

GEOMORPHOLOGICAL CHARACTERISTICS OF LEUKAS ISLAND USING GIS

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ABSTRACT

The purpose of this paper is to study the geomorphology of Leukas island using GIS and GPS techniques in order to improve the accuracy, the speed of quantitative and spatial analysis and finally the presentation of the results.

For the study of geomorphological characteristics such as drainage system, morphological slope and karstic formations, extended fieldwork and photo-interpretation took place, while all collected data were inserted in a Geographical Information System where a quantitative and geographical analysis took place.

This study has resulted to a geographical database with geographical, geological and geomorphological characteristics. Moreover several thematic maps have been created based in the input data, the derived secondary information layers and finally the combined information.

KEYWORDS: Leukas, geomorphology, GIS.

INTRODUCTION

Leukas is the 4th in size island in Ionian Sea (Fig. 1). It is a mountainous island of 294,4km² size and 116,7Km coastal length, with rich horizontal and vertical distribution. Coastal zone differs along the island according to the tectonical, erosional and sedimentation procedures (Fig.2).

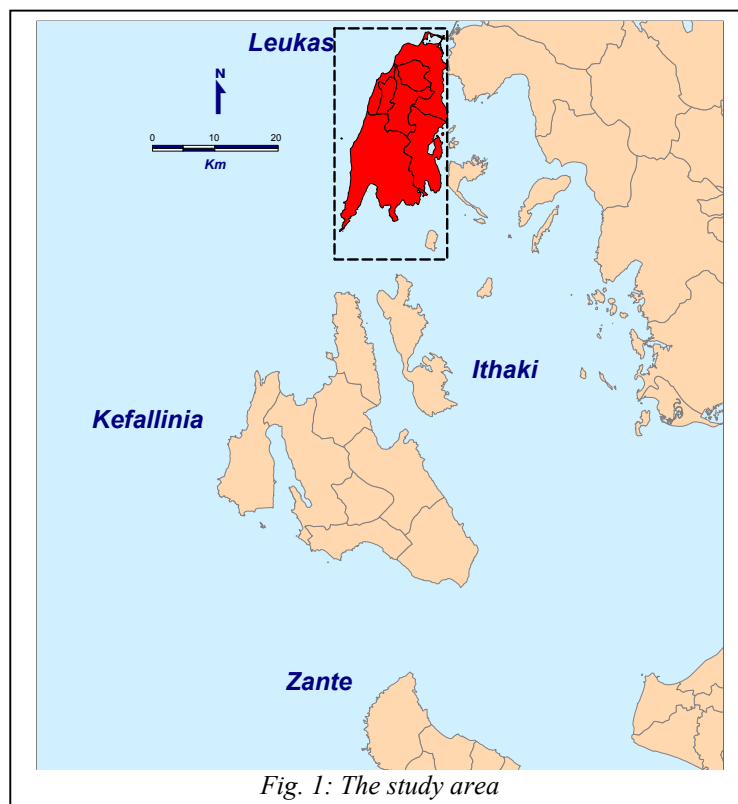


Fig. 1: The study area

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Fig. 2: Characteristic coastal zones of west part of Leukas island.

GEOLOGY

The geological study of the island of Leukas has been the object of many studies such as those of Partsch, J., (1889), Renz, C., (1937 & 1938), W. Seidlitz, W., (1928), Bornovas, J. (1964), Philippon, A., (1958), Verginis, S., (1976), etc.

Two geotectonic zones compose the studied area: Ionia and Paxon. The biggest part of Leukas is covered by the Ionian zone (210,1 Km²) while Paxon is located in the southwest part of the island in Leukata peninsula (covering an area of 63,9Km²). Finally there are some Quaternary formations in the south of the island in Vassiliki basin, in the north of the island in Leukas plain, in the east around Nidri area and in some isolated positions.

METHODOLOGY

The geomorphological study of Leukas island took place through photo-interpretation of aerial photos (HAGS, 1988, scale: 1:33.000) and field work during the years 1999 and 2000. All geographical, geomorphological and geological data (IGME, 1963) collected were imported and analyzed in ArcView geographical information system. All primary data were processed for the development of secondary data, which were finally analyzed to extract different thematic maps such as the morphological slopes and drainage density (Horton, R.E., 1945, Strahler, A.N., 1957). Geomorphological parameters such as morphological slopes, drainage density and frequency, were estimated, analyzed and thematically represented for each drainage basin.

