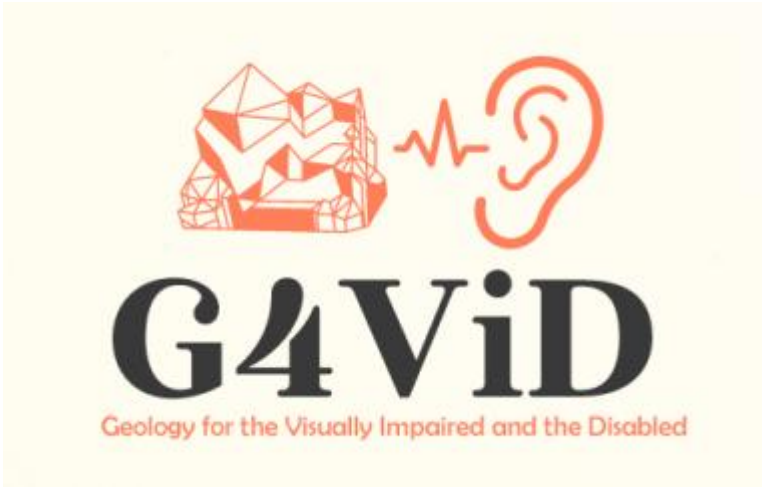

Project No: 2020-1-EL01-KA201-079157

Intellectual Output

O1: Geopark database and mapping

Partner: P1 MOUSEIO FISIKIS ISTORIAS APOLITHOMENOU DASOUS LESVOU
(Natural History Museum of the Lesvos Petrified Forest)

IKY
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Prepared by

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1 Introduction

1.1 General

The “Geopark database and mapping” is the 1st Intellectual Output of the “Geology for the Blind and the Visually Impaired” (G4ViD) Erasmus+ project.

The 1st Intellectual Output contains the mapping of a geosites in Geoparks and areas of interest and all the necessary data and information for a creation of the database. The data contains photographs and descriptions of most important geosites within each Geopark and area.The photographs of the database will be used both as visual material but also for transformation into auditory descriptions via the developed software. This will form the basis of the content of the application that will be developed. Mapping information will also be collected for each geopark including pathways, points of interest, sites of geological importance. This information will be gathered via public available mapping platforms (eg. Google maps) as well as from data that will be provided by collaborating geoparks and areas of interest. This mapping information will be used to add navigational capabilities to the geopark application as well as connect it to the database of photographs and information.

Geoparks is a new consept for the protection, conservation and promotion of the geological features of an area. To achieve this, the Geoparks must continuously develop, experiment and enhance methods for preserving the geological heritage and supporting the development of scientific research in the various disciplines of the Earth Sciences. Geoparks also aim to improve society's recognition of the importance of protecting and conserving the the unique heritage of the Earth. Further activities undertaken by the Geoparks include the protection of endangered geological heritage sites for future generations and the education of the public. The Geoparks take an active role in organizing and hosting education activities at all education levels i, in the enhancement of the natural environment and in sustainable development.

1.2 About this Intellectual Output

The subject of Intellectual Output 1 is the celection of the necessary data for the creation of a database which contains all necessary data and content that is needed in order to get visually impaired people and people with disabilities close to Geoparks and make them familiar to Geology. Apart from this, the database aims to provide all the nessesery information for the development of the applications for visually impaired and disabled people related to geology. The first application is aiming to transform images and geological evidences as fossils, rocks or petrified trees into sound files. When this happens a visually impaired person can touch a touchscreen and “feel” according the sound changes the shape of the fossil or geological evidence. The second application refers into a mapping application with extra possibilities. Within this mapping application a visitor in a Geopark can track its path and provide a detailed route recorded into his mobile phone. This route can then be available to another visitor either if they visit the Geopark, either if they wish to virtually visit the place.

The first step of the creation of the database consisted of the selection of geoparks and area of interest for the partners without a Geopark in their country:

Partner organisation	**Country**	**Geopark**
MOUSEIO FISIKIS ISTORIAS APOLITHOMENOU DASOUS LESVOU (Natural History Museum of the Lesvos Petrified Forest)	Greece	Lesvos Island UNESCO Global Geopark
Eidiko Sxoleio Paidikou Anarrotiriou Erythrou Stavrou	Cyprus	Troodos UNESCO Global Geopark
CEIP LA JARA	Spain	Sierra Norte de Seville UNESCO Global Geopark
OPENCOM I.S.S.C.	Italy	Alpi Apuan UNESCO Global Geopark Tuscan Mining Park UNESCO Global Geopark
Liepajas Neredzigo biedriba	Latvia	-

The second step consisted of the selection of the geosites on specific criteria. The criteria for the seclection of the geosites for the database based on international criteria adjusted to the specific needs of the target group of this project. 20 geosites were selected from each project partner and in total 80 geosites were selected.

2. The ‘geopark’ concept – UNESCO Global Geoparks

The ‘geopark’ coneept was developed mainly in Europe in Cooperation with UNESCO. Geoparks are nationally protected areas which include either a number of internationally important geological heritage sites (geosites and geomorphosites) at any scale, or a mosaic of geological entities of special scientific importance, rarity or beauty These features are representative of the region's geological history and the events and processes that formed it. Geoparks have well-defined limits and comprise a large enough surface area to serve local economic and cultural development (Eder & Patzak 2004; Zouros 2004; UNESCO 2004).

The European Geoparks Network was established in June 2000 in Lesvos by four institutions managing geological and natural monuments: Réserve Géologique de Haute-Provence (France), Natural History Museum of the Lesvos Petrified Forest (Greece), Geopark Gerolstein / Vulkaneifel (Germany) and Maestrazgo Cultural Park (Spain). The aim of the network is the protection, utilization and promotion of the geological heritage of Europe through cooperation and the exchange of good practices and experiences. The key objectives are the education and the promotion of sustainable development of geopark areas through low-impact forms of geotourism. The goal of the network is the participation of the most important geological monuments in Europe.

In 2004, four years after the establishment of the European Geoparks Network, UNESCO recognized that geological formations and landscapes directly influence the development of societies and human civilization and that geoparks play an important role in the preservation of geological heritage, education of young people, popularization of geosciences and development of geotourism worldwide. Thus, the organization decided to establish the Global Geoparks Network. The Global Geoparks Network expanded over the following years and is now a global collaboration platform for stakeholders, targeting the promotion and stewardship of geological heritage monuments all around the world.

Since September 2014, the Global Geoparks Network (GGN) is an international organization based in France. This network covers operating continental geopark networks, such as the European Geoparks Network, the Asian-Pacific Geoparks Network, the Latin America and the Caribbean Geoparks Network, the African UNESCO Global Geoparks Netowrk and the Canadian Geoparks Network.

In 2015 UNESCO established the International Geosciences and Geoparks Program, under which “UNESCO Global Geoparks” are recognized, together with the other two UNESCO site designation: World Heritage Sites (WHS) and The Man and the Biosphere Program (MAB).

Each area that is recognized as a UNESCO Global Geopark is a member of the Global Geoparks Network. In 2015, 120 geoparks from 33 countries were recognized as “UNESCO Global Geoparks”. According to UNESCO definition “UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development. A UNESCO Global Geopark uses its geological heritage, in connection with all other aspects of the area’s natural and cultural heritage, to enhance awareness and understanding of key issues facing society, such as using our earth’s resources sustainably, mitigating the effects of climate change and reducing natural disasters-related risks. Today, there are 169 UNESCO Global Geoparks located in 44 countries around the globe between them the following five Geoparks which are connected with the partner organizations of this project:

Partner organisation	**Country**	**Geopark**
MOUSEIO FISIKIS ISTORIAS APOLITHOMENOU DASOUS LESVOU (Natural History Museum of the Lesvos Petrified Forest)	Greece	Lesvos Island UNESCO Global Geopark
Eidiko Sxoleio Paidikou Anarrotiriou Erythrou Stavrou	Cyprus	Troodos UNESCO Global Geopark
CEIP LA JARA	Spain	Sierra Norte de Seville UNESCO Global Geopark
OPENCOM I.S.S.C.	Italy	Alpi Apuan UNESCO Global Geopark Tuscan Mining Park UNESCO Global Geopark

3. The UNESCO Global Geoparks used for the project implementation

3.1. LESVOS ISLAND UNESCO GLOBAL GEOPARK

The Lesvos Island UNESCO Global Geopark, former Lesvos Petrified Forest Geopark, is a founding member of the Geoparks Network that brings visitors to an ancient forest preserved by a massive volcanic eruption 20 million years ago.

Lesvos with an area of 1.636 km2 and 370 km of coastline is the third largest Greek island, and the seventh largest in the Mediterranean. Lesvos is located in the NE Aegean Sea close to the coast of Asia Minor. The island has two major gulfs those of Gera and Kalloni. Its highest mountains are Lepetymnos and Olympus and the largest part of the eastern and central part of the island belongs to Natura 2000 Network. Lesvos belongs to the Pelagonian geotectonic zone of Greece which represents fragments of the Cimmerian Continent. The geological structure of Lesvos Island UNESCO Global Geopark is composed of the Metamorphic basement, the nappe of the ophiolitic sequence, the Miocene postalpine volcanics, the Neogene marine and lacustrine deposits.

The Lesvos Island UNESCO Global Geopark features rare and impressive fossilised tree-trunks. Formed some 15 to 20 million years ago, due to intense volcanic activity, the trees were covered by lava, ashes and other materials that were spewed into the atmosphere. Heavy rainfalls soon followed and saturated the ashes, thus creating huge mudflows of pyroclastic material. These flows moved from east to west with considerable speed and engulfed the trees that covered the western part of Lesvos at that time. Today some of the trunks can still be seen in their upright position with intact roots of up to seven metres, while others are found in a fallen position measuring up to 20 metres. The forest comprised enormous trees similar to those of the Sequoia family found today in North America - as well as pines, oaks, conifers and cinnamon trees. The fossilised trunks have retained fine details of their bark and their interior reveals a great variety of colours. Not only ancient trees were fossilised but an entire ecosystem as well. Branches, fruits and leaves have also been preserved. The Greek state recognised the major environmental, geological and palaeontological value of the area and declared the Petrified Forest to be a preserved Natural Monument (Presidential Decree 443/85).

Moreover in the area of Lesvos Island UNESCO Global Geopark there are findings of the oldest known land mammal (Prodeinotherium bavaricum) 19 million years ago in Greece,

impressive fossils of animals that lived on Lesvos 2 million years ago, numerous volcanic sites and thermal springs witnesses of the intense volcanic activity (21.5-16.2 million years ago), faults and landscapes created from tectonism, caves and karstic structures, erosional forms and waterfalls as well as impressive coastal landforms.

The local economy of the island is based on agriculture with an emphasis on olive oil production, cattle-raising and fishing. Distillery is developed and its main product is the world famous ouzo. An important component of the Lesvos Island UNESCO Global Geopark management plan is the support of the local economy. Several opportunities have been created through Geoparks activities for tourist enterprises, small hotels, guest houses, restaurants, and other enterprises such as local handicrafts artisans. It is worth to be mentioned that Lesvos Island UNESCO Global Geopark collaborates closely with women's agrotourism cooperatives and every summer organizes an agrotourism festival, which promotes high-quality local products, food, and drinks prepared by the women's cooperatives.

The park includes the Natural History Museum in Sigri that offers visitors a better understanding of the geological evolution of the Aegean Sea, together with a variety of original exhibits. Special guided tours of the area and educational programmes for students can also be organised. Educational activities lie at the core of the UNESCO Global Geopark's operations. Environmental education programs organized for elementary and high school students in Lesvos Island UNESCO Global Geopark cover a broad range of activities such as fossil excavation and conservation, nature observation, and bird watching. School visits are organized all year round, contributing to the local economy through the development of educational geotourism. Educational activities for local schools help raise the awareness of the local inhabitants as to the importance of the natural monuments and the conservation of the earth's heritage.

3.2. TROODOS UNESCO GLOBAL GEOPARK (CYPRUS)

The mountainous Troodos UNESCO Global Geopark area is in the central part of the island with its highest peak, Olympos, at 1952 m and 57 km from the capital, Lefkosia. The mountains are covered by natural forests and agricultural fields, vineyards and orchards. The uplift of the ophiolite fragmented its rocks, with radial drainage patterns creating varied and impressive landscapes.

The Troodos ophiolite is internationally known amongst geoscientists for its stratigraphic completeness and well-preserved and well-exposed plutonic, intrusive, volcanic rocks and chemical sediments. Formed 92 million years ago in the Neotethys Ocean by seafloor spreading above a subduction zone, it was uplifted and placed in a dome structure by the collision between the Eurasian and African plates. Asbestos and umber were exploited since antiquity but it was the production and trade of copper from the Cyprus-type massive sulphide deposits that made Cyprus synonymous with copper. The asbestos mine in the serpentinite, now rehabilitated, the chromite mining galleries in the dunite, the ancient copper slag heaps around the copper mines in the pillow lavas, extensive parallel dyke landscapes, spreading center graben valleys and a fossilized transform fault constitute an important geodiversity with significant contributions to the development of plate tectonic and ocean spreading theories as we know it today.

It includes 110 municipalities with a population of 25.000 falling in four districts, Lefkosia, Larnaka, Lemesos and Pafos. It is easily accessible by short scenic routes from the three biggest cities that meet in Troodos square but also an excellent network of country roads through the 110 traditional villages.

The UNESCO Global Geopark goes hand-in-hand with Government policies for the sustainable development of the Troodos mountains area. The self-sustained Geopark Centre, located in an early 20th century renovated school of the rehabilitated Amiantos mine, is the main education center with geological and mining exhibits, a lecture room and a store. It uses a demonstration kit and a documentary during school visits. Many foreign universities conduct field schools in the ophiolite. The nearby Botanical Gardens, the Environmental Information Centre in the Troodos square and the Environmental Education Centre in Pedoulas village receive thousands of children and visitors every year. The local community, represented by the Troodos District Development Agency, also serves as operator of the Center. Local festivals, taverns, wineries, traditional workshops, geological and nature trails, waterfalls, museums, monasteries, medieval bridges and ten UNESCO World Heritage Byzantine churches complete the picture for a demanding geotourist.

3.3. ALPI APUANI UNESCO GLOBAL GEOPARK (ITALY)

The Alpi Apuani UNESCO Global Geopark is located in north-western Tuscany. The Apuan Alps is well-defined and delimited by the Serchio river (to the north-east, east and south), the Aulella stream, tributary of Magra river (to the north and northwest) and the borders of the Massa Carrara-Versilia plain (to the south-west). The UNESCO Global Geopark comprises the whole territory of the Apuan Alps regional Park and includes all the high slopes next to the main watershed of the mountain range and the deep Apuan valleys.

The Apuan Alps, at the north-western edge of Tuscany in Northern-Central Italy, are a fascinating orographic complex, worldwide known for its marbles, abysses and caves of its karst underground. 250 geosites testify to the outstanding geodiversity of the Geopark. The geological heritage is characterized by a tectonic window at the centre of the Apuan ridge showing the oldest geological units of the Apenninic belt, belonging to the Paleozoic (about 500 million years ago). The Apuan Alps have long been considered a classical area of the Italian geology, as they represent the most important tectonic window of the Northern Appennines where the lowermost units of the belt are exposed, being formed by a complex of greenschist metamorphic rocks. This complex is overthrusted by allochthonous units formed by non-metamorphic rocks. Overall, the Apuan Alps display rocks covering a long time span, from the Palaeozoic basement to the Cenozoic foredeep sandstones. However, their characteristic rocks are the marbles (e.g. the Carrara marble) occurring at different levels of the metasedimentary sequences. As for mineralogy, the Apuan Alps are also a very interesting area with about 200 mineral species, among which 18 were discovered in this region.

The Geopark area is a mountainous territory of great geo-environmental value due to its flora and fauna, which are rich in endemic animals (cave salamander Speleomantes ambrosii, coleoptera Duvalius apuanus, etc.) and vegetal species (small flower Globularia incanescens, plant Salix crataegifolia, etc.).

The fame of the Apuan Alps is due to the beauty of their marbles whose quarrying dates back to Etrurian population (6th c. B.C.) and more significantly to Roman period. During the Renaissance many artists such as Donatello and Michelangelo turned to the Apuans to get the white marble for their sculptures. The Geopark includes the Corchia Underground System and the Equi Terme Park, integrating tourist geosites. The UNESCO Global Geopark territory is a special open-air educational laboratory, as it is characterized by natural phenomena of extraordinary illustrative value, the most remarkable being geological. The Geopark engages in tourism activities in parallel with the promotion of environmental and

nature education and promotes initiatives relating to geo-conservation and/or improvement of the sustainable use of non-renewable geo-resources. Every year the UNESCO Global Geopark offers courses for primary and secondary schools and excursions with the help of the Park Guides. The programme envisages initiatives on the tradition and culture of the Apuan territory as well as activities promoting the understanding and knowledge of landscapes and environments, with a focus on bio- and geodiversity. During summer, the Park organizes “green weeks” in the protected and surrounding area for kids from 8 to 15 years old. Educational activity takes place in the woods and high-altitude meadows while the Park provides facilities for their accommodation.

3.4. TUSCAN MINING PARK UNESCO GLOBAL GEOPARK (ITALY)

The Tuscan Mining Park UNESCO Global Geopark is located in the northern of Province of Grosseto in Tuscany, central Italy. The territory of the Colline Metallifere (Metalliferous Hills), stretches between the provinces of Grosseto and Livorno in Tuscany, a predominantly hilly area, covered by extensive forested areas over an area of 1087 km2.
The geological features of the Geopark have resulted from the long and complex geological evolution of southern Tuscany associated mainly with the formation of the local mountain chain (Apennine chain). The Apennine orogenesis caused in southern Tuscany the translation and overlapping, from SW to NE, of tectonic units from different sedimentation and palaeogeographical areas: Ligurian domain, Subligurian domain, Tuscan domain. The Ligurian domain was an oceanic basin formed by ultrafemic and femic magmatic rocks (ophiolites) covered by a sedimentary succession deposited in a deep marine environment. The Subligurian and Tuscan domains were epicontinental settings constituted by a metamorphic basement underlying a sedimentary coverage.
The geological features of the area are the result of the long and complex geological history of southern Tuscany and the formation of the Apennine chain. This territory embraces the area of the Colline Metallifere (Metalliferous Hills), one of most important ore districts of Italy. In this area, there are several sulphide orebodies that for their grade and size were intensely exploited from remote to modern age for production of lead, zinc, copper, silver, iron, pyrite, alum and lignite.
Visiting the Geopark, one can experience active geological processes such as thermal springs, gas and vapour jets, and thermal pools, which in the last 200 years have been used for the production of boron and electricity. Also you can find ancient sub-marine landslide rocks, evidence of an ancient ocean (250 million years ago) and beautiful fossils of

Cretaceous (150 million years ago).

The agricultural landscape near the coast is crossed by drainage canals that affected the plains in a consistent manner mainly in the nineteenth and the first half of the twentieth century. On the higher ground, large areas of forest prevail.

Mining activity mainly occurred in the medieval period and in the 19-20th century. At the end of the 20th century the last mines shut down.

The gateways offer various services: information about the sites, their services and their activities, museum routes, guided tours (also inside the mines), animation activities, workshops and educational activities, hosting displays and exhibitions, hosting events, sale of informative and educational material. The visitors can discover the world of mining, the geological heritage, the historical landscape, the history of mining activities and, above all, the identity of the area of the Colline Metallifere. The wooded areas are mostly part of nature reserves and are made accessible through an efficient network of hiking trails enabling visitors to reach most of the archaeological sites, mining and geological sites.

The UNESCO Global Geopark is inspired by the concept of sustainability that pays attention to the environmental, economic, social and cultural issues of the territory. It employs environmental guides who follow annual specialized training. LEA-La Finoria International Center for ESD is the UNESCO Global Geopark's operational partner who works with schools coming from all over Europe. A team of very well-trained educators offers about 70 different learner paths suitable for different age from three years up to adults. Most of the activities are based on learning by doing activities and cooperative learning methodologies.

In 2014 the UNESCO Global Geopark received the European Charter for Sustainable Tourism Certification and it is deeply committed by its active involvement of various stakeholders in implementing its sustainable development strategy.

3.5. SIERRA NORTE DE SEVILLA UNESCO GLOBAL GEOPARK (SPAIN)

The Sierra Norte de Sevilla UNESCO Global Geopark is located in the central region of western Sierra Morena, a mountain range in southern Spain, which separates the Central Plateau and the Andalusia Depression. The Geopark is situated in the north of Seville province, respectively flanked, to the west by the "Sierra de Aracena y Picos de Aroche" Natural Park, and to the east by "Hornachuelos" Natural Park.

The UNESCO Global Geopark is located mainly in the geological zone of Ossa-Morena, and less in the Sudportuguese Zone (in the western part), of the Iberian Massif, a part of the Variscan (or Hercynian) orogenic belt. All rocks are marine sedimentary deposits, generaly

slightly metamorphosed, of the ages between Upper Precambrian to Paleozoic. There are several batholiths of igneous rocks, emplaced during the Variscan orogeny or later, that have generated the typical landscapes of craglands. Over the Variscan mountains there are in some points, sub-horizontal sediments related to the Upper Carboniferous, Permian and Triassic ages that represent the fill of continental post-orogenic basins (Alanís - San Nicolás del Puerto and Viar).

The Geopark's rich geological, archaeological and mining history has resulted in the recognition of at least 32 sites of geological interest including: The karst and mine complex at El Cerro del Hierro Natural Monument: a spectacular paleo-karst which originated from Middle-Upper Cambrian erosion of Lower Cambrian limestone.The Valley Syncline, with Ordovician to Devonian sedimentary rocks and an abundance of pelagic fossil species.A site containing the highest concentration of impressions of Lower Cambrian jellyfish recorded in the Iberian Peninsula.The crag-land landscapes in the Geopark's abundant igneous rock outcrops.The "Beja-Acebuches" amphibolites interpreted as the remains of an ancient ocean floor, and a suture between tectonic plates.Permian and the Triassic rocks which represent the filling of post-orogenic continental basins.The waterfalls and travertine deposits in the Hueznar River.Mines and quarries, with over 30 ancient and recent mines.

Next to its many geological and natural sites, the Geopark is also rich in archaeological sites: dolmens used as burial places, castles, buildings and churches, as well as numerous settlements and cemeteries from Roman times.

The Sierra Norte de Sevilla UNESCO Global Geopark is strongly committed to environmental education, largely due to its 25-year history as a natural park. It's a normal place for educational activities on the themes of geology, ecology, conservation strategies, preservation of knowledge on local traditions and historical-cultural values. Several of its most significant places are annually visited by thousands of students from schools in the region and Spain. The Sierra Norte de Sevilla Natural Park has an Environmental Education Plan, approved by Governing Board, and there are several educational centres carrying out the activities of the Environmental Education Programme ("Aldea"), sponsored by the Departments of the Environment and Education and Science of the Andalusian Regional Government. In the UNESCO Global Geopark there are several facilities prepared for education: El Robledo Visitor Centre, El Robledo Botanical Garden, Cortijo Berrocal Visitor Centre, Cerro del Hierro Information Point and the UNESCO Global Geoparks network of paths and viewpoints.

4. Geosites

4.1. Geosite definition – Geological heritage

The geological heritage is composed of its geological past, meaning the appearance of rock formations, plant and animal fossils, significant geological structures (e.g. volcanoes, faults), exceptional geomorphological formations (e.g. forms of erosion, landforms), landscapes of remarkable natural beauty etc.

This geological heritage has been created through complex processes which testify to the long and continuous development of our planet. According to the International Convention for the protection of cultural and natural heritage (UNESCO 1972), a location is identified as a geosite if it is a distinctive example of a stage in the evolutionary development of the Earth or represents a geodynamic process in the development of the surface of the planet. The term “geosite” is used to describe outstanding, unique or representative monumental sites.

The geological history of an area is recorded in its geosites and that is why these are of great significance. Locations that harbor geosites have become the object of many studies and specialized management in recent years and can become, through proper and methodical promotion, areas of knowledge, education, study, inspiration, pleasure and delight.

All UNESCO Global Geoparks possesses geosites of great value that constitute important evidence of the Earth’s history.

4.2. Geosite assessement

Over the past three decades, several methodologies for the quantitative and qualitative assessment of Earth’s heritage have been developed to serve geoconservation and geotourism needs. They aim in minimizing subjectivity in the procedure of organizing the results into an understandable and well recognizable ranking system. The first methods were developed for the assessment of geomorphosites and landscape features in general, focusing mainly on their aesthetic and scientific values, while others on karst geomorphosites, or on volcanic geomorphosites as well. Several other methods also induced the assessment of educational and geotouristic values presenting in that way a more complete approach on the overall geosite value. Among existing methodologies, quite a few were developed primarily for the need of UNESCO Global Geoparks to achieve progress on the 10 focus areas. The assessment of the geosites of a geopark not only has a scientific

purpose but also aims at the management and conservation of its geological heritage at a certain territorial and legislative context and under the operational framework induced by UNESCO. Geodiversity needs to be considered in a wider view, combining sustainable development with the conservation of geoheritage. Therefore, such assessment becomes a useful tool for site managers, because it highlights and quantifies the priorities needed for the proper management and protection of the geopark. It can also highlight priorities for sustainable tourism development and educational as well as for the conservation of geosites.

As mentioned above, several methodologies have been developed to assess eithercertain types of geosites or certain needs (conservation, education, geotourism). Synthetic methodologies too, have been developed to assess in certainlevels (international, national, etc.) the total values of geosites. In addition to these, only three main methods so far have been proposed for thequantitative assessment of geoparks' geosites.

As one of the main and practically principal objective of this study is the evaluation of the individual geosites for educational reasons, the most appropriate for the evaluation of geoparks' educational geosites is the method proposed by Zouros & Valiakos (2010).

Zouros & Valiakos (2010) proposed a quantitative method for the evaluation of each geosite, which consists of five criteria with different weighting, and each criterion is subdivided into indicators. Each indicator receives a numerical value during the assessment process. Hence, this assessment is a great tool for the overall assessment of the geosites of a geopark. The above methodology was adjusted to the needs of this G4ViD ERASMUS+ project.

Based on the methodology for each geosite the following "Geosite inverntory sheet" was prepared:

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME:	

GEOGRAPHICAL DATA

GEOSITE LOCATION	
GEOGRAPHICAL COORDINATIONS	
ALTITUDE	
LENGTH	

GEOSITE CATEGORY:

DESIGNATION:

ACCESSIBILITY:

GEOSITE USE:

GEOSITE DESCRIPTION

PHOTOGRAPH

Finaly, 20 geosites from each Geopark of Lesvos Island UNESCO Global Geopark (Greece), Troodos UNESCO Global Geopark (Cyprus), Sierra Norte de Seville UNESCO Global Geopark (Spain), Alpi Apuan UNESCO Global Geopark and Tuscan Mining Park UNESCO Global Geopark (Italy) and Latvia where no Geopark has not been recognized yet was selected highlighting their educational value for visual impered and disable people.

