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REVEALING THE GEOHERITAGE OF EASTERN CRETE, THROUGH THE DEVELOPMENT OF SITIA GEOPARK, CRETE, GREECE

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Abstract

In the present document we present the main studies, actions, initiatives and infrastructure developed under the project GEOTOPIA aiming to develop a geopark at the easternmost part of Crete, in Sitia area. The developed activities may be considered as model to establish a geopark in a rural area under the provisions of European and Global Geoparks Networks, aiming intimately to a responsible tourist development. Study area includes the eastern coastal zone of Sitia municipality extended westwards to the Sitia mountains. It presents an impressive geological heritage constituted mainly by the landscape variations (including gorges, plateaus and long cave systems), hydrological resources, rock types and abundant mammal fossils. The project resulted in an inventory, mapping and evaluation of geotopes using existing methodologies, in undertaking conservation, educational and geotourisitc activities, among them the development of two educational projects, two local museums, 15 geotrails, outdoor panels and signposts, as well as printed, visual and web material. A management and action plan has been also conducted presenting the goals, the methodologies, the resources and the timetable to manage the area as a real geopark. Furthermore, the plan foresaw the interaction of geopark initiative in respect to other planned investments and activities in the area.
Key words: *Geoparks, Geoheritage, Geotourism, Sustainability, Sitia.*

Περίληψη

Η παρούσα εργασία αναφέρεται στις δράσεις, τις πρωτοβουλίες και τις υποδομές που αναπτύχθηκαν στα πλαίσια του έργου ΓΕΩΤΟΠΙΑ, με στόχο τη δημιουργία ενός γεωπάρκου στην περιοχή της Σητείας, στην Κρήτη. Το σύνολο των δράσεων αυτών μπορεί να θεωρηθεί ως ένα μοντέλο σχεδιασμού ενός γεωπάρκου σε μια αγροτική περιοχή κατά τα πρότυπα της υπεύθυνης και βιώσιμης ανάπτυξης που πρεσβεύουν τα Ευρωπαϊκά και Παγκόσμια Δίκτυα Γεωπάρκων. Η περιοχή μελέτης αφορά στην παράκτια και ορεινή ζώνη στα ανατολικά του Δήμου Σητείας που χαρακτηρίζεται από μια ιδιαίτερη γεωλογική κληρονομία την οποία απαρτίζουν οι ποικίλες μορφές του αναγλύφου, με χαρακτηριστικά φαράγγια, οροπέδια και επιμήκη σπήλαια, οι σημαντικές πηγές, τα ποικιλόμορφα πετρώματα και τα πλούσια απολιθώματα θηλαστικών. Το πρόγραμμα εστιάστηκε στην αναγνώριση, αποτύπωση και αξιολόγηση των γεωτόπων, στην ανάπτυξη δράσεων προστασίας, εκπαίδευσης και γεωτουρισμού, με τη δημιουργία δυο εκπαιδευτικών προγραμμάτων, δυο κέντρων ενημέρωσης, 15

γεω-διαδρομών, πινακίδων ενημέρωσης, καθώς και έντυπου, οπτικού και διαδικτυακού υλικού. Παράλληλα, προχώρησε στη σύνταξη ενός διαχειριστικού σχεδίου δράσης που έθεσε τους στόχους και αναγνώρισε τα μέσα, τις πηγές και το χρονοδιάγραμμα επίτευξής τους, και σχολίασε την αλληλεπίδραση της λειτουργίας του γεωπάρκου με άλλες αναπτυξιακές πρωτοβουλίες και έργα που σχεδιάζονται για την περιοχή.
Λέξεις κλειδιά: *Γεωπάρκα, Γεω-κληρονομιά, γεωτουρισμός, βιωσιμότητα, Σητεία.*

1. Introduction

Geological heritage has been well established as a term many centuries ago by the development of the first geological reserves and the initiatives to recognise and protect it, whereas its value is not only scientific and philosophical as many may argue but extents to economical, educational and touristic too (Ellis et al., 1994; Gray 2004). Accepting this fact, the field for discussing, analysing and considering geoheritage widens a lot, opening new opportunities for study, interpretation and conservation of geological environment.

It is a general trend of all organisations dedicated to the study and conservation of nature to combine development activities together with conservation actions, so that the one can support the other (Milton, 2002). The reason for this new approach is the increasing lack of sufficient funds to support nature conservation. The problem became apparent the last decades but has been magnified due to the economic crisis in Europe. The need to discover resources for study and conservation has been covered in many cases by the adaptation of sustainable development actions because only sustainable development can ensure the prosperity of the present generation and the wellbeing of future ones (Croall 1995; Smith and Rees, 1998). Thus many international organisations have focussed their efforts in identifying actions and means that can support such development activities adapted to the needs of sustainability.