For the accuracy of field measurements we used GPS technology in simultaneous combination with GIS, so that the position of each characteristic was immediately inserted and tested to the GIS. This methodology of primary data collection was used in order to have better results during the combined analysis of different information layers.

GEOMORPHOLOGY

The mountainous area of Leukas is characterized by abrupt slopes, which are intersected by deep ravines. The highest peak is situated at Stavrota mountain (1.141m). There is a central calcareous area covering one fifth (1/5) of the total area with an average altitude of 900m. This central area consists of the mountains Stavrota, Elati (1.084m), St. Ilias (1.014m) and Mega Oros (1.012m). Other smaller mountains are the Lainaki, Achrada and Sikeron to the south, Skaroi to the east, Megali Rachi to the north and Leukata to the southwest. At the central calcareous area there are many calcareous tablelands, the highest of which is the Kalokairinos one extending between Mega Oros - Epano Pyrgos, with an average height of 800m. There is an eastern tableland at the mountain Skaroi with an altitude of 550-600m consisting of limestones and neogene formations. To the north Sfakioton plain extends (of 400m altitude), consisting of Neogene



Fig. 4: Basin, result of Tsoukaladon fault, consisted of alluvial deposits and coastal formations.

formations while western there exists the low altitudinal (350-400m) tableland Tsoukaladon-Lagadas Grias consisting of limestones. In Leukata peninsula, there is a narrow tableland of the same name and 400-500m altitude.

There are some basins in Leukas island. The Vassiliki one at the south part of the island, is faulted in the south part and erosional in the north. Vassiliki basin has been formed between

the Hortaton-Komiliou, the Stavrota mountain to the east and Leukata peninsula to the west. It is expanding to the south and reaches smoothly the sea, where a narrow coastal aggrading plain is created (Fig. 3). Another basin situated in the central part of the island between the mountains Stavrota - Elati - Lainaki and Korifi called St. Ilia Sivrou, which meets the Vasiliki basin in the southwest and is possibly a branch of it. Other erosional basins are the Egloubi and Dimosari (between the north part of Elati mountain and the south cliff of Skaroi mountain). In the north part of the island there is a big plain, a result of the Tsoukaladon fault (Fig. 4 & 5) (Livaditis, G., et al, 1987). It is a flat and low altitude area consisting of talus and other transferred materials which gradually joins at the north and east the lagoon marshy and mad covered area.



Fig. 3: The south part of Vassiliki basin and the homonymous basin.



Fig. 5: Part of Leukas plain and the salt - pits.

The drainage system mainly consists of torrents, some of which are flowing out in small closed basins or karstic gaps. There are many karstic sew pipes in the calcareous tablelands as well as other karstic formations (Fig. 6 & 7) such as doline, uvala and polje (Fig. 8, 9 & 10 & 11). Most of doline and uvala are situated in the

Kalokairinos tableland, mainly used for agriculture. The most significant poljes are: a) Livadi, north of Karia village which overflows during winter and drains through two karstic pipes situated at the north b) the two poljes north and south of Marantochori village, c) one north of Alexandros area d) in Strogilo tableland. The most significant uvalas have been observed in Megali Rachi and Strogilo area. The most significant dolines are that southeast of Platistoma village and two at the tableland south and north of Karia village. All these characteristics are presented in a map, a part of which is shown in Figure 15.



Fig. 6 & 7: Cave in Sivros area.

