts capacity. The marina hinders the northwester, and the docks limit the material that is brought by the ways that come to Orhaneli bay. The formation of Kızkumu spit continues with the red soils which are brought by the streams. The most important stream that nourishes the soil is Kısık Dere. However, people get soil from this stream to use in construction, and they sell it in the upper Keçibük district.

## 6. SUGGESTIONS

In 1990, the first conservation status of Kızkumu spit is to remain in "Datça-Bozburun Speacial Environment Protection District" that was founded in the Protocol related to Special Protection Areas in Mediterranean Region. In this area, an approval has to be taken from Environmental Protection Agency for Special Areas for construction plans. In 1996, Kızkumu spit is in the grade 1 Natural Site Area and in the grade 3 archeological site area that were announced according to the Code of Protection of Cultural and Natural Properties. Grade 1 natural site areas are the areas which have universal value in the aspect of scientific protection, must be protected for public welfare because they are rare and they have interesting features and beauties and the places that are protected except for the scientific studies about protection. In the grade 1 natural site areas, housing that can harm the flora, topography and can affect the silhouette badly isn't allowed. Only the constructions of excursion recreation facilities are allowed. In Grade 3 archeological site areas, the intensity of construction mustn't exceed the intensity decided with a construction plan. In 2010, Marmaris Tourism and Nature Volunteers Association has started some works for protection. To hinder the yachts' harbor under the sea, some works done to construct vault and float. A legal process has been started for unlicensed constructions and docks. The trips by the camels on Kızılkumu has been banned. The stream that brings red soil has been improved. Marmaris Tourism and Nature Volunteers Association had been applied to UNESCO in 2014, they wanted the spit of Kızılkumu to enter the Temporary List of UNESCO World Heritage.

## 7. CONCLUSION

Spit of Kızılkumu is in integrity of the sea, forest, bay, gulf and rural life. This ecosystem should be protected. For this reason, the tourists should be informed about the formation of the spit, its features and protection through the media and the other digital ways. It should be highlighted that the formation continues and improves, and it is harmful to the formation of spit that too many people walk on it. The most important effect on spit formation is recreation and tourism. Too many tourists come from Marmaris walk on the spit. In the crowded seasons, it is found that 5000 people walk on the spit. To hinder this, turnstiles were put to the entrance of the spits so that only 50 people can walk on the spit, but the project couldn't be applied.

Endemic underwater plant Posidoniaoceanica population that balances the Mediterranean underwater ecology and protects Kızılkumu against erosion should be protected. Daily excursion yachts should be harbored by the system of vault, not by the system of anchor. This plant's root shouldn't be plucked to clean the sea. The importance of this plant should be told to the local people and the tourists in the activities such as festivals.

Kocapınar Delta and Orhaniye Bay should be protected from unplanned construction due to coastal tourism. There are so many accommodation facilities on the bays in Marmaris and it's around. This bay shouldn't be used as an accommodation

place. The other construction is related to the coastal installations for yachts. Stone or wooden docks and marinas hinder the sea flow. The bay is preferred for yacht tourism. Some vaults and floats should be constructed and docks shouldn't be constructed on the coasts.

The bay should be planned for the use of rural tourism. In Bozburun Island, opening some east bays such as İçmeler and Turunç for tourism protects the western bays from mass tourism. Some rural tourism plans should be made to protect Orhaniye bay that is the closest to Marmaris in the west from construction. In this bay, nature, forest, sea and rural life are integrated. Orhaniye village has two neighborhoods in it and the center, Keçibük neighborhood was founded away from the coast. This layout is due to the mountainside surface features of Bozburun. Shift to organic agriculture enables healthy life and healthy diet on a natural bay. Rural tourism mostly appeal to the people who comes daily. The people who accommodate in Marmaris come to the bay for rural tourism. Local people earn mostly from agro-tourism. In this tourism type, tourists participate in local economic activities, and accommodate in the village houses. To decrease the pressure on Kızılkumu, the tourists should be directed to the other tourism types. One of them is archeological tourism. The closest ruins are belongs to Bybassos. On the Eren Mountain, there are Hemithea Temple and Kastabos city ruins. Another antic city ruin that can be included in archeological tourism is Hydas city which is in the south of Tugut thicket next to Orhaniye bay. There is a Byzantine castle ruin on Kale Island in Keçibük that belongs to closer ages. There is a church of Byzantine on the area of Martı Marina.

