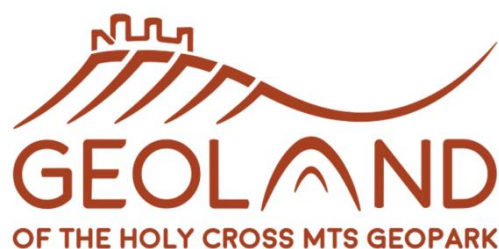


APPLICATION DOSSIER FOR MEMBERSHIP  
IN THE UNESCO GLOBAL GEOPARKS



GEOLAND OF THE HOLY CROSS MOUNTAINS GEOPARK



Chęciny



Kielce



Morawica



Piekoszów



Sitkówka-Nowiny

NOVEMBER 2017

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## A. IDENTIFICATION OF THE AREA

### A1. NAME OF THE PROPOSED GEOPARK

In Polish: **Geopark "Geoland Świętokrzyski"**

In English: **Geoland of the Holy Cross Mountains Geopark**

The main part of the Geopark name refers to the name of the Świętokrzyskie (Holy Cross) Mountains. This, in turn, derives from an important historical event that was the creation of the Benedictine abbey in Łysa Góra (the second highest mountain peak of the Świętokrzyskie Mountains in the central part of the mountains – beyond the Geopark) and brings back to the abbey by the Benedictines the relics of the Holy Cross. The cult that surrounded them made Łysa Góra, which until the 11th century was the center of pagan worship, the most important pilgrimage place in Poland and began to function under the name of the Holy Cross. Hence the historically conditioned names: Świętokrzyskie Mountains, Świętokrzyskie Region and Świętokrzyskie Voivodship.

The name "Świętokrzyskie (Holy Cross) Mountains" has also been established in Polish and foreign geological literature, as a definition of a region in Central Poland where sedimentary rock representing all geological periods from Cambrian to Quaternary crop out at the surface. In consequence, the Świętokrzyskie Mountains (in particular the Geopark area) have been one of the first area in Poland investigated by geologists for more than two hundred years. Now, this region also plays an important role in geological research works and geological education.

The second part of the Geopark name - "Geoland" - refers to the above-mentioned geodiversity and the science and didactic significance of the geopark. The name also corresponds to the modern approach to geological education and the promotion of local geological heritage, which is reflected in many of the activities and investments realized or being implemented in the Geopark area. In the minds of the creators (local authorities), the foundation and name of the Geopark: Geoland Świętokrzyski is a bridge between the tradition of protecting and usage of the local geological heritage in science and didactics and the modern approach to the use of this heritage as a tool for local sustainable socio-economic development.

### A2. LOCATION OF THE PROPOSED GEOPARK

Geoland of the Holy Cross Mountains Geopark is located in Poland, specifically in the western part of Świętokrzyskie Voivodship (from administrative point of view) and Świętokrzyskie (Holy) Cross Mountains (from geologically and geographically point of view), (Figure A1).

**Demarcation:** Geoland of the Holy Cross Mountains Geopark covers the area of five communities: Kielce, Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów, and its borders coincide with the administrative boundaries of the listed local government units (Figure 1, with the red line marked Geopark). The total Geopark area covers the western part of the Świętokrzyskie (Holy Cross) Mountains that is characterized by the distinctive nature of the natural and cultural heritage and the landscape, against the background of other surrounding areas. Unique natural, historical and cultural values, with particular emphasis on the unique geological heritage and associated mining heritage (numerous remnants of the historic ore and rocky mining) made that since 1996 a large part of this area has been protected as Chęcińsko-Kielecki Landscape Park. This is the first geological park in Poland to represent the richness of inanimate nature in combination with the living nature and cultural heritage (Urban, Wróblewski, 2004). This area constitutes the core of our Geopark.