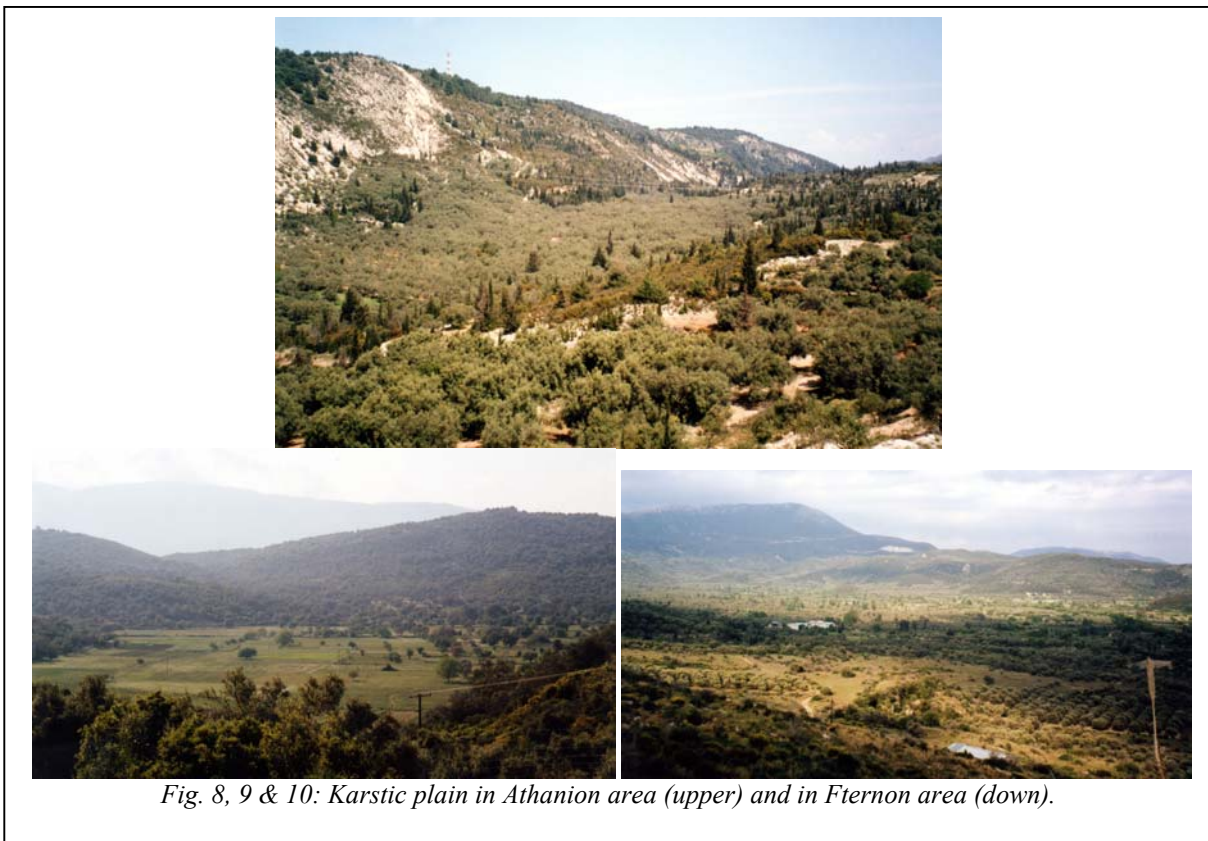


Fig. 8, 9 & 10: Karstic plain in Athanion area (upper) and in Fternon area (down).