5. Selected geosites - GEOSITE INVENTORY SHEETS

5.1. MOUSEIO FISIKIS ISTORIAS APOLITHOMENOU DASOUS LESVOU / Lesvos Island UNESCO Global Geopark (Greece)

Below there are the "GEOSITE INVENTORY SHEET" of the 20 geosites of Lesvos Island UNESCO Global Geopark (Greece) that were finaly selected by the Natural History Museum of the Lesvos Petrified Forest for the database.

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Giant Petrified Tree with Branches

GEOGRAPHICAL DATA

GEOSITE LOCATION	Sigri, West Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.230889 Y: 25.902917
ALTITUDE	
LENGTH	19.5m

GEOSITE CATEGORY: Volcanic geosite

DESIGNATION: Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (accessible by bus, car, etc.)

GEOSITE USE: Scientific, Educational and Tourist use

GEOSITE DESCRIPTION

A giant petrified tree trunk appeared during excavations in the broader area, in November 2020. The excavations in the area were took place in the frame of the constructions of the new Kalloni-Sigri road.
This is a rare find as it is the first time a fossilized tree with its branches has been found in the broader area of the Lesvos Petrified Forest.
The petrified trunk is kept almost intact in the horizon of volcanic ash that covered it. The tree is in its original position of growth and it seems that the violence of the volcanic eruption laid it on the ground in the place where it was found. The volcanic material covered and kept the trunk, branches, and roots of the tree intact.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 01 Sequoia Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208759 Y: 25.898221
ALTITUDE	240
DIMENSIONS	20m Length

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

A well-known petrified tree trunk of a Sequoia tree in the Petrified Forest Park.
This giant lying fossilized trunk was covered by volcanic ash layers, due to giant pyroclastic flows caused by volcanic eruptions that took place on Lesvos island 20 million years ago.
The scientific name of the petrified tree trunk is "Taxodioxylon albertense", an ancestral form of Sequoia.
The outer surface of the trunk and the morphological features of the wood have been maintained in excellent condition. On the trunk appears the signs of where the branches of the tree started, while in the main trunk, smaller branches were revealed. The length of this trunk is 20m.
The tree was swept away from its growing place by pyroclastic flows and held by a standing tree trunk of a pine. Both of them have been fossilized in this place due to the circulation of hydrothermal fluids rich in silicon dioxide.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 03 Pine Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208723 Y: 25.898484
ALTITUDE	240
HEIGHT	1.50m
CIRCUMFERENCE	4.20m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

One of the most characteristic petrified trunks in the Petrified Forest Park discovered in its original position. This is a primitive pine tree that belongs of the Protopinaceae family and it is characterized by extremely well-preserved external and internal structures including a root system. Its impressive large annual rings with a number of concentric groups are a characteristic feature of this species. At the base of the trunk is a root system in full development demonstrating that the Petrified Forest of Lesvos is autochthonous, meaning that the trees were located in the same position prior to petrification. The autochthonous nature of the forest makes this petrified monument unique.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 12 Pine Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.209267 Y: 25.899360
ALTITUDE	240m
HEIGHT	1.40m
CIRCUMFERENCE	4.00m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

One of the most characteristic petrified trunks in the Petrified Forest Park discovered in its original position. This is a primitive pine tree that belongs of the Protopinaceae family an ancestor of today's pine.
Characterized as a twin trunk since two petrified trunks branch out from a single root system. The trunk displays alternating coloration and clear annual growth rings in three different groups – a characteristic feature of this species.
A visible section of the root system has not been further uncovered because it is poorly preserved.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 15 Sequoia Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208723 Y: 25.898484
ALTITUDE	240
HEIGHT	3.10m
CIRCUMFERENCE	5.30m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrifiedforest -** Located within the NATURA 2000 protected area SCI “Western peninsula-Petrified Forest” - Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

A characteristic petrified trunk of a Sequoia tree in the Petrified Forest Park lying in its original position.
This large standing petrified conifer trunk with 3.10 meters height and 5.30 meters circumference, belongs to the Taxodiaceae family.
Prior to petrification it is likely that this tree was over 100 meters high. A large lengthwise crack in the lower trunk has undergone restoration with mortar and coloring agents to stabilize the fossil.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 20-21 Pine Petrified tree trunks, 22 Sequoia Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208723 Y: 25.898484
ALTITUDE	240
HEIGHT	2.20-2.66m
CIRCUMFERENCE	2.50-2.90m
LENGTH	4.90m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

An impressive cluster of petrified trees is visible at the petrified forest park.
The perfectly preserved petrified tree trunks represent primitive pines (Pinoxylon paradoxum), that belong to the Protopinaceae family have been unearthed due to excavations conducted by the Natural History Museum of the Lesvos Petrified Forest.
The first tree trunk No 21, is 2,66m high and 2,90m perimeter, with impressive colours and perfectly preserved the internal structure of the wood.
The second tree trunk No 20, is also a primitive pine 2,20m high and 2,50m perimeter. Among the standing tree trunks excavations uncovered a lying sequoia tree trunk 4,90m long, covered by the pyroclastic material.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 29 Sequoia Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208723 Y: 25.898484
ALTITUDE	240
HEIGHT	4.50m
CIRCUMFERENCE	3.70m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

A characteristic petrified trunk of a Sequoia tree in the Petrified Forest Park lying in its original position.
This standing petrified trunk of 4.50 meter height and 3.70 meters circumference, was the symbol of the park for many years.
The petrified trunk was revealed by the natural erosion of the volcanic rocks. The outer surface of the trunk is so well-preserved that it gives the impression of an aged tree rather than a fossil.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 30 Sequoia Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208723 Y: 25.898484
ALTITUDE	240
HEIGHT	2.52m
CIRCUMFERENCE	3.75m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

Along the main thematic trail "walking along the sequoia forest" in the Lesvos Petrified Forest Park at Bali Alonia the visitor meets clusters of standing and lying sequoia tree trunks 20 million years old, fossilized in their natural position.
One of the most remarkable fossils is the petrified tree trunk no 42 with vivid colors. This large standing conifer tree has impressive red-brown colors and perfectly preserved morphological characteristics of the wood.
The trunk belongs to the Taxodiaceae family, on species Taxodioxylon gypsaceum, an ancestral form of the modern species Sequoia sempervirens. The tree trunk is 2,52m high and its circumference is 3,75m. At this particular location in the park it appears that once existed a dense Sequoia forest which is slowly being uncovered in the course of excavations.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 01 / Petrified Forest Park at Bali Alonia

FOSSIL SITE: 49 Sequoia Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Bali Alonia petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.203687 Y: 25.900160
ALTITUDE	160m
DIMENSIONS	7.02m Height, 8.58m Perimeter

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION:: Core zone of the petrified forest - Located within the NATURA 2000 protected area SCI "Western peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

The emblematic standing petrified tree trunk of the Petrified Forest Park lying in its original position.
This giant petrified trunk of a Sequoia species is the tallest standing petrified tree trunk in the world.
It is standing in its original growing position, covered by volcanic ash layers, due to volcanic eruptions that took place on Lesvos island 20 million years ago.
It is the lower part of the trunk, which has been kept in very good condition. At its base is the root system of the tree, which proves that it is in the exact same position as it was 20 million years ago.
It belongs to the species "Taxodioxylon albertense", an ancestral form of the modern species "Sequoia sempervirens" which can be found on the west coast of the USA. (California, Oregon), along the Pacific coast, where the climatic conditions are favorable for its development.
This species, together with its species "Taxodioxylon gypsaceum", participated in the composition of the Sequoia forest in the Aegean during the Tertiary, 20 million years ago.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 02 / Sigri Petrified Forest Park

FOSSIL SITE: 07 Conifer Petrified tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Sigri petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.210806 Y: 25.855510
ALTITUDE	40m
HEIGHT	60cm
CIRCUMFERENCE	2.70m
DIAMETER	86cm

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

An exceptional preserved petrified tree trunk and root system of a conifer tree is located at the Sigri Petrified Forest Park.
The tree trunk belongs to a primitive pine tree and presents well preserved internal (growth rings) and external structures. Nine large roots radiating outwards from the root collar are visible.
A large shelter has been built in this site in order to protect the fossil from the atmospheric conditions to a minimum, thus providing an ideal environment for the presentation, exhibition and promotion of this exceptional specimen.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 02 / Sigri petrified Forest Park

FOSSIL SITE: No 08 Conifer tree trunk

GEOGRAPHICAL DATA

GEOSITE LOCATION	Sigri petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.210806 Y: 25.855510
ALTITUDE	40m
HEIGHT	1.04m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

This site contains a standing fossilized trunk of a pine tree.
Excavation work to a greater depth has not proceeded since the objective for the specific site was the focused promotion of the standing petrified trunk and the deeper understanding of the excavation procedure by visitors.
The conifer petrified tree trunk has well preserved external surface and internal wood structures. At the base of the trunk was found a fossil-bearing horizon with fossilized leaf imprints of a rare angiosperm plant species of the subtropics zone which grew in the forests of Lesvos during the lower Miocene.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 02 / Sigri petrified Forest Park

FOSSIL SITE: No 10-11 Tree trunks with root system

GEOGRAPHICAL DATA

GEOSITE LOCATION	Sigri petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.210806 Y: 25.855510
ALTITUDE	40m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

An important fossil-bearing site was discovered at the eastern edges of the Sigri Petrified Forest Park.
A large cluster of petrified trunks was uncovered on two levels. The upper level presents 10 downed petrified trunk sections of angiosperm trees, located one on top of the others. This arrangement is probably due to a pyroclastic flow which swept along the downed trees until they were caught or snagged here by some natural obstruction. The trees were severed from their roots by the explosion of gases during the volcanic eruption which caused the destruction of the forests.
The lower level presents three standing petrified trunks in their original position of growth. The upper parts of the trunks were severed during the volcanic eruptions.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 03 / Plaka Petrified Forest Park

FOSSIL SITE: 01 Cinnamon Petrified tree trunk (East part)

GEOGRAPHICAL DATA

GEOSITE LOCATION	Plaka petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.204334 Y: 25.853628
ALTITUDE	80m
CIRCUMFERENCE	13,7m
DIAMETER	3,7m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

The excavation work in this site unearthed an enormous standing petrified trunk with its root system in excellent condition. This fossil, belonging to the Laurel family, is the largest fossilized trunk in the Lesvos petrified forest with 13.7 meters circumference and 3.7 meters diameter.
In 2002 after extensive research in the Petrified Forest of Plaka, a gigantic standing fossilized log was excavated, belonging to the Laurel family, genus *Laurinoxylon*. All the petrified forms which belong to the cinnamon tree are categorized in the genus *Laurinoxylon.*
The trunk has excellently preserved macro- and microscopic details as well as a root system. From the trunk project large branches which were uncovered intact from the volcanic material. The lower section of the trunk revealed part of a root system, a fact which proves that the trunk is in the same position as was while it was growing, before its petrification. Fossilized leaf imprints, found in the pyroclastics materials at the base, have been identified as leaves of an angiosperm dicotyledonous plants.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 03 / Plaka Petrified Forest Park

FOSSIL SITE: 01 Fossil Site (West part)

GEOGRAPHICAL DATA

GEOSITE LOCATION	Plaka petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208759 Y: 25.898221
ALTITUDE	20m
HEIGHT	79cm
CIRCUMFERENCE	1.80m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

A few meters from the entrance to the Plaka Petrified Forest Park (west side) located a site exhibiting a profusion of roots extending from their root collars and short standing fossilized coniferous trunks, mainly in shades of brown, which belong to the genus *Pinoxylon,* the ancestor of today's pine.
This cluster of 3 conifer trees coexisted with the fruit-bearing trees which dominated the region.
One of the standing fossil trunks in the cluster found in this location. It was uncovered during systematic excavations along with the impressive web of roots of the root system, a proof of its autochthonous nature. Its intense coloration is dominated by brown with shades of black and white in the interior and green and yellow on the exterior. It belongs to the gymnosperm conifers of the genus *Pinoxylon*, a relative of today's pine.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 03 / Plaka Petrified Forest Park

FOSSIL SITE: 06 Petrified tree trunk (West part)

GEOGRAPHICAL DATA

GEOSITE LOCATION	Plaka petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.204334 Y: 25.853628
ALTITUDE	80m
HEIGHT	3.78m
CIRCUMFERENCE	1.80m

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

This excavation site is one of the most interesting in the Plaka Petrified Forest Park because it provides important evidence for reconstructing the creation process of the Petrified Forest. Visitors can easily observe the successive layers of pyroclastic formations which covered the vegetation of this area 18 million years ago and led to the fossilization of the trunks.
The excavation activity brought to light an impressive petrified standing trunk of 3.78 meters heigh and 1.8 meters circumference. This petrified tree trunk is an angiosperm tree with excellently preserved anatomical characteristics of its external wood structure. The external anatomy of the wood is in excellent condition.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 03 / Plaka Petrified Forest Park

FOSSIL SITE: 16 Angiosperm Petrified tree trunk (West part)

ASSOCIATED GEOSITES:
Honeycomb weathering
Geological fault

GEOGRAPHICAL DATA

GEOSITE LOCATION	Plaka petrified forest park, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.208759 Y: 25.898221
ALTITUDE	0m
LENGTH	13m
DIAMETER	52cm

GEOSITE CATEGORY: Paleontological geosite

DESIGNATION: **Core zone of the petrified forest -** Located within the NATURA 2000 protected area SCI "Western Peninsula-Petrified Forest" -
Global interest

ACCESSIBILITY: Excellent (Access to the Park by bus, car, etc. Access to the fossil site through cobblestone path)

GEOSITE USE: Educational and Tourist use

GEOSITE DESCRIPTION

The southern shoreline of Plaka peninsula has been shaped by tectonic activity: this site exhibits the surface of the geological fault which has led to the faulting and sinking of the southern sections of land which are today covered be sea water.
In this site a lying fossilized trunk of an angiosperm tree 13 meters long appears, in shades of brown, red, yellow and white. Most of the trunk is submerged in the sea. Its external anatomical characteristics are well preserved. Natural erosion of the volcanic rock uncovered this fascinating fossil.
Along the length of the fault surface, impressive honeycomb structures have been eroded into the volcanic formations by the action of the water, air and salt.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 04 / Nissiopi Marine Petrified Forest Park

ASSOCIATED GEOSITES: 44 Fossil Sites Volcanic Geosites Coastal Geosites Tectonic Geosites

GEOGRAPHICAL DATA

GEOSITE LOCATION	Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.219219 Y: 25.839531
ALTITUDE	0-60m
SURFACE AREA (m^3)	815 ha
LENGTH	2.605m
MAX. WIDTH	540m

GEOSITE CATEGORY: Fossil geosite

DESIGNATION: Located within the NATURA 2000 protected areas of SCI "Western Peninsula-Petrified Forest" (GR4110003) and SPA "Southwest Peninsula, Lesvos Petrified Forest (GR4110010) – International Interest

ACCESSIBILITY: Poor (accessible only by special glass-bottomed boat of the Natural History Museum of the Lesvos Petrified Forest, during the summer period)

GEOSITE USE: Scientific, Educational and Tourist use

GEOSITE DESCRIPTION

Nissiopi or Megalonisi is located on the western tip of Lesvos and it ranks as its largest islet. Its elongated shape stretching NNE – SSE serves as a natural barrier which protects the bay and harbor of Sigri.
The excavations have uncovered a total of 250 fossils embedded within three different successive horizons of pyroclastic materials mainly of volcanic as hand volcanic pebbles-breccia layers.
Many petrified logs are still standing in their natural growth positions along with fossilized root systems. Visitors can also view downed petrified trunks, which were trapped in volcanic material mud flows, as well as many fragments of thee trunks, branches, twigs and some leaf horizons.
Guided tours on the islet of Nissiopi permit to visitors to access 44 fossil sites featuring impressive standing and downed fossilized tree trunks, root systems, branches and twigs, fruit and leaf imprints on layers of volcanic ash which are all part of the Lesvos Petrified Forest, a unique natural monument on the world stage.
Visitors to the park can tour the sea around the island in special glass-bottomed boat to view the important fossil sites on the seabed as well as along the coastline.
Based on the existence of fossils on the island and in the surrounding sea, the Natural History Museum of the Lesvos Petrified Forest has established the first marine fossil park in

Greece. The objective is to enhance and promote the natural riches of the landscape, fossils and coastal geosites, land ecotopes, the marine biodiversity, as well as the cultural elements tied to the long presence of humans in the region.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 06 / Ipsilou Volcanic Dome

ASSOCIATED GEOSITES:
Ipsilou volcanic dome,
Ipsilou columnar lavas
Pumice layers in Sigri pyroclastics formation
Andesite intrusion within the Sigri pyroclastics
Fossil tree within the pyroclastics
Fault plane affecting pyroclastics

GEOGRAPHICAL DATA

GEOSITE LOCATION	The top of the Ipsilou volcanic dome is the Ipsilou Monastery, Western Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.231251 Y: 25.936376
ALTITUDE	531m
SURFACE AREA (m^3)	23 ha

GEOSITE CATEGORY: Volcanic geosite

DESIGNATION: Located within the NATURA 2000 protected areas: SCI “Western Peninsula-Petrified Forest” (GR4110003) and SPA “Southwest Peninsula, Lesvos Petrified Forest” (GR4110010) - National Interest

ACCESSIBILITY: Excellent (accessible by bus, car, etc.)

GEOSITE USE: Scientific, Educational and Tourist use

GEOSITE DESCRIPTION

The hill of Ordymnos dominates the western peninsula of Lesvos, with the highest peak reaching 531 meters. It represents a volcanic dome and with its conical shape is one of the most characteristic volcanic structures of Lesvos.
At the top of the Ordymnos volcanic dome the Ypsilou Monastery was build during the 7th ad.
The volcanic structure formed in the last phase of volcanic activity, 16.5 million years ago, and is the largest of a series of volcanic structures arranged along a large tectonic eruption from north to south.
Its creation is associated with the rise of magma that moved at a slow speed, intruded the older metamorphic rocks of the basement, dislodged the layers of pyroclastic formations that covered the area. The magma cooled and solidified to a relatively shallow depth and created a giant dome without causing a volcanic eruption.
The erosion of the area since that time removed the pyroclastic rocks that initially surrounded this volcanic structure and revealed the andesitic rocks.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 12 / Vatousa Caldera

ASSOCIATED GEOSITES: Volcanic domes inside the caldera Weathering of rocks from hydrothermal activity

GEOGRAPHICAL DATA

GEOSITE LOCATION	Vatoussa, West Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.230242 Y: 26.053533
ALTITUDE	
DIAMETER	8.5km

GEOSITE CATEGORY: Volcanic geosite

DESIGNATION: A part of the caldera is located within the following NATURA 2000 protected areas: SCI “Western Peninsula-Petrified Forest” (GR4110003) and SPA “Southwest Peninsula, Lesvos Petrified Forest” (GR4110010) - National Interest

ACCESSIBILITY: Excellent (accessible by bus, car, etc.)

GEOSITE USE: Scientific, Educational and Tourist use

GEOSITE DESCRIPTION

One of the largest volcanic structures on Lesvos island is the volcanic caldera of Vatoussa with a diameter more than 8.5km.
The Vatoussa volcano is connected to the main phase of the volcanic activity on Lesvos that occurred 18.5 to 17 million years ago. Volcanic eruptions formed the extensive caldera and caused the collapse of the western side of the volcanic cone. The hills surrounding Vatoussa today delineate the edges of the caldera. Exposures of the pyroclastic rocks and lavas of the Vatoussa caldera are visible along the new Kalloni-Sigri road between Skalochori and Vatoussa.
After the caldera formation, subsequence extrusions of magma formed small lava domes, the various hills that we can see today between Vatoussa and Chidira villages.
Since the period when the volcano was active, intense tectonic movements have occurred, as well as the erosion and destruction of rocks, so it is not easy to distinguish the original formation anymore. However, the shape of the large oval caldera is visible to the informed eye. The bounteous vegetation inside the caldera can be attributed to the rich soil created by the weathering of volcanic rocks.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 30 / Voulgaris river gorge

ASSOCIATED GEOSITES: Geological faults Volcanic rock formations

GEOGRAPHICAL DATA

GEOSITE LOCATION	Vatoussa-Antissa, West Lesvos
GEOGRAPHICAL COORDINATIONS	X: 39.234056 Y: 26.018889
ALTITUDE	
LENGTH	More than 3km

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Located within the NATURA 2000 protected area SPA "Southwest Peninsula, Lesvos Petrified Forest" (GR4110010) - National Interest

ACCESSIBILITY: Excellent (accessible by bus, car, etc.)

GEOSITE USE: Educational use

GEOSITE DESCRIPTION

In Western Lesvos, the Voulgaris river valley which forms a narrow gorge between the settlements of Vatousa and Antissa.
The area of the Voulgaris valley has been formed in the volcanic rocks of the volcano of Vatoussa which relates to the main volcanic activity of Lesvos, about 18 million years ago. The intense tectonic activity of the area created faults that affected and fragmented the volcanic rocks.
The formation of the gorge is due to geological faults crossing the volcanic rocks that appear in the area. The water of the Voulgaris River follows the fragmented zone of the faults and erodes at depth with high speed creating steep rocky sides. The action of water erodes volcanic formations and creates impressive geomorphs.
The gorge area is a protected area and an ideal place for bird watching, and belongs in the NATURE 2000 network, as many rare birds find refuge there. Also, the importance of the area arises from the existence of a remarkable breeding population of the species: *Buteo rufinus*, *Ciconia nigra*, *Dendrocopos medius*, *Emberiza cineracea, Falco biarmicus, Falco naumanni, Puffinus yelkouan* etc.

PHOTOGRAPH

5.2. Eidiko Sxoleio Paidikou Anarrotiriou Erythrou Stavrou / Troodos UNESCO Global Geopark (Cyprus)

Below there are the "GEOSITE INVENTORY SHEET" of the 20 geosites of Troodos UNESCO Global Geopark (Cyprus) that were finaly selected by the Natural History Museum of the Lesvos Petrified Forest for the database.

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 5 / Asbestos mine

ASSOCIATED GEOSITES:

GEOGRAPHICAL DATA

GEOSITE LOCATION	ASBESTOS MINE
GEOGRAPHICAL COORDINATIONS	E: 492051 N: 3865569
ALTITUDE	1.500 m
SURFACE AREA (km2)	3,3

GEOSITE CATEGORY: MINING ACTIVITY

DESIGNATION: TROODOS NATIONAL FOREST PARK

ACCESSIBILITY: EXCELLENT (NEXT TO THE MAIN KARVOUNAS - TROODOS SQUARE ROAD)

GEOSITE USE: EDUCATIONAL, GEOTOURISTIC, GEOCONSERVATION

GEOSITE DESCRIPTION

In the Amiantos Mine area is located the biggest deposit of chrysotile asbestos in Europe with an average grade of the ore between 0,8 % and 1,0 %. The production of asbestos on an organised scale began at the present site in 1904. Since then and until the mine's closure in 1988, it is estimated that 130 million tonnes of rock have been excavated, producing one million tonnes of asbestos fibres. Following the termination of the mine operation and the mining lease in 1992, the Government undertook the rehabilitation works. The rehabilitation works began in the autumn of 1995 under the guidance of a multidisciplinary team with general aim the stability, rehabilitation and reforestation of the waste dumps of the broader mine area, restoration of several industrial buildings and more recently the design of a Broader Master Plan for the mine area. Asbestos mineralization appears in veins up to 2cm thick with fibres growing perpendicular to the direction of the veins. This mineralization occured due to the serpentinization of the ultramafic rocks of Troodos Ophiolite Complex. The circulation of seawater through harzburgite and dunite, caused the serpentinization of the original minerals (mainly olivine) and their transformation into serpentine minerals such as antigorite, lizardite and chrysotile. Cyprus is regarded as one of the most ancient sources of asbestos. The asbestos outcrops attracted the interest of people, due to its characteristic

fibrous texture. Use of asbestos was quickly discovered, utilising its natural properties. In antiquity, particularly during the Classical and Roman periods, asbestos was used for the manufacturing of shrouds for the cremation of the dead, shoes, and wicks for lamps. Picrolite, which is another mineral formed in paragenesis with chrysotile, was also widely used in antiquity for the manufacture of jewellery and small figurines like cruciform figurines during the Chalcolithic Period (3.900-2.500 BC), their size varying from 5-6 cm to 15 cm in height.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 3/ Kokkinopezoyla mine

GEOGRAPHICAL DATA

GEOSITE LOCATION	Near the village of Bsero
GEOGRAPHICAL COORDINATIONS	N : 35 02 36 E : 33 07 00
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: MINING ACTIVITY

DESIGNATION: It is located near a village called Bsero, where there is a short quarry nearby

ACCESSIBILITY: THE ROAD IS TRAFFIC WITH ASPHALT

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

The mine operated in the period 1953-1966 and from it were extracted with surface exploitation around 5,486,000 tons of ore, with an average content of 24% sulfur. The ore was processed at a mineral enrichment plant in Mitsero to produce sulfur concentrate by the flotation method. The export of the final product was done by loading ships from Karavostasi.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 4 / Memi mine

GEOGRAPHICAL DATA

GEOSITE LOCATION	Near the village of Agia Marina
GEOGRAPHICAL COORDINATIONS	N 35 02 16 E 33 02 17
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: QUARRY ACTIVITY

DESIGNATION: The quarry to the northwest has the village of Agia Marina and to the east has the other quarry Arestos