The same has been started in geoheritage management by initiatives aiming, either to identify and promote geological and geomorphological features, or trying to conserve and study their value (Fassoulas and Zouros, 2010; Martini and Pages, 1994). The most successful among the others can be considered the initiative of *geoparks* that has been present in literature for several decades but became active just recently, serving the needs for modern nature management in the form of European geoparks (Zouros, and Martini, 2003). National geoparks or individual geotopes or geosites that have been recognised in many countries, are serving only the needs of conservation and study, with quite a few development activities. Digne Declaration for "the Rights of Mother Earth" established the scientific, philosophical and inherit value of geological heritage and set the basis for the development in 2000 of the European geoparks network (Martini and Pages, 1994).

The European Geoparks not only combine geoconservation and sustainable development as fundamental constituents of their existence, but work and collaborate together at a European scale to maximise the benefits of their actions (Zouros and Martini, 2003). The geoparks thus aim to protect and conserve geological heritage simultaneously with the development of various activities that serve the needs of education and information of visitors, attract tourists through geo-touristic and eco-touristic activities and support in various ways local economy and production. By a sufficient and central management, both geopark and local economy receive benefits to continue implementing actions and ensure the necessary economical resources (Fassoulas and Zouros, 2010). As a general rule, all geoparks have to keep high quality standards in services and products not only for the management structure, but also for the collaborating organisations and stakeholders of the geopark. This is ensured by the unique internal revalidation process that justifies every four years the ability of a geopark to achieve the goals and demands of a European geopark (EGN Charter: http://www.europeangeoparks.org/?page_id=357).

Another very important aspect of European geoparks that discriminates them from other similar or in general, nature protection initiatives, is the fact that they represent bottom up processes that are not governed or manipulated by central or governmental authorities. It is this the main reason that UNESCO has embraced since 2004 European Geoparks and used them as a model to develop the Global Geoparks Network assisted by the organisation. By the Madonie Declaration in 2004, all European Geoparks become automatically Global Geoparks Members.

Following these achievements, an increasing number of territories submit every year applications to become a geopark. Also in Greece, which currently hosts four European Geoparks, namely the Lesvos Petrified Forest, the Psiloritis Natural Park, the Helmos – Vouraikos and the Vikos – Aoos national parks, several territories have expressed their intension to create geoparks. In addition, several years ago a project was implemented by IGME to identify areas of important geological heritage and possibilities to create geoparks in several territories (Theodosiou, 2010).

However, the EGN internal evaluation process has become more strict and formalised in order to cope with the large number of applications and the fact that in several countries like Germany, Great Britain and Spain, a large number of geoparks already exists concentrated in many cases in few regions only. A fundamental question comes thus on the surface; namely, how to create and develop a geopark capable to become a European Geopark in future?

This document presents the basic steps that had been followed, under GEOTOPIA project, in order to create the necessary infrastructure, the facilities and the procedures to develop Sitia Nature Park as a geopark initiative, at the far eastern part of Crete, the Sitia Municipality, and to submit an application for a European Geopark membership in future.

2. Geoheritage Presentation and Analysis

In order to establish a geopark at the area of Sitia a certain strategy has been developed analysed in a series ofs steps, each one resulting in a robust deliverable. The first step was related with the inventory of geological, environmental and cultural features of the area, followed by the analysis and evaluation of geological environment and geotopes. A management plan was then conducted parallel with the development of the geotouristic and geoeducational activities. The final step was focused on the development of an action plan and the establishment of a management structure. The latest two steps are supposed to be completed by the summer of 2013.

2.1. Geological Setting of the Area

The area for the proposed geopark is located at the easternmost part of Crete and at the municipality of Sitia, covering the whole area of former Itanos and parts of the former Sitia and Lefki municipalities (Figure 1). It is characterized by a rich geoheritage which includes impressive rocks and geoformations from both the alpine and post-alpine units, as well as a great variety of landforms. The alpine units comprise the “Plattenkalk unit”, the “Phylites – Quartzites nappe”, the “Tripolitsa nappe” and the “Magassa unit” (Creutzburg et al., 1970; Fytrolakis, 1980). Additionally, the geopark includes large series of post-alpine rocks and especially units from the Miocene, Pliocene and Pleistocene eras (Peters, 1985).

