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Gerakas Gulf, Greece: A natural park and a geological monument

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ABSTRACT: Gerakas Gulf in Laganas Bay, SE of Zakynthos island, constitutes the most important remaining nesting area for the loggerhead sea turtle *Caretta caretta* in the whole Mediterranean. In addition, it comprises an important geological monument as it is possible to recognise the Plio-Pleistocene boundary based on calcareous nannofossil biostratigraphic events. For these reasons, Gerakas Gulf is thought to represent a special site of Natural heritage.

1. INTRODUCTION

Gerakas Gulf is found in the SE side of Zakynthos island (Ionian sea) and constitutes part of the Laganas bay (Fig. 1). One of the most representative geological sections of Gerakas Gulf - Gerakas section- has been studied in detail in order to establish the existence of a possible geological monument (definition of the Plio-Pleistocene boundary).

In addition special reference is made to the loggerhead sea-turtle *Caretta caretta* - a threatened species - which its existence depends entirely on the protection of the nesting area of Laganas bay.

The scope of this paper is to reinforce the general consensus that Laganas bay and specially Gerakas Gulf represents a special site of Natural heritage, as it may combine a sea turtle Marine Park with a very important geological monument.

2. GERAKAS GULF AS A SPECIAL ECOSYSTEM

Caretta caretta is the only of the seven species of sea turtles of the world and the only of the three species of the Mediterranean which is nesting in our country. Several nesting beaches of the loggerhead sea-turtle *Caretta caretta* have been identified by the Sea Turtle Protection Society (STPS) in Greece. Laganas bay in Zakynthos - which includes the Gerakas area (Fig. 1)- is the most important remaining nesting area for the loggerheads in the whole Mediterranean, hosting 800 to 1800 nests, depending on the season, on a total of 4km of sandy beach.

Sea turtles spend almost all their life in the sea, but their existence depends entirely on specific beaches where female turtles lay their eggs. Every summer loggerheads from different parts of the Mediterranean return to their nesting beaches in the bay of Laganas. The female turtle comes ashore at night to lay her eggs in the sand. Sea turtle eggs must remain undisturbed in the warm sand for about 60 days before they hatch. From late July, hatchlings start making their appearance on the surface of the beach. They then make their way down to the sea.

Today, sea-turtles are considered a threatened species as the uncontrolled exploitation of the environment by man has reduced their numbers. Sea-turtles, their nests, eggs and hatchlings as well as their breeding habitats are protected under greek and international legislation. The protection of the bay of Laganas and Gerakas on Zakynthos, the single most important loggerhead nesting area in the Mediterranean, has been a hot environmental issue in Greece for over 10 years and has been high on the agendas of international conventions and meetings. Progress has been made in small but decisive steps. The nesting beaches of Laganas bay, have been declared as "specially protected areas for nature conservation" (1984, Presidential Decree). For Greece, the establishment of the first sea-turtle Marine Park will be a major break through in conservation.

3. GERAKAS GULF: A GEOLOGICAL MONUMENT

Gerakas section is located in the SE side of Zakynthos along the coast of Gerakas Gulf (Fig. 1).