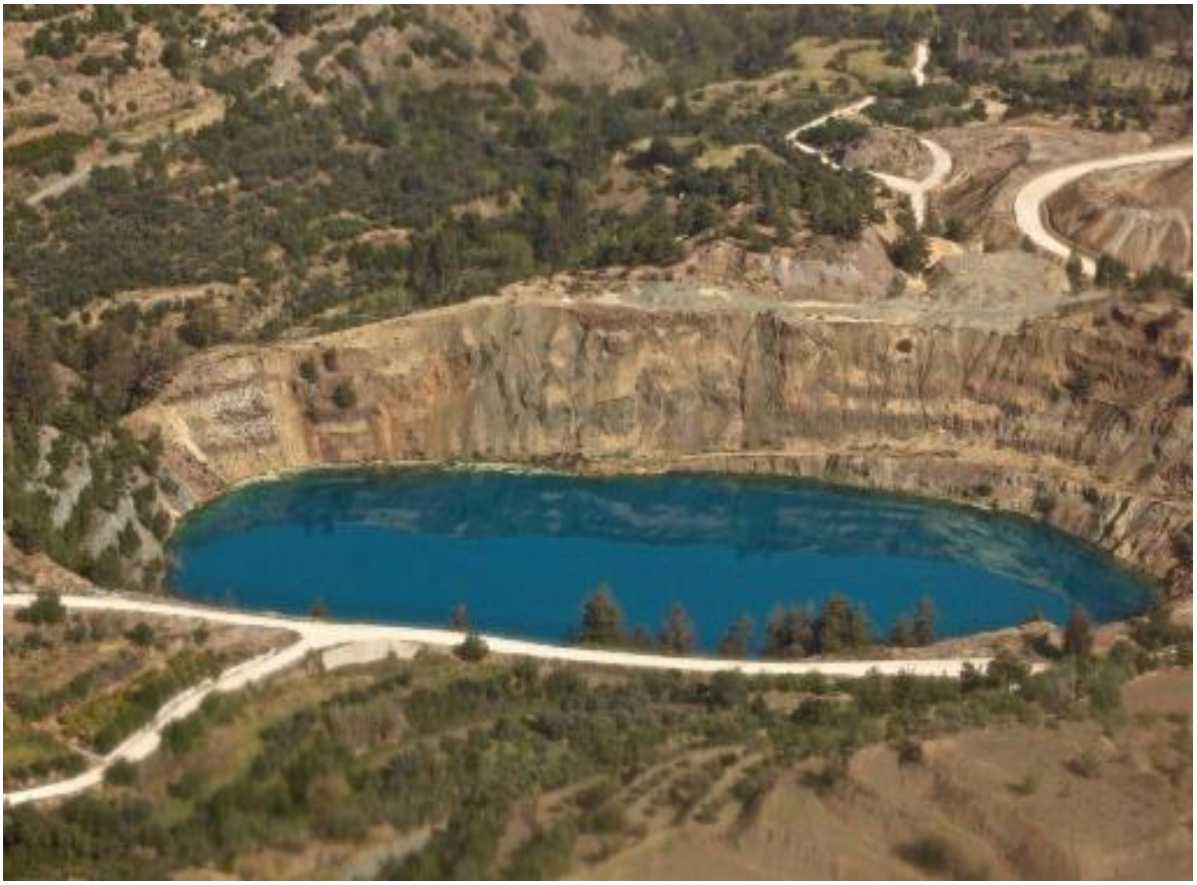
ACCESSIBILITY: Road in general is moderate

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

The mine operated in the period 1954-1971 and partly in the period 1987-1990. The exploitation was done superficially by the method of closed excavation and from it were extracted around 2,125,000 tons of iron pyrite ore, with an average content of 26% in sulfur. The ore was processed at a mineral enrichment plant in Mitsero to produce sulfur concentrate by the flotation method. The export of the final product until 1974 was done by loading ships from Karavostasi and after 1974 by loading ships from Vasiliko.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 6 / Skouriotissa mine slag heap

ASSOCIATED GEOSITES:

GEOGRAPHICAL DATA

GEOSITE LOCATION	SKOURIOTISSA
GEOGRAPHICAL COORDINATIONS	E: 489525 N: 3883324
ALTITUDE	220 m
SURFACE AREA (km2)	

GEOSITE CATEGORY: MINING ACTIVITY

DESIGNATION: Archaeological site

ACCESSIBILITY: GOOD (NEAR NARROW ASPHALT ROAD)

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

The uplift of Troodos, in conjunction with the erosion that followed, exposed the sulphide deposits on the surface, where they were oxidized, forming gossans (iron cap) of iron oxides and hydroxides with spectacular red and yellow colours. These attracted the ancient cypriots and resulted in their exploitation. Cyprus became a big centre for the production and trade of copper for more than 3,000 years and rightly became synonymous with it. The most convincing evidence of this extensive mining activity is the 100 copper slag heaps scattered around the Troodos foothills (26 occurring in the area of the Troodos Geopark). The biggest heap is found here in Skouriotissa and its name is derived from the greek word “skouria” which means slag. The slag was the waste product of the furnace, which the ancient metallurgists tossed away, forming large heaps.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 15 / Old gypsum quarries

ASSOCIATED GEOSITES:

GEOGRAPHICAL DATA

GEOSITE LOCATION	KATO MONI VILLAGE
GEOGRAPHICAL COORDINATIONS	E: 509226 N: 3880108
ALTITUDE	380 m
SURFACE AREA (km2)	

GEOSITE CATEGORY: QUARRY ACTIVITY

DESIGNATION: STATE LAND

ACCESSIBILITY: GOOD (NEAR ASPHALT ROAD)

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

At the slopes of the abandoned gypsum quarries east of the Kato Moni village, impressive shiny evaporite deposits are exposed. Evaporites are sedimentary rocks (such as gypsum) that were formed when seawater evaporated and salts precipitated and settled on the bottom of an enclosed basin. Gypsum deposits were formed between 5.96 and 5.33 million years ago (Upper Miocene, Messinian) and represent a significant event in the geological history of the Mediterranean region, known as the Messinian Salinity Crisis (MSC). During MSC the Mediterranean Sea level dropped significantly (up to 2 km), as a result of the reduced circulation of sea water between the Atlantic Ocean and the Mediterranean Sea due to the closure of the Gibraltar strait and the climatic conditions (evaporation, rainfall and river runoff) that prevailed. This led to widespread salt precipitation around the Mediterranean Sea, and in small tectonically controlled isolated hypersaline basins around Troodos, such as the small basin near the Kato Moni village, in which the maximum brine depth was probably less than 100 m.

At this location, gypsum mainly occurs in two varieties such as laminated gypsum and selenite with colour variations (transparent, grey, beige to white). Selenite deposits are the transparent gypsum crystals that formed in shallow low energy waters (no deeper than 10 m) at the basin margins. Laminated gypsum deposits are the alternating grey and beige finely gypsum laminae (1-3 mm thick), which formed across the entire basin from the action of bottom currents and are known as “marmara”. This type of gypsum has been used for centuries as interior floor tiles and courtyard paving slabs.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 20 / Umbers, radiolarites and bentonitic clays

GEOGRAPHICAL DATA

GEOSITE LOCATION	PERA PEDI VILLAGE
GEOGRAPHICAL COORDINATIONS	E: 489615 N: 3883324
ALTITUDE	740 m
SURFACE AREA (km2)	

GEOSITE CATEGORY: SUBMARINE GEOTHERMAL ACTIVITY

DESIGNATION: PRIVATE LAND

ACCESSIBILITY: EXCELLENT (NEAR ASPHALT ROAD)

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

Here is the typical locality of the Pera Pedi Formation, composed of chemical sediments such as umbers which alternate with deep marine sediments such as radiolarites at the top of the sequence. The umbers occur on top or within the extrusive volcanic rocks. They have been formed at fault zones along the Neotethys seafloor spreading axis by the circulation of metal-rich hydrothermal fluids. The seawater, which percolates through the oceanic rocks via a network of fissures, is heated by ascending magma, washes out metallic elements such as iron, copper, zinc and manganese from the surrounding rocks and ascends. Once the hydrothermal fluids reach the seafloor at temperatures around 350oC, they form “black smokers”. The finer material of black smoke spread over the ocean bottom and the precipitation in cavities on the surface of the lavas of iron and manganese oxides, which were dissolved in the black smoke, formed the brownish fine-grained chemical metalliferous sediments. These sediments are found today in small bodies scattered around the foothills of the Troodos massif. Age determination of these sediments around Troodos Mountain Range, yield a date range between 92-83 million years ago, based on micropaleontological analysis of abundant well-preserved radiolarian assemblages. These results are consistent with radioactive dating of the Troodos ophiolite and the beginning of its formation some 92 million years ago.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 7 / Apliki mine

GEOGRAPHICAL DATA

GEOSITE LOCATION	Apliki village
GEOGRAPHICAL COORDINATIONS	N 35 02 16 E 32 50 36
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: MINING ACTIVITY

DESIGNATION: North of the Apliki mine is the village where the mine got its name (Apliki) and north of the mine there is another mine Skouriotisa

ACCESSIBILITY: GOOD

GEOSITE USE: EDUCATION, TOURISM, OFFICIAL STUDIES

GEOSITE DESCRIPTION

The mine operated in the period 1968-1971 by applying a surface mining method. Around 1,064,493 tons of ore were extracted from it, with an average content of 1.8% in copper and 36% in sulfur. The ore was processed at an ore processing plant in Mitsero for the production of copper and sulfur concentrates by the flotation method. The export of the final product was done by loading ships from Karavostasi.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 8/ Kokkinorotsos mine

GEOGRAPHICAL DATA

GEOSITE LOCATION	Next to the village of Pedoulas
GEOGRAPHICAL COORDINATIONS	N 34 57 08 E 32 51 48
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: QUARRY ACTIVITY

DESIGNATION: In the northwest of the quarry there is the village of Pedoulas and a little further down the village of Prodromos, still near there are 2 quarries: Kanoures which is west and Hadjipavlou which is south

ACCESSIBILITY: The road is passable for cars

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

The Kokkinorotsos mine operated during the period 1924-1983 and underground mining methods were used to extract the chromium ore. It is estimated that more than 600,000 tons of ore were mined from the Kokkinorotsos mine. In total, out of the three chromite mines located around the top of Olympus, it is estimated that around 1,200,000 tons of ore were mined, which yielded more than 605,000 tons of chromite concentrate after processing.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 9 / Xadjipavlou mine

GEOGRAPHICAL DATA

GEOSITE LOCATION	Trikoukia
GEOGRAPHICAL COORDINATIONS	N 34 55 21 E 32 51 52
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: MINING ACTIVITY

DESIGNATION: The closest village is Trikoukia and the nearest quarry is Kanoures to its north

ACCESSIBILITY: Mediocre condition, the cars go up to a point and then we have to go on foot

GEOSITE USE: EDUCATIONAL, SCIENTIFIC, GEOTOURISTIC

GEOSITE DESCRIPTION

The Xadjipavlos mine operated periodically from 1950 to 1954 and underground mining methods were used to extract the chromite ore. It is estimated that a total of about 1,500 tons of ore was mined from the Hatzipavlos mine. In total, out of the three chromite mines located around the top of Olympus, it is estimated that around 1,200,000 tons of ore were mined, which yielded more than 605,000 tons of chromite concentrate.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 48 / Sheeted Dykes Complex

GEOGRAPHICAL DATA

GEOSITE LOCATION	Agios Epifanios
GEOGRAPHICAL COORDINATIONS	N 34 59 08 E 33 03 49
ALTITUDE	597 m
LENGTH	

GEOSITE CATEGORY: Volcanic geosite

DESIGNATION: Near the village of Agios Epifanios

ACCESSIBILITY: Good asphalt road

GEOSITE USE: EDUCATIONAL, TOURISM, OFFICIAL STUDIES

GEOSITE DESCRIPTION

This is a characteristic outcrop that is composed entirely of Sheeted Dyke Complex. Most of the dykes have both chilled margins due to the solidification of the magma in-between other solidified and cold material. Some dykes have only one chilled margin present, with the other part of the dyke rifted away, perhaps to the other side of the spreading axis. Some dykes are bright green, showing that the original minerals have been replaced by yellow green epidote.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 5 / Ophiolate base horizon (Basal Group)

GEOGRAPHICAL DATA

GEOSITE LOCATION	Agios Epifanios
GEOGRAPHICAL COORDINATIONS	N 35 01 41 E 33 05 13
ALTITUDE	451 m.
LENGTH	

GEOSITE CATEGORY:

DESIGNATION: Near the village of Agios Epifanios which is in a mountainous part

ACCESSIBILITY: Good road for cars but also for a walk

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

This is a representative section of Basal Group in the area of Mitsero village, which consist of over 50% dykes with screens of pillow lavas in-between them.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 49 / Upper and Lower Pillow Lava

GEOGRAPHICAL DATA

GEOSITE LOCATION	Kato Moni
GEOGRAPHICAL COORDINATIONS	N 35 03 18 E 33 05 01
ALTITUDE	402 m
LENGTH	

GEOSITE CATEGORY:

DESIGNATION: Near the village of Kato Moni

ACCESSIBILITY: Asphalt and then continues with a dirt road that is very good for cars

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

Near the village of Kato Moni is an exposure of one of the very best sections of submarine volcanism. The section exposes pillow lavas in tectonic contact with sheet flows set in a matrix of volcanic breccia and hyaloclastite, which is composed of clasts of volcanic glass. The sheet flow unit is cut by a sill with characteristic sharp chilled margins at top and bottom.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Amiantos Fault

GEOGRAPHICAL DATA

GEOSITE LOCATION	Next to Pano Amiantos
GEOGRAPHICAL COORDINATIONS	N 34 56 00 E 32 55 40
ALTITUDE	1.318 m
LENGTH	

GEOSITE CATEGORY: Fault

DESIGNATION: Next to Pano Amiantos

ACCESSIBILITY: Very good road both for cars and for walking

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

The Asbestos Fault is located near the Asbestos Mine along the eastern boundaries of the serpentinite, has a north-south direction and is parallel to the widening axis of the Solea moat. The fault brings into tectonic contact serpentine rocks of the mantle sequence, such as the serpentine harzvourgite (left) with sorority rocks, such as gabbro (right).

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 10 / Layered and Massive Gabbro

GEOGRAPHICAL DATA

GEOSITE LOCATION	Close to Pano Amiantos
GEOGRAPHICAL COORDINATIONS	N 34 56 21 E 32 55 40
ALTITUDE	1.224 m
LENGTH	

DESIGNATION: Close to Pano Amiantos

ACCESSIBILITY: The road is good

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

At this outcrop a thinly layered gabbro at the base of the roadcut is overlain by massive gabbro indicating that at the lower part, the fractional crystallization was interrupted by the repeated ascend of new magma into the magma chamber causing the formation of alternating layers of plagioclase rich (leucocratic) and pyroxene rich (melanocratic) gabbroic layers. Furthermore, several randomly oriented veins and small irregular bodies of plagiogranite are also observed within the gabbros.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 22 / Chalks and Cherts

GEOGRAPHICAL DATA

GEOSITE LOCATION	Near the village of Koilani
GEOGRAPHICAL COORDINATIONS	N 34 51 00 E 32 49 14
ALTITUDE	738 m
LENGTH	

DESIGNATION: Near the village of Koilani

ACCESSIBILITY: Good with asphalt

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

Bedded chalks with cherts are exposed along the road of Pera Pedi - Koilani villages. The influx of foraminifera and radiolarian rich calcilutites within a pelagic carbonate slope-basin setting near the carbonate compensation depth (CCD), formed both chalk and chert deposits during Early to Middle Eocene period (56-41 million years ago). The cherts are of turbiditic origin and were formed from the replacement of calcium with silica.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 44 / Ancient Mine Galleries

GEOGRAPHICAL DATA

GEOSITE LOCATION	Near the villages of Lemesoy & Mandria
GEOGRAPHICAL COORDINATIONS	N 34 52 24 E 32 49 14
ALTITUDE	835 m
LENGTH	

DESIGNATION: Near the villages of Lemesoy & Mandria

ACCESSIBILITY: Road with asphalt

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

In this outcrop basaltic dykes host sulphide deposits, which attracted the attention of ancient prospectors. Four small ancient galleries appear in this roadcut and an excavated furnace site in a vineyard down the road.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 7 / Poikilitic Wehrlite

GEOGRAPHICAL DATA

GEOSITE LOCATION	Near to the village of Pano Platres
GEOGRAPHICAL COORDINATIONS	N 34 54 17 E 32 51 33
ALTITUDE	1.429 m
LENGTH	

GEOSITE CATEGORY: Igneous rock

DESIGNATION: Near to the village of Pano Platres Foini

ACCESSIBILITY: Good

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

In this outcrop the poikilitic feldspathic wehrlite, a dark grey cumulate rock, consists mainly of olivine and scattered large oikocrysts (2-3 cm) of clinopyroxene, which includes minor crystals of plagioclase and accessory chromite.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 14 / Faulted Plagiogranite with Basaltic Dyke

GEOGRAPHICAL DATA

GEOSITE LOCATION	Next to Agios Dimitrios villages
GEOGRAPHICAL COORDINATIONS	N 34 55 54 E 32 49 00
ALTITUDE	1.011 m.
LENGTH	

GEOSITE CATEGORY: Tectonic, Volcanic

DESIGNATION: Next to Agios Dimitrios villages

ACCESSIBILITY: Good road

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

In this outcrop a plagiogranite body, after its crystallization in gabbro, was intruded by dykes of basaltic composition. After the intrusion of the dykes the area was affected by tectonic activity, which shifted both the plagiogranite and the dykes in the form of a normal fault, due to the uplift of the Troodos Ophiolite.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 25 / Peridotite, Pyroxenite & Pegmatitic Gabbro

GEOGRAPHICAL DATA

GEOSITE LOCATION	Near to the village of Pedoula
GEOGRAPHICAL COORDINATIONS	N 34 57 38 E 32 50 34
ALTITUDE	1.313 m.
LENGTH	

GEOSITE CATEGORY: Volcanic

DESIGNATION: Near to the village of Pedoula

ACCESSIBILITY: Road with asphalt

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

The roadcut exposes at least three episodes of magmatic activity, which are evidence of the complex multiple intrusive evolution of the lower oceanic crust. Banded ultramafic rocks such as dunite and pyroxenite are intruded by plagioclase bearing poikilitic wehrlite and subsequently younger dykes cut all the older rock types.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 32 / Pillow Lavas and Lava Flows

GEOGRAPHICAL DATA

GEOSITE LOCATION	Close to Lageia village
GEOGRAPHICAL COORDINATIONS	N 34 51 02 E 33 14 08
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Volcanic

DESIGNATION: Close to Lageia village

ACCESSIBILITY: Good

GEOSITE USE: Education, tourism, exploration, scientific studies, various programs

GEOSITE DESCRIPTION

At this locality, very distinctive black pillow lavas are intercalated with lava flows and hyaloclastite flows, in which small pillows are set in a matrix of black glass shards.

PHOTOGRAPH

5.3. OPENCOM I.S.S.C. / Alpi Apuani UNESCO Global Geopark & Tuscan Mining Park UNESCO Global Geopark (Italy)

Below there are the "GEOSITE INVENTORY SHEET" of the 20 geosites of Alpi Apuani UNESCO Global Geopark & Tuscan Mining Park UNESCO Global Geoparks (Italy) that were selected by OPENCOM I.S.S.C.

Alpi Apuani UNESCO Global Geopark geosites

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Val Serenaia "path of all"

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Orto di Donna, municipality of Minucciano, Alpi Apuane Park
GEOGRAPHICAL COORDINATIONS	X: 44.135198480047116 Y: 10.204634422744707
ALTITUDE	1068 m
LENGTH	490 m

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: the path is in Val Serenaia, the basin of Serchio river, in Orto di Donna, the grassy basin at the head of the valley.

ACCESSIBILITY: Excellent (Access to the beginning of the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people).

GEOSITE USE: Tourist use

GEOSITE DESCRIPTION:

Despite the inaccessibility of the Apuan Alps due to the conformation of its territory, the Apuan Alps Park has created the "path for all" of Val Serenaia, a short path, 490 m and with maximum slope of 7%, accessible to disabled people and visually impaired.

The path is immersed in a typically alpine landscape consisting of beech woods of remarkable beauty, east of Mount Pisanino, along the Val Serenaia, in a wide and suggestive basin of glacial origin of the Wurmiano period (20-18 million years ago) where the Serchio di Gramolazzo stream is born.

To ensure accessibility, the path is free of obstacles and is equipped with a wooden fence on both sides, useful as a handrail and as a protection support, there is also a descriptive poster of the natural and folkloric emergencies of the valley, flanked by panels in Braille alphabet.

Along the path there are also some rest areas equipped with benches and tables andareas in which are placed blocks of rocks belonging to the present formations of the Apuan autochthonous and pieces of trunks of trees typical of the area, both accompanied by Braille tags.

In particular, the route begins near the parking lot at an altitude of 1068 m and develops in a South direction, first in the hydrographic left at the creek, next to a forest track that ends just beyond at a small building, to continue as path CAI n. 178 that connects the Val Serenaia with the Foci del Cardeto, then cross the creek with a footbridge and back to the north where it ends at an area equipped for rest.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Zucchi del Cardeto

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), ApuanAlps Park
GEOGRAPHICAL COORDINATIONS	X: 44.121945 Y: 10.214195
ALTITUDE	1680 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia “path for all” in Orto di Donna, from here you can see Zucchi del Cardeto from afar.

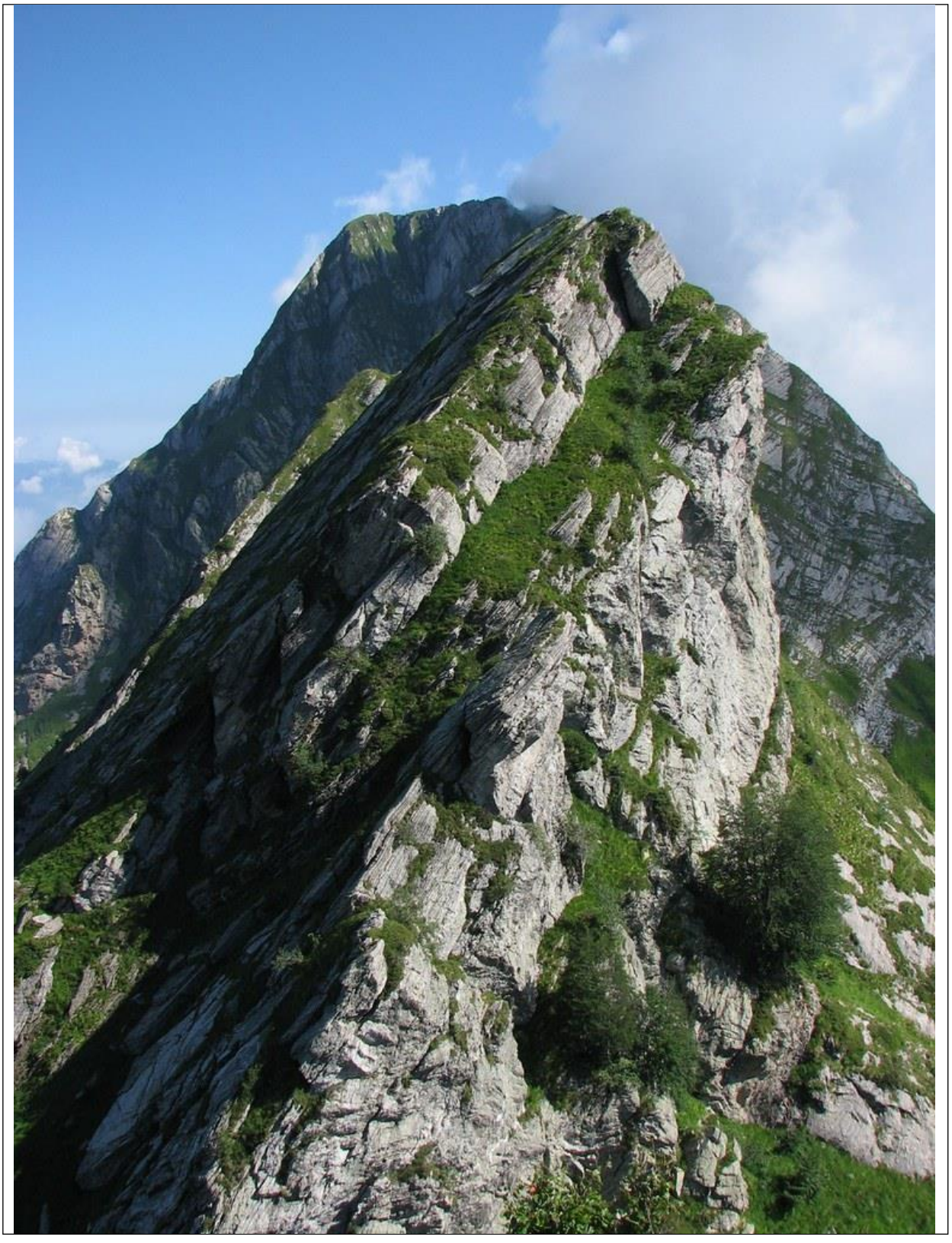
ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

The Zucchi del Cardeto are They are rocky pinnacles that from Mount Pisanino descend to Foce Cardeto.
There are four heights called Zucchi: the Pizzo Altare (1746 m) the closest to the mouth Cardeto, the Pizzo di Mezzo (1741 m), the Pizzo Maggiore (1749 m) which is the highest and another minor relief. Also called Scissors, in fact this term locally means "bumpy ridge with rock carvings".
The climb of the Zucchi and the crossing of the same is reserved for experienced climbers. In the valley floor there are rocks detached from the Zucchi easily recognizable for having the same geological conformation.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Mount Pisanino

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Minucciano, Alpi Apuane Park
GEOGRAPHICAL COORDINATIONS	X: 44.13490359320546 Y: 10.216709615341808
ALTITUDE	1.946 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, from here you can see Mount Pisanino from afar – Regional interest.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

Mount Pisanino is the highest peak of the Apuan Alps and among the highest mountains belonging entirely to Tuscany.
The name "Pisanino" comes from an ancient legend according to which two soldiers of the ancient Pisan Republic, accused of treason, fled to the Apuan Alps. One of them died, but the other He managed to take refuge in a house where a man and his daughter lived, and they took care of them.
The climb to the top, due to the presence of steep and/ or slippery sections, is decidedly difficult and can be addressed only by experienced hikers, but it is also perfectly appreciable from afar.
I The orographic node of Monte Pisanino (1947 m) is characterized by the presence of three main rocky ridges that, with planar angles of about 120 , join on the summitof the highest peak of the Apuan Alps. This singular morphology is realized outside the main watershed of the same mountain range, along the connection with the second peak of Mount Cavallo (1882 m). The development of the secondary avenue towards North, it separates the valley of Orto di Donna-Serenaia, to the west, from that of Acqua Bianca, to the east.
Sharp ridges like those of Monte Pisanino are unusual in the Tuscan-Emilian Apennines, especially for the diffusion of sandstone and sandstone-marly Flysch along the ridge, that return rounded profiles and not so airy and acute as the carbonate and radiolaritic formations of the Apuane.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Glacial valleys of Orto di Donna

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Orto di Donna, Minucciano (Lucca), Alpi Apuane Park
GEOGRAPHICAL COORDINATIONS	X: 44.12222951806155 Y: 10.201202083513293
ALTITUDE	1500 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, from here you can see Glacial valleys of Orto di Donna from afar.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

The high valley of Serchio di Gramolazzo is surrounded, at its southern head, by a horseshoe arrangement of the highest peaks of the Apuan Alps, including the M. Pisanino (1947 m), with a ridge that never goes below 1497 m (Foce di Giovo)Averaging at 1,700. During the Würm, the longest and most extended Apuan glacier originated from this mountainous circle, whose ablation language reached the modern town of Gramolazzo, at about 640 m of altitude. Thanks to the contribution ofthe smaller glaciers of the northern slope of Pisanino (along the ditches Libardo and Sirchia), it occupied an area of almost 12 km2, with a length of the current greater than a little more than 6 km.