The **Plattenkalk Unit**, is the relatively autochthonous on Crete meaning that it forms the base of the tectonic edifice constructed by the nappes that shape the island (Fassoulas et al., 1999). It includes pelagic, metamorphosed limestone, namely marbles, with very characteristic and distinctive dense bedding planes (Fytrolakis, 1980). Across the bedding planes cherts and other silica material are embedded. The age of these rocks is considered as Upper Jurassic to Oligocene, and their appearance in the area is restricted only at its northeastern part and especially in Cavo Sidero cape. The **Phyllite-Quartzite nappe** consists of pre-alpine and alpine in age, metamorphic rocks of blueschist to greenschist phases metamorphism and is tectonically posed upon plattenkalk rocks (Franz, 1992; Zulauf et al., 2002). Apart from metamorphosed, the rocks of this unit are also very intensely tectonised. Within the area of the geopark the most characteristic rock include purple

phyllites, schists, and quartzites with very impressive outcrops around Karidi, Zakros, at the beaches south of Vai and at the beach Maridati. Additionally, they include meta-conglomerates, and other metamorphosed sedimentary rocks, not to mention the unique red marbles dispersed at the regions between Vai and Toplou Monastery. The **Tripolitsa nappe** consists of a very thick sequence of shallow marine Triassic to Jurassic carbonate rocks including both limestone and dolomites (Creutzburg et al., 1977; Fytrolakis, 1980). In many places these rocks expose a very intense karstic weathering accommodating almost the total of the karstic geoformations of the park, namely the caves, the gorges, the springs and they also shape the most significant aquifers of the territory. These rocks dominate within the park and their outcrops are almost everywhere visible. Over the carbonate series are to be found Eocene flysch deposits comprising conglomerates, sandstone and clay. Tripolitsa rocks normally overlay Phyllites-Quartzites nappe. The **Magassa unit** is the equivalent of the broader Pindos nappe that overlie Tripolitsa rocks elsewhere (Fytrolakis, 1980; Zambetakis, 1977). It includes micro-breccia and oolithic, deep sea, light-colored limestone. These appear mainly around the village of Magassa (also known as Vrisidi), but also in very impressive outcrops at the beach of Agia Eirini, at the region between Ziros and Sitanos, as well as at Plativolo plateau where the Kato Peristeras cave is located. The contacts between these units are in most cases impressive low angle faults.

The **post alpine** sediments occur mainly at the areas along the northern coast and at the area of Zakros, consisting of Middle Miocene sediments (limestone, sandstone, marls and clay) attributed to Skopi, Kastri and Palekastro formations (Peters, 1985). Near the area of Agia Fotia and within the early Miocene Skopi sediments the *Deinotherium giganteum* has been excavated (Poulakakis, et al., 2005). The Pliocene and quaternary rocks occur mainly at the coastal zone in the area between Kato Zakros and Xerokampos, hosting the impressive Pleistocene mammal fauna of the area (Dermitzakis and de Vos, 1987; Kuss, 1980; Reese, 1996).

Landscape of the area is characterized by the presence of the large karstic areas constituted by the Tripolitsa and Magassa limestone. Vertical cliffs exist in many places, bounding the mountainous area from the coastal zone, whereas many gorges form either due to crustal uplift and weathering or due to coastal cave erosion. Various sized plateaus occur everywhere, together with many long, in some cases of several kms scale, caves (Platakis, 1975). Crustal uplift has also created another impressive landform feature in the area of Kato Zakros, that of the coastal terraces, that depict also the Pleistocene glacial sea level changes (Strobl et al., 2009).

2.2. Geotope Inventory and Assessment

Geological field studies and mapping identified more than 88 sites of geological importance in Sitia Nature Park that have been recorded using a template produced for the field inspection. Data collected refer to the geological and geomorphological characteristics of the geotopes, the existence of fossils or other important structures, the geodiversity of the site, the relations and connection to the broader ecological and human environment, aesthetic and visibility characteristics, existing activities and uses, as well as the protection and conservation status. According to the prevailing geological features, the geotopes were after attributed into several categories, like geomorphologic (analysed further into landforms, coastal, karstic, gorges and caves), geological (that are distributed in petrological and stratigraphical), tectonic (categorised further in tectonic, folds, and microtectonic), hydrogeological, fossiliferous, geocultural and geohistorical.

From the 88 geotopes that have been identified, 73 of them were then assessed using the methodology developed by Fassoulas et al., (2012), in order to recognise the touristic, educational, and conservation values (Figure 1). The rest geotopes refer to caves for which we couldn't collect sufficient data. According to this evaluation (Appendix 1) the highest **educational value** share two gorges the Kato Zakros and Moni Toplou, mainly due to their proximity to tourist and other landmark points, followed by the spring of Pano Zakros, the Voila Venetian settlement and the Pindos Tectonic nappe at Xirolimni. Regarding the **touristic value** the geo-archaeological site of

Kastri near Palekastro received the highest rank, closely followed by Maridati beach, the Kato Zakros gorge and the tectonic nappe at Xirolimni, whereas the Voila Venetian settlement and the Moni Toplou gorge got also high value. Due to these two results it becomes apparent that Kato Zakro and Moni Toplou gorges, Voila Venetian castle and settlement, as well as the nappe at Xirolimni appear the most important geotopes of the area in respect to geotourism and education.

