

## GEOschools Project teaching modules: Teaching Geosciences in the Field - Geoparks and Geosites

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### ABSTRACT

GEOschools is a European Union Comenius project whose target is to define a “Framework on Geosciences Literacy Principles” for the secondary school in Europe.

One of the products of this project is the teaching modules reflecting this framework. It will be presented “Teaching Geosciences in the Field: Geoparks and Geosites” module projected for Naturtejo Global Geopark. These are teaching modules, which include material for teachers and worksheets for the students use during fieldtrips.

The proposed approach is based on brainstorming activities around a key-question for each selected geosite that will promote on site observation and debate. Such a teaching approach will develop skills contributing for the education of a conscientious citizen.

“Teaching Geosciences in the Field: Geoparks and Geosites” in Naturtejo Geopark is a privileged area to explore the Geoscientific subjects and including *Geodiversity*, *Geological Heritage*, *Geosites*, *Geoparks* and *Geoconservation*. But also to promote interdisciplinary bridges with approaches in *Archeology*, *Biodiversity* and *Culture*.

**KEY WORDS:** GEOschools Project, geosites, Naturtejo Global Geopark, teaching module.

### INTRODUCTION

GEOschools (<http://geoschools.geol.uoa.gr/>) is a European Union project supported by the Comenius Lifelong Learning Programme, which brings together geoscientists from universities, museums, geoparks, teaching training institutions and educators and focuses to “translate” geosciences into language and learning opportunities to be understood by school students (Fig. 1).

The main goal of the GEOschools project is to define a “Framework on Geosciences Literacy Principles” (Fermeli et al., 2011), for the general European citizens, to be applied at least for the revision of obligatory school curricula for secondary schools for the participant countries: Greece, Spain, Italy, Portugal and Austria. Main aims of the project are: (a) bridging the gap between scientific knowledge and school knowledge in geosciences; (b) increasing the knowledge of teachers and the ability of students in valuing and appreciating

geosciences; (c) improving educational skills of geosciences in European school environment; (d) establishing and sustaining a consortium on research and initiatives on geosciences didactics; and (e) supporting education for sustainability.

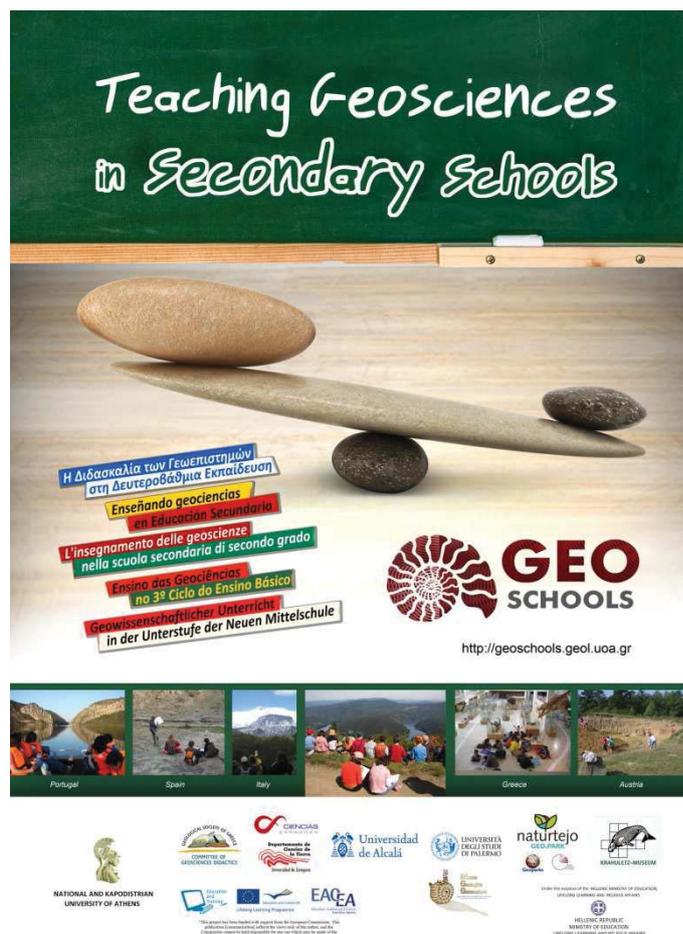


Fig. 1 – GEOschools Project dissemination image (<http://geoschools.geol.uoa.gr/>).