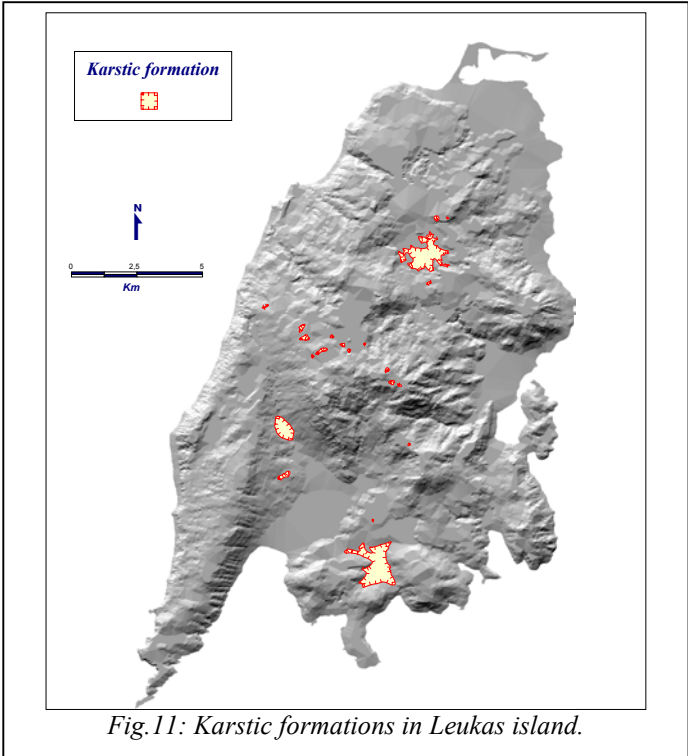
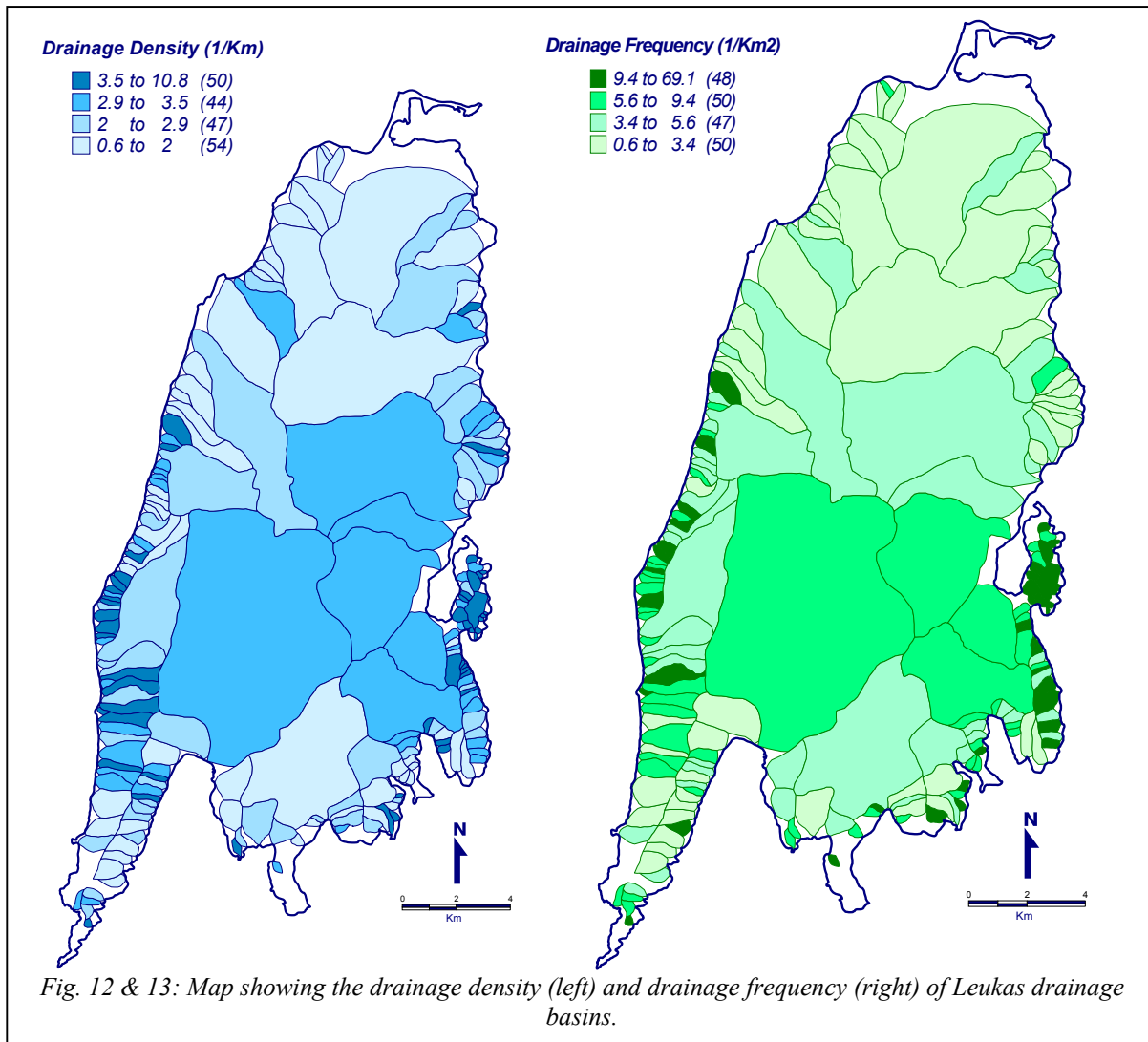


Fig.11: Karstic formations in Leukas island.



DISCUSSION-CONCLUSIONS

The morphology of Leukas island is mainly influenced by the tectonic regime, which has affected all the Ionian islands (Gournelos, Th., et al, 1997, Vassilopoulos, A., 2001) and the erosional activities that have mainly affected carbonate formations. The drainage system of the island is influenced by tectonic activity, as a knick points analysis (Verikiou, E., et al, 2000) has showed. Many of the Leukas' basins have been created because of big fault zones, such as the Leukas and Vassiliki basin. The drainage basins analysis of drainage density, frequency and slopes, showed very high values in the northern part of east and west zone and high in most of the big basins of the south part (Fig. 12, 13 & 14). Erosional processes mainly in limestones are prevailing in Leukas with several karstic formations such as dolines, either isolated or grouped and combined to form ouvalas and then poljes.

