COASTAL GEOMORPHOLOGICAL CLASSIFICATION IN GIS ENVIRONMENT OF KEFALLINIA ISLAND

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ABSTRACT

Kefallinia is the largest island in the Ionion Sea and the 6th in size Greek island. This paper presents a geomorphological and tectonic study on Kefallinia's coastal zone, together with the corresponding coastal classification.

For the purposes of this study different techniques have been elaborated based on GIS, Remote Sensing and coastal fieldwork, which took place from the land and from the sea as well.

The results of this study have been visualized through color thematic maps and graphs. Finally, the GIS database that was developed has been published on the Web, through a custom-made web-based GIS platform.

KEYWORDS: Kefallinia, Geomorphology, Coastal zone, web-GIS, erosion, fault tectonism

INTRODUCTION

Kefallinia is the biggest Ionian island (Fig. 1). The main geological formations that Kefallinia consists of are limestones, Neogene formations and Quaternary deposits.

In this paper the geomorphological and tectonic characteristics of Kefallinia coastal zone are studied.

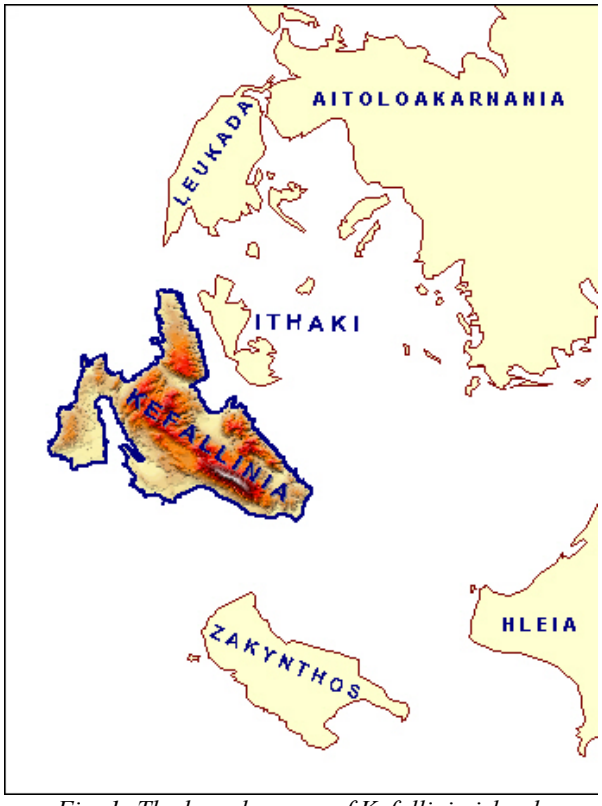

Fig. 1: The broader area of Kefallinia island.

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METHODOLOGY

The collection of primary and secondary data has taken place through systematic fieldwork as well as Remote Sensing and GIS techniques. Coastal fieldwork was divided into two parts: one from the land and one from the sea. Data collected from photo-interpretation and fieldwork was imported into the GIS, in order to develop secondary data, perform data analysis and produce various thematic maps.

Because of the big size of the studied island and the quantity of the collected data mainly concerning the geomorphological characteristics of Kefallinia, it is not possible to present all derived maps into this paper. For this reason, all data and the corresponding thematic maps were imported in the web GIS platform that had been developed (Fig. 2). This makes remote access easy and instant. The web-GIS http address, where all data and maps are presented, is www.remsenslab.geol.uoa.gr/gis (change geoset to Kefallinia).