The key results to be issued during the development of the project are: a curriculum comparison research; students and

teachers interest research; a school geosciences dictionary (lexicon); teaching modules on specific subjects, and an interactive website/portal including an e-Newsletter.

#### TEACHING MODULE. *TEACHING GEOSCIENCES IN THE FIELD: GEOPARK AND GEOSITES*

Naturtejo Geopark, European and Global Geopark under UNESCO since 2006, has about 170 geosites and a geological history with over 600 million years spread in 4627 km<sup>2</sup>. The selected geosites for the teaching module include protected areas, archeological sites, and walking trails.

The module “Teaching Geosciences in the Field: Geoparks and Geosites” in Naturtejo Geopark is centered not only in the topic Geoparks and Geosites but also in Geodiversity, Geological Heritage, Geoconservation, Nature Conservation, and Human Impact in the Landscape. It is a privileged site to propose interdisciplinary bridges with approaches in Archeology, Biodiversity and Culture.

In Naturtejo Geopark there are Educational Programmes prepared according to curricula programs of the Portuguese Ministry of Education, which are addressed to all education levels, from kindergarten till university (Catana, 2009a). In the programme “School meets the Geopark”, students and teachers visit geosites, museums, carrying out walking trails, boat trips, visit science centres, always guided by the Geopark specialised team. There is also the “Geopark goes to School”, where the geopark’s team operates several activities inside the classroom or taking the geodiversity around the school. A special annual programmes “Anim'a Rocha” (which may be translated as Hearten Rock), is conceived to support teachers and students all over the school year, is also part of the educational offer. As Education does not finish in the school, the Geopark works to communicate heritages to the public, by fitting particular strategies, with proper tools, specific strategies and specialized guides (Catana, 2009b; Neto de Carvalho, 2009; Rodrigues, 2012).

#### *Geosite Selection*

During the I GEOschools Conference, on the scope of the GEOschools Project, about 100 teachers visited selected geosites (Neto de Carvalho et al., 2011, Rodrigues et al., 2011). Besides the recognized scientific importance of the geosites and its pedagogical relevance, already used in the Naturtejo Geopark Educational Programmes, teachers discussed their pedagogical use in classes.

Some of these geosites are also used as examples in Portuguese textbooks for different subjects. All these sites have high pedagogical value, with good legibility and magnitude of the phenomena or processes involved, easy accessibility, most of them with interpretative walking paths, and include one Natural Monument, one National Monument and sites associated with other heritage values.

Monsanto Inselberg was selected because it is one of the best examples of this kind of large scale landform in Portugal.

Rises up as a residual relief from Castelo Branco Surface, with a 310 million years history since the magma intrusion and crystallization. This typical granite landscape, covered by giant boulders, displace many examples of granite landforms, including ingenious uses of the granite by Man along millennia and a unique geomorphological-dependent culture. These features make this geosite an excellent open air classroom, where geological, historical and cultural heritage are combined in harmony. It is possible to visit the geosite through the geotourist footpath “Boulders Trail”.

Penha Garcia Ichnological Park is one of the ex-libris of Naturtejo Geopark (Fig. 2). It integrates landforms (epigenetic valley), structures (faults, folds, beds, physical and biogenic sedimentary structures) and geological materials (rocks and fossils) with high scientific and pedagogical value. Within the Fossils Trail, that crosses the geosite, it is possible to have a general overview of these different types of coexisting heritage, including popular architecture using quartzite, the Templar Castle, water mills, rock-related habitats for flora and fauna of special interest for conservation. In this sense, Penha Garcia Ichnological Park is considered a Nature Exomuseum.