Spits are the formations that continue to formate. İmportant formations are the subjects of geomorphic tourism. The tours for Kızılkumu should be done under the name of geomorphic tourism, and tourism should be framed in this concept.

## 8. FIGURES, TABLES AND REFERENCES

**Figure 1:** The Kızkumu Spit sometimes lies under the water, sometimes extends over the water at the bay of Orhaniye

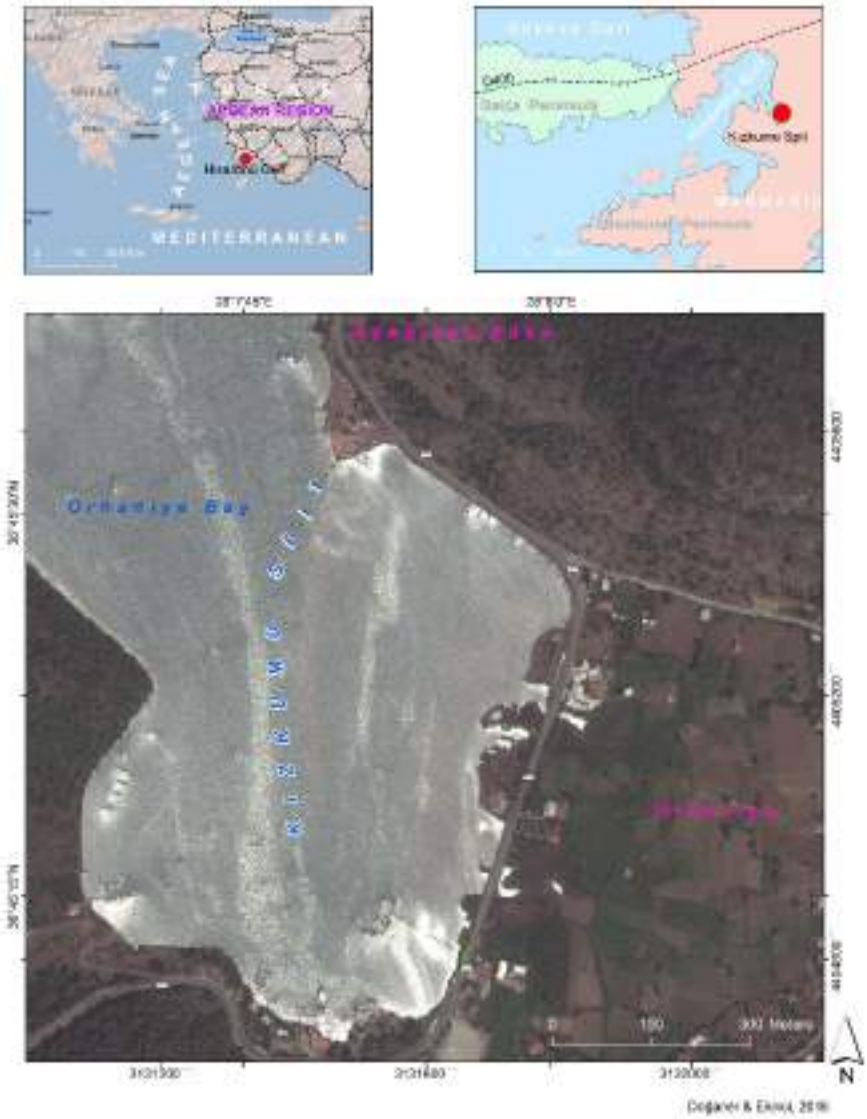


**Figure 2:** Geographical Location of the Study Area


**Figure 3:** Headland and Orhaniye Bay - Kızkumu Lies from Kayabaşı to Orhaniye

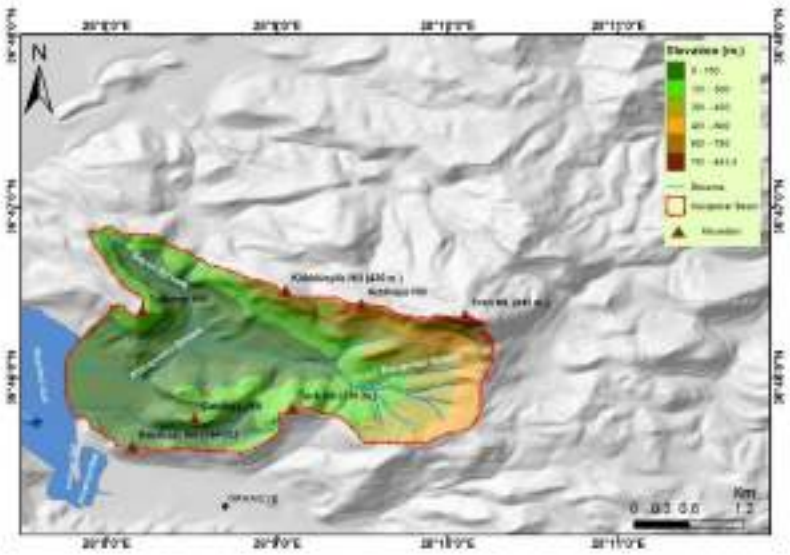


**Figure 4:** Kocapınar Stream and its Catchment (HGK, 2010)

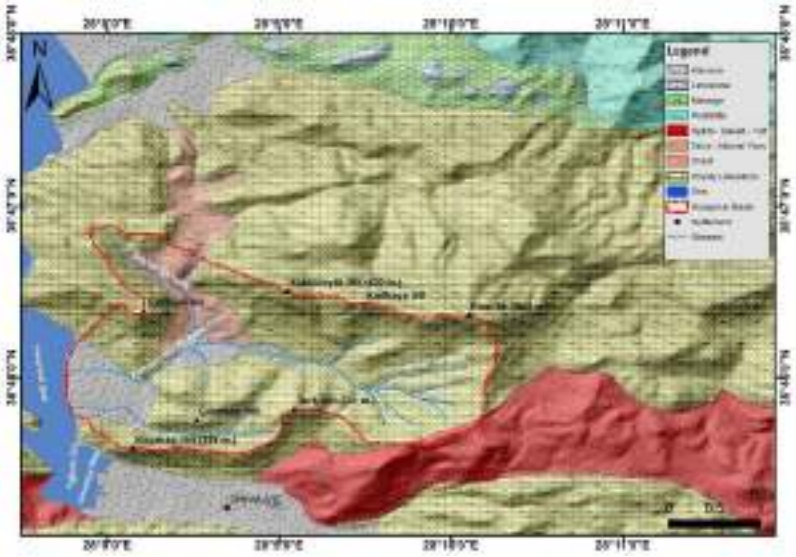