Regarding the protection-conservation value (Appendix 1), the majority of the geotopes received values below 5 meaning that quite a few need protection measures and special conservation strategy. The most vulnerable appears the *Deinotherium giganteum* excavation site at Agia Fotia. However, as for the geopark needs, this area is a private land and thus the potential geopark is not allowed by itself to develop any conservation activities without the agreement of the owner. The next most vulnerable site appears the stone path at Magassa-Mitato villages, followed by the coastal caves at Agia Eirini bay and Karidi spring.

Compared to other areas of Crete where the same formula has been applied the results of Sitia geotopes present quite similar touristic and educational values than those of Psiloritis and Lassithi Mountains areas, and much lower compared to protection need values (Fassoulas et al., 2007; Fassoulas et al., 2012). Hence, the concentration of such a large number of impressive geotopes in a small area, and their relation to other geomorphological, environmental and cultural features of the area increase significantly their potential value.

3. Developing Geopark Activities

The next step following the inventory and analysis phases of this project was the design of certain geopark activities to interpret, promote and disseminate the value of geological heritage. These activities in a European geopark are mainly attributed in three basic categories, the interpretation, the educational and the geo-touristic, that in most cases can be combined to each other.

3.1. Interpretation Activities

The interpretation designed for Sitia Natural Park was shared into **insitu** interpretation, and in **printed** material. Insitu interpretation was mainly achieved by the designation and interpretation of certain *geotrails* and the development of outdoor *panels* that refer either to the established trails or to a specific geotope. According to the study and the assessment of geotopes, 15 trails were developed, some of them based on existing road network, some on pre-existing paths and some newly traced. From these trails four of are car or bicycle trails, whereas eleven of are trekking or hiking trails. Many of these trails can be used for various activities and can serve the various needs of a visitor. The trails run over all territory connecting geological, archaeological and touristic places of the area. The *information panels or signposts* are used mainly for the introduction of trails and have been set up at the most important attractions of the area and the places that a big concentration of visitors happens. These have thus been emplaced at the area of Epano and Kato Zakros villages, the Vai Palm Forest, the Moni Touplou Monastery, and the Karidi village. Their dimensions vary in size depending on the number of trails illustrated (Figure 2a). The geotopes' signposts are simpler displays located at the area of the most important geotopes.

Printed material on the other hand was designed for the various needs of visitors as well as the educational processes. The most important item is the *Geotouristic field guide* that has been produced including general and popularised information on the landscape and geology of the area, the natural and cultural environment as well as the main cultural assets in Greek and English language. A series of five bi-lingual *leaflets* has been also produced for the interpretation of the trails distributed in the various geomorphological and geographical areas of the geoparks. In addition, a big geomorphological and *geotouristic map* of a scale of 1:35000 has been produced. The map at its back-side includes again bi-lingual information on the geology of the area as well as on the various geotopes and the developed trails. Finally, a series of 13 small *posters* was also produced in great number for publicity needs.

3.2. Educational Activities

Two educational projects have been developed for Sitia Nature Park that both fit into the special geological, geomorphological and ecological features of the area. One is dedicated to cave and karstic environment, whereas the second explores and interprets the endemic animal and plant species. The educational projects have been designed as museum kits that occur in the form of suitcases, which can be transferred and implemented in many places and not only indoors. Both projects are based on educational pathways approach and on the concepts of inquiry and experiential based learning (Endelson et al., 1999). They include theory and instructions booklets, a number of educational activities that can be performed indoors and outdoors, games, as well as small models and exhibits. The educational projects are indented to be used at the facilities of the two information centres that have been developed in Zakros and Karidi villages, as no other official educational centre exists at the area. Both projects encompass experiential activities along two of the trails around Karidi and Zakros areas, urging children to experience the nature and geology of geopark.

3.3 Geo-Touristic Activities

Activities that are dedicated to support tourism in the area were focused on sustainable and responsible development (Smith and Rees, 1998). Issues of sustainability in tourism have long ago been established aiming to environmental integrity, social justice and maximising local economic benefit (Croall 1995). This philosophy runs across all products that have been designed for tourism in Sitia Nature Park, including the development of trails.

Thus, the main tourist actions developed so far refer to the development of two **information centers** that will act as contact and dissemination points. These have been established at the villages of Pano Zakros in the form of a Local Natural History museum and at the Karidi as a speleological center. *Local Natural History Museum of Zakros* hosts information on the natural environment of the territory, explaining the local geology and geological heritage in the form of posters, six small dioramas of ecosystems and two displays with representative samples of rocks minerals and fossils of the area (Figure 2b). The *Karidi Speleological center* will serve the needs of speleological research and dissemination. It provides all necessary infrastructures for accommodation and hosting of speleological groups and expeditions.