#### **Geographic coordinates of Geopark:**

Latitude: 50°40'4.56"N – 50°55'10.45"N

Longitude: 20°17'48.76"E - 20°43'15.71"E

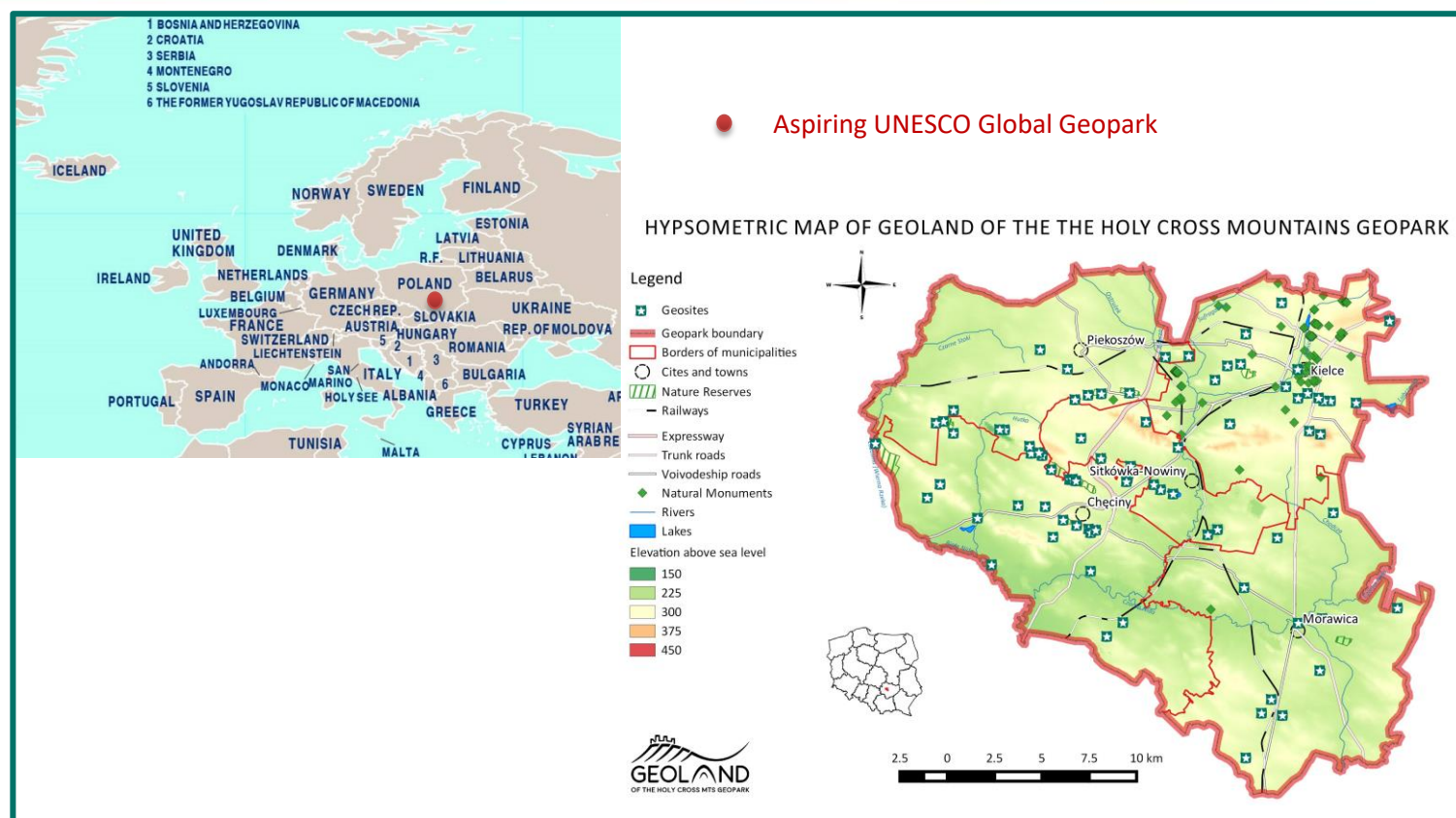


Fig. A1 – Localization of the Geopark territory

## A3. SURFACE AREA, PHYSICAL AND HUMAN GEOGRAPHY CHARACTERISTICS OF THE PROPOSED GEOPARK

### A.3.1. Area of the proposed Geopark

The total area of Geoland of the Holy Cross Moutains Geopark comprises 526 km<sup>2</sup>.