**Figure 5:** Geology Map of the Hisarönü Gulf (MTA; 2002)

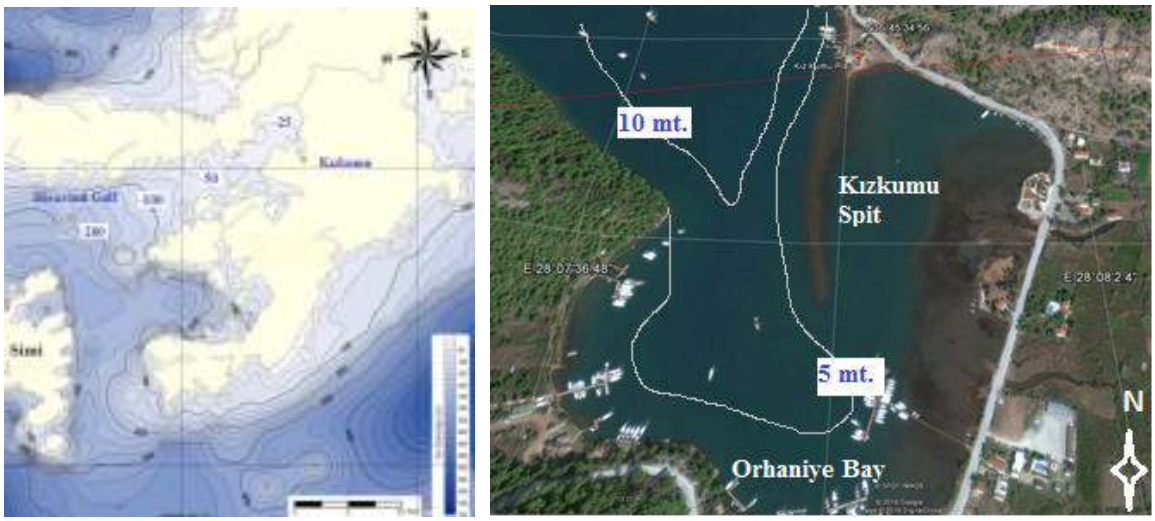


**Figure 6:** Bathymetric Images of the Hisarönü Gulf (Kaşer, 2010:5) and Orhaniye Bay

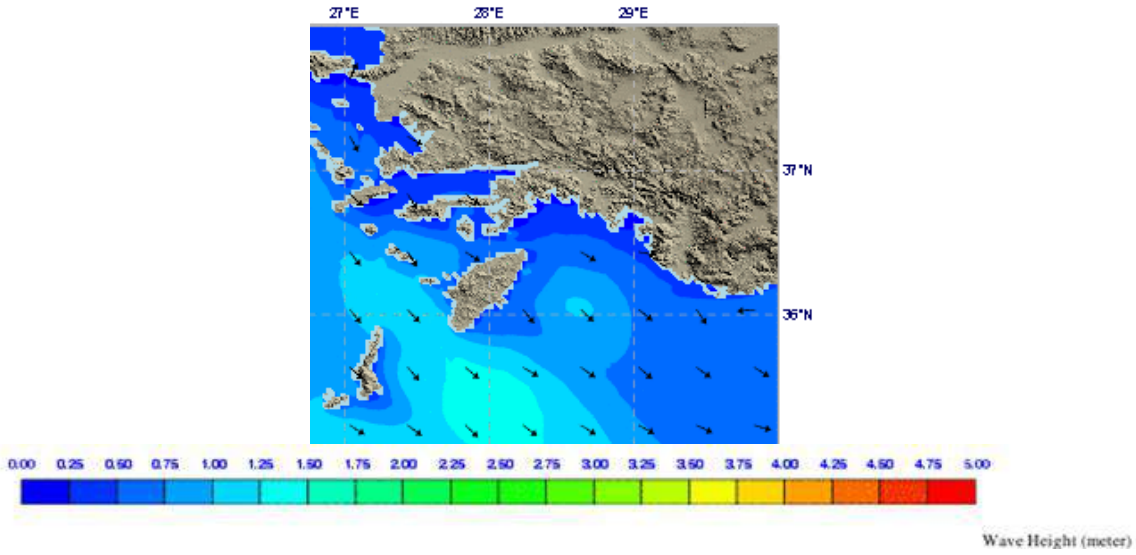


**Figure 7:** Wave Height (meter) and Direction in Southeast of Aegean Sea (http://www.mgm.gov.tr)

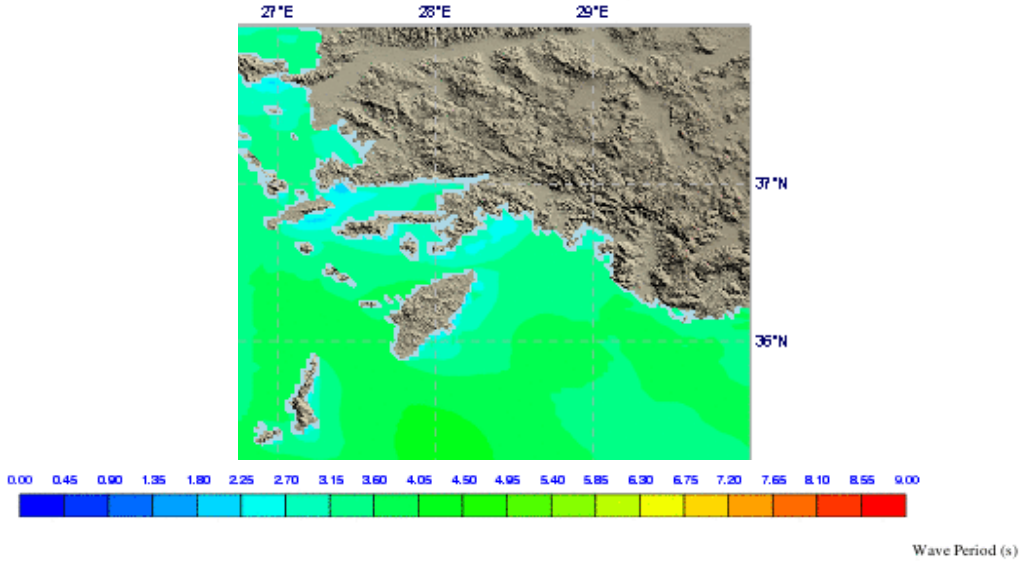