The Gramolazzo glacier has left numerous forms of erosion and deposition along its course, both in the advanced phase and in the retreat phase. Of particular geomorphological evidence, also for the dimensions, it is the wide and flat valley floor, which develops for about 1 km in length between the resorts Serenaia and Ortodi Donna (between 1000-1100 m of altitude). In this stretch of the high valley of Serchio di Gramolazzo, it is possible to observe a rare example of glacial valley in the Apuan Alps, with a transverse profile in the most typical "U" shape, with some weak steps. The morphology is made even more evident by the presence, along the opposite sides of the valley, of two opposite shelves and delimited by escarpments. The symmetrical course of these two elements and their longitudinal development, at the same altitude, are to be put in relation to a phase of stasis in the movement of glacial masses, which has thus produced a greater erosive action.

The valley of Orto di Donna-Serenaia has seen the prevalence of fillings and debris

accumulations, now also fed by small alluvial conoids and by cryonival processes (snow avalanches) especially on the right hydrographic and in the eastern slope. At the extreme lower limit, the valley has a sharp morphological jump, perhaps due to a recovery in the Postglacial linear erosion of Serchio di Gramolazzo. Below the step, the slopes become steeper and take on the typical appearance of river incisions, which contrast with the glacial profile of the upper section. The backwardness due to torrential erosion of the threshold of the step has progressively isolated a wreck of hanging glacial valley, on the left side in Tecchiarella (1031 m), where you meet sheepfold rocks.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Mount Cavallo

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), AlpiApuane Park
GEOGRAPHICAL COORDINATIONS	X: 44.11955555726667 Y: 10.215914576709038
ALTITUDE	1 895 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, from here you can see Mount Cavallo from afar.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

Mount Cavallo is the second peak of the famous Tuscan chain of the Apuan Alps, on the border between the provinces of Massa Carrara and Lucca.
The mountain is located on the main watershed of the Apuan chain: it is a wall of rock enlivened by four characteristic humps that give it its name.
The Horse is a wall of limestone forest (schistose rocks with very inclined layers) that rest on a marble base. It is arranged in a North-West direction / South-East and is delimited to the north and west respectively by the mouth of Cardeto and the mouthof Monte Cavallo and to the south by the Passo della Focolaccia.
From Mount Cavallo three of the most important branches of the Serchio River are born, both on the eastern and the western and southern sides: (1) Serchio di Gramolazzo; (2) Acqua Bianca torrent; (3) Frigido river.
Access to the summit is via a mountaineering route. The view from the summit sweeps across the valley of the Frigido River, and all the peaks of the eastern and western and

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Mount Grondilice

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), AlpiApuane Park
GEOGRAPHICAL COORDINATIONS	X: 44.12293035695919 Y: 10.189347246025424
ALTITUDE	1.809 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, from here you can see Mount Grondilice from afar.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

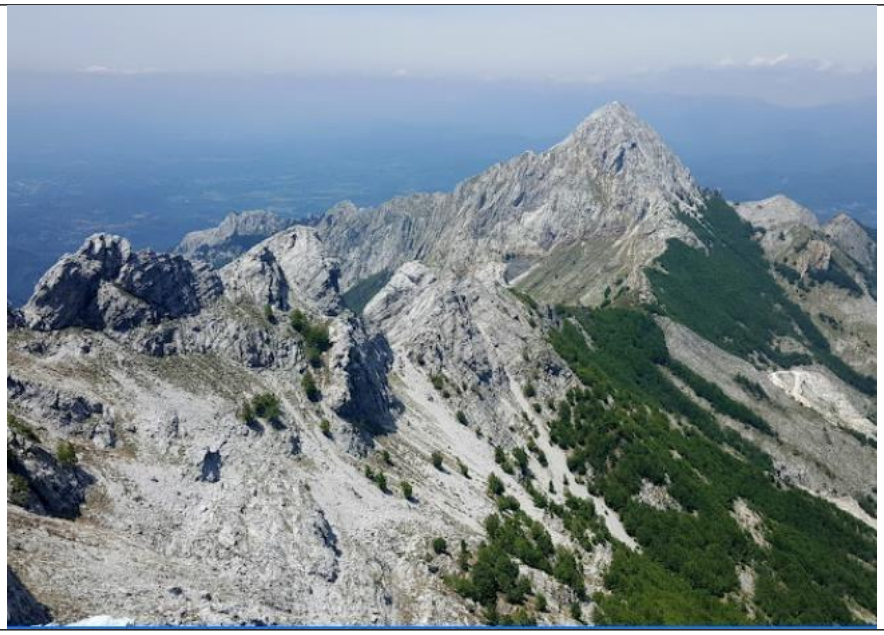
Monte Grondilice is the fifth peak, by height, of the Apuan Alps. It is located on the watershed that marks the border between the provinces of Lucca (municipality of Minucciano) and Massa - Carrara (municipality of Fivizzano) in the northern part of the Regional Natural Park of the Alpi Apuane.

Practically it is the continuation of the Cresta Garnerone from which it is not distinguished in a very marked way. From the north-west anticima of the Grondilice the chain is connected to the group of Mount Sagro situated to the south-west by modest grassy offshoots, which divide the municipality of Massa from that of Fivizzano. Just near the mountain the ridge, which from Giovetto descends in the North-South, sharp bend to the east. The long ridge separates the valley of Vinca in the territory of Fivizzano and the high Valle di Forno in the territory of Massa from those of Orto di Donna and White Water in the municipality of Minucciano.

From the Grondilice Window a rocky spur, called the Forbice, departs towards the south-east, from which in turn, to the south, a rocky branch delimits the Canal Fondone from the Valley of the Hotels. It has two famous towers loved by rock climbers: the Torrione Figarie the Punta This so called by the name of two heroic Ligurian alpinists active in the Apuan Alps and not only at the end of the nineteenth century and the beginning of the twentieth.

Mount Grondilice is of fundamental importance for Italian speleology as it hosts twoof the deepest caves found in Italy: the Olivifer abyss, 1215 m deep, just below the summit, and the Abyss Satanachia identified in 1990 and extended to a depth of1040 meters in 2010.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Pizzo d'Uccello

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), ApuanAlps Park
GEOGRAPHICAL COORDINATIONS	X: 44.140036 Y: 10.183033
ALTITUDE	1781 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, from here you can see Pizzo d'Uccello from afar.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

Pizzo d'Uccello is a mountain in the Apuan Alps, which marks the orographic and hydrographic border between the high valley of Serchio (Garfagnana) and that of Magra (Lunigiana), distinguishing itself from the other peaks of the chain especiallyfor its North Wall, almost 800 m in height, which compares it directly with the most famous Dolomite walls and the western Alps.
Wherever you look at it has a rocky and daring pyramid shape and gives thesurrounding area an alpine appearance, which justifies the name of Cervino delle Apuane.
The mountain has the shape of a pyramid with three faces and three ridges: the North-East ridge or Capradossa and the South-South-East that delimit the eastern slope triangular shape.
The West-North-West ridge is very long and runs towards Mount Bardaiano up to Pizzo dell'Aquila, to the south it descends towards Vinca while to the north it forms the imposing north wall.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Mount Contrario

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), ApuanAlps Park
GEOGRAPHICAL COORDINATIONS	X: 44.11919290704464 Y: 10.207042915341807
ALTITUDE	
DIMENSIONS	

GEOSITE CATEGORY:

DESIGNATION: Val Serenaia “path for all” in Orto di Donna, from here you can see Mount Contrario from afar - Environmental interest.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

Mount Contrario is a mountain belonging to the chain of the Apuan Alps and is part ofthe regional park of the Apuan Alps and is recognized as a Site of Community Interest and locality of significant environmental interest in the EEC.
The peak rises on the ridge that separates the municipality of Massa from that of Minucciano and is between Mount Cavallo to the east and Mount Grondilice to the west.
Its morphology is characteristic: the southern side consists of a mostly marble bastion, about 700 meters high, and wild valleys that precipitate towards the river Frigido and the valley of the Hotels, above Massa. The northern slope, facing the Serenaia valley and the Serchio valley, is less steep and is covered by beech woods. At the base of the overhanging southern rock wall of Monte Contrario and an ancient "lizza", we find the characteristic Hotel House, now abandoned, where the quarrymenlived in the past centuries, as well as an ancient marble quarry where you can understand the techniques of excavation prior to the introduction of helical wire for cutting blocks.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Serchio di Gramolazzo banch of river

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), ApuanAlps Park
GEOGRAPHICAL COORDINATIONS	X: 44.17877 Y: 10.30713
ALTITUDE	1800 m
LENGTH	17 km

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, the banch of river is along the path.

ACCESSIBILITY: Excellent (Access to the path by car; the path is perfectlyaccessible by disabled people with wheelchair and visually impaired people).

GEOSITE USE: Tourist

DESCRIPTION

The Serchio di Gramolazzo is the branch of the river Serchio coming from the Apuan Alps, joining the Serchio di Sillano near the municipality of Piazza al Serchio.
During its course, the Serchio di Gramolazzo reaches a remarkable flow rate for its length, crossing regions where the rainfall is constant even in summer and the tributaries are many.
There are numerous valleys crossed by the river, in the heart of the Apuan Alps, in a picturesque landscape rich in flora and fauna.
The stream comes from the mouth of Cardeto, between Mount Cavallo (1888 m above sea level) and the famous Mount Pisanino (1943 m above sea level). Numerous streams of limited length go to join the stream that, just two kilometersfrom the springs, goes to enter the Serenaia valley.

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Foce di Cardeto

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Val Serenaia, Orto di Donna (Lucca), ApuanAlps Park
GEOGRAPHICAL COORDINATIONS	X: 44.12321523136522 Y: 10.214653876709038
ALTITUDE	1 680 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: Val Serenaia "path for all" in Orto di Donna, from here you can see Foce di Cardeto from afar.

ACCESSIBILITY: Good (Access to the path by car; the path is perfectly accessible by disabled people with wheelchair and visually impaired people. Disabled people can appreciate the geosite only from afar).

GEOSITE USE: Tourist

DESCRIPTION

The pass of Foce di Cardeto is located inside the Regional Natural Park of the ApuanAlps and has the shape of a narrow rocky creek engraved between the hump of Mount Cavallo, high 1888 meters a.s.l. and the Pizzo Altare, the southernmost of the two Zucchi di Cardeto forming part of the massif of Monte Pisanino which is 1947 meters high.
The aerial rocky ridge in which the Foce di Cardeto is carved separates the Valle dell'Acqua Bianca from the U-shaped valley called Val Serenaia, but also known as Orto di Donna.
The area is important from an environmental and landscape point of view for the animal and plant species that live there and for the spectacle offered by the surrounding valleys, bordered by the highest peaks of the Apuan chain. It is also important for the numerous speleological explorations that have identified manycaves.
The basin of the Val Serenaia-Orto di Donna, in which is located the Foce di Cardeto, for the variety of the existing geological heritage, is one of the most important geosites of the Apuan Alps, since it is rich in geological structures that testify to the genesis and evolution of the Apuan chain.
The Foce di Cardeto is an important crossroads for the paths of the Italian Alpine Club and trekking in general of the northern Apuan chain.

PHOTOGRAPH

Tuskan Mining Park UNESCO Global Geopark

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Ammonite red limestone quarries

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Gerfalco, Montieri
GEOGRAPHICAL COORDINATIONS	X: 43.17930111521717 Y: 10.947559154858343
ALTITUDE	1081
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: in the Cornate di Gerfalco Regional Nature Reserve – Fosini, SACof the European Natura 2000 network – Regional interest.

ACCESSIBILITY: Not accessible (Access to the geosite by a footpath)

GEOSITE USE:

DESCRIPTION

It is the area of extraction of ammonitic red limestone, also known as "Gerfalco Red", used in the Middle Ages for the construction of the Cathedral of Siena.
Two quarries can be visited, placed on the west side of the relief of the Cornate di Gerfalco, where it is possible to observe the quarry fronts from where the blocks of ammonitic red limestone have been extracted, used also in the local historical building and for valuable sculptural works.
From the quarries it is also possible to admire the splendid panorama that ranges from Poggio di Montieri, to Poggio Mutti and the Tyrrhenian coast up to the Island of Elba.

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Rocky spur of La Pietra

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Nature Reserve La Pietra, Roccastrada, Colline Metallifere Park
GEOGRAPHICAL COORDINATIONS	X: 43.08403 Y: 11.084933
ALTITUDE	440m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: in the Nature Reserve La Pietra, Located in the upper Val di Farma,a few kilometers south-west of the village of Monticiano.

ACCESSIBILITY: Not accessible to disabled people (Access to the Rocky spur by a footpath)

GEOSITE USE:

DESCRIPTION

Le rocky spur La Pietra, composed mainly of radiolarites, is a 5000-year-old jasper chipping quarry and workshop.
This, more commonly known as "jasper", is a silex-like sedimentary rock, mainly red in colour and lying in layers not very thick and thickly overlapping.
In addition to being a site of great importance from a naturalistic point of view, the spectacular outcrop of La Pietra was the scene, during the Prehistory, of important craft activities related to the exploitation of radiolarite.
Since radiolarite is a very hard siliceous rock, the traces of prehistoric mining activity have been perfectly preserved on the rock wall, where extraction areas can be identified which also extend to heights that could only be reached with the support of stairs or scaffolding.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME : Marble quarries of Caldana

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Caldana, municipality of Gavorrano, Grosseto
GEOGRAPHICAL COORDINATIONS	X: 42.893889 Y: 10.918611
ALTITUDE	178 m
DIMENSIONS	

GEOSITE CATEGORY: Geomorphological geosite

DESIGNATION: in Caldana, an ancient medieval village

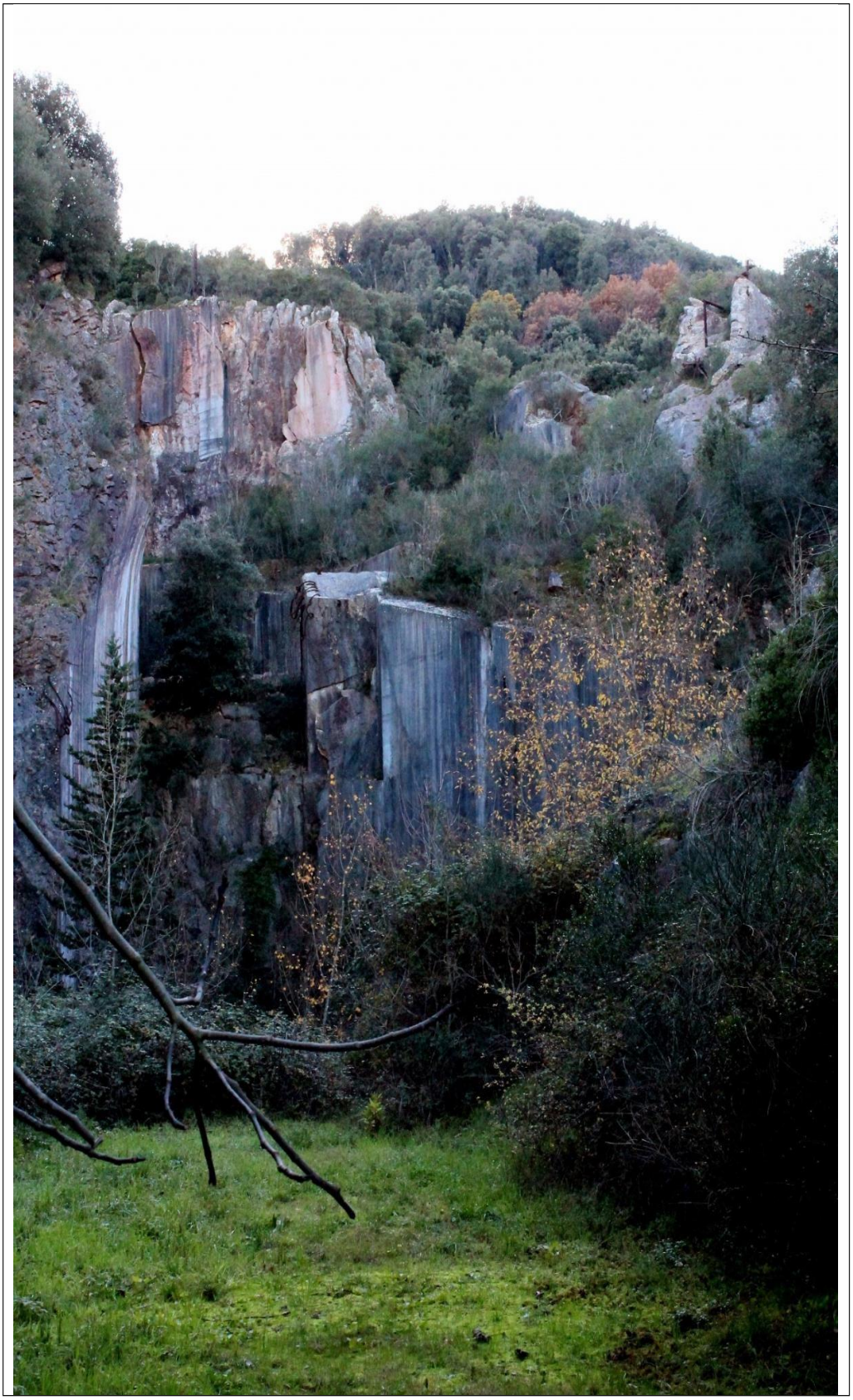
ACCESSIBILITY: Not accessible

GEOSITE USE:

GEOSITE DESCRIPTION

Around the castle are visible traces of ancient marble quarries rose ornamental, called door holder, similar to a type of marble that is found in the Monti di Campiglia (LI) and in the Montagnola senese (SI).
The quarry business has certainly been present since the sixteenth century, althoughit is not to be excluded earlier stages, and the Austini family was very interested in the sale of marble that was certainly a good income.
the marble of Caldana was used for the construction of the Church of Santa Maria di Provenzano in Siena (for the Prepositura of Livorno (perhaps the Duomo) and for the Church of Cavalieri in Pisa.
The Caldana marble can be distinguished by three types: (1) classic Portasanta with dark red-purple color with light shades of pink, white, gray and green; (2) modern Portasanta that has a lighter background color; (3) Fallani Portasanta named after the owner of the quarry, which differs from the modern for the even clearer background ranging from pale red to pink with gray shades.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Roste di Boccheggiano

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Boccheggiano, Montieri, Colline Metallifere Park
GEOGRAPHICAL COORDINATIONS	X: 43.10923642507686 Y: 11.039470959397704
ALTITUDE	675 m
DIMENSIONS	

GEOSITE CATEGORY: Mining geosite

DESIGNATION: Boccheggiano, a hamlet of municipality of Montieri (Grosseto), in Tuscany, in the core of Colline Metallifere Park.

ACCESSIBILITY: Not Accessible (you can approach the principal road by car or bus,but to access the Roste you need to take a path).

GEOSITE USE:

DESCRIPTION

In the surroundings of Boccheggiano it is possible to find some curious red gullies called Le Roste.
Although it may seem a particular natural geological formation, it is actually an area formed by mineral deposits. In fact, the Roste area collects the remains of copper processing, extracted in the Mine Merse from the late nineteenth, early twentieth century.
These processes were carried out with the Conedera Method, which involved crushing, roasting, leaching and then electrochemical separation to obtain pure copper.
The name "Le Roste" and the red colouration derive from this procedure, in particular from the roasting phase in the open air; while the particular morphology, similar to the Sienese gullies, is due to the erosive action of the rainwater.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Buca delle Fate tunnel

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Montieri, in a footpath inside the CollineMetallifere Park
GEOGRAPHICAL COORDINATIONS	X: 43.12762081474709 Y: 11.019366169142518
ALTITUDE	704 m
DIMENSIONS	14 m

GEOSITE CATEGORY: Geomorpholofical and mining geosite

DESIGNATION: in Montieri, an Italian municipality in province of Grosseto, Italy. The Buca delle Fate is located along a footpath inside the Colline Metallifere Park – Cultural interest.

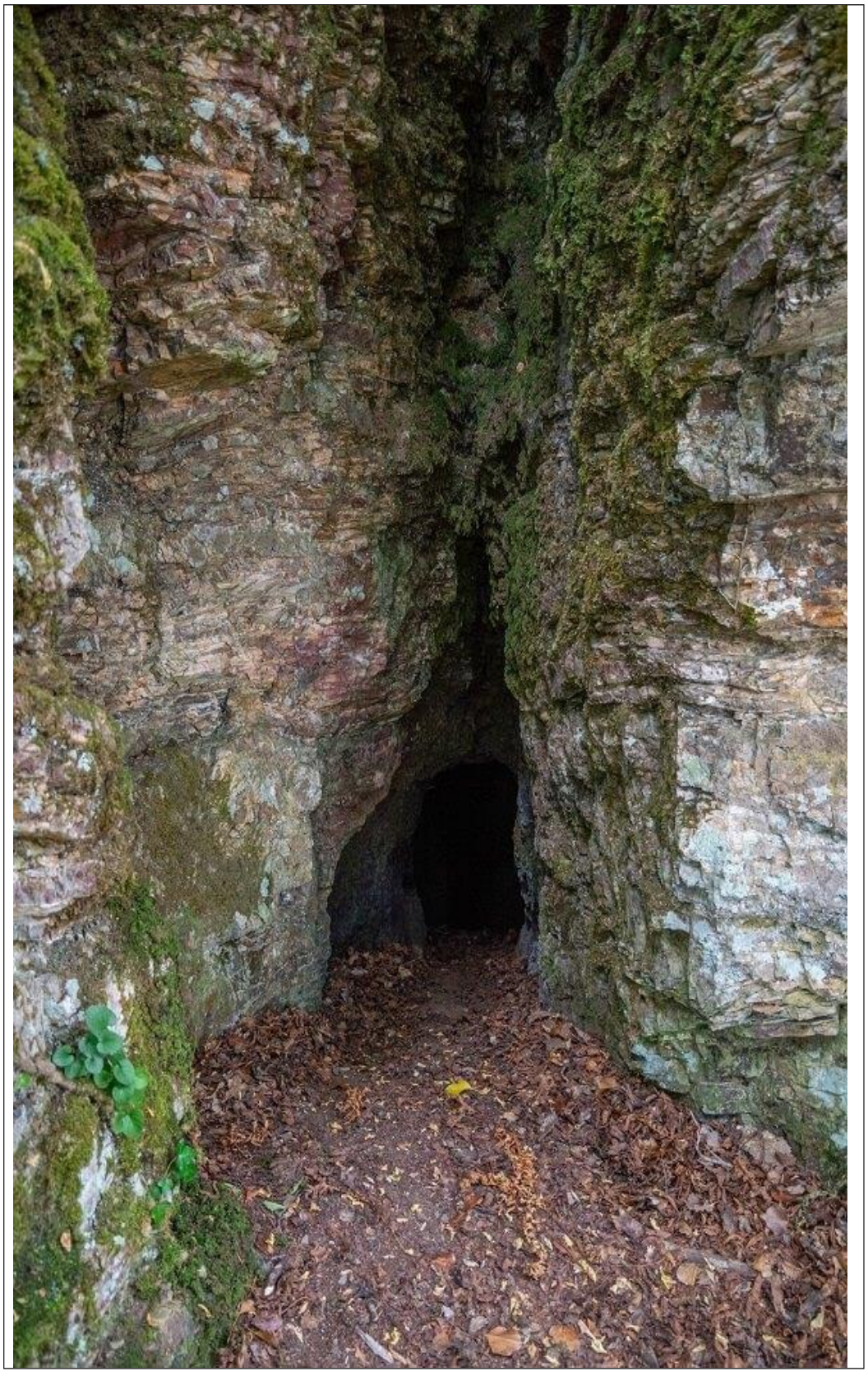
ACCESSIBILITY: Not Accissible (Access to Montieri by car, bus or bicycle, access tothe Buca delle Fate only on foot via a path).

GEOSITE USE:

DESCRIPTION

The Buca delle Fate tunnel is located along a footpath, to which it gives its name, that start near the historical centre of Montieri.
The tunnel, about 14 meters long, was excavated entirely in the Diaspro. At the endof the tunnel is a well filled with debris, where you can see the recesses that served as a support for the beams that supported the winch.
It is also possible to observe niches dug to allow the transit to two miners and the spaces in which the lamps were placed to illuminate the tunnel.
In addition to the Buca delle Fate tunnel, along the path of which it is part, you can see three other points of interest: (1) the San Barbera tunnel, excavated to follow a small vein mineralized with silver sulfide; (2) Montieri diamonds, that is quartz crystals; (3) the "red marble" of Montieri, a small quarry.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: lake Lago dell'Accesa

FOSSIL SITE:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Maremma grossetana, southern end of the Massa Marittima municipal territory
GEOGRAPHICAL COORDINATIONS	X: 42.98825 Y: 10.895494
ALTITUDE	157 m
DIMENSIONS	0,14 km^2
MAX DEPTH	39 m
AVARAGE DEPTH	30 m

GEOSITE CATEGORY: Hydrological geosite

DESIGNATION: Degradation area of the Colline Metallifere Park, South of Massa Marittima, about 6 km north of Gavorrano, in the North-central Maremma.

ACCESSIBILITY: Not Accessible (Access to the lake by a footpath)

GEOSITE USE:

DESCRIPTION

The lake Lago dell'Accesa, of karst origin, gives life to the river Bruna. It is characterized by depths ranging on average between 20 and 40 meters and has the typical lake flora, with shrubs and reeds that develop near the banks.
The lake was already known at the time of the Etruscans, who settled in the sixth century B.C. thanks to the presence of the nearby mineral deposits of silver, lead, ferrous materials and gold, although the latter in rather small quantities. The industrial activity continued in the following centuries and was interrupted by the beginning of the eighteenth-century reclamation works undertaken by the Lorraine, which led, among other things, a significant reduction in the surface of the lake, in favor of agricultural activities.
As for its geomorphology, the hydrographic basin of the lake has a subcircular shape and develops on an area of about 4 km.
In the eastern part of the basin emerge some lithologies belonging to the series Tuscany, including the oldest of the complex of Verrucano. In the western sectors there are the cavernous limestone of the Reticulum. Whereas, at the southern edge of the basin are present the clays allochthonous scagliose of the Ligurian Units of Cretaceous-Eocene age.
The waters of the river have an alkaline reaction, they are oligotrophic and rather cold, so much so that in depth they reach the 7 ° C.

PHOTOGRAPH

5.4. CEIP LA JARA / Sierra Norte de Sevilla UNESCO Global Geopark (Spain)

Below there are the "GEOSITE INVENTORY SHEET" of the 20 geosites of Sierra Norte de Sevilla UNESCO Global Geopark (Spain) that were selected by the Natural History Museum of the Lesvos Petrified Forest for the database.

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 3 / Cerro del Hierro Karst

GEOGRAPHICAL DATA

GEOSITE LOCATION	Cerro del Hierro
GEOGRAPHICAL COORDINATIONS	X: 37.95557309215 Y: 5.6247528215695
ALTITUDE	
LENGTH	1774.84

GEOSITE CATEGORY: Geomorphology - Geological history

DESIGNATION: An overview can be obtained from the viewpoint and the path of Cerro del Hierro.The area of Calizas Chicas is accessed by a path from the village.