### A.3.2. Geographical setting of the proposed Geopark

In terms of division into administrative units, Geopark covers the area of five communities belonging to Kielce County: Kielce, Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów. The community of Kielce is both the municipal district and the capital of the Świętokrzyskie Voivodeship. According to the physical-geographic division of Poland (Kondracki, 2000), Geopark "Geoland Świętokrzyski" is situated in the province of the Polish Highlands in the sub-area of the Małopolska Upland. The largest part of Geopark's territory is located within the mesoregion of the Świętokrzyskie Mountains, which is part of the Kielecka Upland macroregion belonging to the above-mentioned sub-region. The other mesoregions which the Geopark includes are the following: Nida Valley, Przedborsko-Malogoskie Range, Jędrzejowski Plateau, Szydłowski Foothills and Łopuszniańskie Hills. Owing to its affiliation to the Świętokrzyskie Mountains, almost all of the Geopark area is characterized by low mountains cut by wide river valleys and with steep structural debris of the ESE-WN course, referring to the diverse geological structure of the geological substratum. The highest hill in the Geopark is Mount Telegraf with a height of 405.4 m. The lowest point is located at the intersection of the Nida River with Geopark boundary at 205 m n.p.m. The height difference of the entire area of Geopark is about 200 meters.

### A.3.3. Geographical setting of the proposed Geopark.

The Geopark "Geoland Świętokrzyski" is located in the southern part of Poland, in the central part of the Świętokrzyskie voivodeship (Fig. A1). In terms of division into administrative units, Geopark covers the area of five communities belonging to Kielce County: Kielce, Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów. The community of Kielce is both the municipal district and the capital of the Świętokrzyskie Voivodeship.

According to the physical-geographic division of Poland (Kondracki, 2000), Geopark "Geoland Świętokrzyski" is situated in the province of the Polish Highlands in the sub-area of the Małopolska Upland. The largest part of Geopark's

territory is located within the mesoregion of the Świętokrzyskie Mountains, which is part of the Kielecka Upland macroregion belonging to the above-mentioned sub-region. The other mesoregions which the Geopark includes are the following: Nida Valley, Przedborsko-Malogoskie Range, Jędrzejowski Plateau, Szydłowski Foothills and Łopuszniańskie Hills.

Owing to its affiliation to the Świętokrzyskie Mountains, almost all of the Geopark area is characterized by low mountains cut by wide river valleys and with steep structural debris of the ESE-WNW course, referring to the diverse geological structure of the geological substratum. The highest hill in the Geopark is Telegraf Mountain with a height of 406 m. The lowest point is located at the intersection of the Nida River with Geopark boundary at 205 m above sea level. The height difference of the entire area of Geopark is about 200 meters.

### A.3.4. Access and transportation.

The Geopark Area "Geoland Świętokrzyski", located in the heart of the Świętokrzyskie Mountains possesses a convenient transport location, in relation to the most important Polish cities (Warsaw, Cracow, Łódź, Katowice). There is a dense network of national, voivodship, provincial and district roads which are within the Geopark area (Fig. A2). The most important communication routes are national roads of European importance: DK7 (Gdańsk - Warsaw - Kielce - Chęciny - Kraków), DK 73 (Kielce - Morawica - Tarnów), DK 74 (Piotrków Trybunalski - Kielce). It should be added that the authorities of Świętokrzyskie voivodeship for several years, have been carrying out a lot of investments aimed at modernizing transport routes in order to improve safety and speed of access to the destination.

The communication accessibility of the Geopark "Geoland Świętokrzyski" is also influenced by bus communication. Bus routes are the busiest in Kielce, which is connecting with most urban centers and rural areas of Geopark. Taking into account tourist transport accessibility, it is worth emphasizing that there is a tourist connection from Kielce with the western part of Geopark (Tokarnia - Podzamcze Chęcińskie - Chęciny - Paradise Cave - Kielce). Besides, rail transport is in operation in Kielce. Kielce - the capital of the Świętokrzyskie voivodeship is a place where Kielce - Warsaw, Cracow, Katowice, Gdansk, Lublin, and Wrocław daily depart and arrive of passenger trains.