**Figure 8:** Wave Period (s) in Southeast of Aegean Sea (http://www.mgm.gov.tr)

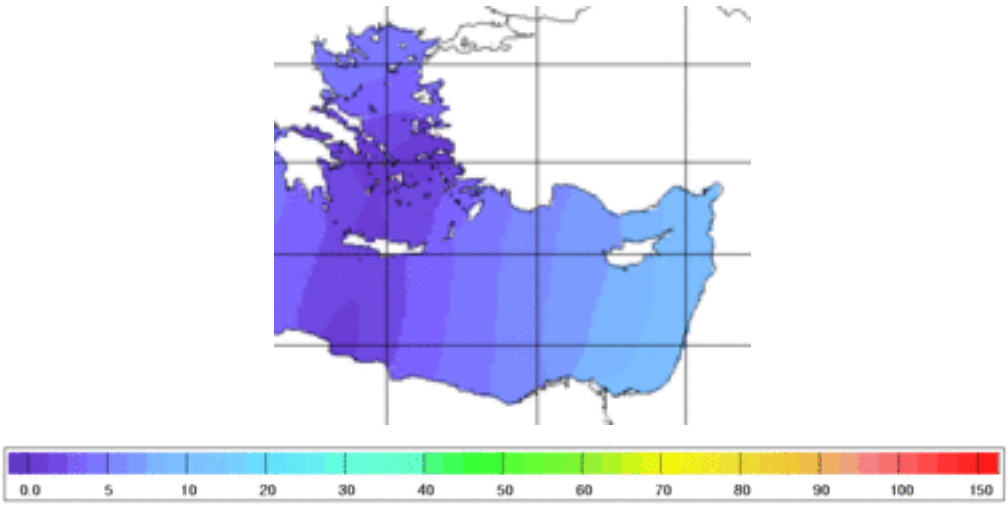


**Figure 9:** Tidal Amplütüde Map (cm) in Southeast of Aegean Sea

(http://wegc203116.uni-graz.at)

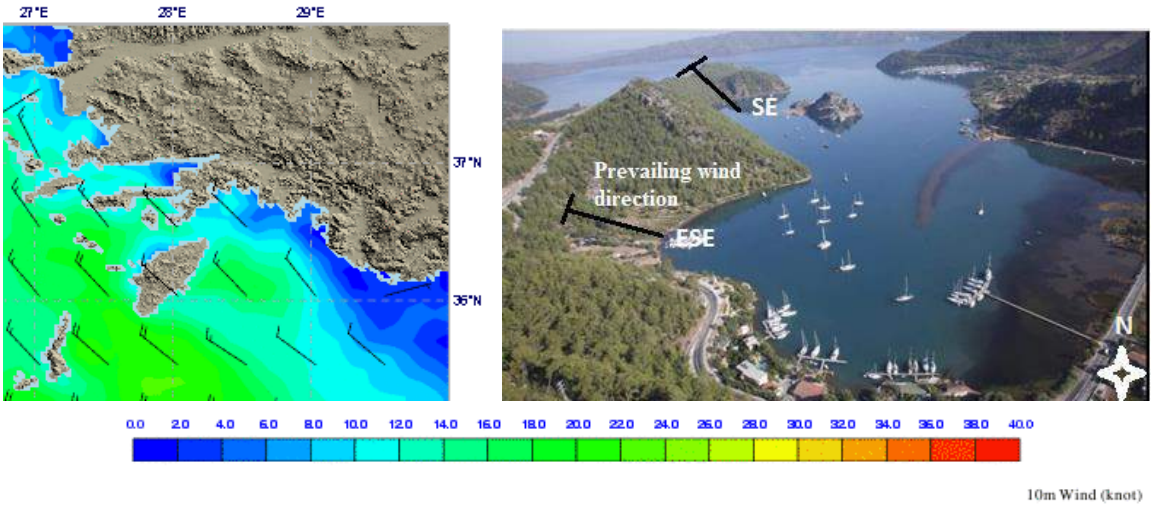


**Figure 10:** Wind Direct and Run (Knot) in Southeast of Aegean Sea and Prevailing wind Direct in Orhaniye Bay (http://www.mgm.gov.tr/)