In addition to the developed infrastructure a **video** has been produced to present the values of landscape, geology, environment and culture of the area, contributing also to the dissemination purposes, the visualization of geopark and as a summary of the activities that have been developed. Finally, all information and products of this project have been uploaded in project's **website** that will act as the entrance gate to geopark's visitors, providing in two languages the activities that are developed, the opportunities existing in the area as well as any other tourist and visitor data (www.sitia-geopark.gr). The website hosts a series of interactive google-based maps that presents geotopes and geotrails in pop-up windows, whereas it offer downloadable files for mobile phones or GIS software (Figure 2c).

4. Putting Things Together

One of the most important prerequisites of a territory to be accepted as EGN member is to act already as a real geopark (Fassoulas and Zouros, 2010). It should thus have set all infrastructure and processes in action, should receive visitors and provide information and services to them and manage all activities and materials in a common and sustainable way.

To meet these purposes two further measures have been undertaken, the production of an Action and Management plan, as well as, after a public consultation the establishment of the Management structure that will be responsible for geopark management. The **management plan** is shared in three parts. The first refers to the inventory and recording of all special features of the natural,

cultural and economical environment putting emphasis on the geological heritage of the area. It includes also the evaluation of the geotopes and identifies the value and the strength of the main sites, resulting in a SWOT analysis. The second part deals with the development of a Strategic plan for geopark development presenting the vision for the operation as a geopark. This strategic plan is based on the provisions and consideration of responsible development putting emphasis on education, development of geotourism and conservation. Based on the evaluation of former part it also sets the priorities for the actions and the measures that have to be developed, sets the targets and recognises the means to achieve them. The third part presents the detailed action plan which summarises the goals and the actions to be undertaken, identifies the organisations, stakeholders, economical and human resources to be used for their achievement and sets the time table for their implementation.

The **public consultation** is one of the most important aspects of any development activity and has already started with discussions with the local authorities, the Foundation Panagia Akrotiriani that owns large properties in the area, as well as local trading and tourism associations, organisations dedicated to the conservation of nature (like WWF, Hellenic Speleological Society, etc.), as well as local inhabitants. For these reasons special meetings, public talks and informative events have been developed and also planned. The interest of all engaged organisations appeared considerably high especially due to other development activities that are planned for the area and have caused very serious arguments and objections. This may be identified as the reason that no Management structure has been set yet.

5. Discussion

The development of a geoprak is a challenging issue for many rural areas along Europe that host important geological features and wealthy environment. This effort regardless the money and resources spent is not always successful due the very crucial parameters that normally are not taken into account during the preparation phase. These parameters refer to the establishment of sustainable and responsible tourism and other development actions that will serve also the need for nature conservation and support of local communities. In addition, an issue that is also underestimated is the existence of a strong management structure that should coordinate all activities developed under the umbrella of the geopark, taking into account the will and opinion of local societies, basic constituents of any responsible development action.

The latter is not always considered seriously, and at the level the phrase “geoparks are not only for rocks, but rather for people” (oral expression by Chris Woodley-Stewart-North Pennines Geopark) summarises the philosophy of geoparks, leading to arguments with local societies and finally miss-functioning of geopark that may lead to its rejection during the evaluation phase. Furthermore, a crucial parameter that needs to be considered is that a territory should actively work as an already established geopark which means that education, conservation and geotouristic activities should be in place prior to application.

Considering all the above issues the project to develop the Sitia geopark was undertaken by the Natural History Museum of Crete and the Sitia Municipality Company for Cultural and Economic development. The effort was based on the scientific inventory, recording and mapping of geological heritage of the area and its further evaluation in order to reveal the individual value of each geotope and the capabilities for education and tourism, not excluding their vulnerability in such development activities and the conservation need. It also encompassed all existing information on the environmental, historical and cultural environment. The developed infrastructure, interpretation material and educational activities, were in accordance with a generic action and management plan that was finally delivered with progressive implementation of the project, aiming to sustainable and responsible development of this particular area under the means of a European geopark.

Regardless the important value of geological heritage, several factors point to the high potentiality of developing a geopark in this area. The first and most important is the inhabitants' willingness to develop and support sustainable development activities, respecting and conserving thus their unique environment, which is the base of all tourism activities developed so far. In addition, the area has a high tourism capability as its distance from the big cities of the island and the difficulties in transportation have resulted in a low tourism profile, with minor for the moment infrastructures, and mainly development of eco- and cultural tourism, for which the area is already famous. The third parameter is related to the fantastic cultural heritage which found its outmost expression on the local diet and cousin.