The development of international geo-tourism has a significant impact on air transport. There are currently 12 airports (including 1 in Warsaw) and more than 40 regional airports. Average arrival time by car to airports from neighboring provinces is approx. 2h 30 min. In the Świętokrzyskie voivodeship, part of which is Geopark "Geoland Świętokrzyski", there is one local airport in Masłów, located about 8 km from Kielce. The airport serves small and medium dispositional and sports airplanes.



Fig. A2 Communication map of Poland with marked area of Geopark

### A.3.5. Social Economy.

#### 1) Population

The geopark area is characterized by a high density of population resulting from its location within the capital of the voivodeship - about 200 000 inhabitants of Kielce city and smaller urban centers: Chęciny and Morawica, with between 10,000 and 15,000 inhabitants. The total number of inhabitants in the Geopark border area is 252 744 persons (GUS data from 1st.Jan, 2017).

Geo-community of the Geo-code "Geoland Świętokrzyski" consists of the municipality of Kielce, the urban-rural communes - Chęciny and Morawica and the rural communes - Sitkówka-Nowiny and Piekoszów.

#### 2) Economic Activity

Entrepreneurship ratio, defined as the number of business entities (entered in the REGON register) per 10,000 inhabitants, is slightly below the national average in the Geopark border area. Its values for individual municipalities vary, for example, Kielce municipality and Morawica and Sitkówka-Nowiny communes as the centers of the largest



concentration of entrepreneurship are characterized by higher than the national average or the average of Świętokrzyskie voivodeships. The economic structure of the Geopark is also diversified in terms of sector participation. In the communes with the highest entrepreneurial index (Kielce, Morawica, Sitkówka-Nowiny) the service sector (including tourism and related sectors) and the industrial and construction sectors are the most important. In the Chęciny and Piekoszów Communes these sectors of the economy also have an important role, but the share of agriculture is higher than in the previously mentioned centers. Current research carried out for local and regional development strategies (including Local Strategy for Local Development Action Group "Perły Czarnej Nidy" for the years 2014-2020 and Strategy for Integrated Territorial Investments of the Kielce Area for 2014-2020) shows that the overwhelming majority of the area covered by the Geopark has lost its agricultural character. Many areas still have the status of agricultural land, but agricultural production is in fact occupied by few people. This is due to the fact that many residents find employment outside the municipality of residence in the service sector and in the industrial and construction sector developed to the greatest extent in Kielce as the only urban agglomeration in the Geopark area. In addition, the municipalities of Sitkówka-Nowiny, Morawica and Chęciny have significant mineral resources, whose mining has a long tradition deeply rooted in the local community. This is not only an important element of the local heritage, but a resource that still largely determines the specificity of the site. The opencast mines and their cooperating businesses increase the income of the communes and give employment to many residents. This is of particular importance in the context of Geopark, given the fact that the Geopark management has plans to devise strategies to exploit today's post-mining mines as geotouristic objects that generate tourist traffic, and thus have a positive impact on employment growth in tourism and related sectors of the economy.

### 3) Employment

In terms of employment structure, the area covered by the Geopark borders varies between urban and non-urban areas. The first covering the municipality of Kielce with the main agglomeration in Geopark - the city of Kielce, shows the features of urban economy with a low 2% share of agriculture in the general working structure. More than half of the inhabitants of this part of the Geopark work in the sectors of industry-construction and trade, transport and accommodation. Almost half of the workforce is employed in the service sector, which accounts for 70% of the workforce and services, of which 4% in advanced services, which is a determinant of the moderately advanced urban economy. In the communes with the highest entrepreneurial index (Morawica, Sitkówka-Nowiny and Chęciny), the employment structure differs from Kielce in the higher percentage of agriculture and slightly above zero employment in advanced services. The least developed economic area of the commune of Piekoszów has a typical agricultural structure, with more than 50% employment in the above mentioned sector.