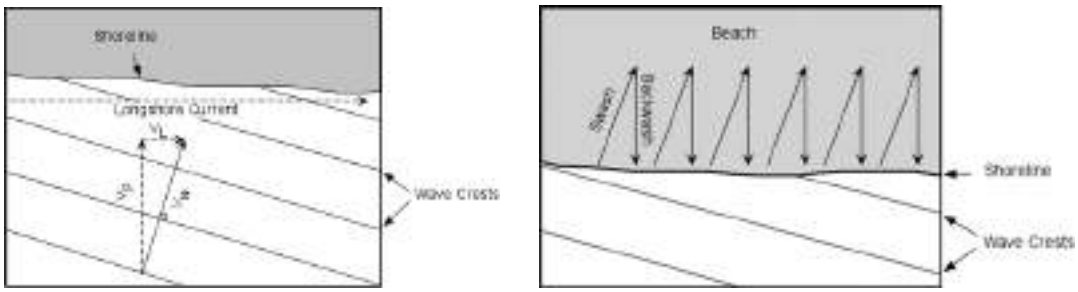


**Figure 11:** Longshore Current and Beach Drift (http://earthsci.org)


**Figure 12:** Formation of Kızkumu Spit (Prepared processed on google maps)


**Figure 13:** Spit Curved: Short Term Change in Wind and Wave Direction


**Figure 14:** Estuary Territory and Fastest Stream Current

## REFERENCES


1. *Black, G. P., (1988), Geological Conservation: A Review of Past Problems and Future Promise, Paleontology, 40, 105-111.*
2. *Cavallin, A., Marchetti, M., Panizza, M., Soldati, M., (1994), The Role Of Geomorphology In Environmental Impact Assessment, Geomorphology, 9, 143-153.*
3. *Cook, J. M., Plommer, W.H., (1966), The Sanctuary of Hemithea at Kastabos, Cambridge University Press, New York.*
4. *Coratza, P., Giusti, C., (2002), A Method for the Evaluation of Impacts on Scientific Quality of Geomorphosites: Preliminary Researches, Geomorphological Sites: Research, Assessment and Improvement, Modena (Italy), 19-22.06.2003, Università degli Studi di Modena e Reggio Emilia, Dipartimento di scienze Della Terra.*
5. *Coratza, P., Giusti, C., (2005), Methodological proposal for the assessment of the scientific quality of geomorphosites, II Quaternario, 18 (1), 307-313.*
6. *Çörekçioğlu, E., Ömür, Ş., Bilgin, R., Bilgiç, T., Yüksel, M., (1997), Bozburun-Marmaris-Köyceğiz-Dalaman (Muğla) Dolayının Jeolojisi, MTA, Ankara.*
7. *Dirik, K., Türkmenoğlu, A., Tuna, N., Dirican, M. (2003), Datça Yarımadasının Neotektoniği, Jeomorfolojisi ve Bunların Eski Medeniyetlerin Yerleşimi Ve Gelişimi Üzerindeki Etkisi, ODTÜ AFP-00-07-03-13 Kod Nolu Proje, Ankara.*