ACCESSIBILITY: On the road SE-163, between Constantina and San Nicolás del Puerto, about 11 kilometers from Constantina, leaves the access road that leads to the old mine village of Cerro del Hierro. From the village or from the parking area next to the Information Point, begin several trails to access Cerro del Hierro.

GEOSITE USE: With high scientific, educational and touristic interest

GEOSITE DESCRIPTION

In the Capas de Campoallá sedimentary unit, the upper part is constituted by massive limestones that are the ones that form Cerro del Hierro. This upper section, with more than a hundred meters of thickness, is formed by bio-constructed limestones; with fossil remains of living beings: archaeocyathids (marine invertebrates) and stromatolites (cyanobacteria).
Above these limestones, occupying the nucleus of a synclinal structure is a set of slates, which present a characteristic splinter disjunction, named as "Capas de Alanís" or "Pizarras de Alanís". These slates have abundant remains of trilobites, with an association that indicates an approximate age of 520 Million years.
The layers of these slates rest over the limestones, fossilizing an old karstification surface. The dissolution of the Cerro del Hierro limestones began immediately after its sedimentation in a tropical environment, with the generation of several typical karst structures: large karren, deep

depressions surrounded by pinnacles, long alleys and multiple holes filled with iron oxides. Nowadays the Cerro del Hierro is an operative karstic system, which forms part of the underground aquifer Guadalcanal-San Nicolás, whose main discharge zone is the Rivera del Huéznar Spring.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 4 / Cerro del Hierro mine

GEOGRAPHICAL DATA

GEOSITE LOCATION	Cerro del Hierro
GEOGRAPHICAL COORDINATIONS	X: 37 57 18 Y: 05 37 32
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Mining history

DESIGNATION: The Information Point is the access to the viewpoint and the trails through Cerro del Hierro

ACCESSIBILITY: In the road SE-7102, between Constantina and San Nicolás del Puerto, about 11 kilometers from Constantina, exit the access road to the old mining village, and from there is the access lane to the parking lot and the Information Point

GEOSITE USE: High scientific, educational and touristic value.

GEOSITE DESCRIPTION

Cerro del Hierro was the largest iron ore mine in Sierra Norte de Sevilla during the 19th and 20th centuries.
It is an excellent example of the iron mines related with the limestones of Capas de Campoallá Formation, common in the northeastern region of the geopark. These mines are characterized by the existence of a primary mineralization inside the limestones, originated by the sedimentation of silts and sands with high iron content between the carbonates in the marine platform, and a later concentration associated to the first processes of karstification during the Lower Cambrian (540 to 520 Ma). In numerous places of Cerro del Hierro can see the paleokarst holes filled with iron oxides.
There is evidence of its exploitation in Roman times, and there are quotes about the Cerro del Hierro in the Middle Age, according to various Muslim and Christian sources, but the maximum exploitation was made by the Scottish company William Baird Mining and Co. Ltd., from the late nineteenth century (1893) to the mid-twentieth (1946), which extracted large quantities of massive iron and oligist.
In its last stage till the end in the 1980s, the mine was under the ownership of a cooperative formed by the workers, who exploited the barite dikes and veins of the area.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 5 / Anfibolitas en almaden da la plata

GEOGRAPHICAL DATA

GEOSITE LOCATION	South of the village of Almadén de la Plata
GEOGRAPHICAL COORDINATIONS	X: 37 51 49 Y: 06 04 52
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Geological history

DESIGNATION: The coarse grain banded facies can be observed near the Wast Point of Almadén, on the path to Cerro de los Covachos and on the old path from Almadén de la Plata to Cazalla de la Sierra.
The fine grained facies can be observed at several points in the vicinity of the village of Almadén de la Plata, as in the near Calzadilla stream, and in several ravines near the waste-water treatment plant.

ACCESSIBILITY: By the A-450 road you will reach the village of Almadén de la Plata, from the A-66 highway or from the village of Castilblanco de los Arroyos.

GEOSITE USE: High scientific and didactic value

GEOSITE DESCRIPTION

At the latitude of the village of Almadén de la Plata there are rocks of blue-gray color, forming an east-west orientation belt of 10 kilometers long. These rocks are amphibolites named “Amphibolites of Beja-Acebuches”.
The amphibolites can be separated cartographically into two units according to their facies. The northernmost rocks are medium to thick grained, with banding depending on their composition: light color levels, rich in plagioclase and quartz, and dark levels, rich in amphiboles. The rocks located just south of the village, which constitute the topographically lower areas of this region, are fine-grained and blue-gray in color. They have a very fine foliation, with loss of continuity of the narrow levels rich in plagioclase and quartz, stretching mineral lineation and hinges of folds without flanks; these characteristics were produced by an intense deformation.
These amphibolites, appearing discontinuously over 200 kilometers long from Beja (Portugal) to this location, come from the metamorphism of ancient basic volcanic rocks; the geochemical tests indicate a composition similar to the basalts existing in the middle ocean ridges.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 6 / Grupo Pulo Do Lobo

GEOGRAPHICAL DATA

GEOSITE LOCATION	South of the village of Almadén de la Plata
GEOGRAPHICAL COORDINATIONS	X: 37 48 09 Y: 06 09 50
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Tectonic

DESIGNATION: At the south of the village of Almadén de la Plata starts the El Calvario path thatintersects this unit.The Cordel del Pedroso path also cross this unit at 2 kilometers southeast of the village of Almadén de la Plata.

ACCESSIBILITY: By the A-450 road you will reach the village of Almadén de la Plata, from the A-66highway or from the village of Castilblanco de los Arroyos

GEOSITE USE: High scientific and didactic value

GEOSITE DESCRIPTION

At the south of the village of Almadén de la Plata there is a group of terrigenous rocks, in an elongated band of about 15 kilometers in length and less than 1 kilometer of width, constituted by a set of white schist and clear quartzites, derived from the metamorphism of clay and sand rocks.
Usually in the middle of this group outcrop there is a bank of quartzite with a few metters thickness, that due to its hardness generates the line of peaks of an east-west mountain range: Loma del Puerto, Cerro del Calvario, Cerro Palomares, Cerro Montes, Cerro Traviesa, Cerro Gallego; although there are other quartzite banks inside this rocks' group.
Within the schists there are abundant boudins of quartzite and veins of stretched quartzes, which are evidence of an intense deformation of these old sediments.
This sedimentary group, denominated "Pulo do Lobo Group ", has been interpreted as an "accretionary prism" or "accretion complex", of Lower-Middle Devonian age (420 to 380 Ma). At subduction zones between tectonic plates, most of the oceanic sediments transported over the oceanic crust not subducted under the continent, but remains adhered to it. The fine sediments of the oceanic plains incorporate sandy sediments of the near continent, and intense processes of deformation and metamorphism occur in relation to the stacking and compression of the accretionary prism during the subsequent continental collision.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 7 / El Choro

GEOGRAPHICAL DATA

GEOSITE LOCATION	At southeast of the village of Almadén de la Plata
GEOGRAPHICAL COORDINATIONS	X: 37 51 59 Y: 06 01 06
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Waterfall

DESIGNATION: There is an overview of the geosite in the hole located at the base of the gorge.To observe the site in detail it's necessary to enter into the lower part of the gorge, or surrounding it on the left, access at the top

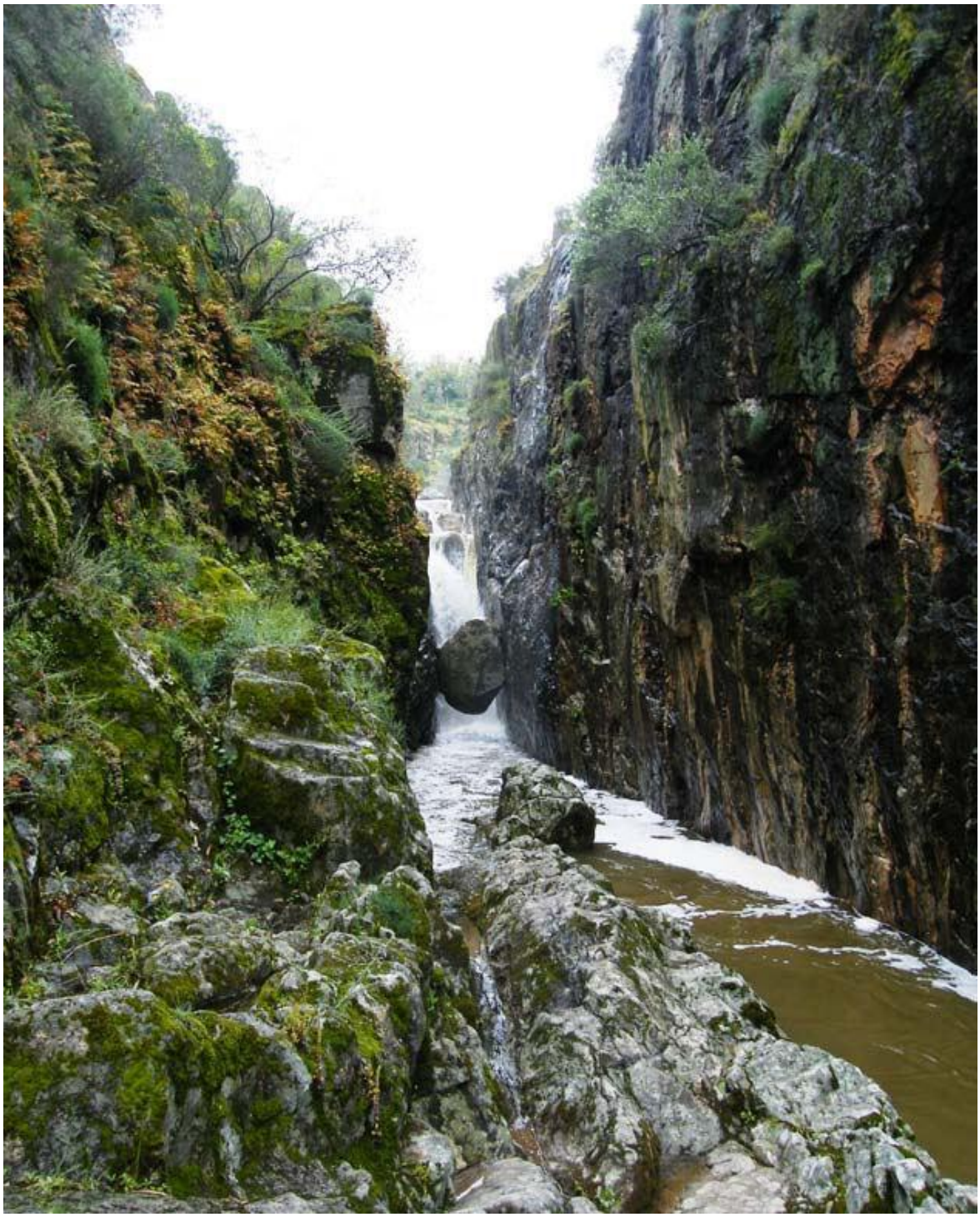
ACCESSIBILITY: In the village of Almadén de la Plata begin the Cordel de El Pedroso cattle path,and about 6 kilometers towards east the path cross again the Arroyo de la Calzadilla. Take the trail on the left riverside, parallel to the stream and goes 600 meters upstream

GEOSITE USE: High educational and touristic interest

GEOSITE DESCRIPTION

El Chorro is a group of waterfalls and rapids of great beauty and singularity, located in the Calzadilla (or Cezadilla) stream.
The Calzadilla stream, which born near the village of Almadén de la Plata, cuts the northern end of the granite pluton of El Berrocal about 5 kilometers from the urban center, through a spectacular gorge.
Most of the substrate rocks at this point are biotitic granodiorites, which are fractured and crossed by diabase dikes, which due its more basic composition are more erodible than granites that surround them, leading to differential atmospheric weathering. At this point, the vertical diabase dike has been eroded strongly, while granite is more resistant to erosion, in part because of the silicify produced by the diabase intrusion.
The result is a gorge of vertical walls, with an elongated hole where the diabase was before, and several waterfalls. Another interesting aspect is the fall in the gorge of large balls of the adjacent granodiorites, which fit in between the walls when was sweep along the stream in floods, that can reach a great volume of water in short periods of time.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 10 / Berrocal de el Pedroso

GEOGRAPHICAL DATA

GEOSITE LOCATION	At west of the village of El Pedroso
GEOGRAPHICAL COORDINATIONS	X: 37 50 26 Y: 05 46 30
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Petrology

DESIGNATION: In the village of El Pedroso begin the signposted path Arroyo de Las Cañas, which is one of the best routes to see the granite tors. The access road to the public forest. La Atalaya is also a good place of observation of granitic landscapes.

ACCESSIBILITY: The village of El Pedroso can be accessed from Cazalla de la Sierra at north (road A-432), and from Constantina at east (road A-452). The road between Cantillana and El Pedroso (A-432) cross the batholith.

GEOSITE USE: High educational and touristic value

GEOSITE DESCRIPTION

El Pedroso's batholite is a large pluton, with more than 150 square kilometers of surface and approximately North-South orientation, located between the Public Forest of UPA at north and the village of Villanueva del Río y Minas at south, and enclosed between two main tectonic structures; at west the Viar Fault and in the east the fault that limits the Monesterio Anticlinorium and the syncline of the Sierra de El Pedroso.
The batholith shows a compositional zonation, with biotite monzogranites in the central and meridional zones, and biotite granodiorites in the external and north zones. There are abundant bodies of cordierite white-granites and dikes of rhyolitic porphyries. The small bodies of gabbros occupy an external position to the main body of the batholith.
The igneous rocks present different degrees of alteration: the monzogranites of the central part of the batholith shows a high weathering degree, giving rise to wide sandy valleys with a great development of soils and few outcrops of intact rock; while the granodiorites of the external zone have a much lower degree of weathering, due to their greater resistance to atmospheric alteration, so they offer a characteristic granite tors, within a soft relief of sandy soils.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 14 / Cascadas del Huesna

GEOGRAPHICAL DATA

GEOSITE LOCATION	Riverbed of Rivera del Huéznar
GEOGRAPHICAL COORDINATIONS	X: 37 59 37 Y: 05 40 10
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Waterfall

DESIGNATION: There are several viewpoints on the public path.

ACCESSIBILITY: From San Nicolás del Puerto by the SE-7101 road, about 2 kilometers from the villag

GEOSITE USE: High didactic and touristic interest.

GEOSITE DESCRIPTION

The Huéznar Waterfalls are located in a small section of the Rivera del Huéznar River, with a series of small waterfalls and pools, which are declared Natural Monument of Andalusia.
The Rivera del Huéznar is divided in this zone into two branches. On the left branch there are two waterfalls of greater height, named “Chorrera Grande” and “Chorrera del Moro”, and on the right branch there is a group of smaller cascades named “Chorreritas”.
The origin of the waterfalls is the existence of several vertical faults that have produced various slopes. The waters of the river had produced, and continue nowadays, large deposits of calcareous tuffs (also called travertines), because the water precipitate the calcium carbonate that carry in solution by the loss of pressure in the waterfalls, over the roots of trees and other remains of the abundant riverside vegetation. These rocks are very characteristic, with a multitude of holes and tubes, produced when the roots, branches and leafs disappear.
The water of the river, which arise in the Rivera del Huéznar Spring, is rich in carbonates because it comes mainly from the “Guadalcanal – San Nicolás del Puerto” subterranean karstic aquifer, where water dissolves the limestone that constitute the aquifer and incorporates the calcium carbonate.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME:	8	/	Berrocal	de	Almaden	de	la	Plata	

GEOGRAPHICAL DATA

GEOSITE LOCATION	El Berrocal Public Forest
GEOGRAPHICAL COORDINATIONS	X: 37 51 49 Y: 06 04 41
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Watering

DESIGNATION: Travelling through the public use paths and the public forest ways, there are anoverview of the pluton and various views of the geomorphologic granite forms.

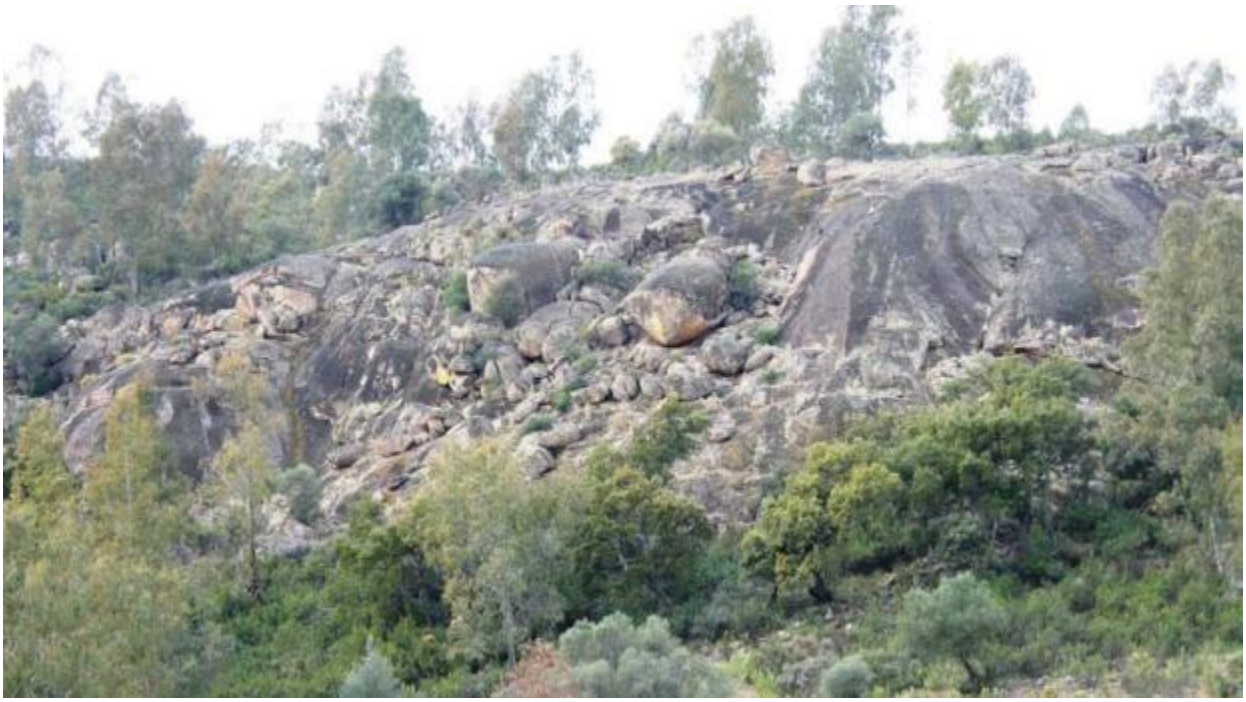
ACCESSIBILITY: The access to Berrocal Public Forest is from the village of Almadén de la Plata,following the El Pedroso cattle path. At 4.5 km from the village take a road on the right and cross the Vegas de Tirado gate, where is indicated “Visitor Center Cortijo del Berrocal”, which is reached after traveling 1.5 kilometers.

GEOSITE USE: High educational and touristic value

GEOSITE DESCRIPTION

At southeast of Almadén de la Plata village outcrops a granite, known as “Granito del Berrocal”. It is a relatively small intrusion, about 16 km2 on surface, which was lintruded during the Upper Carboniferous in the northernmost part of the Sudportugese Zone. It is a pink colored granite composed of quartz, alkaline feldspar, plagioclase, biotite and garnet. Its texture is grainy and coarse- grained.
The atmospheric weathering of granite has created a characteristic granite tor that constituted an excellent space for the observation of the different landscape forms of granite rocks: accumulations of stone balls, flat stones, knight’s stones and sandy valleys.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 12 / Falla del Viar

GEOGRAPHICAL DATA

GEOSITE LOCATION	Cantillana – El Pedroso road
GEOGRAPHICAL COORDINATIONS	X: 37 43 55 Y: 05 49 49
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Tectonic

DESIGNATION: The best place for observation is the left side of the old road. The access to this section begins in the intersection with the road to Castilblanco de los Arroyos.

ACCESSIBILITY: Road A-432 between Cantillana and El Pedroso.

GEOSITE USE: High scientific and educational interest.

GEOSITE DESCRIPTION

The eastern edge of the Viar Basin is deformed by a large zone of fractures, generally named as “Viar Fault “. In this zone, with a width between 200 and 1,200 meters and a longitudinal extension greater than 25 kilometres, the Paleozoic rocks of the Ossa-Morena zone ride over the continental sediments of the Viar Basin, deposited after the Variscan Orogeny.

The fractures that set up the Viar Fault, three to five inverse faults, produce the overlap of the Paleozoic rocks (Cambrian marbled limestones, Devonian biodetritic limestones and Ordovician schists with vulcanites), over the siltstones with levels of carbonates and conglomerates of the Upper Red Unit of the Viar Basin. These sediments are inverted (upsidedown), as evidenced by grain positive selection of the conglomerates. The deformation of the sediments of the Viar Basin is slight and, a few meters westward, the layers recover their original horizontal position.

The deformation of the Viar Fault is later the rising of Sierra Morena and subsequent the formation of the Viar Basin, possibly in the Alpine period by reactivation of the old fractures that constituted the eastern boundary of the basin.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 15 / Capas de Campoalla

GEOGRAPHICAL DATA

GEOSITE LOCATION	Northeastern half of the Geopark
GEOGRAPHICAL COORDINATIONS	X: 37 58 11 Y: 05 38 39
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Stratigraphic unit

DESIGNATION: Along Las Laderas trail and the Green Way of Sierra Norte de Sevilla can be realized an overview of this sedimentary formation, and can view different sedimentary and tectonic structures.

ACCESSIBILITY: The access to the Greenway of Sierra Norte de Sevilla may be from the road between Cazalla de la Sierra and San Nicolás del Puerto or from this last village.
The access to Las Laderas trail it's at Cazalla de la Sierra.

GEOSITE USE: Scientific, educational and touristic interest.

GEOSITE DESCRIPTION

"Capas de Campoallá" is the name of a stratigraphic unit of Cambrian age, constituted by detrital and carbonate sedimentary rocks (slates, sandstones and limestones), which is widely represented in the northeast half of the Geopark and with many outcrops in other areas.
The relative proportion of slates, sandstones and limestones varies strongly from one point to another, so that it is sometimes formed almost entirely by only one of these types of rocks, two of them or all three in assorted proportions. When the latter occurs, the "Capas de Campoallá" appears as an alternating sequence of layers of slates, limestones and sandstones with centimeter thickness, of a very striking appearance, such as can be seen in the road cuttings of: Cazalla de la Sierra to Alanís, Cazalla de la Sierra to San Nicholas del Puerto, Constantina to Las Navas de la Concepción, or in the Green Way of Sierra Norte de Sevilla. At the top of the sedimentary formation there is a significant increase of the carbonates compared to the sandstones and slates, reaching to be a section of massive limestones that constitutes the highest reliefs of several mountain ranges.
The sedimentation of these materials took place in a wide, homogeneous and shallow marine basin, probably in a closed sea.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 28 / Chimeneas Volcanicas

GEOGRAPHICAL DATA

GEOSITE LOCATION	Gallinero hill; Public Forest Dehesa de UPA
GEOGRAPHICAL COORDINATIONS	X: 37 53 52 Y: 05 57 22
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Volcanic

DESIGNATION: The A-450 road, when arriving at Public Forest Dehesa de UPA, continues along one of the service paths.
The outcrops of volcanic chimneys appear about 1 kilometer from the beginning of the path.

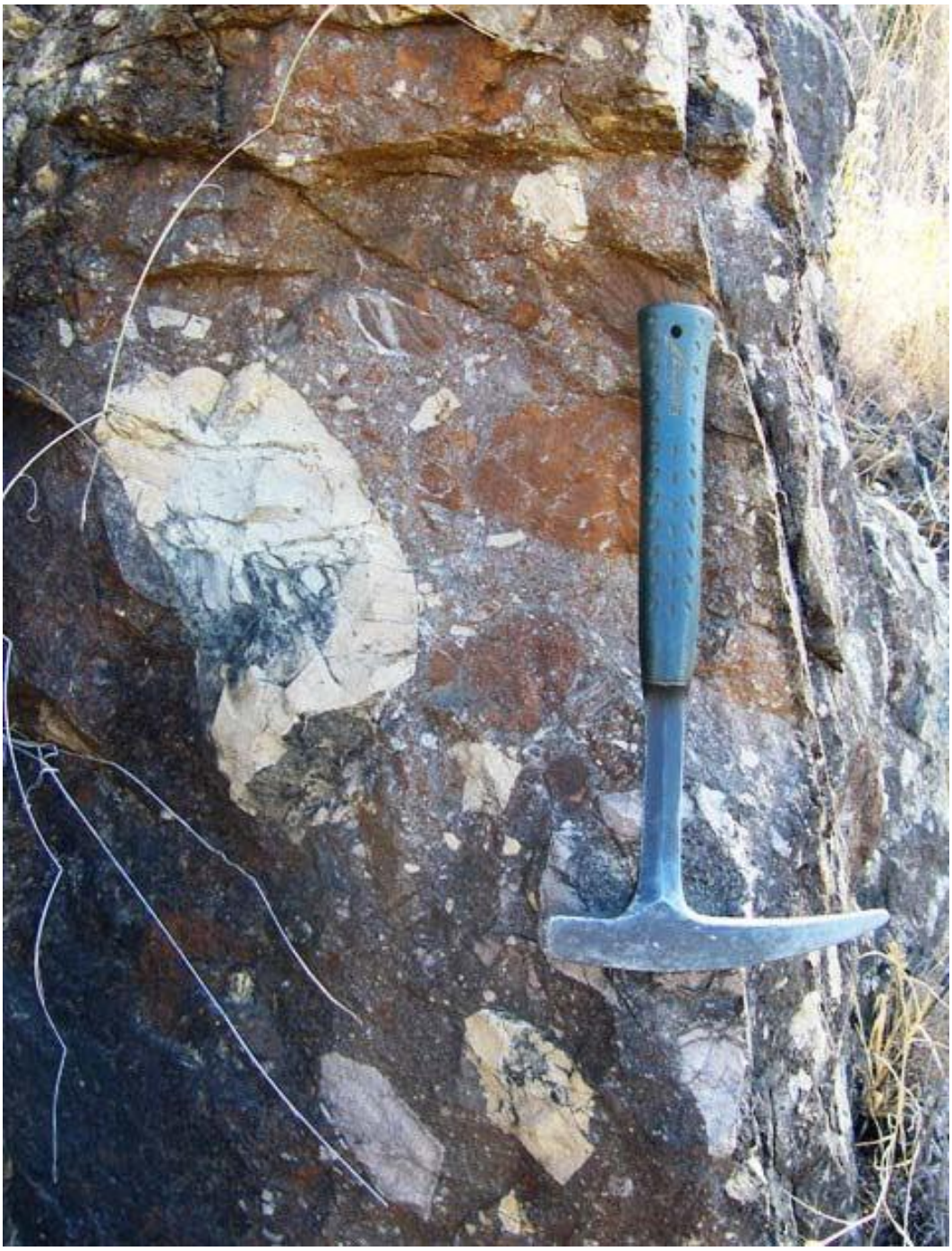
ACCESSIBILITY: From Cazalla de la Sierra, the road A-450 access to the base of the Gallinero hill

GEOSITE USE: Scientific and educational interest.