## A.3.6. Natural Environment

### 1) Landscape

The most important morphological feature of the Geopark area is the structural sculpture, reflecting the geological structure. The range uplift and the existing between it the unrelated non-river valleys allows reading the shape and direction of the main folds of the Palaeozoic shaft and its Permian-Mesozoic rim. The lithological diversity reflected in the land relief also has a significant influence on the diversification of water relations and soils, and thus on the natural vegetation and structure of the land by man. All of the above components contribute to the landscape of the Geopark, as a result of natural (abiotic and biotic) and human activities. The most important natural elements of the landscape are the hills of the valley, located in the area of Chęcińsko-Kielecki Landscape Park and designated as the Nature 2000 Area "Chęcińsko-Kieleckie Hills" (Fig. A3). These areas are characterized by varied morphology and varied vegetation cover. The most important mountain ranges in the Geopark area are composed of the most resistant to the weathering and erosion processes of the Cambrian and Ordovician sandstones (Dymińskie, Pośłowickie and Zgórskie ranges) of short, mid- and highland dolomites



**Fig. A3 Uplands and valleys in the area of the Nature 2000 "Chęcińsko-Kieleckie Hills" in the central part of the Geopark.**

(Zelejowskie, Skibskie, Kadzielniańskie, Bolechowickie and Miedzianki massif -fig A5 and Upper Jurassic limestones (Grzywy Korzeckowskie and Bolmińskie Mills and Milechowska Mountain).

Karst areas of the Devonian and Jurassic, with the most valuable inanimate nature in the form of: Paradise Cave (nature reserve), cave system Chelosiowa Jama - Jaworznicka Cave (nature reserve), caves located in the massif of the Milechowska Mountain (nature reserve) and caves located within the hills and inactive Kadzielnia quarry in Kielce (natural part of the hill protected as a nature reserve), (Fig. A4) are of the particular attention.

Most of the uplands are not used by the farmer, they have natural habitats and are characterized by natural rock formations (mountain ridges, playing, natural rock cliffs) and growing areas of natural plant communities (including the characteristic limestone grasslands and the most valuable forest in the area of the Geopark - so-called *dąbrowa świetlista*), (Fig. A7). Important elements of the landscape in the area of Geopark „Geoland Świętokrzyski” are remnants of historical exploitation of ore and rock resources. Former quarries and mining fields after the exploitation of the ores have become an integral part of the landscape and places of occurrence of many valuable and rare species of flora and fauna. Today, these sites are among the most valuable biodiversity enclaves in the Geopark area. Natural hills covered by mostly dense vegetation, diversified by the rocky cliffs of the former quarries are the distinguishing feature of the Geopark area against the surrounding areas. Most of these locations, due to outstanding landscapes, scientific and educational values, are protected as reserves or monuments of inanimate and developed nature in the tourist direction. Exceptional aesthetic qualities have made some of them used as a place for movie scenes.

### 2) Climate

The Świętokrzyskie Mountains (including their western part within the borders of the Geopark, “Geoland Świętokrzyski”), due to the specific characteristics of the climate, constitute a separate, in Poland scale, a climatic region called Świętokrzyskie. The climatic singularity of the Świętokrzyskie Mountains is predominantly in terms of precipitation and temperature, which in turn results from their absolute altitude, greater than the surrounding areas and more varied terrain.

Both elements are the resultant varied (in relation to the surrounding and internal areas) of the geological structure. Also within the Świętokrzyskie Mountains are the differences between their highest central part located outside the boundaries of the Geopark (the so-called “Łysogóra”) and areas of lower altitudes with a milder terrain (for example west and south-west part). Due to the varied morphology, the “Geoland Świętokrzyski” area of the Geopark also have such diversity. The northern part of the Kielce municipality, due to the higher altitudes of the range uplift (more than 350 m above sea level) and much more diversified morphology, is characterized by a slightly harsher climate than the south and south-west part, situated in areas with milder sculptures and absolute altitude 250 m above sea level. Taking into account the overall picture of the climate of the western part of the Świętokrzyskie Mountains covered by the Geopark, the differences with the surrounding areas result from the large number of frost days (130-140 per year), varied rainfall (650 to 800 mm) and longer snow cover (especially on the northern slopes of the highest slopes belonging to the Dymiński, Połowicki and Zgórski ranges - up to 140 days per year). Average annual air temperature is between 5.7 ° C in the highest parts (Dymińskie, Połowice and Zgórskie range), to 7.8 ° C in the southern part of the Geopark in the Nida and Morawka river valley. In recent years, the average annual temperatures are high, with very hot summers (with temperatures reaching up to about 40 ° C) and relatively mild winters (with average temperatures around -4 ° C).