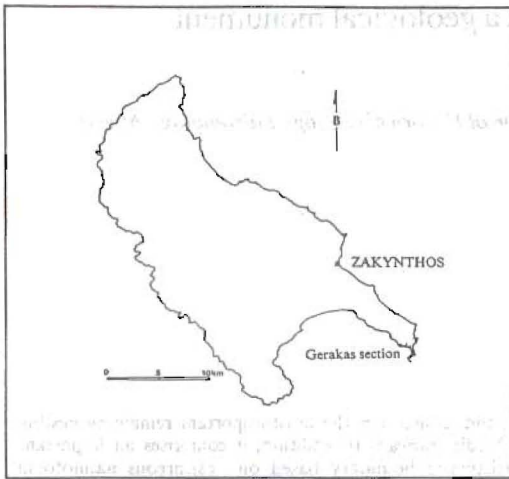


Fig. 1. Gerakas section in Laganas bay

It consists of three Depositional Sequences (Fig. 2), which are indicative of a coastal - shallow marine environment and are bounded by unconformities (Triantaphyllou *et al.*, in press). Depositional Sequence I comprises "Seliniako Topio Unit" and covers the west edge of Gerakas coast. It is composed of 30m of laminated marls with occasional lenses or layers of fine to very fine grained siltstone and sandstone with dispersed macrofossils. Depositional Sequence II is composed of "Gerakas Unit". Most of the part of this Sequence is exposed along the rest of the coast up to the cape Gerakas. This part is mainly composed of 60m of clays, silty clays and calcarenites with dispersed thin conglomeratic channels in between. Depositional Sequence III consists, at its base, of parallel-laminated calcareous sandstones alternating with yellow sandy marls which become more marly in a higher position.

Several papers have been published concerning planktonic and benthic foraminifera, ostracodes and calcareous nannofossils of Gearakas section (Dermitzakis, 1978, Dermitzakis *et al.* 1979,

Dermitzakis & Georgiades-Dikeoulia, 1987, Tsapralis, 1981, Triantaphyllou, 1996, Triantaphyllou *et al.*, in press).

Based on calcareous nannofossil biostratigraphic events (detection of medium *Gephyrocapsa* spp. FAD / bmG event), it is possible to determine the Pliocene-Pleistocene boundary in Depositional

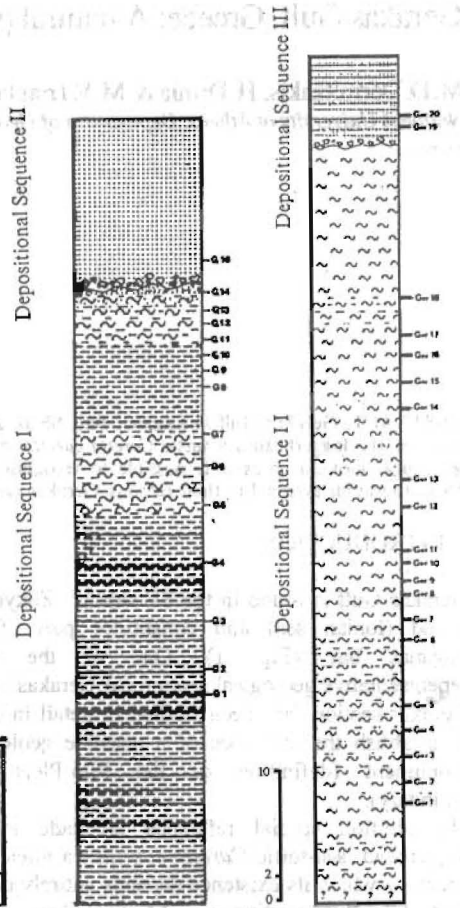


Fig.3. Stratigraphical column of Depositional Sequences I and II



Fig.2. Depositional Sequences I (A) and II (B) in Gerakas section. The frame shows where the Pliocene/Pleistocene boundary has been recognised

Sequence I of Gerakas section (Fig. 3, 4).

It must be noted that the matter of the definition of the Plio-Pleistocene boundary stratotype remained in a controversial state for several years. Following a decade of study and discussions the Working Group of International Geological Correlation Program (IGCP) Project 41 "Neogene-Quaternary Boundary" and the International Union on study of the Quaternary (INQUA), as well as the Committee on Mediterranean Neogene Stratigraphy (CMNS) considered a section near Vrica, S. Italy, as the potential Pliocene-Pleistocene boundary stratotype (Aguire & Pasini, 1985). ICS (International Commission on Stratigraphy) approved the definition of the Plio-Pleistocene boundary in Vrica section (Basset, 1985).

The "golden spike" marking the boundary in Vrica section was placed at the base of a claystone unit conformably overlying the sapropelic marker bed e. This level has been shown to lie at or near the top of the Olduvai (C2n) Subchronozone (Backman *et al.* 1983, Tauxe *et al.* 1983) indicating an age of 1.71 Ma (Berggren *et al.* 1995b).