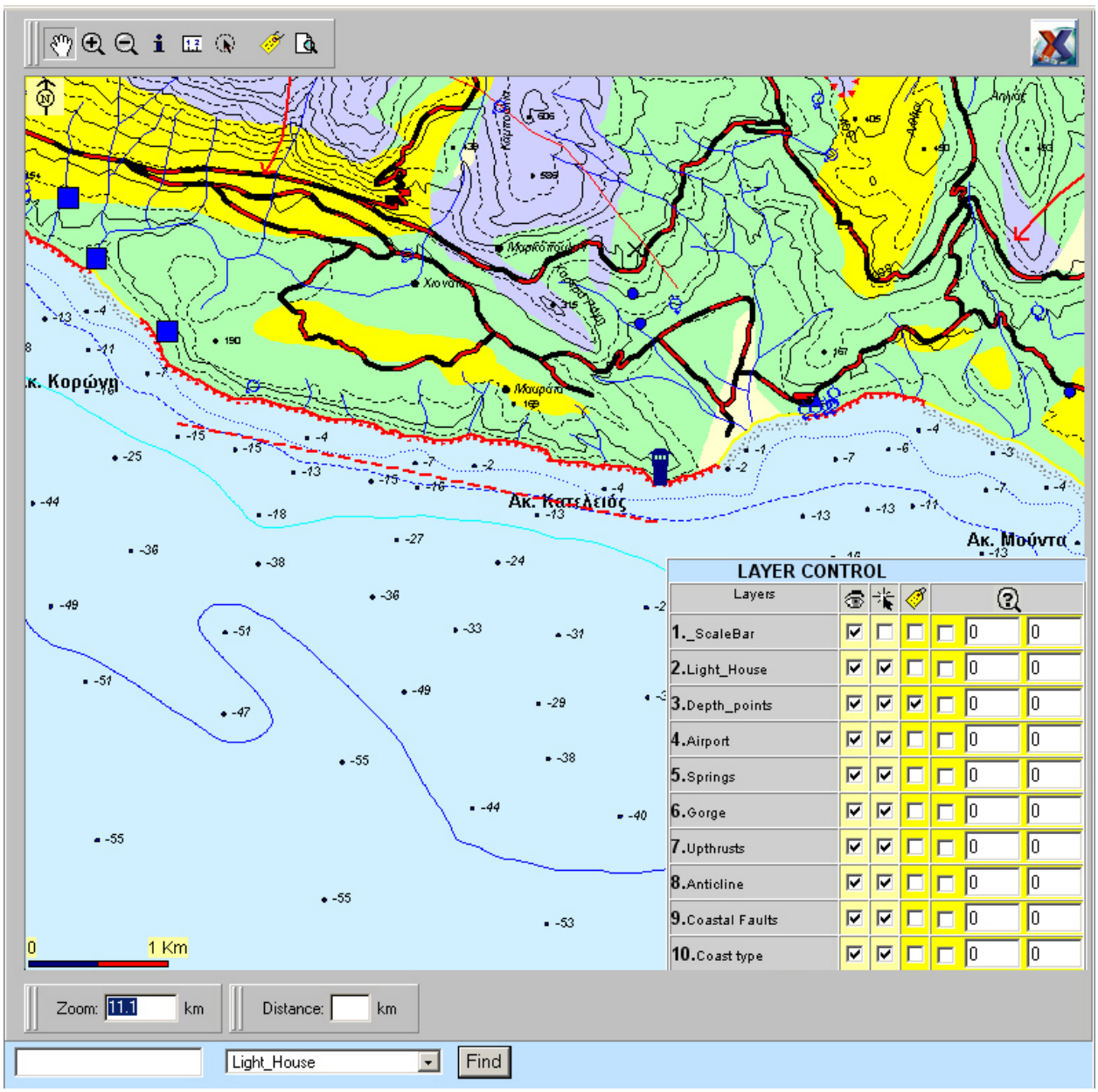

Fig. 2: A part of the coastal zone map that has been created, through the developed web GIS. In the web GIS (www.remsenslab.geol.uoa.gr/GIS) is presented all geomorphological and geological characteristics of Kefallinia island.

DESCRIPTION OF THE COASTLINE OF KEFALLINIA

The coastal study has resulted into six main tectonic zones (Vassilopoulos, A., 2001): a) one of NW-SE direction which has formed the Kefallinia-Ithaki narrow and possibly the gulf of Argostoli, b) one of NE-SW direction which has affected the west coastline of Paliki peninsula and the area of Mirtos gulf, c) one of NW-SE direction which has affected the east coastline from the Miticas to Capri cape, d) one of N-S direction which has influenced the east coastline of Paliki peninsula, e) one of ENE-WSW which is responsible for the tectonical characteristics of the south part of Paliki peninsula and finally f) one of NW-SE that has affected the south part of Kefallinia island.

The west coastal zone has intense relief that continues under the sea from Sxizas to Atheras cape and a straight coastline, characteristics that refer to a tectonically derived morphology (Fig.3). Even areas like Mirtos, Petanioi and Atheras have been formed mainly through tectonic activity. There are many bays developed by similar processes at the west part of Leukas island in St. Nikitas areas, at Zante island (Leivaditis, G., 1987) and in the north-west part of Ithaki island (Vaiopoulos, D. et al, 2000).

The part where massive or thick-bedded limestones prevail, wave erosion often results to relatively big and smooth caves like those in the south

Fig. 3: Part of the tectonized coastline (west Paliki peninsula).

coastline of the island (Fig.4).

The east coastline of Kefallinia island is faulted in NW-SE direction, but the tectonic characteristics are not as clear as in the rest tectonized

Fig.4: Coastal caves in south Kefallinia.

coastline parts. There are only few exceptions to the previous notification such as the Skala area and the cape of Capri (Fig.5 & 6). Erosional processes in this part of the coastline cover up the tectonical characteristics. Joints and

Fig.5 & 6: The faulted zone south of Skala area with intense landslide phenomena (left figure) and faulted zone south of Capri cape (right figure).

faulted zones eroded by seawater result through their widening in landslide phenomena and form coastal caves (Fig.7 & 8).

In the northern part of the east coastline, where thin-bedded limestones prevail, caves are small and rough. There are many coastal caves in the area between Kefallinia and Ithaki islands being used as shelter by the Mediterranean seal 'Monachus monachus'.