**Fig. A4 Abandoned quarry „Kadzielnia” in Kielce - now protected as Nature Reserve and Kadzielnia Park**



**Fig. A5 Miedzianka Hill with natural rocky forms**



### 3) Wildlife and ecosystem



**Fig. A6 One of the characteristic species associated with limestone substrate in the Geopark area**

(over 46% of Polish flora), of which 264 are particularly valuable - protected, rare and/or threatened. The dominant species in the forest stands are: *Pinus silvestris*, *Quercus robur* and *Quercus petraea*, fir (*Abies alba*), *Betula pendula*, Common beech (*Fagus sylvatica*), *Carpinus betulus* the maple (*Acer platanoides*) and Sycamore (*Acer pseudoplatanus*) and the small-leaved lime (*Tilia cordata*).

The geological structure which has a direct influence on the landform and the different types of soils plays a key role in the distribution of the most valuable forests in the Geopark area. For example, the highest range uplift formed on the outcrops of the Cambrian and Ordovician sandstones are the enclaves of the highland fir mixed forest (*Abietetum polonicum* – Fig. A7). This is an endemic type of forests mainly connected with the Highlands of South Poland and outside of the region generally outside the continent. The second example of one of the most valuable forests is the so-called „dąbrowa świetlista” (*Euro Siberian steppic woods with quercus spp.* – Fig. A7).

Research conducted by biologists in the Geopark area within the borders of Chęcińsko-Kielecki Landscape Park provided information the occurrence of many valuable species of fauna, including 20 species of beetles, 76 species of butterflies, 23 species of some kinds of the bumblebees, about 60 species of snails, 35 species of fish (including 7 species listed on the Red List of in danger of extinction and Endangered Animals), 14 species of amphibians (75% domestic fauna, all protected species), 6 species of reptiles (including the ‘*Coronella Austriaca*’ Gniewosz Plamisty’ found on the Polish List of in danger of extinction and Endangered Animals), more than 104 species of birds and 25 species of mammals (15 of which are strictly protected).

#### A.3.7. Cultural and historical records

##### 1) Historical Property

The documented history of man's inhabitancy in the Geopark border area, "Geoland Świętokrzyski", dates back about 60,000 years to an era called the Palaeolithic or Old Stone Age by geologists and Pleistocene geologists. Traces of Neanderthal camps described from the most beautiful cave in Poland - Paradise Cave, located in the central part of the Geopark, are also the oldest traces of people's inhabitancy in the entire Świętokrzyskie region. The history of settlement in Geopark is primarily a history of human connections with geology, as well as the history of the influence of different cultures. The earliest surviving traces of the settlement include the discovery of stone tools and the ochre red hematite dye found in many places.

The Geopark area Geoland Świętokrzyski is also an area of exceptional biodiversity because of its unique geo-diversity. The richness of the types of plant communities is due to the large variability of abiotic habitats (geological structure of the substrate, soil cover and terrain), variable climatic conditions and human history of the area. The most important feature of the area covered by the Geopark is the presence of different types of species on relatively small areas (Fig. A6). The abundance of flora and fauna is particularly marked in the part of the Geopark covered by the Chęcińsko-Kieleckie Landscape Park.

There are about 1117 species of vascular plants



**Fig. A7 *Abietetum polonicum* and Euro-Siberian steppic woods with *Quercus* spp.**



**Fig. A8 Paradise Cave (photo by Ł. Zarzycki)**



In the Świętokrzyskie region, including the Geopark area, traces in the Paradise Cave (Fig. A8) are also a valuable testimony of mankind's life during the Pleistocene, when the Neanderthal group found refuge in the cave for protection against the cold and fears of predatory animals from the south.