Fig. 2 – Penha Garcia Ichnological Park during a school visit.

Ponsul Fault is the major tectonic structure in the region and its effects can be observed in several sites of Naturtejo Geopark. It is possible to observe the fresh scarp and the two different blocks in a larger scale geosite (Castelo de Idanha-a-Nova Viewpoint) and also to analyse the recent reverse movement of the fault that thrustured tardi-Variscan granites over the more recent sandstones from Palaeogene (Road 354, Idanha-a-Nova).

Portas de Ródão Natural Monument is one of the ex-libris of Naturtejo Geopark and includes several geosites in its national protected area. From the viewpoints it is possible to appraise the magnitude of the Appalachian-type quartzite crest, the epigenetic gorge and the Ródão Syncline. The relation between Biodiversity and Geodiversity is also very significant in the inaccessible cliffs, with priority habitats.

Fossil Tree logs were selected because they are rare paleobotanical findings in Portugal (Fig. 3). They are two specimens of the few fossils known of the *Annonoxylon teixeirae*, described for the first time in Portugal and still poorly known in the world fossil record. It is possible to observe the presence of interaction marks between distinct

insects and the trunks (drilling patterns). The taphonomy of the logs allows reconstructing the climatic conditions in the region for the Miocene in the past.

Portas de Almourão is an impressive epigenetic gorge in the quartzite crest with a cultural landscape where Biodiversity, Archeology and Culture coexist and were threatened for a long time by the construction of a dam that would change this landscape and the ecosystems.



Fig. 3 – Vila Velha de Ródão Fossil Tree logs.

#### *Contents and skills under the “Framework on Geosciences Literacy Principles”*

The “Framework on Geosciences Literacy Principles” is the main goal of the GEOschools project. It reflects the results obtained through a curriculum comparison research (Calonge, 2011) and students and teachers interest research based on questionnaires. This Framework embraces the basic topics that every European citizen should study. For each general axis, the most important subjects to be developed and the main skills with related bibliography to support teachers was identified.

After the selection of the geosites, the teaching module was designed considering contents and skills for the secondary school from the “Framework on Geosciences Literacy Principles”.

Another tool arising from GEOschools is the School Geosciences Dictionary (Meléndez et al., 2012) focused on the vocabulary of the curricula of high schools. It is a series of glossaries covering the main branches of Geosciences in a multi-lingual version using a language suitable for students.

#### *Development of the strategies and tools for all the geosites*

For each geosite there are specific activities related with one key-question, where the students will be actively involved with. These activities encourage the explanation of abovementioned concepts, formulation and confrontation of hypothesis, contributing to the debate and to take decisions due

to topics related to Geodiversity, Geological Heritage and Geoparks.

Within the basis of the entire teaching module is the construction of the geological history of Naturtejo Geopark that is revealed through the activities in the different geosites. This constructivist perspective makes the student active in its learning process.

Each geosite has a main topic, developed through a key-question:

- Monsanto Inselberg (Fig. 4): How does the water shapes the landscape?



Fig. 4 – Monsanto Inselberg: granite landforms and local history.

- Penha Garcia Ichnological Park: Which testimonies do we have about the past environments?
- Ponsul Fault: How do the mountains are formed?
- Portas de Ródão Natural Monument: How does Geodiversity influences Biodiversity, human occupation and activities?
- Fossil Trunks: How these fossils do allow us to recognize climate changes?
- Portas de Almourão: What is the sustainability of the construction of a dam in this geosite?

The module is designed for teachers and it is divided in two main parts: one for teachers and one to be used for students.

The first part presents the themes and geosites, the contents and the dexterities, giving also bibliography for each topic. There are also available tools that the teachers can provide, using common materials and PowerPoint presentations dedicated to all the geosites to use in classes to introduce the fieldtrip or to reinforce it after.

On the second part, teachers have a first worksheet to prepare the fieldwork in the classroom with specific activities to the students targeted to the Naturtejo Geopark. There is also one worksheet for each geosite to explore in the field.

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