The model proposed under this geopark project is found by many individuals, as well as organisations of the area, as an alternative proposal to the extreme investments that are in progress in the area of easternmost Crete. These investments, although most of them are related to renewable energy -which from a first view appear environmental friendly- if considered under the provision of sustainability and responsible development, one may find significant contrasts especially on the issues that deal with the reduction of negative economic, environmental, and social impacts, the creation of greater economic benefits for local people and enhancement of the well-being of host communities, and their positive contribution to the conservation of natural and cultural heritage. The reasons for these arguments depend on several facts like their incredible size which occupies in many cases several hundreds of hectares on the mountainous area, the feature of these investments that either are water consuming or waste producing and for which both results there is not yet a clear solution, and finally, that are actually implemented in most cases without the positive opinion and acceptance of local communities. Furthermore, these investments due to occupation of large areas, actually lead into fragmentation of natural environment, landscape modification and increase of threats to species and ecosystems.

Considering the management plan developed for geopark and the activities that have been scheduled, the operation of many of these investments, especially at the mountains areas is not consistent with concept developed for the Sitia Nature Park, but also for the geopark initiative itself. Many of the existing trails need to be modified as they cross areas of large investments, the changes of landscape in some areas can be considered as irreversible and tremendous for the scale of the landscape and the operation of these activities can not be in accordance with visitors' attraction needs. During public consultation all aspects and arguments have been exposed, identifying that both initiatives find supports at local societies and authorities. However, only the implementation of the management plan and the operation of the geopark will prove if these various investments can coincide with a geopark and which of the two approaches is more proper of the culture and local characteristics of Sitia.

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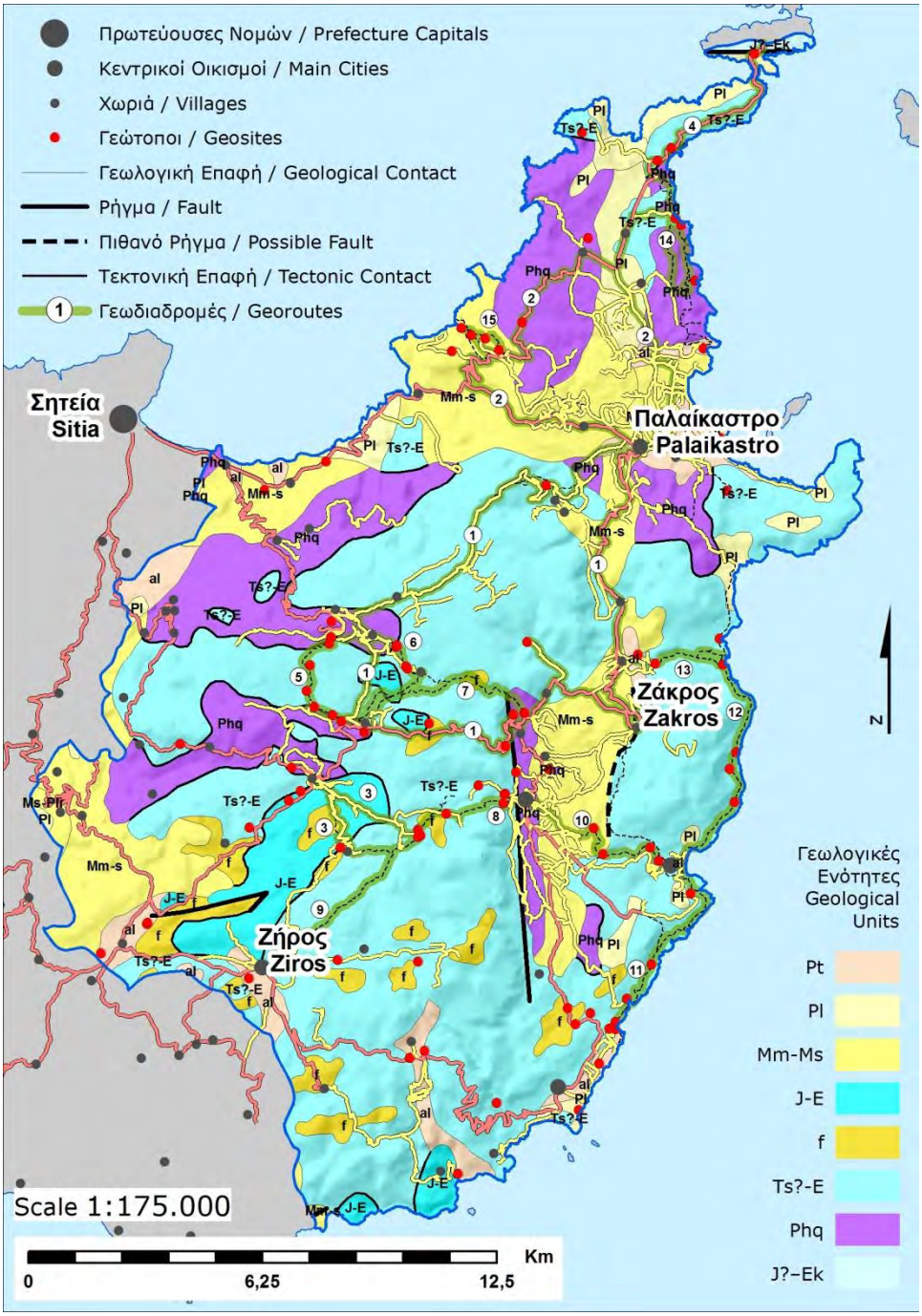
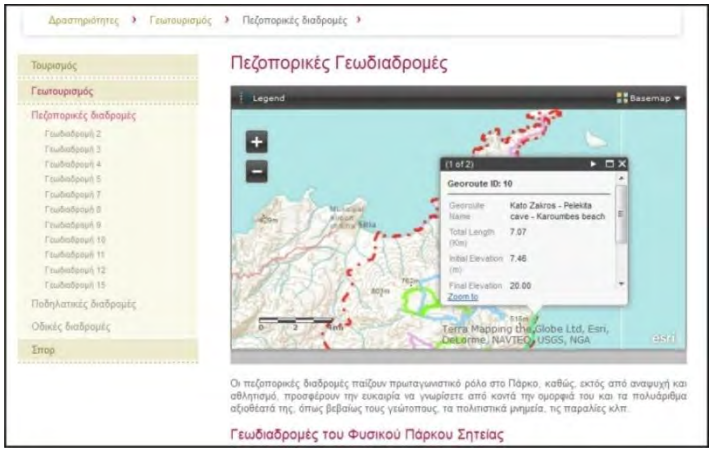