The establishment of a new global high-resolution biostratigraphy based on numerous calibrated nanofossil bioevents transformed to biochronologic datums (Rio *et al.* 1990, in press, Raffi *et al.* 1993, Berggren *et al.* 1995a) provided a detailed biostratigraphic and biochronologic framework for the Plio-Pleistocene time interval.

The biostratigraphic analysis based on calcareous nanofossils of the marly deposits of Depositional Sequences I, II of Gerakas section lead to the following conclusions. The lower part of Depositional Sequence I can be assigned to MNN19a biozone (Rio *et al.* 1990). The first appearance of medium *Gephyrocapsa* spp. (*Gephyrocapsa oceanica* s.l.) specimens -at about 36m from the base of the Sequence- allows at the specific point the definition of the Pliocene/Pleistocene boundary, based on biostratigraphic events and suggests an age of 1.67-1.70 Ma (Berggren *et al.* 1995a) for the specific stratigraphic interval. The uppermost part of Depositional Sequence I can be correlated with MNN19b biozone. The derived data point to uppermost Pliocene/ lowermost Pleistocene time span. Concerning Depositional Sequence II the derived data point to lower Pleistocene in age (Triantaphyllou *et al.* in press).

4. DISCUSSION-CONCLUSIONS

A very important geological event has been

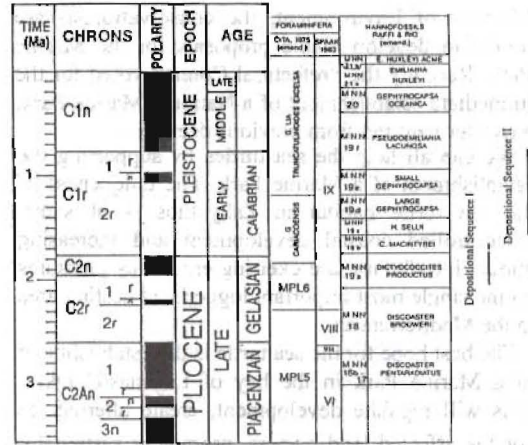


Fig.4. Biostratigraphic location of the studied Gerakas section (Depositional Sequences I and II) based on calcareous plankton biostratigraphy in the Mediterranean, correlated to chronostratigraphy and to the Geomagnetic Polarity Time Scale (Rio *et al.*, 1990. Magnetostratigraphy is based on Berggren *et al.*, 1995a,b)

recognised in Gerakas Gulf. The determination of the Plio-Pleistocene boundary based on calcareous nannoplankton biostratigraphic events in the continuous sedimentary sequence of Gerakas section is unique in the greek area. This fact allows the attribution to the Gerakas section as a geological monument.

The existence of the Plio-Pleistocene boundary in the sequence of Gerakas section in combination with the fact that Gerakas Gulf constitutes the most important nesting area for the sea turtle *Caretta caretta* in the whole Mediterranean, strongly supports the efforts of the Sea Turtle Protection Society (STPS) to declare Laganas Bay a Marine Park.

In the last couple of years, things have started to move in favour of the protection of Gerakas Gulf. This can be attributed to many factors: the persistence of the STPS to remain on the island and approach local authorities and individuals, campaigning both at local and international level for a National Marine Park; the close cooperation with local and other NGOs (Zakynthian Ecological Movement, WWF Greece, Greenpeace Greece); the determination of the greek government to go ahead with the National Marine Park speeding up Management Plan Study that has been dragging on since 1991. Local communities, the Prefecture, the

Ministry of Environment, the conservationists are online to develop viable proposals for the Marine Park. Recently the Prefectural Council voted for the immediate establishment of a National Marine Park, a real turn around from previous decisions.

We can all help the sea turtles by supporting the establishment of a Marine Park. The uniqueness of the sea turtle habitat in Zakynthos is at stake. Uncontrolled coastal development and increasing human interference are exerting enormous pressures on the single most important loggerhead nesting area in the Mediterranean.

The best hope for the sea turtle is the establishment of a Marine Park in the bay of Laganas/Gerakas. This will regulate development, create alternatives for the affected land owners, promote a sustainable tourism that respects the environment and at the same time fully protects the nesting beaches. This way we are giving the sea turtles a fair chance to survive.

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