GEOSITE DESCRIPTION

The volcanic centre, which is presumably responsible for the pyroclastic deposits of the Viar Basin, has been detected about 5 kilometres northeast of the basin, at the south of Gallinero hill, in the Public Forest Dehesa de UPA.
The presence of several volcanic pipes has been detected in an area with an extension of about 3 square kilometres. These channels or chimneys are identified by the presence of breccias made up of fragments of the host rock: feldspar sandstones and slates (of Cambrian age), and a matrix of volcanic tuff. In some cases there are deposits of fine-grained pyroclastic rocks and volcanic ash which represent the basis of volcanoes.
These rocks, clearly related to the multiple volcanic deposits of the nearby Viar Basin, indicate the existence of an important volcanic centre with several craters; more than 15 possible channels with vertical position have been identified, several of which have been certified its volcanic nature. Due to the subsequent erosion only the rocks that fill the pipes are preserved in most of the outcrops.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 35 / Cerro La Capitana

GEOGRAPHICAL DATA

GEOSITE LOCATION	At northwest of the village of Guadalcanal
GEOGRAPHICAL COORDINATIONS	X: 38 07 09 Y: 05 51 29
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Geomorphology

DESIGNATION: At one kilometer from Guadalcanal village by the A-433 road, Fuente del Arco direction, begin the signposted path of Sierra del Viento. The Viewpoint of La Capitana is at the end of the trail (about 4.7 kilometers from its start).

ACCESSIBILITY: The village of Guadalcanal can be reached from Alanís and Fuente del Arco (Extremadura) by the road A-433, and from Cazalla de la Sierra by the road A-8200

GEOSITE USE: Educational and touristic interest.

GEOSITE DESCRIPTION

The Capitana Hill is a splendid observation point of the general modeling of Sierra Norte of Seville Geopark.
This hill, located in the Sierra del Viento (wind mountain range), is the highest elevation point of the Geopark with 952 meters of altitude above sea level, and due to its location it's a magnificent viewpoint of the mountainous landscape, in which alternate abrupt mountain ranges, narrow and deep river valleys and areas of soft and hilly plains.
The Sierra del Viento, at northwest of the village of Guadalcanal, separates the watersheds from two rivers: to the north the Bembezar and to the south the Viar. This mountain range is made up of light-colored marble limestones, with slate levels. They are algae limestone's breccias, with structures of stromatolites, among which are intercalated some levels of dolomite limestones of brecciated aspect. These marbled limestones correlate with the massive limestones of the upper section of the Campoallá Layers Formation, which outcrops commonly in this region of Ossa-Morena zone.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 18 / Cαnteras romanas de Los Covachos

GEOGRAPHICAL DATA

GEOSITE LOCATION	Los Covachos Hill
GEOGRAPHICAL COORDINATIONS	X: 37 52 37 Y: 06 05 02
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Mining - Archeology

DESIGNATION: The Cerro de los Covachos is located about 1,000 meters north of the urban center and can be accessed from the road to El Real de la Jara or by the Santiago's Trail (in the section from Almadén de la Plata to El Real de The Jara).

ACCESSIBILITY: The village of Almadén de la Plata can be reached from the A-66 highway and Castilblanco de los Arroyos by the A-8175 road and from El Real de la Jara by the A-5301 road.

GEOSITE USE: With high scientific, educational and touristic interest.

GEOSITE DESCRIPTION

In Roman times the region of Almadén de la Plata was one of the main centers of marble production in Andalusia, and the quarry of Cerro de Los Covachos (Los Covachos Hill) is a good example.
In this quarry are preserved the remains of a Roman exploitation front that was partially buried by the debris of several exploitations of the XX century. This is the largest of the ancient documented quarries in the area, and an archaeological excavation conducted in 2008 allowed the exposure, valuation and more effective protection of this site.
In the site it is noticed various blocks extraction fronts, and the marks left by various stone cutting tools. This situation is exceptional, since during the 20th century there was an intensive exploitation of the marble in this area, which eliminated the multiple remains of Roman activities which took place between the first and third centuries after Christ.
The Almaden de la Plata marble is widely documented in the cities located in the navigable area of the Guadalquivir River and especially in Italica (near Seville), as well as at different points on the Atlantic coast of the Bética and also in North Africa, but not on the Mediterranean coast.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 29 / Necropolis de La Traviesa

GEOGRAPHICAL DATA

GEOSITE LOCATION	Traviesa Hill
GEOGRAPHICAL COORDINATIONS	X: 37 52 07 Y: 06 07 10
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Geological history, Archaelogical site

DESIGNATION: The necropolis is located in the Public Forest of La Traviesa, which is bordered by SE-6405 road, about four kilometers at west of the urban center of Almadén de la Plata.

ACCESSIBILITY: The village of Almadén de la Plata can be reached from the A-66 highway and Castilblanco de los Arroyos by the road A-8175, from El Real de la Jara by the road A-5301 and from Santa Olalla de Cala by the road SE-6405

GEOSITE USE: With scientific, educational and touristic interest.

GEOSITE DESCRIPTION

The necropolis of La Traviesa, located on the public forest of the same name at west of the village of Almadén de la Plata, was discovered in 1986 and excavated in 1992 and 1993. It is one of the largest necropolis of the Bronze Age (2,250 to 1,000 years before Christ) known in southwest of the Iberian Peninsula, composed by a total of 29 burials in cists.
A cist (from Greek: κίστη, chest or box) is an individual megalithic funerary monument of small dimensions, constituted by a quadrangular grave with walls of slabs (flat stones) placed vertically and covered by several slabs, that form a chamber within which an individual was deposited in fetal position.
The topographical arrangement of the burials in La Traviesa shows a peculiar pattern; 28 of the cists are placed in a semicircle around a burial of peculiar characteristics, the cist number 5, which is located at a higher elevation, is of larger dimensions and has a tumulus structure (stone mound). In this grave has been found a bronze halberd, which further differentiates this burial from the rest, in which only ceramic bowls have been found. This indicates that this tomb would correspond to a person of maximum social status, who has been identified by his funeral garment as the military leader of the community

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 37 / Formacion Capas de Benalija

GEOGRAPHICAL DATA

GEOSITE LOCATION	Southern area of the villages Guadalcanal and Alanís
GEOGRAPHICAL COORDINATIONS	X: 37 59 52 Y: 05 45 16
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Volcanic, sendimentology

DESIGNATION: On the A-432 road, before the village of Alanís, there are several cuttings with excellent outcrops of the unit. Also on the A-8200 road there are multiple slopes with good outcrops

ACCESSIBILITY: The village of Alanís can be reached from Guadalcanal by the A-433 road, from San Nicolás del Puerto by the SE-8100 road, and from Cazalla de la Sierra, by the A-432 road. The village of Guadalcanal can be reached from Alanís and Fuente del Arco (Extremadura) by the A-433 road, and from Cazalla de la Sierra, by the A-8200 road.

GEOSITE USE: Scientific, educational and touristic interest

GEOSITE DESCRIPTION

The “Capas de Benalija” formation, also known as “Esquistos de Benalija” (Benalija Schists) or “Capas de Alanis” (Alanís Layers), is the name of a sedimentary unit of Cambrian age, which outcrops in the northwestern sector of the Geopark, extends widely into the valley of Benalija river, between the Sierra del Agua, at northeast, and the Sierras de Santiago and San Antonio, at southwest, as well as other smaller areas in Cerro del Hierro, Constantina and Las Navas de la Concepción. Over the section of massive limestone that constitutes the upper part of Capas de Campoallá Formation, there is a set of terrigenous sediments, mostly formed by green slates, sometimes purple, always with some carbonates, containing small layers of sandstones and basic volcanic rocks.
These slates have a very characteristic appearance, with splinter fracturing, showing a blue-green color in the fresh cuts. Within this formation carbonated and purple slates levels have been identified.
The cartography allows visualizing the structure of the Benalija valley, constituted by the flank of a large syncline of vertical axial plane, repeated and broken by several longitudinal faults.
The fossil finds (trilobites) allow dating this formation as Lower Cambrian.
The sedimentation of these materials took place in a marine basin, deeper and farther from the ancient coast than the Capas de Campoallá Formation.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 21 / Cuenca De Alanis-San Nicolas del Puerto

GEOGRAPHICAL DATA

GEOSITE LOCATION	At south of Alanis and northeast of San Nicol Puerto
GEOGRAPHICAL COORDINATIONS	X: 37 59 56 Y: 05 38 54
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Geological history

DESIGNATION: At the south of the village of Alanís there is a public path that crosses several outcrops of sedimentary rocks and basaltic lava flows.
The public path Las Dehesas, which starts and ends in the village of San Nicolás del Puerto, crosses the largest surface extension of the Alanís - San Nicolás del Puerto Basin: there are several outcrops of conglomerates, sandstones, lutites and slates.

ACCESSIBILITY: The village of Alanís can be accessed from Cazalla de la Sierra and Guadalcanal by the A-432 road. San Nicolás del Puerto is accessed from Cazalla de la Sierra by the SE-168 road and from Constantina by the SE-163 road

GEOSITE USE: With scientific, educational and touristic interest.

GEOSITE DESCRIPTION

Between the villages Alanís and San Nicolás del Puerto there is a very heterogeneous group of sedimentary rocks that outcrop in multiple disconnected places.
This basin is located over an extension of about 14 kilometers long and 5 kilometers wide, with an approximate arrangement Northwest – Southeast The rocks are conglomerates, sandstones, shales and some lava flows, with fossils of leaves and tree trunks. Due to their low visibility, as they are partially covered by quaternary deposits, it has not been possible to define a complete stratigraphic record. These rocks correspond to the deposits of alluvial fans, fluvial systems and lacustrine zones, with the occurrence of some volcanic episodes.
They are considered to constitute the filling of a continental basin (Upper Carboniferous - Permian), partially dismantled, over the deformed basement, similar in spatial arrangement and age to the Viar Basin. The location and orientation of these basins was controlled by Variscan folding and fracturing structures, so that they are aligned according to the dominant northwest - southeast direction.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 32 / Canon del Rio Viar

GEOGRAPHICAL DATA

GEOSITE LOCATION	Viar River upper course
GEOGRAPHICAL COORDINATIONS	X: 37 57 45 Y: 05 56 12
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Geomorphology

DESIGNATION: There are several points to see the Viar canyon: Bajos de Jadraga viewpoint, at south of the El Pintado reservoir; the old road from Almadén de la Plata to Cazalla de la Sierra, which reaches the Viar river; in the Public Forest of UPA, in Cazalla de la Sierra, where there are several paths from where the canyon can be observed.

ACCESSIBILITY: The area of El Pintado reservoir can be reached from El Real de la Jara and from Cazalla de la Sierra by the road SE-179. The upper course of the Viar River can also be access from Almadén de la Plata. The area of Melonares reservoir is acceded by the Cordel de El Pedroso cattle path, from Almadén de la Plata or from Cantillana, Castilblanco de los Arroyos and El Pedroso, by the road A-432

GEOSITE USE: Education, Scientific and touristic interest

GEOSITE DESCRIPTION

The upper course of the Viar River, from the reservoir of El Pintado to the proximity of Los Melonares reservoir, presents morphology of river canyon: a deep gorge of nearly vertical walls, with a length of more than 21 kilometres.
This canyon has been generated by the erosion of the Viar River, which has excavated various metamorphic and sedimentary rocks. Although the main geographic direction of the upper course of the river is north - south, this long canyon presents alternating orientations: northwest - southeast and northeast - southwest. These river directions do not agree with the usual orientations of the rocks, which are aligned with a general orientation northwest – southeast. For that reason it is deduced that the river has take advantage of diverse faults, possibly generated during Alpine Orogeny. This orogeny caused a general uprising of the Ossa-Morena region and its fracturing according to various fault systems. This canyon has high biodiversity, as the climate of this area is warmer due that the Viar valley is open to the south, towards the Guadalquivir River basin. The upper course of the River Viar is classified as a Reserve Zone, dedicated to the conservation of biodiversity through the protection of its ecosystems.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 38 / Berrocal de la Jarosa

GEOGRAPHICAL DATA

GEOSITE LOCATION	At north of Huéznar Reservoir
GEOGRAPHICAL COORDINATIONS	X: 37 48 37 Y: 05 41 33
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Erosional

DESIGNATION: The best observation point is the old road from El Pedroso to Constantina, whichleads to the Huéznar Reservoir, that begin at the current road between Constantina and El Pedroso (A-452), about 4.5 kilometers from the village of El Pedroso.

ACCESSIBILITY: The area can be reached from Cazalla de la Sierra and from El Pedroso by the road\A-432 or from Constantina by the road A-452. In the road between Constantina and El Pedroso, begin the old road that leads to the Huéznar Reservoir.

GEOSITE USE: Educational and touristic interest

GEOSITE DESCRIPTION

At north of the Huéznar Reservoir there is a granitic pluton of elongated shape, about 16 kilometers long and about 5 kilometers wide, with an approximated northwest - southeast direction.
This pluton is composed of several types of granitic rocks: coarse grained biotite granite (called Garrotal Granite), leucocratic granite and cordieritic leucogranites. The spatial distribution of the main bodies of plutonic rocks is quite heterogeneous and equally with the diverse host rocks: schists, black quartzite, gneisses and migmatites (Montemolín unit); slates, sandstones and limestones (Campos de Campoallá Formation); and feldspathic sandstones and slates (Alternancia de Cumbres sedimentary unit).
The atmospheric weathering of granitic rocks is highly developed, due to its compositional and structural characteristics, so that a highly evolved granite tors has been formed, than in other zones in the Geopark, with very smooth hills and valleys, where highlight the areas where outcrops the leucocratic granites..

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: 2 / Calizas marmoreas de Guadalcanal

GEOGRAPHICAL DATA

GEOSITE LOCATION	Road A-8200, between Cazalla de la Sierra and Guadalcanal
GEOGRAPHICAL COORDINATIONS	X: 38 00 39 Y: 05 51 07
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Sendimentary

DESIGNATION: The best place is the road A-8200, mid-point between Cazalla de la Sierra and Guadalcanal, about 14 kilometers from each village. There are several curves with a wide lateral shoulder to stop.

ACCESSIBILITY: Road A-8200 between Cazalla de la Sierra and Guadalcanal.

GEOSITE USE: Good place of educational interest: Interesting folds features and associated axial plane fractures in limestones

GEOSITE DESCRIPTION

In the high area at northwest of Cazalla de la Sierra there is a detrital-carbonate succession, named “Calizas del Agua” (water limestones). These layers of limestone and siltstone ffected by folds can be clearly observed on the road cuttings between Cazalla de la Sierra and Guadalcanal.
This sedimentary unit is located above the arkoses, slates and sandstones of Torreárboles Formation. The lower section of the “Calizas del Agua” unit are formed by an alternation of slates, sandstones and arkoses, with layers of limestone and carbonate siltstones. The following sections are characterized by a greater abundance of carbonates. The last section of this unit is constituted by a thick package of marbled limestones, which in this zone forms the highs of Sierra de Santiago, where the karst complex of Santiago caves is located. The fossil occurrences provide this unit a Lower Cambrian age, similar to many of the calcareous rocks of the eastern part of the Geopark.
The limestones of the intermediate section, which are slightly metamorphosed, are laminated in layers of small thickness with intercalations of siltstone, and show abundant folds.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Fossil Flora

GEOGRAPHICAL DATA

GEOSITE LOCATION	Dehesa del Viar, Cordel de El Pedroso cattle path
GEOGRAPHICAL COORDINATIONS	X: 37 55 03 Y: 05 56 01
ALTITUDE	
LENGTH	

GEOSITE CATEGORY: Fossil

DESIGNATION: There are multiple outcrops with fossils of flora.

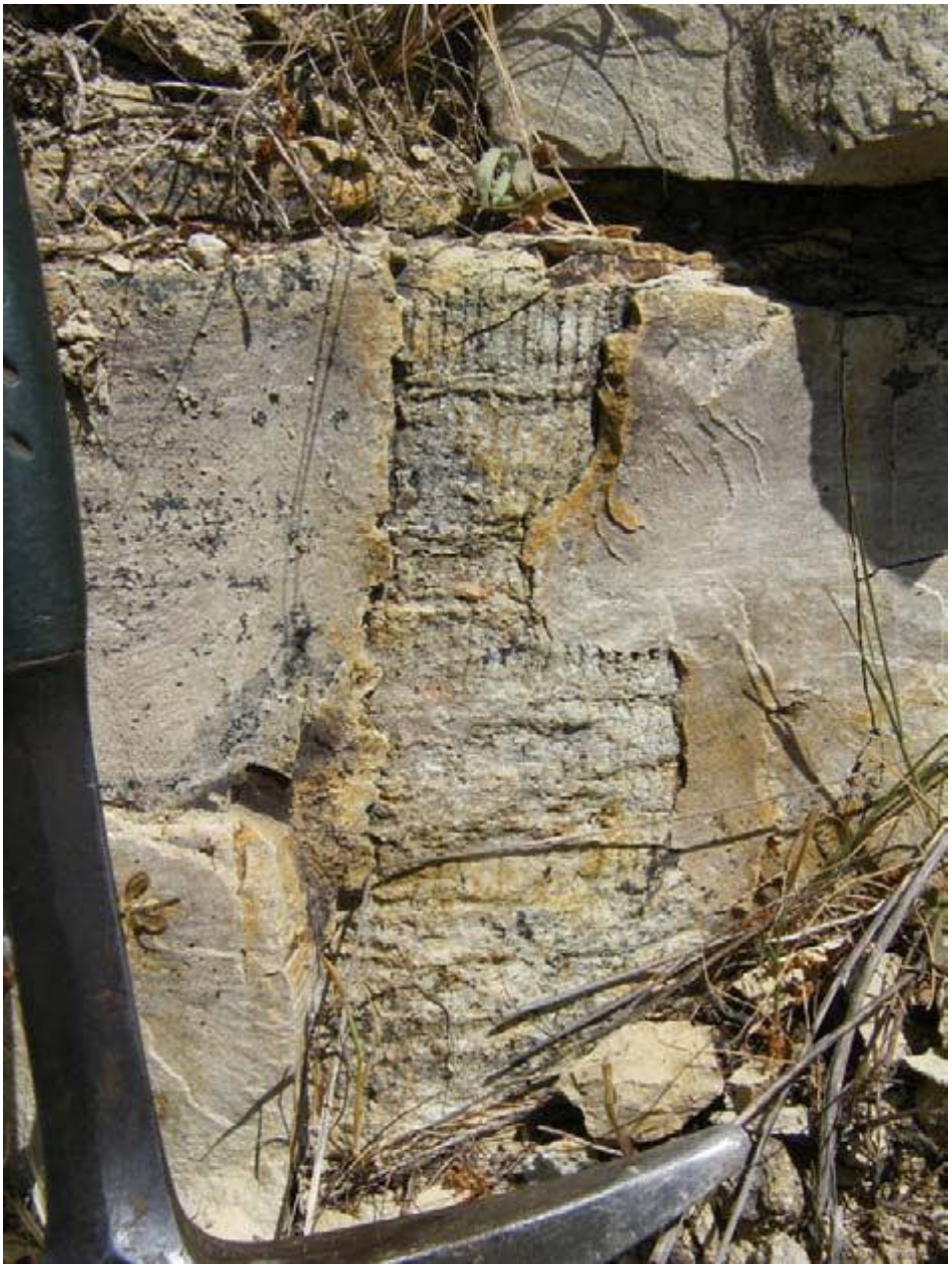
ACCESSIBILITY: The Viar Basin is crossed longitudinally by the Cordel de El Pedroso cattle path, which can be accessed from Cantillana or El Pedroso by the A-432 road, or from the town of Almadén de la Plata (where the path terminates).
It's possible to access the Cordel de El Pedroso from Cazalla de la Sierra, by the A-450 road and then uses the path that crosses the Public Forest of UPA.

GEOSITE USE: Education, scientific interest.

GEOSITE DESCRIPTION

In the Viar Basin there are several sites with Upper Carboniferous - Permian fossil flora, consisting of both leaves and logs fragments.
About 40 species of flora have been identified, which confirm an age for the sediments of this basin as Upper Carboniferous (303 Ma) - Lower Permian (290 Ma).
Practically most of the plant remains were found in deposits produced in a humid environment, usually alluvial or lacustrine, with several inputs of volcanic materials: fiery clouds deposits and / or pyroclastic breccia. The presence of volcanic material promoted the processes of silicification, by which the cellulose of the trees was replaced progressively by silicon dioxide (silica: SiO_2), which is the compound that currently forms these fossils.
There are abundant fossils of tree trunks, some of them large, and sometimes occur in life position.

PHOTOGRAPH



5.5. Liepajas Neredzigo biedriba (Letvia)

Below there are the “GEOSITE INVENTORY SHEET” of the 20 geosites of Letvia that were selected by Liepajas Neredzigo biedriba.

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0442070 **NAME: Abava Rapid**

ASSOCIATED GEOSITES: Abava River, Nature park “Abava Ancient Valley”

GEOGRAPHICAL DATA

GEOSITE LOCATION	Talsu county, Abava parish. The territory is located in the ancient valley of Abava, in the depression of the ancient valley, between the highlands of North and South Kurzeme.
GEOGRAPHICAL COORDINATIONS	X: 410709 Y: 326289 E22° 31,636' and N57° 4,280'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 3.35 ha. Waterfall height: 1 meter, width: 30 - 35 meters, there is a pit about 1 meter deep below the waterfall.

GEOSITE CATEGORY:
Protected geological and geomorphological natural monument.

DESIGNATION:
Located in Nature park “Abava Ancient Valley”. There are EU protected habitats in the area – outcrops of carbonate bedrock (8210) and river streams (3260).

ACCESSIBILITY:
Good. The parking lot for clients is free of charge. There is basic information about the waterfall in the area and for additional charge site visitors can rent a boat, picnic and camp. An entrance fee is charged to visit the area: for adults 1.20 EUR; children up to 6 years old - free of charge; children from 6 to 18 years of age, pensioners, people with disabilities and pregnant women – 0.80 EUR.

GEOSITE USE:
Important site for nature tourism.

GEOSITE DESCRIPTION

Abava Rapid is the second widest waterfall in Latvia and one of the most popular natural objects in Latvia with very rare outcrops, where sediments from the end of the ice age are dated.

The formation of the Abava Rumba waterfall at the specific site has been determined by the presence of a dense layer of dolomite at the base of the Abava Valley. The dolomite layer together with the lying and less durable layers under the influence of the river current ensures the formation and existence of the step across the entire width of the river valley.

Traces of brachiopods can be found in dolomite outcrops. Downstream of the waterfall, on the right bank of the river, in the section of the floodplain, peat layers and wood remains have been found, which date back to the end of the ice age and the beginning of the Holocene. Peat dates back to 10,400 years.

There is evidence that the waterfall has not changed much in more than 100 years.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0200300
NAME: Cape Kolka

ASSOCIATED GEOSITES: Slitere National Park

GEOGRAPHICAL DATA:

GEOSITE LOCATION	Dundaga county, Kolka parish, Slītere National Park
GEOGRAPHICAL COORDINATIONS	X: 416688 Y: 6402489 Lat: 57.7567421, Lon: 22.5999625
ALTITUDE	
DIMENSIONS	16 365 ha

GEOSITE CATEGORY: place where the Baltic Sea meets the Gulf of Riga.

DESIGNATION: Slītere National Park, NATURA 2000 territory, place of international importance for birds.

ACCESSIBILITY: There is an information centre with facilities and information stands. The parking place can be reached by a car. There is a dirt/sand pathway from the parking space to the seaside. Not suitable for people with reduced mobility.

GEOSITE USE: This area is a significant tourism object.

GEOSITE DESCRIPTION:

Cape Kolka is the most prominent promontory on the Latvian coast. Here the open Baltic Sea and the Gulf of Riga alternate their waves.
Although this area has an outstanding cultural value, it is also an important concentration place of natural values. The seasonal migration routes of birds cross here. The bird-watching tower built in Cape Kolka will help you see the migrating birds. The beach is home to a number of European protected habitats of importance, such as embryonic dunes and foothills.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440520
NAME: Ergli Cliffs

ASSOCIATED GEOSITES: Gauja National park, Ramatu Cliff

GEOGRAPHICAL DATA

GEOSITE LOCATION	Priekuli Municipality, Priekuli parish, Gauja National Park
GEOGRAPHICAL COORDINATIONS	X: 576336 Y: 358180 E25° 16,136' and N57° 21,604'
ALTITUDE	
DIMENSIONS	The cliffs occupy the left bank of the Gauja river for about 500 m. Their height is from 18 to 26 m.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument of national significance.

DESIGNATION: NATURA 2000 territory. There are EU protected habitats in the area – sandstone bedrock outcrops (8220), undisturbed caves (8310), natural eutrophic lakes with submerged and floating vegetation (3150), boreal forests (9010*) and alluvial forests (91E0*).

ACCESSIBILITY: There is a gravel trail that leads to the cliffs with several viewing platforms. It can be slippery in wet weather. A wooden staircase leads down to the Gauja river and the site of the cliffs. In the parking place above the Ergli cliffs there is an information stand about the specific geosite. Not suitable for people with reduced mobility.

GEOSITE USE: It is one of the most popular tourist attractions in the Gauja National Park

GEOSITE DESCRIPTION

Ergli cliffs, also called Pieshkali or Pieshkalni rock, are the most powerful in their integrity in the entire Gauja ancient valley. The rocks are formed by Devonian sandstone, which has a sloping layer. Remains of ancient Devonian fish and phosphorite nodules (inclusions) are found in the sandstone. Ergli cliffs stand out among the other rocks and outcrops with many traces of iron compound migration, which can be seen as a pattern of rusty bands formed by the periodic deposition of iron hydroxides as groundwater seeps through the porous sandstones. Another interesting geological feature of these rocks is the fractures. The origin of the fractures is related to ancient tectonic processes in the depths of the earth, as well as to the formation of the Gauja ancient valley many millions of years ago.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441100 **NAME:** Ezurgas Cliffs

ASSOCIATED GEOSITES: Zivtini sandstone outcrops

GEOGRAPHICAL DATA:

GEOSITE LOCATION	Salacgriva Municipality, Liepupe parish and the rural territory of Salacgriva town
GEOGRAPHICAL COORDINATIONS	X: 522113 Y: 379537 E24° 22,174' un N57° 33,466'
ALTITUDE	
DIMENSIONS	37,44 ha. The total length of the outcrops band is more than 2.6 km.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument.