Figure 1 – Simplified geological map of Sitia Nature Park based on Creutzburg et al., 1977 and field studies. Pt, Pleistocene seds.; Pl, Pliocene seds.; Mm-Ms, late Miocene seds.; J-E, Magassa Unit; f, Tripolitsa flysch; Ts?-E, Tripolitsa limestone; Phq, Phyllites-quartzite nappe; J?-Ek, Plattenkalk rocks.

a.

b.



c.

Figure 2 – Images of developed products. a. One of the outdoors panels; b. The Epano Zakros Natural History Museum; c. Capture of project's website with the interactive presentation of geo-trails.

Appendix 1: Sitia Nature Park Geotope assessment

Code	Name	λ	φ	V_{edu}	V_{tour}	V_{prot}
1.1.1	Mavro Mouri Tafoni	26,199143	35,222256	2,88	2,44	2,44
1.1.2	Toplou Monastery Tafoni	26,213046	35,222269	5,23	5,61	3,38
1.1.3	Rock Garden	26,211301	35,112922	4,15	4,31	3,17
1.1.4	Quartzite Walls	26,164487	35,133511	4,26	5,64	2,63
1.1.5	Zakros Boulders	26,279056	35,111859	3,68	4,37	2,9
1.1.6	Kastri Hill	26,277546	35,199825	5,05	6,63	2,88
1.2.1	Katsounaki Sand Dunes	26,242658	35,05778	4,89	3,02	3,41
1.2.2	Psili Ammos Sand Dunes	26,267285	35,251316	4,41	2,68	3,24
1.2.3	Xerokambos Salt Lake	26,237683	35,049575	5,63	3,78	4,42
1.2.4	Hiona Salt Lake	26,277373	35,196582	4,05	3,93	3,56
1.2.5	Coastal Caves Ag Irini bay	26,19557	35,023841	3,7	3,2	4,83
1.3.1	Mavros Kambos	26,19457	35,110634	2,73	3,38	4,17
1.3.2	Zakanthos	26,16324	35,103126	3,53	3,48	4
1.3.3	Handras Plateau	26,092466	35,078751	2,9	4,62	4,5
1.3.4	Ziros Plateau	26,135648	35,0721	2,9	4,62	4,5
1.3.5	Karstic Karrens	26,240842	35,057936	3,31	2,94	1,91
1.4.1	Katsounaki Gorge	26,235495	35,061772	6	4,8	3,83
1.4.2	Kato Zakros Gorge	26,256424	35,098213	7,58	6,48	4,17
1.4.3	Epano Zakros Gorge 1	26,211936	35,115171	3,38	3,11	4,33
1.4.4	Epano Zakros Gorge 2	26,215207	35,120251	4,8	5,17	3
1.4.5	Hohlakies Gorge	26,256821	35,145675	3,88	3,77	3,83
1.4.6	Xerokambos Gorge	26,207515	35,040685	4,25	4,14	2,06
1.4.7	Maza Gorge	26,218053	35,134572	3,73	3,55	2,83
1.4.8	Toplou Monastery Gorge	26,209024	35,225151	6,95	5,68	4,33
2.1.1	Plakoures	26,289982	35,292258	4,6	3,64	2,71
2.1.2	Megali Kefala	26,271085	35,237791	4,6	2,94	2,78
2.1.3	Red Marbles	26,260783	35,267015	4,16	3,7	2,34
2.1.4	Red Metamorphic siltstones	26,214782	35,13417	3,41	5,17	3,8
2.1.5	Maridati	26,273113	35,221557	5,78	6,28	4
2.1.6	Tripolitsa Flysch	26,182183	35,051962	4,45	5,3	3,83
2.1.7	Argilos (Clay)	26,231421	35,038492	4,95	3,83	3,44
2.2.1	Karoumbes Unconformity	26,276656	35,145028	3,43	4,12	2,5
2.2.2	Rousso Spasma	26,246211	35,065047	5,45	3,94	3,28
2.2.3	Agia Fotia Unconformity	26,161591	35,196281	3,8	4,77	3,5
3.1.1	Erimoupoli Detachment Fault	26,264978	35,269997	4	3,4	3,04
3.1.2	Katsidoni Detachment Fault	26,116944	35,128889	2,9	3,4	3,17
3.1.3	Kato Zakros Detachment Fault	26,240173	35,100044	4,1	4,17	3,04
3.1.4	Xirolimni Tectonic Nappe	26,16209	35,157665	6,1	5,83	3,83
3.1.5	Adravastoi Detachment Fault	26,212442	35,126553	4,25	5,2	3,67