The south part of Kefallinia island appears to be tectonically uplifted. The coastline is highly affected by the tectonic and erosional processes. The intense erosional process is expressed through torrents whose mouths are situated 12m above the sea level, while the erosional process to approach again the base level is already in progress (Fig. 9 & 10). This kind of torrents has

Fig. 7 & 8:Erosion process along existing joint, south of Capri cape.

been observed in the whole coastal zone from Koroni to Katelios cape. The tectonic activity in the same area is expressed through the surface of 20 m altitude, which exists at this area and the area of Skala as well. This surface may assumed to be a depositional terrace and consists of conglomeratic calcitic sand with ostreid and algae fauna (IGME, 1985). At the Lourdaton bay there is a faulted zone with the same direction (Fig.11).

Inspite the influence of uplifted faulted zone, the southwest part has been submerged, as the sunken part of drainage system shows (Fig.12 & 13) in the Liakas place. In figure 13 there are remnants of pebbles in the old drainage system bed, which nowadays is submerging.

Fig. 9 & 10: Erosional processes are responsible for the morphological characteristics of the south coastline of Kefallinia island.

Besides, Dias islet situated in the south part of Kefallinia island close to Liakas cape, seems to have been affected by tectonic movements and large parts

Fig.11: Successive faulted zones in Lourdaton bay.

of the islet have been detached. The tectonic and erosional processes become obvious by the collapse of previous man made structures.

Erosion in the Neogene formations has resulted in the development of relatively big and smooth caves (Fig.4).

Coastal classification related to lithological characteristics showed that it mostly consists of limestones followed by Neogene deposits, Pleistocene sediments and finally alluvial. Table I shows the percentage of lithological formations in the Kefallinia coastal zone.

The limestones are highly faulted and eroded. There are many coastal caves shaped according to the position and the nature of their lithological formation. The Neogene and Pleistocene sediments mainly existing in the south part of the

Fig. 12: Sea arch and the submarine torrent mouth close to Liakas cape.

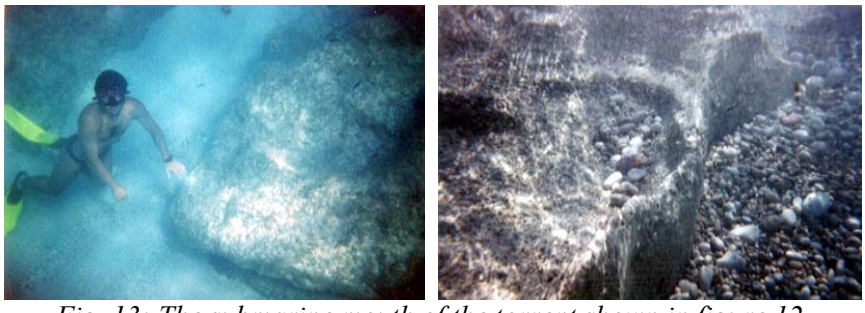

Fig. 13: The submarine mouth of the torrent shown in figure 12.

island, are eroded and faulted and form sandy beaches with high inter slopes mainly because of tectonical factors. Alluvial deposits occupy only a small part of the coastal zone and form sandy beaches. Characteristic examples are the beaches with dunes in the area of St. Theodoroi cape and in some parts of the

east coastline in Skala and Razacli area (Fig.14). In this lithological category a tombolo has been observed, in Lourdaton bay. Nowadays the sandy zone that combines Kefallinia with the highly faulted islet is being used as a private beach by an adjoining hotel.

Topographical slopes observed in the coastal zone of Kefallinia island are steep, because of the lithological formation and the tectonic characteristics. Only some individual bays and beaches, consisting of Quaternary and Neogene formations are of gently sloping. The parts of the coastal zone consisting of limestones are steep and the same is happening in the Neogene formation in south Kefallinia. The steepest slopes are observed at the east, north and west coastal zones mainly from the Gerogobos to Katergaki cape and from Assos peninsula to Vliotis cape. They have also been observed at the east coasline of Erisos peninsula, from Fiskardo bay to Agrioskilo cape. Inside the coastline, slope

Εικ. 14: Consolidated dunes Skala area.

values are lower. A statistical analysis in a zone of 2Km width showed that 28% of slope values are less than 14%, 28,42% percent of slope values vary between 14 and 28%, the 21,95% of slope values vary between 28 and 41%, the 13,64% is between 41 and 55%, while only 6,33% and 0,99% of slope values is between 55-69% and 69-83% respectively.

Table I

Lithological composition	**%**
Alluvial	6,84
Pleistocene deposits	8,10
Neogene formations	24,18
Limestones	60,88

RESULTS

This paper resulted to a morphotectonical study of Kefallinia's coastal zone as described earlier. A GIS database with geological and geomorphological characteristics of the coastal zone was developed and all data and maps where input in the web GIS that have been created at the http address: www.remsenslab.geol.uoa.gr/gis (change geoset to Kefallinia).

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