Moreover a geographical database has been developed with geographical, geological and geomorphological characteristics and corresponding thematic maps. The descriptive part of the geographical database has been linked to several photos that have been taken during fieldwork. The scale that most of the presenting data have been collected is 1:30.000, while the created thematic map may be shown at any scale as it has been developed in a GIS. Figure 15 shows only a part of the resulted map for reasons of better visualization.

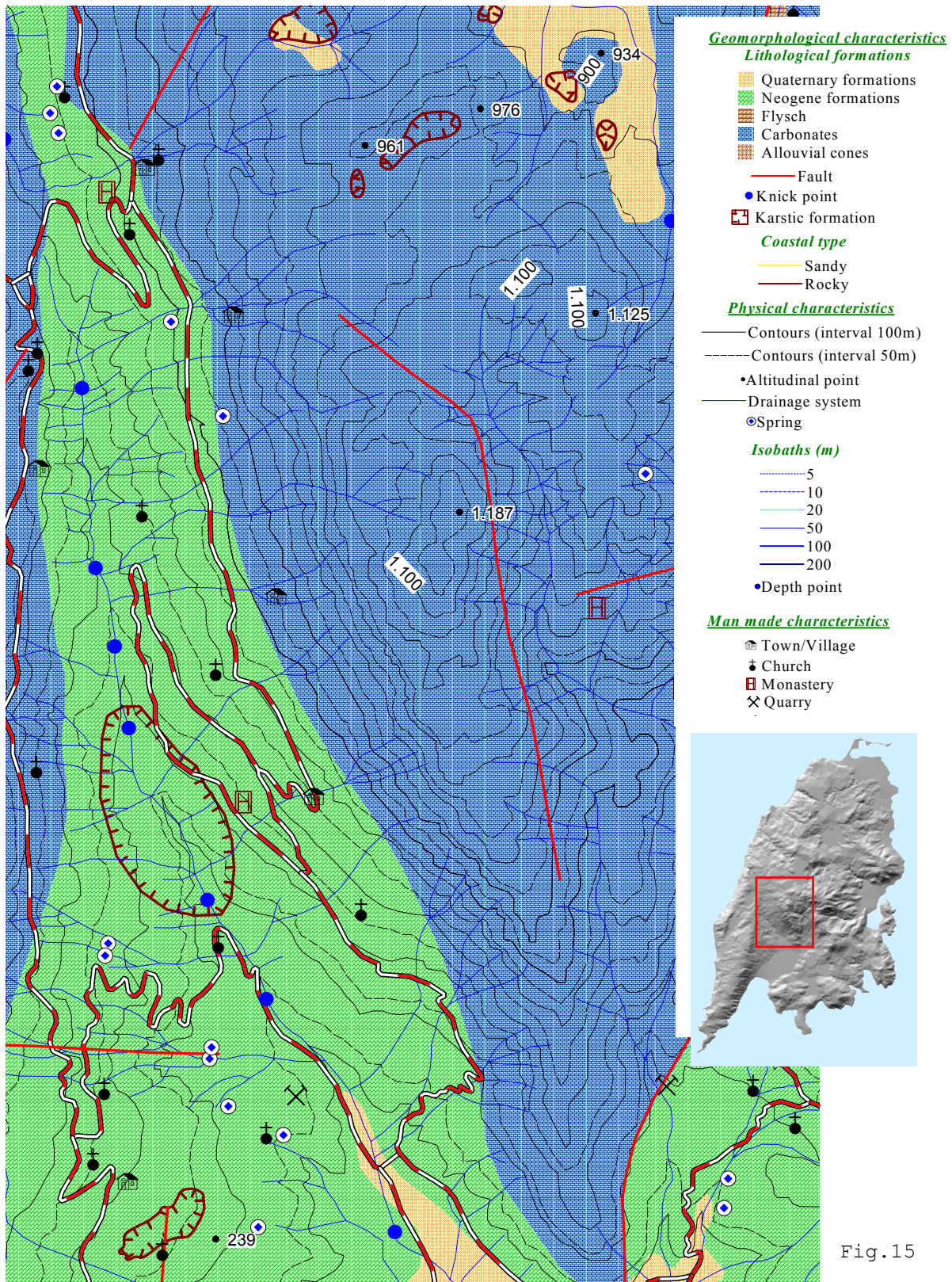


Fig.15

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