DESIGNATION: Located in a nature reserve and in Natura 2000 territory on Vidzeme's rocky coast. There are EU protected habitats in the area – sea steep banks (1230), embryonic dunes (2110), herbaceous gray dunes (2130 *), wooded seaside dunes (2180), black alder walks (9080 *) and boreal forests (9010 *)

ACCESSIBILITY: Parking place can be accessed by car. There is a staircase from the parking place to the seaside. In order to get to the cliffs, you have to walk along the sea. Earth and sand cover. Not suitable for people with reduced mobility.

GEOSITE USE: This area is a significant tourism object.

GEOSITE DESCRIPTION:

The Ezurgu Cliffs with Devonian sandstone outcrops is unique not only for Latvia, but also for the Baltic States as a whole. The outcrops are the most scenic places on the entire Latvian coast and can be viewed the entire band length.
The natural monument is formed by the steep bank of sea erosion, where the sandstones and clayey sediments of the Middle Devonian Burtnieki suite are exposed, which provides an opportunity to get to know the structure of the respective rocks and interpret the conditions of their formation. The dunes formed on the coastal slope contrast with the reddish sandstone cliffs and the rocky coast of Vidzeme, which highlights the peculiar forms of the cliffs. The color of the cliffs changes from light brown to red.
Geological processes are actively manifested in the area – mainly as coastal erosion, which takes place during larger and smaller storms. However, the retreat of the steep bank is relatively slow, on average a few centimeters a year, due to the durable sandstones.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440940
NAME: Galmicu, Lejeju and Muizaraju cliffs

ASSOCIATED GEOSITES: Venta Rapids in Kuldiga, Riezupe sand caves, Ivande river waterfall

GEOGRAPHICAL DATA

GEOSITE LOCATION	Kuldiga Municipality, Rumba parish and Ventspils Municipality, Zleku parish
GEOGRAPHICAL COORDINATIONS	X: 375236 Y: 330004 E21° 56,442' and N57° 5,786'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 16,56 ha. The total height of the outcrops is up to 20 m. The total length of the exposure strip is 1600 m, including several breaks.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument

DESIGNATION: located in the nature park and Natura 2000 territory Abava ancient valley. There are EU protected habitats in the area – sandstone bedrock outcrops (8220), river streams and natural river sections (3260), mineral-rich springs and avocs (760), spruce deposits (7220 *), slope and ravine forests (9180 *), boreal forests (9010 *), eutrophic tall herbaceous stands (6430) and park - like meadows and pastures (6530 *).

ACCESSIBILITY: Accessibility is limited. The cliffs are accessible both from Abava river (by boat) and along forest roads. In the forest massif, north of Kuldiga, there are bicycle lanes with signs and names of objects found here, including Abava coastal cliffs. Not suitable for people with reduced mobility.

GEOSITE USE: The area is an important nature tourism destination, which is best seen by boating on the Abava river.

GEOSITE DESCRIPTION

The natural monument consists of three expressive sections of sandstone outcrops in the ancient valley of Abava, on both banks of the river. In the direction downstream, first are Galmici cliffs on the left bank of the river, then Lejeju cliffs on the right bank and at the lower end are Muižaraju cliffs on the left bank of Abava. The outcrops are formed by sandstones and clays of the Middle Devonian Živeta floor, the Gauja regional floor, and possibly also the Burtnieki regional floor. The total length of the exposure strip is 1600 m, including several breaks. The outcrops are located on several levels - usually 2 levels - one near Abava, the other in the middle of the cliff to the top - sandstone outcrops, but they are separated by a layer of sandy and clayey sediments, which is mostly leaked, but in some places downstream. The total height of the outcrops is up to 20 m.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441410 **NAME:** Gutmanis Cave

ASSOCIATED GEOSITES: Gauja National Park, Viktora Cave

GEOGRAPHICAL DATA

GEOSITE LOCATION	Sigulda county, Sigulda parish, Sigulda town, Turaidas street 4
GEOGRAPHICAL COORDINATIONS	X: 550892 Y: 337317 E24° 50,505' and N57° 10,574'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 3.98 ha. 10 m high, 12 m wide, 18,8m length

GEOSITE CATEGORY: Protected geological and geomorphological natural monument. Archaeological monument from 1967, as well as a protected geological object from 1974.

DESIGNATION: Located in Gauja National Park, the NATURA 2000 territory. There are EU protected habitats in the area – slope and ravine forests (9180 *).

ACCESSIBILITY: Great. The object can be visited by people with special needs. Stairs leading from the parking space to the tunnel are equipped with wheelchair lift. The pathway to the cave is made of asphalt path or gravel. Available in all weather conditions. There is parking and visitor center with toilets. The visitor center offers tourist information, internet, souvenirs and coffee.

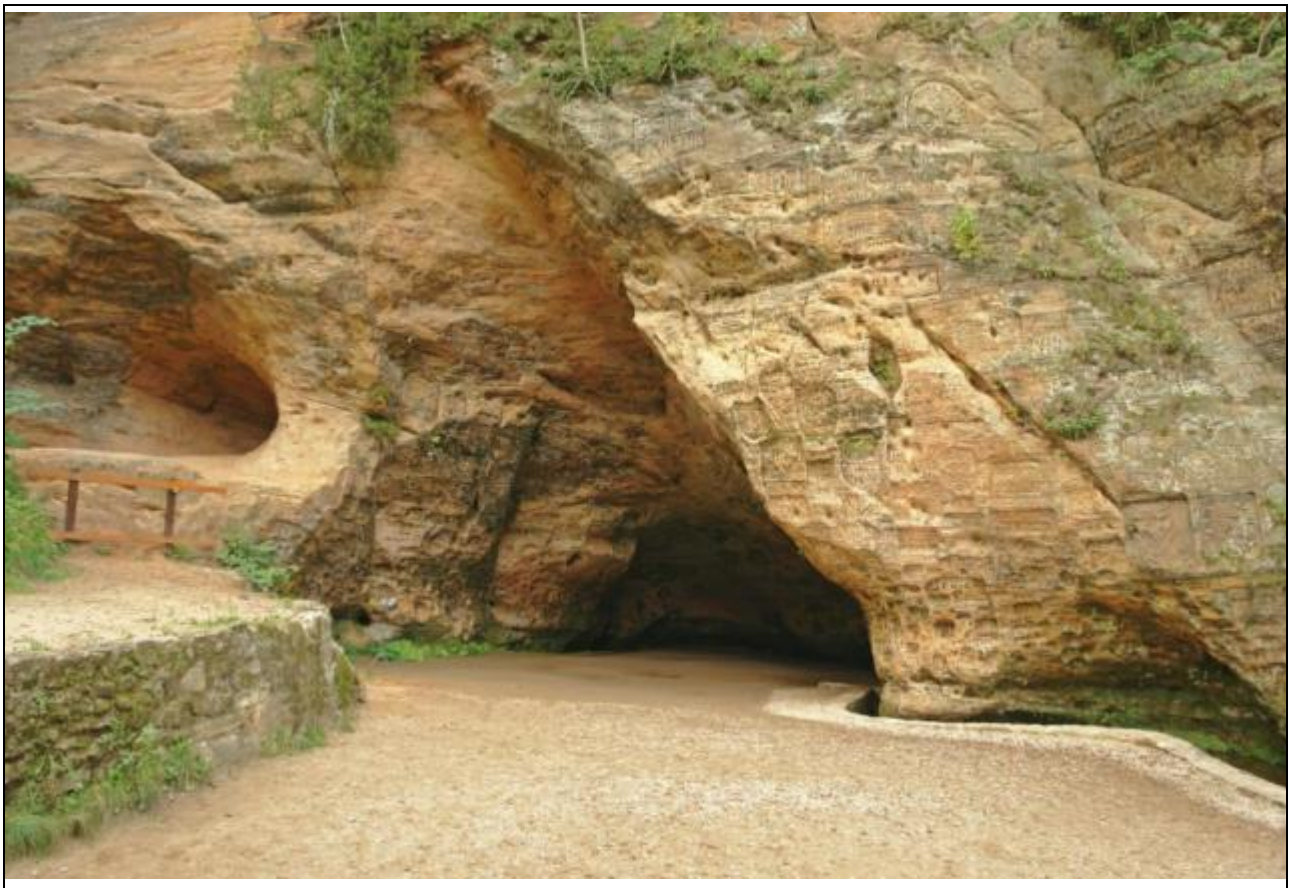
GEOSITE USE: The most visited natural monument in Latvia, which has been popular among travelers since at least the beginning of the 17th century.

GEOSITE DESCRIPTION

The cave began to form in the post-glacial era about 10,000 years ago under the influence of suffusion processes, as the water buried in the Devonian sandstones of the Gauja suite. It is also the highest cave in Latvia, the largest cave also in the Baltic States, the spring that flows out of the cave, in ancient times served as a sacred spring, and the water is considered healing. The spring continues to wash away the sandstone, thus today the underground erosion continues. The legend about Turaida Rose – Maija and her tragic love is connected with Gutmanis Cave. The names of barons and lords can also be read in the sandstone. According to their instructions and order, they were engraved by the masters who stayed here and kept their tools – ladders and carving tools – with them. Names and other details were engraved for a fee. Unfortunately, most of the ancient inscriptions have been irretrievably lost because they have

been rewritten several times, which has long been no longer allowed because of the destruction of this million-year-old sandstone rock. Thus, a layer of sandstone up to half a meter thick has been scrapped.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE/ NAME: Kapsedes boulder

ASSOCIATED GEOSITES: Kapsedes Rusty boulder

GEOGRAPHICAL DATA

GEOSITE LOCATION	Plienkalni, Liepaja district, Grobiņas county, Medze municipality (LV-3461). From Grobiņa on the road Grobiņa - Pāvilosta (P111), after 6.2 kilometers turn left to Grobiņa ABR (3 km). After 1.8 km, a large stone can be found at the intersection. Liepaja - Ventspils railway side at the crossing, 350 m S from Kapsede railway station. The railway line is abandoned now.
GEOGRAPHICAL COORDINATIONS	X: 322444 Y: 6275131 N 56°35'12,0" and E 21°06'30,2" Lat: 56.5867847, Lon: 21.1086525
ALTITUDE	
DIMENSIONS	Length – 5,5 m, width – 3,4 m, height – 4,2 m, circumference 16,5 m, volume of the largest piece - 60 m³. Three large pieces. Initial volume of the stone, before dividing in pieces: 80 – 110 m^3.

GEOSITE CATEGORY: Geological formation, Natural monument, Boulder

DESIGNATION: Latvian Natural monument

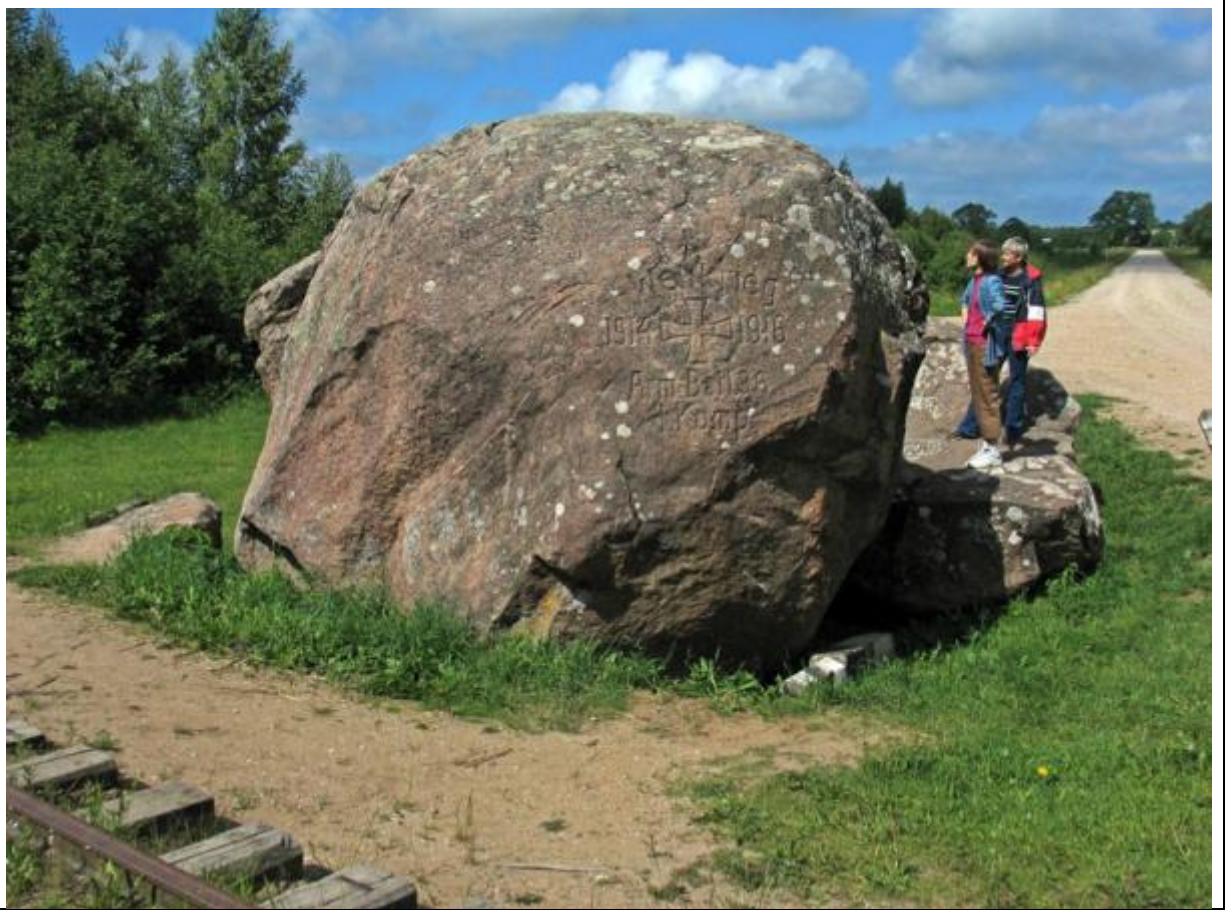
ACCESSIBILITY: Good – accessible by bus, car, bicycle etc.

GEOSITE USE: Educational, scientific and nature tourism

GEOSITE DESCRIPTION

Kapsede boulder is the highest boulder in Latvia – 4.3 meters. The stone is split into several parts, only two parts have survived to these days. The circumference of most of the stone is 16.5 meters, height 4.2 meters, length 5.5 meters, width 3.5 meters and volume 60 m³. The volume of the smallest part is about 10 m³. The total volume of the stone was initially estimated at 80 – 110 m³. The boulder is located on the formerly washed-out plain of the Baltic Ice Lake, where it was washed away by the waves and pushed out of the moraine about 10.5 – 11 thousand years ago. Much more recent history can also be seen on the side of the boulder – the inscription "Weltkrieg 1914–1916" or "World War 1914-1916" is inscribed on the course of the First World War. Protected geological object since 1957.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440640 **NAME:** Katrina's Rock

ASSOCIATED GEOSITES:

GEOGRAPHICAL DATA

GEOSITE LOCATION	Pargauja Municipality, Straupe parish, Gauja National Park, In the lowland of the Gauja, on the slope of the ancient valley of the Gauja, on the right bank of the river.
GEOGRAPHICAL COORDINATIONS	X: 561249 Y: 346118 E25° 0,912' un N57° 15,241'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 3.87 ha.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument

DESIGNATION: Located within the Natura 2000 protected area. There is a EU protected habitat in the territory of the natural monument – sandstone outcrops (8220).

ACCESSIBILITY: The outcrops can be easily accessed by boat along the Gauja, as well as from the settlements on the left bank of the river. However, there is no indication of the area and no information is available about it. There are no landmarks of the natural monument.

GEOSITE USE: This natural monument is a popular tourism object. The territory needs to be preserved both for scientific geological research, as well as for research of modern plant species and habitats.

GEOSITE DESCRIPTION

Katrīna's Rock also known as Mermaids Rock consists of the slope of the ancient valley of the Gauja with the sandstone outcrops of the Gauja suite of the middle Devonian Živeta floor, which has a niche, as well as a small ravine. This area is characterized by sandstone outcrops of the Middle Devonian Gauja Suite.

These are relatively high and wide outcrops, where the length of the main strip of outcrops is 160 m, outside which there are other, smaller, outcrops. The height of the cliff is up to 50 m, but the height of individual outcrops reaches 15 m.

The sandstones of the Gauja suite in the Katrina's Rock are similar to other widespread sediments of this suite – they are dominated by embankment-like sloping textures, less frequent thick oblique series. Katrina's Rock with sandstone orange color contrasts well with the dark color of the Gauja water and the green color of the rich vegetation. This outcrop is very scenic and is located on the very bank of the Gauja river.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440470
NAME: Lustuzis

ASSOCIATED GEOSITES: Gauja National Park, Līgatne ancient valley, Amata river, Vanagu Rock, Zvartes Rock

GEOGRAPHICAL DATA

GEOSITE LOCATION	Gauja National Park, Līgatne county, Līgatne. The territory is located on the slope of the Līgatne ancient valley and next to the ancient valley, in the Gaujava lowland. Lustuzis is located east of Vanagu Rock, on the right bank of the Amata River.
GEOGRAPHICAL COORDINATIONS	X: 562929 Y: 343949 E25° 02,550' un N57° 14,058'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 4,49 ha. Lustuzis is a 140 m long and up to 3,5 m high rock.

GEOSITE CATEGORY:
Protected geological and geomorphological natural monument.

DESIGNATION:
Located within the Gauja National Park. There are EU protected habitats in the area - sandstone outcrops (8220) and undisturbed caves (8310). Some man-made cellars are important as wintering grounds for bats.

ACCESSIBILITY:
Good. At the southern end of the territory, next to the center of the town, there is a developed amenity infrastructure – footpaths with capital railings, stairs and viewing platforms. Tour guide services available with prior booking at Amata Municipality Tourism Information Centre. There is a parking space by Veclauci bridge (free of charge) and Zvartes Rock (for a charge from May until October). There is a free picnic spot and restroom by Zvartes Rock Visitor Centre.

GEOSITE USE:
The view from the Lustuzis is a popular place among travellers for taking photos. This site is important from the point of view of geology, landscape and cultural history.

GEOSITE DESCRIPTION

Lustuzis is the only Devonian period red sandstone rock in Ligatne, where caves are located on several floors in basements. The cellars were built here by the people of Ligatne in the 18th century. In the rock, which is exposed as vertical and slightly sloping sandstone fields, cellars were cut for the needs of the locals. In total, there are more than 20 separate cellars and 2 larger collective cellars with one main aisle and separate cellars as short sides. The large cellars are abandoned, but the small ones, which are located on the 2 floors of the outcrop, are still partially used. In total, there are 230 such cellars in Ligatne.

The rock embraces the curve of the Amata River like a big horseshoe and from the top of the rock there are beautiful views of the ancient valley of Ligatne, the town of Ligatne and the paper mill. In springtime, experienced water tourism enthusiasts include Lustuzis rock in their adventure routes as it gives an opportunity to feel adrenaline and speed, and the thrill of navigating rapids and suddenly being pressed against the rugged rock wall.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441490
NAME: Kautraka ravine and Svikupite river

ASSOCIATED GEOSITES: Gauja National Park

GEOGRAPHICAL DATA

GEOSITE LOCATION	Gauja National Park, Sigulda Municipality, Sigulda parish, in the Gauja National Park reserve zone – Nurmizi ravine reserve.
GEOGRAPHICAL COORDINATIONS	X: 555345 Y: 338895 E24° 54,945' and N57° 11,393'
ALTITUDE	
DIMENSIONS	The length of the ancient valley of Svikupite within the recommended limits of the natural monument is 2350 m. The length of the steepest and most pronounced part of the Great Kautraka ravine is 790 m, and the length of the Small Kautraka ravine is 440 m. The total length of the ravines and side ravines is more than 2 km. The area of the natural monument is 80.09 ha.

GEOSITE CATEGORY: protected geological and geomorphological natural monument

DESIGNATION: Natura 2000 territory. There are EU protected habitats in the area – sandstone outcrops (8220), carbonate bedrock outcrops (8210), undisturbed caves (8310), sloping and ravine forests (9180 *), mineral-rich springs and avocs (7160), river streams and natural river sections (3260). There are a number of rare and protected species of living organisms.

ACCESSIBILITY: Getting around the ancient valleys and ravines is difficult, in some places even risky, there are no information stands, signs and other tourist infrastructure. Moving downhill is difficult, even risky, and due to the status of the reserve, must be agreed in advance with the Nature Protection Board. Not suitable for people with reduced mobility.

GEOSITE USE: The territory is mostly managed with the aim to ensure the reserve regime in it for scientific geological research, as well as for research of modern plant species and habitats, and a set of scenically beautiful natural formations.

GEOSITE DESCRIPTION

The natural monument consists of the deep valley of Svikupite, rich in Devonian rock outcrops, as well as ancient valleys – Kautraka ravine – Big Kautraka ravine (connects with Svikupite ancient valley) and Small Kautraka ravine (joins Nurmiža ancient valley through a wider ancient valley-type form). The slopes of the ancient valleys are eroded by ravines and impressive side

ravines are formed.
There are a large number of big, impressive as well as smaller bedrock outcrops in the area. The sandstones and clays of the Gauja suite on the middle Devonian Ziveta floor, the sandstones of the Upper Devonian Frata Amata suite with carbonate inclusions and the dolomite marls and dolomites of the Upper Devonian Plavinas suite are exposed.
On the slopes of the Kautraka ravines there are large and expressive sandstone outcrops of the Amata suite. At the top of the outcrops, the sandstones contain carbonate cement – dolocrates are present – formations of carbonate crusts in the Devonian desert (dolomite slabs, veins and honeycomb deposits are found in sandstones and clayey sediments)
At the top of the Great Kautraka ravine there are several waterfalls formed over the dolocrated and ball sandstones that are typical of the upper part of the Amata suite.
On the bed and on the left slope of the small Kautraka ravine there are red, less often gray Devonian Gauja suite clay outcrops. Engraved petroglyphs – ancient signs can be found in both outcrops of Kautraka ravines.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441430
NAME: Petera Cave

ASSOCIATED GEOSITES: Gauja National Park, Kraukļu Gorge, Vejupite Ravine, Vejupite Valley, Satezele Castle Mound

GEOGRAPHICAL DATA

GEOSITE LOCATION	Sigulda county, the town of Sigulda. The territory is located in Gauja National Park, in the lowlands of Gaujava, on the slope and side ravine of the Vejupite ancient valley, on the left bank of the river.
GEOGRAPHICAL COORDINATIONS	X: 553014 Y: 336784 E24° 52,604' and N57° 10,272'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 4.5 ha. The cave is 6.3 m long (only 4 m below the sandstone ceiling), up to 6.4 m high and up to 2.3 m wide.

GEOSITE CATEGORY:
Protected geological and geomorphological natural monument.

DESIGNATION:
Located in Gauja National Park. There are EU protected habitats in the area – sandstone outcrops (8220), undisturbed caves (8310).

ACCESSIBILITY:
Good. There is an information board and a parking lot free of charge near the area. For many years, Petera Cave has been a popular tourist attraction, led and still leads several wide trails with well-maintained and constantly maintained bridges, stairs and railings. The structure created in front of the cave – a viewing area, a platform with a staircase allows you to see and photograph the Vejupite Ravine, rocks, the entrance to the cave. Not suitable for people with reduced mobility.

GEOSITE USE: Important site for nature tourism.

GEOSITE DESCRIPTION

Petera Cave offers a wide view of the Vejupite valley and the cliff. The cave has a unique and human-friendly shape. It has a peculiar formation of exotectonics and underground erosion. It is located at the crossroads of several large cracks. Cracks, at least some of them, have formed as ruptures parallel to the slope due to gravity. The outcrops are typical of the Gauja suite on the Middle Devonian Ziveta floor. They consist predominantly of fine-grained, sanded and

horizontally layered red sandstone, with clay and fossil inclusions. In the cave in the sandstone there are colored migration bands of mineral compounds.
The Cave is considered an ancient place of worship. As such, it has been evaluated before the discovery of petroglyphs in the cave walls. Petroglyph signs on the walls of a high cave were discovered in 1997 by historian Andris Grīnbergs. They were studied in detail in 1998 and it was found that in total at least 42 different petroglyph marks have been preserved in the cave. Some older engravings with dates dating back to the 18th century have also been found in the rock and cave walls.
It is convenient for the visitors to visit the cave, including Kraukli Gorge, Vejupite Ravine, Satezele Castle Mound and other natural and historical objects in the area.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441040
NAME: Pusenu Dune

ASSOCIATED GEOSITES: Bernati Nature park

GEOGRAPHICAL DATA

GEOSITE LOCATION	Nīca county, Nīca parish, Bernāti Nature park. The territory is located in the Seaside Lowland, in the Bārtava plain, in the dune strip of the Baltic Sea coast.
GEOGRAPHICAL COORDINATIONS	X: 313707 Y: 246627 E20° 59,215' and N56° 19,660'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 37.87 ha. This dune was isometric with a diameter of about 350 m before its partial excavation. The current length of the unexcavated part in the east-west direction is about 260 m, but in the north-south direction about 280 m. The absolute height of the dune is 37.0 m, but the relative height from the foot of the dune on the quarry side is about 29 m, while on the north and east side it reaches up to 31 m.

GEOSITE CATEGORY:
Protected geological and geomorphological natural monument

DESIGNATION:
Located within the NATURA 2000 protected area, Bernati Nature Park. In the territory of the natural monument there are habitats protected by the EU – wooded seaside dunes (2180) and boreal forests (9010).

ACCESSIBILITY:
Good. Relatively close to the dune there is a parking lot and a picnic place, there is an information stand about Pusenu dune, as well as cartographic material of Bernati Nature Park. From the parking lot a footpath and wooden stairs lead to the top of the dune. The footpath is partially marked. At the top of the dune there are two benches on the side of the excavated part of the dune, which offers a scenic view of the sea. Not suitable for people with reduced mobility.

GEOSITE USE:
Popular tourism site and has a use for scientific research in geology (stratigraphy, geomorphology), species and habitats.