Code	Name	λ	φ	V_{edu}	V_{tour}	V_{prot}
3.1.6	Skalia Detachment Fault	26,186143	35,106884	2,68	3,22	2,33
3.1.7	Katsounaki Detachment Fault	26,230936	35,05919	3,85	4,17	2,71
3.2.1	Agrilia Fault Scarp	26,228809	35,063171	4,85	4	4,38
3.2.2	Hamaitoulo Fault Scarp	26,186634	35,053574	3,8	4,07	3,73
3.3.1	Vai Fold	26,265561	35,252968	4,8	3,47	2,88
3.3.2	Profitis Ilias Folds	26,21995	35,228764	4,2	3,87	3,21
3.4.1	Dandoula's Microtectonic Formations	26,180952	35,151134	4,8	4,94	3,67
3.4.2	Magassa Cataclasite	26,184181	35,145828	3,5	3,5	3,67
4.1.1	Karidi Spring	26,171025	35,130679	4,58	5,52	4,67
4.1.2	Epano Zakros Spring	26,211672	35,114971	6,43	5,49	5
4.1.3	Flegas Spring	26,219428	35,151684	5,43	3,14	3,67
4.1.4	Skalia Spring	26,186178	35,105149	3,95	3,08	4
4.1.5	Toplou Monastery Spring	26,202039	35,22779	5,95	3,11	3,61
5.1.1	Epano Zakros Roudists	26,204084	35,117225	3,11	2,33	3,27
5.2.1	Zakros Deinotherium	26,224871	35,120783	1,91	1,96	4,63
5.2.2	Gela's Deinotherium	26,143297	35,189682	3,23	2,22	5,73
5.2.3	Kato Zakros Corals	26,237731	35,106384	2,83	2,81	3,03
5.2.4	Karoumbes Corals	26,27582	35,151409	3,95	3,01	4,17
5.2.5	Toplou Monastery Corals	26,204945	35,226019	3,25	2,34	2,04
5.2.7	Trapeza Urchins and Bivalves	26,238903	35,274174	3,08	2,32	2,73
6.1.1	Petrokopio Ancient Quarry	26,23997	35,248703	3,83	3,94	3,57
6.1.2	Katsounaki Ancient Quarry	26,242744	35,059617	3,73	3,27	2,04
6.1.3	Molivokamino Ancient Quarry	26,253654	35,073189	3,73	3,27	2,04
6.1.4	Pelekita Ancient Quarry	26,279831	35,123928	4,33	3,87	2,28
6.1.5	Petsofas Summit Sanctuary	26,2789	35,187083	3,83	3,94	3,57
6.1.6	Voila Venetian Castle	26,106111	35,08559	6,11	5,81	3,32
6.1.7	Voila Fountain	26,106351	35,085863	2,58	3,18	4,17
6.2.1	Chonos	26,161958	35,153903	3,51	4,1	3,97
6.2.2	Lydia	26,225889	35,189456	3,31	4,1	3,8
6.2.3	Kamares	26,251883	35,147913	3,31	4,1	3,8
6.2.4	Skalia	26,18701	35,105555	2,55	2,9	3,67
6.2.5	Magassa – Mitato Stone Paved Old Path	26,183649	35,146405	4,34	5,23	5,13
6.2.6	Lamnoni Stone Paved Old Path	26,161706	35,075962	3,44	5,08	3,97
6.2.7	Karidi – Agios Ioannis Stone Paved Old Path	26,161859	35,134984	3,51	4,3	3,8