8. *Devlet Meteoroloji İşleri Genel Müdürlüğü, (2016), Meteorologic Data, Ankara*
9. *Doğaner, S., (1999), Bozburun Yarımadası: Coğrafi Ortam ve İnsan İstanbul Üniversitesi Coğrafya Dergisi no: 7, ss.29-53.*
10. *Ekinci, D., Doğaner, S., 2014, Assessment of Geomorphosites in the Celil Gorge (Cihanbeyli Plateau, Turkey), International Journal of Humanities Social Sciences and Education (IJHSSE), Volume 1, Issue 12, December 2014, PP 83-91.*
11. *Ercan, T., Günay, E., Baş, H., Can, B. (1981-1982), Datça Yarımadası'ndaki Kuvaterner Yaşlı Volkanik Kayaçların Petrolojisi Ve Kökensel Yorumu, Maden Tetkik ve Arama Dergisi, (97-98), 46-57.*
12. *Ersoy, Ş., (1991), Datça Yarımadasının Stratigrafisi Ve Jeolojisi, Türkiye Jeoloji Bülteni, (34), 1-14.*
13. *Ersoy, Ş. (1993), An Example From Bozburun (Marmaris, Mugla) Peninsula To Transgressive Carbonate Platform Sequence, Geological Bulletin of Turkey, (36), 171-177.*
14. *Görür, N., Şengör, C., Sakınç, M., Tüysüz, O., Akkök, R., Yiğitbaş, E., (1995), Rift Formation In The Gökova Region, Southwest Anatolia: Implications For The Opening Of The Aegean Sea. Geological Magazine, (132), 637-650.*
15. *Gray, M., (2004a), Geodiversity, Valuing and Conserving Abiotic Nature, Chichester, Wiley.*
16. *Gray, M., (2004b), "Land Form" rather than "landforms": Geomorphological Conservation Outside Protected Areas, in: Parkes, M.A. (ed.) Natural and Cultural Landscapes -The Geological Foundation, Dublin, Royal Irish Academy, 171-174.*
17. *Held, W., Şenol, G. C., Şenol, A.K., (2008), "2006 Yılı Bybassos Araştırması". AST25, 1, 365-380.*
18. *Held, W., Şenol, G.C., Şenol, A.K., (2007), "2005 Yılı Bybassos Araştırması". AST, 24, 1, 37-50.*
19. *http://earthsci.org/education/teacher/basicgeol/ocean/ocean.html*
20. *http://farm4.staticflickr.com/3683/9563306672_da9dcd9885.jpg*
21. *http://fastwindtoaim.blogspot.com.tr/2013/02/coastal-and-oceanic-landform-46-spit.html*
22. *http://ihouse.hkedcity.net/~hm1203/hydrosphere/sea-spit.htm*
23. *http://montessorimuddle.org/2011/07/10/beach-geomorphology-on-deer-island/*
24. *http://pr2014.aaschool.ac.uk/LANDSCAPE-URBANISM/Sandways*
25. *http://www.ezg.com.tr/dosyalar/harita/ruzgar_harita.jpg*
26. *http://www.google.maps.com*
27. *http://www.hgk.msb.gov.tr/gdetay?id=886964&gorunum=11*
28. *http://www.mgm.gov.tr/deniz*
29. *http://www.unesco.org/csi/pub/source/ero22.htm*
30. *http:// www.wegc203116.uni-graz.at/meted/oceans/tides_intro/print.htm*
31. *Kaşer, N., (2004), Güneybatı Anadolu Neotektoniğinin Deniz Sismik Verileri İle Araştırılması, Dokuz Eylül Üniversitesi Basılmamış Yüksek Lisans Tezi, İzmir.*
32. *Kaşer, N., (2010), Hisarönü Körfezindeki Deniz Seviyesi Değişimi, Sedimantasyonu Ve Bölgedeki Eski Çağ Kıyı Yerleşimleri Üzerindeki Etkileri, Dokuz Eylül Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, İzmir*
33. *Kayan, İ., (1988), Late Holocene Sea-Level Changes on the Western Anatolian Coast. Palaeogeography, Palaeoclimatology, Palaeoecology, (68), 205-218.*
34. *Kurt, H., Demirbağ, E. ve Kuşçu, Ş., (1999), Investigation of the Submarine Active Tectonism in Gulf of Gökova, Southwest Anatolia-Southeast Aegean Sea, By Multi-Channel Seismic Reflection Data, Tectonophysics, (305), 477-496.*
35. *Lambeck, K., (1995), Late Pleistocene and Holocene Sea-Level Change İn Greece and South-Western Turkey: A Separation of Eustatic, Isostatic and Tectonic Contributions, Geophysical Journal International, (122), 1022-1044.*
36. *Maden Tetkik ve Arama Genel Müdürlüğü Jeoloji Haritası, (2002), http://www.mta.gov.tr*
37. *Okuş, E., Yüksek, A. (2007), Marine Diodiversity of Datça-Bozburun Specially Protected Area (Southeastern Aegean Sea, Turkey), J. Black Sea Mediterranean Environment, vol 13:39-49.*
38. *Panizza, M., (2001), Geomorphosites: Concepts, Methods and Examples of Geomorphological Survey, Chinese Science Bulletin, 46, 4-6.*
39. *Taymaz, T., Jackson, J., ve McKenzie, D., (1991), Active Tectonics of the North and Central Aegean, Geophysical Journal International, (106), 433-490.*
40. *Urbano, L., (2011), Beach Geomorphology on Deer Island, Retrieved May 11th, 2016, from Montessori Muddle: http://MontessoriMuddle.org.*
41. *Yeşilyurt, S. ve Taner, G., (2002), Datça Yarımadasının Geç Pliyosen Pelecypoda Ve Gastropoda Faunası Ve Stratigrafisi (Muğla-Güneybatı Anadolu). MTA Dergisi, (125), 89-120.*

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