GEOSITE DESCRIPTION

Pusenu Dune is considered to be the highest coastal dune in the Baltic Sea in Latvia.
From the top of the dune, on the side of the quarry slope, there is a great view of the surrounding landscape – across the abandoned quarry area and a forested strip of seaside dunes the sea can be seen.
Pusenu dune is one of the dunes that belongs to the Pape-Jūrmalciems-Bernāti complex dune ridge. In this range, two dune sections are distinguished, Pape-Jūrmalciems and Jūrmalciems-Bernāti section. These sections are interrupted in the middle by an approximately 1.5 km long section of blown sand formed after deforestation and fire more than 300 years ago. Both sections of the dunes are characterized by a parallel dune ridge along the sea shore, which has formed during the last stages of the Baltic Sea.
Deeper on land, there is a second dune embankment, which is a ridge of wind-deformed parabolic dunes and the like. These dunes are associated with the Litorina Sea stage and delimit the lagoon plain from the sea.
Historically, these dune strips have been forested, but as a result of deforestation and fire that occurred about 300 years ago, these dune strips reactivated and became flowing dunes, which were stopped in some places in the 1940s. As a result, the dunes are inflated and wind deformed.
A quarry was built on the south and west sides of Pusenu dune in the 1980s, where the sand obtained was used for the production of silicate bricks, and excavation work was stopped in the mid-1980s. The quarry area is currently about 8 ha, and although no special reclamation has been carried out for this area, it tends to overgrow slowly.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440960
NAME: Riezupe Sand Caves

ASSOCIATED GEOSITES:
Riezupes Nature Park, Sandstone outcrop on the bank of the Venta River (6 m), Venta Rapid

GEOGRAPHICAL DATA

GEOSITE LOCATION	Kuldiga district, Rumba parish, Lowlands in the ancient valley of Riezupe
GEOGRAPHICAL COORDINATIONS	X: 377735 Y: 319897 E21° 59,209' and N57° 0,382'
ALTITUDE	~ 30 m
DIMENSIONS	The area of the natural monument is 2,34 ha. Total length of the caves is 2,5 km, available 360 m.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument

DESIGNATION: Located in the nature park and Natura 2000 territory Riežupe. Natural monument to preserve an artificial cave maze in light gray sandstones. There are EU protected habitats in the area – sandstone bedrock outcrops (8220).

ACCESSIBILITY: Satisfactory. On the way to the parking space, in some places there is a scenic view of Riežupe, which is about 30 meters lower. Excursion to the caves takes place only with a tourism guide. Entrance fee: Adults 6 EUR / person; for groups over 10 people 5 EUR / person; Pupils, seniors 4 EUR / person; free entrance for children under 6 years. Not suitable for people with reduced mobility.

GEOSITE USE: Tourism object. Wintering bat monitoring station.

GEOSITE DESCRIPTION

Riezupe Sand Caves is the longest maze of artificial caves in the Baltics – a total length of 2.5 km, carved in white sandstone. During the time of Duke Jacob, the white sand from the sand caves of Riezupe was transported along the Venta River by ships abroad for the glass industry. Sand was also used in the production of glass in Latvia. The industrial development of the caves was stopped in 1939.
Today, the caves are privately owned, fortified and visible about 360 m long. The caves are located 8 – 11 m below the ground. The temperature of the caves is constant +7 - +8 degrees all year round. The caves have been identified as a wintering bat monitoring station.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441990
NAME: Sietiniezis Rock (white sandstone cliff)

ASSOCIATED GEOSITES: Liepas Rock, Gauja National park

GEOGRAPHICAL DATA

GEOSITE LOCATION	Koceni Municipality, Vaidava parish, territory of Gauja National park
GEOGRAPHICAL COORDINATIONS	X: 583 141 Y: 365 861 25° 23,077' E and 57° 25,672' N
ALTITUDE	
DIMENSIONS	The area of the natural monument is 26,20 ha. 15 m high and 400 m wide.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument

DESIGNATION: Located within the NATURA 2000 territory of Gauja National park. The area is home to EU protected habitats – sandstone outcrops, undisturbed caves, springs and avocs, and boreal forests.

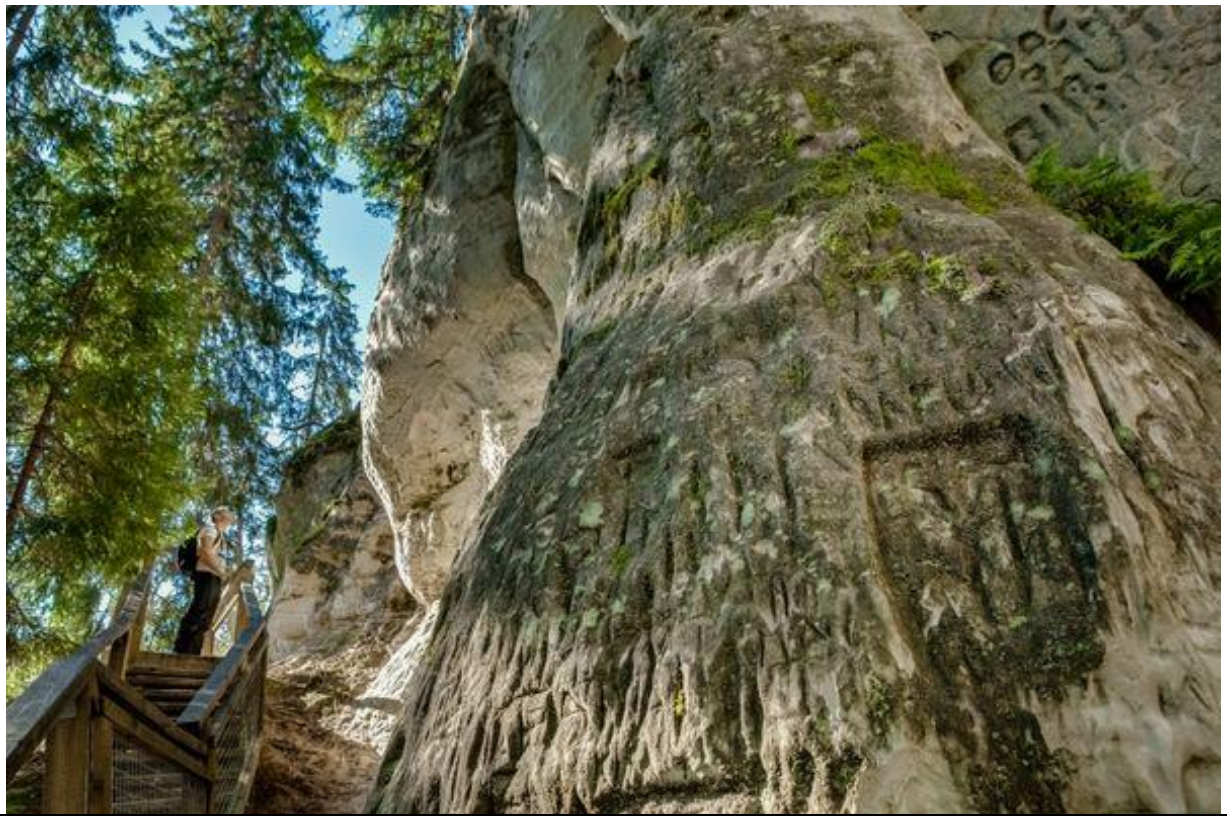
ACCESSIBILITY: Good. There is a well-established nature trail with several viewing platforms. Places for picnic are available, as well as information stands and a parking space.

GEOSITE USE: Tourism site.

GEOSITE DESCRIPTION

Sietiniezis is one of the highest white sandstone outcrops in Latvia – 15 m high and 400 m wide. Located on the right bank of Gauja river between Valmiera and Jāņmuiža, about 2 km below Liepas Rock. From the southern part of Sietiniezis there is an impressive view of the Gauja ancient valley, but in its vicinity there are scenic pine forests. The name of Sietiniezis (fine - sieve rock) comes from the extensive serration of the rock. The rock has multiple extraordinary forms – caves, pillars, alcoves, a forming arch. Outcrop surfaces, their fragmentation and relief forms including outcrops have formed at the end of the last glaciation, 12,000 years ago and earlier during the formation of the ancient Gauja valley.
In the sun it warms up and keeps warmth, hence, wild bees have chosen it as their home, creating the unique honeycomb in the walls of the outcrop.
At the top of Sietiniezis there is a spring with a water supply of 6 l / sec. It is one of the largest sources in North Vidzeme. The spring water catchment area is covered with forest and has a thin and fragmentary Quaternary sedimentary blanket, just below which lies the white quartz sandstones with interlayers of clay and siltstone lying in the Middle Devonian Sietiņi suite. Thus, spring water contains few minerals ("soft" water) and can be used as quality drinking water.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440220 **NAME:** Skaistkalne Karst Sinkholes

GEOGRAPHICAL DATA:

GEOSITE LOCATION	Vecumnieki Municipality, Skaistkalne parish
GEOGRAPHICAL COORDINATIONS	X: 542681 Y: 249653 E24° 41,479' and N56° 23,374'
ALTITUDE	
DIMENSIONS	The territory covers more than 113 ha and stretches in the south-west-northeast direction for 2 km, width up to 800 m.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument.

DESIGNATION: Located within Natura 2000 territory. There are EU protected habitats in the area – karst sinkholes (3190 *), species-rich pastures and grazed meadows (6270 *), floodplain grasslands (6450), boreal forests (9010 *).

ACCESSIBILITY: Parking place can be reached by car. It is difficult to get to Skaistkalne Karst Sinkholes, but they can be viewed with a tour guide.

GEOSITE USE: Skaistkalne Karst Sinkholes is a wide natural monument with the most expressive karst process landscape in Latvia, which is still developing.

GEOSITE DESCRIPTION:

This territory is located in the Central Latvian Lowland, in Zemgale Plain. Skaistkalne Karst Sinkholes is a wide natural monument with the most expressive landscape of karst process in Latvia, which is still developing, with karst sinkholes of different sizes, lakes in sinkholes or with wet sinks at the bottom of the sinkholes.
The most outstanding sinkholes are mentioned in various sources, such as Liepu bed, Audžu bed, Čurkstu bed, Kugurdobe, Big White bed, Small White bed, Goat bed, etc. There are also lakes in sinkholes – Mežezers and Mežmalas lake. The sinkholes are represented by impressive depressions, up to a depth of 10 – 12 m, but there are also canal-shaped beds, bowl-shaped deposits, dozens of small deposits and depressions, which form several distinct bands.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0442120
NAME: Staicele Iron Springs

ASSOCIATED GEOSITES: Vīksnu caves

GEOGRAPHICAL DATA:

GEOSITE LOCATION	Aloja county, Staicele town
GEOGRAPHICAL COORDINATIONS	X: 545532 Y: 409913 E24° 45,999' un N57° 49,731'
ALTITUDE	
DIMENSIONS	The area of the natural monument 1,92 ha

GEOSITE CATEGORY: Protected geological and geomorphological natural monument.

DESIGNATION: North Vidzeme Biosphere Reserve, Salaca Valley Nature Park, Natura 2000 territory. There are EU protected habitats in the area – mineral-rich springs and avocs (7160).

ACCESSIBILITY: Parking place can be reached by car. Staicele Iron Springs are difficult to reach.

GEOSITE USE: This area is a significant tourism object.

GEOSITE DESCRIPTION:

Staicele Iron Springs are unique natural formations from the point of view of geology and hydrogeology and made of two weak ascending springs located on the left bank of the Salaca River. The springs are located at the top of two parallel ravines, and then the spring water, like streams in these ravines, flows into Salaca.
The spring, which closest to the road, located a little more to the north, is the largest one. In fact, the spring discharge is not concentrated in one place, but there are several separate discharge points spread over an area of about 5x8 m. The outlets of the second, smallest spring are also spread over an area of about 5x5 m.
Both springs discharge groundwater rich in divalent iron compounds, which, when they reach the surface, begin to oxidize iron compounds, forming a sediment – ocher. What is unique about both iron springs is the very thick ocher deposits, which have filled the spring ravines, their thickness is more than 1.5 m.
During the Soviet era, and most likely before World War II, ocher was mined from the second spring, where nowadays there are some building ruins. The ocher was further used to produce color pigments. The land color (ocher) factory was still operating in the 1970s.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441070, EU code 172737
NAME: Strante-Ulmale steep bank

ASSOCIATED GEOSITES: Jurkalne steep bank

GEOGRAPHICAL DATA

GEOSITE LOCATION	Pavilosta municipality, Sakas parish, Seaside lowland, Piemare plain, Baltic Sea coast
GEOGRAPHICAL COORDINATIONS	X: 332057 Y: 311463 E21° 14,470' and N56° 54,981'
ALTITUDE	Up to 25m
DIMENSIONS	The area of the natural monument is 111.44 ha. The steep shore and beach of the Baltic Sea is 6.75 km long. The height of the steep bank varies from a few meters to 25 m

GEOSITE CATEGORY:
Protected geological and geomorphological natural monument

DESIGNATION: Latvian Natural monument. There are EU protected habitats in the area – sea steep banks (code 1230), herbaceous gray dunes (2130 *) and wooded coastal dunes (2180). In a very small section, the natural monument overlaps with another natural monument – the dendrological plantation Ulmale Park.

ACCESSIBILITY: Good. It is accessible by bus, car, bicycle, etc.

GEOSITE USE: Educational, scientific, recreation and nature tourism

GEOSITE DESCRIPTION

The steep bank is located in the southern part of the so-called Labrags Bay and has long been the largest and most pronounced zone of long-term sea shore erosion on the Latvian coast. The area of the natural monument includes a modern sea shoreline with a shallow part of the underwater slope to a depth of about 1 m, a beach or erosion terrace, a sea erosion dune (steep bank) and a main shoreline up to about 150 m wide.
The main features of the coastal development over the last 2,500 years have been the predominant south-westerly, westerly winds and the constant alluvial flow of the eastern Baltic coast. The wide and flat Labrags Bay (Pāvilosta - Jūrkalne - Melnrags) has formed as a result of long-term coastal erosion and now the longest strip of high sea cliffs stretches along it.
Due to the peculiarities of the Strante-Ulmale steep bank section, it can be considered to have a high landscape value, moreover, the coastal erosion in this section is important in maintaining the stability of the entire Pāvilosta-Užava coastal section. The smooth running of

natural processes, including coastal erosion, is also a key precondition for maintaining the quality of the area itself.
The southwestern end beach of the natural monument area is very narrow (5-10 m). There is a very pronounced shortage of fine sediments in this section of the coast, which can lead to beachless conditions, where a narrow (2-5 m) and sloping (1: 5-1: 10) erosion terrace without a layer of beach sediments is formed at the foot of the erosion step. At times, when the beach is formed, it usually contains poorly sorted granular sand with pebbles (sand predominates).
The relief of the upper coastal shoreline of this stretch of coastline is formed by a low to medium-high steep bank (relative height 3-13 m), which reveals several layers of Holocene and Pleistocene sediments.
Further northeast, the beach is relatively narrow (15-25 m in summer, rarely wider) and during strong sea winds in some sections the whole beach is flooded. At this stage there are high (up to 15-20 m) steep cliffs with a complicated geological structure of Quaternary sediments. The alluvial sandy sediments of the shallow basin (previously interpreted as interglacial sediments), moraine loam, sand and gravel with pebbles, layered deformations and glaciostructures are exposed on the steep bank.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440660
NAME: Vejini caves, underground lakes

ASSOCIATED GEOSITES: Brasla river, Brasla valley

GEOGRAPHICAL DATA:

GEOSITE LOCATION	Pargauja county, Straupe parish.
GEOGRAPHICAL COORDINATIONS	X: 554550 Y: 355932 E24° 54,381' and N57° 20,581'
ALTITUDE	underground
DIMENSIONS	The area of the natural monument is 6.55 ha. It is a 42 m long cave with a 5 m wide winding main aisle and two larger extensions.

GEOSITE CATEGORY: Protected geological and geomorphological natural monument.

DESIGNATION: Caves of considerable size, strong springs, active spring erosion processes, sinkholes' formation One of the few underground lakes and the largest one in Latvian caves. The area contains EU protected habitats – sandstone outcrops (8220), undisturbed caves (8310), springs and avocs (7160), river streams and natural river sections (3260). Caves are a wintering place for bats.

ACCESSIBILITY: Parking place can be reached by car. There is earth pathway on the way to the caves, and there are stairs built in the caves. To go through the caves rubber boots are a necessity.

GEOSITE USE: This area is a significant tourism object.

GEOSITE DESCRIPTION:

The natural monument consists of the section of the ancient Brasla valley and the adjacent territory where the sandstone of the Gauja suite on the middle Devonian Živeta floor is exposed on the right bank of the river.
As a result of underground erosion, voids and falls have formed in the sandstone layer, in places where the surface of the earth has collapsed above the underground voids.
There are two larger and one small cave in the area, as well as small niches. The entrance to the river cave is located on the bank of the river Brasla, at river level. It is a 42 m long cave with a 5 m wide winding main aisle and two larger extensions. The entrance to the lake is located in one of the sinkholes, and most of it is occupied by one of the few and the largest underground lake in Latvian caves with an area of 45 square meters. The lake is 48 m long and up to 5 m wide.
A network of underground cracks and their extensions has been found in the area, but only a small part of the underground voids is accessible. Periodically, precipitation occurs over underground sinkholes, which are usually soon filled.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0507100
NAME: Venta Rapid

ASSOCIATED GEOSITES: Alekšupīte waterfall

GEOGRAPHICAL DATA

GEOSITE LOCATION	Nature reserve Venta valley, Kuldiga town
GEOGRAPHICAL COORDINATIONS	X: 377140 Y: 315706 E21° 58,744'; N56° 58,115'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 8,71 ha. Width 249 m, height 1.75 m

GEOSITE CATEGORY: Protected geological and geomorphological natural monument of national significance.

DESIGNATION: Located within NATURA 2000 territory, nature reserve Venta Valley. There are EU protected habitats in the area – outcrops of carbonate bedrock (8210) and river streams (3260).

ACCESSIBILITY: There is a tourism centre, information signs and a parking space. To get to the rapid, you need to use wooden stairs and a footbridge located on the left side of the river. This site is not accessible for people with reduced mobility.

GEOSITE USE: Popular tourism object.

GEOSITE DESCRIPTION

Venta Rapid is the widest waterfall in Europe reaching 249 metres.
During the Devonian period 380 million years ago, layers formed as a barrier similar to coral reefs. Beneath these layers are older plate-like dolomites with sandstone and clay interlayers that are more fragile. The line of this dolomite step is clearly defined in nature. Depending on the amount of water in the river, the dolomite step may be completely or partially covered with overflowing water. In the summer months when the water level is low people can cross the rapid by foot.
Every spring and autumn there is an unusual behavior of fish, they go to the spawning grounds up the rapid and try to overcome it by jumping in the air. In the time of Duke Jacob, these " flying fish " were caught in baskets with a peculiar method. Thanks to that, Kuldiga has gained fame as a city where fish fly.
The monument creates a beautiful scenic view that can be viewed from both sides of the river and an old brick bridge (1874) corssing the Venta river.

PHOTOGRAPH

GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0441190 **NAME:** Viksnu Caves

ASSOCIATED GEOSITES: Staicele Iron Springs, Planchi swamp nature trail, Gauja National park

GEOGRAPHICAL DATA

GEOSITE LOCATION	Alojas parish, Staicele rural area, North Vidzeme Biosphere Reserve, Salaca Valley Nature Park
GEOGRAPHICAL COORDINATIONS	X: 542197 Y: 412035 E24° 42,653' and N57° 50,894'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 1.22 ha

GEOSITE CATEGORY: Protected geological and geomorphological natural monument.

DESIGNATION: Located within Natura 2000 protected area, North Vidzeme Biosphere Reserve, Salaca Valley Nature Park. There are EU protected habitats in the area – sandstone outcrops (8220), undisturbed caves (8310) and wet broad-leaved forests (91E0 *).

ACCESSIBILITY: There is access both from the shore and from the river by boat. The object is accessible to knowledgeable pedestrians from the Ainaži-Staicele road, as well as water tourists. There are no landmarks of the natural monument.

GEOSITE USE: Viksnu Caves is a relatively popular tourist attraction, which is mainly visited by boaters.

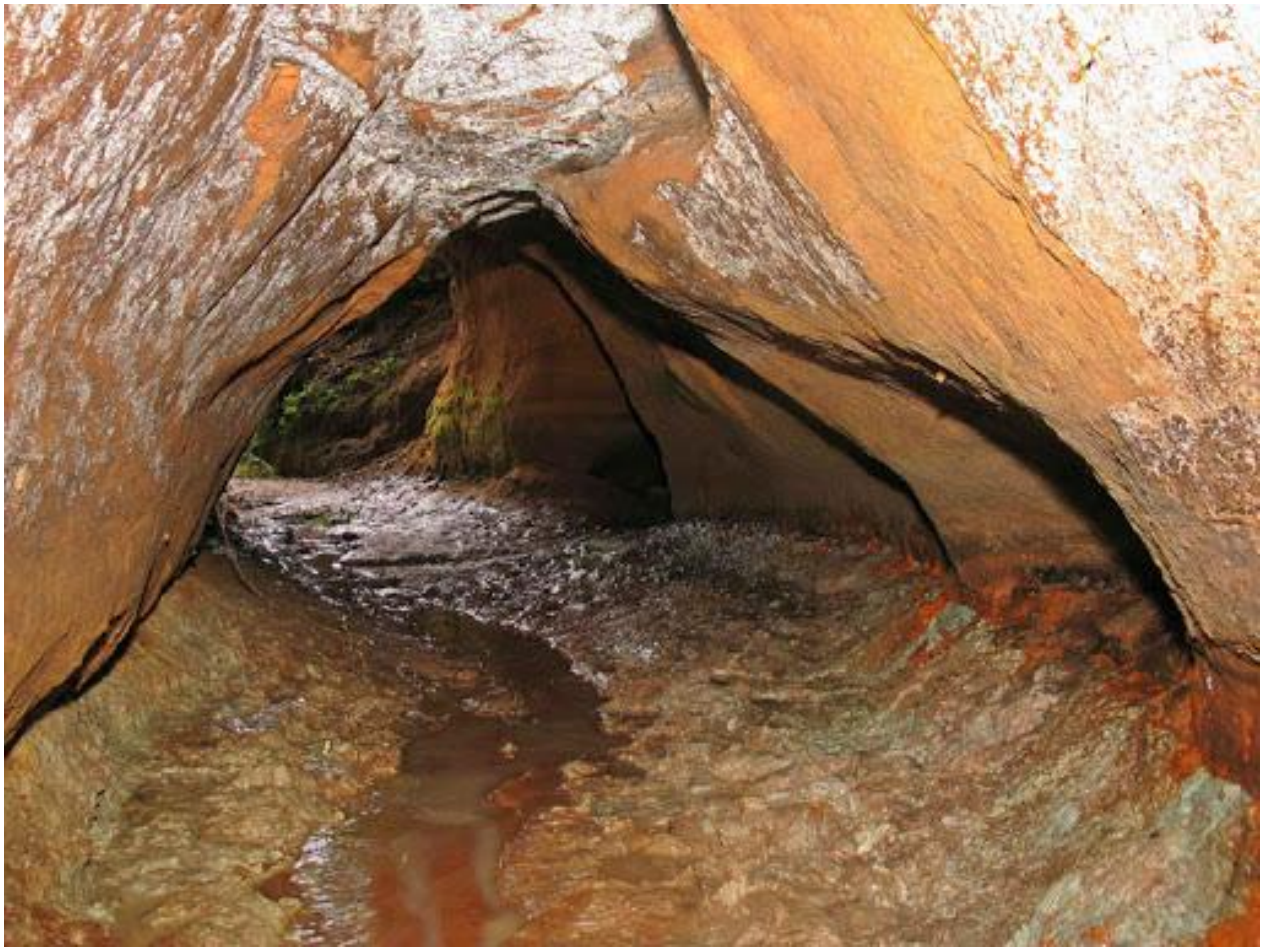
GEOSITE DESCRIPTION

Viksnu Caves consist of three outcrops with two caves on the right slope of the main coast of Salaca and is considered one of the longest caves in Salaca. The cave is formed in a yellow sandstone rock about 5 m high, the height of the shore here is 12 m. It is believed that the cave originated here only in the 2nd part of the 20th century at the source of the spring. The entrance to the cave is oval, about 2 m high. The anteroom of the cave is higher, to its left – two side branches, which are 8 and 4.4 m long. The main straight cave is 24 m long. In two other places, the height of the cave ceiling allows a person to stand in full height.

The natural monument includes sandstone outcrops of the Burtnieki suite of the Middle Devonian Ziveta floor. The total length of the outcrop chain is 82 m, height up to 2.8 m.

Sandstone is fine-grained to medium-coarse-grained, yellowish, sloping with a series of thick sloping layers, and layered horizontally in parallel, mainly with layers of mica on the sloping layers. The sandstone outcrops stands out relatively well against the background of Salaca river and vegetation.

PHOTOGRAPH



GEOSITE INVENTORY SHEET

GEOSITE CODE: LV0440400 **NAME:** Zvartes Rock

ASSOCIATED GEOSITES: Zvartes Rock on the other bank of Amata there is Migla Rock and Pļava Rock (height 14 m); nature trail along the shores of Amata; Cognitive trail "In the forest kingdom"

GEOGRAPHICAL DATA

GEOSITE LOCATION	Amata county, Drabeshi parish, on the bank of the river Amata
GEOGRAPHICAL COORDINATIONS	X: 568896 Y: 345331 E25° 8,502' and N57° 14,751'
ALTITUDE	
DIMENSIONS	The area of the natural monument is 9.27 ha. Rock height – 45 m. Total cliff length about 320 m.

GEOSITE CATEGORY: Protected geological natural monument of national significance

DESIGNATION: Located within Natura 2000 territory, Gauja National Park. There are EU protected habitats in the area – sandstone outcrops (8220); river rapids and natural river sections (3260).

ACCESSIBILITY: Near Zvarte Rock there is a parking space for visitors, bicycle parking places, 9 picnic places, 5 facilities. Gauja National Park administration has created a wooden staircase leading to the top of the Rock, a pathway, a bridge over the Amata River, 3 viewing platforms and information stands. There are direction signs in the area and on the trails. Due to such infrastructure, the Rock is both accessible to visitors and protected from the damage caused by the large flow of tourists. As there are stairs in several sections of the trail, the trails are not accessible for people with special needs or wheelchair users.

GEOSITE USE: Popular tourism object.

GEOSITE DESCRIPTION

Zvartes Rock has long been known for its scenery and is one of the symbols of Latvian geology. The ridge of the Zvartes Rock is formed by the sandstones of the Upper Devonian Gauja suite. The total length of the Zvartes Rock outcrops, including the curvature around the sandstone ridge, is 320 m, but the total height of the cliff reaches 45 m. The outcrops are formed by the characteristic reddish, yellow and variegated sandstones and clays of the Gauja and Amata suites. The Rock is very steep, exposed to ground and groundwater, wind, frost and other natural phenomena. General characteristics of the geological section: in the lower part, starting from the level of the Amata River, the sandstones of the Middle Devonian Gauja suite are exposed (up to

about 10 m thick), followed by a layer of sandstone and clay (exposed about 5 m thick). The top of the cut is relatively well exposed due to the slump that occurred a few years ago. Above the slope formation, the very top of the Gauja Suite is exposed – a 5 m thick layer of sandy and clayey sediments (gray and purple). The Amata Suite sandstones (4 m thick) lie on them and are clearly visible – yellow at the very bottom and orange at the top.

PHOTOGRAPH