Further events of human activity in the Geopark boundary are recorded in more than 200 archaeological sites dating back to the Stone Age, sacred and secular architecture, as well as numerous remains of the ore and rock mining dating back to the Middle Ages. The most important thread that connects the history of human activity in the Geopark area in various historical epochs is the exploration, extraction and usage of local mineral resources: metal ore and rock raw materials. This thread appears from the beginning of man's existence in the Geopark boundary and continues to the present day, continued by the activities of local mining, cement-lime and stone mining companies. These exceptional conditions in the Geopark area allow you to trace historical human relationships with inanimate nature over more than 50,000 years.

## 2) Culture and customs



**Fig. A9 Local folklore groups in Geopark**

of harvest and field work celebrating in the first half of September. In pre-Christian times it was an ethnic Slavic feast, just as the so-called Pentecost. In pagan times it was the feast of Spring, associated with the magical power of trees and plants symbolizing all fertility, and in the present folk culture, the Christian feast of the Pentecost in May, in which many old habits were adopted: written into the rhythm of nature, decorating homes with green twigs.



**Fig. A10 Local event "Chałupkowe Garcynki"**

Folk culture preserved in numerous tangible and intangible remnants of the Geopark Geoland Świętokrzyski grew out of historical experiences and its character was influenced by ethnic features and the natural environment. Despite numerous historical turmoil and very strong social changes in the Świętokrzyskie region over the last 100 years, indigenous folk culture has not completely disappeared, and some habits have survived in a slightly altered form until now (Fig. A9 and A10). The most important of these are related to rituals and customs practiced during religious holidays, some of which are rooted in ancient (pre-Christian) beliefs. The most popular folk holiday practiced in rural areas of the Geopark is the Harvest Festival, otherwise known as the Harvest Festival. It is a folk holiday combined with Thanksgiving solemnities for the completion

An important testimony to the culture and traditions of the people is the Świętokrzyskie voivodeship, which is still cultivated by local folklore groups and rural women's groups (Fig. A9) which are members of the local community engaged in maintaining local traditions. Local traditions related to folk customs, handicrafts and local music are exhibited during the annual events held in individual communes, in the Ethnographic Park in Tokarnia and at the "Chałupkowe Garcynki" (Fig A10), which is related to the tradition of pottery and folk customs in the Morawica Commune (south-east part of Geopark).

## 3) Cultural Heritage

The cultural heritage of the Geopark, "Geoland Świętokrzyski", which consists of material and intangible elements are a testament to the over 50,000 years of history of the settlement and development of people living in this area. Prehistoric times (Paleolithic and Neolithic) document numerous archeological sites with the foundations of stone tools, ornaments, weapons and everyday objects (Fig. A11). Later times (pre-Christian) were recorded in the form of material heritage (archaeological sites) as well as immaterial (pagan rituals and customs that survived in folk rituals and Christian beliefs).



**Fig. A11 Neanderthal Center near Paradise Cave**



**Fig. A12 The Ethnographic Park in Tokarnia**



**Fig. A13 Royal Castle in Chęciny**

Medieval times and modern times have a very rich cultural layer associated with the material heritage, such as: monuments of secular and sacral architecture (the ruins of the Royal Castle in Chęciny – Fig. A13), numerous church and monastic complexes, urban and landscape complexes, tenements), numerous objects related to industrial heritage (residues of historical ore and rock mining, objects of the former technical infrastructure) and the remnants of rural and small-town construction documenting the development of rural settlement in the period from the 18th to the 20th century (Fig. A12). The folk arts, folklore and craft folk elements that survived at the Geopark in the form of cyclical events, local craft traditions, and folk costumes displayed by local folk groups are also part of the material heritage of the Geopark. The intangible cultural heritage is primarily local customs and rituals cultivated during religious festivals, as well as folk beliefs and legends as well as the history of the ore and rock mining in the Geopark.

## A4. ORGANIZATION IN CHARGE AND MANAGEMENT STRUCTURE

### A.4.1. Geologic of Holy Cross Mountains Geopark Association

Geopark "Geoland Świętokrzyski" has been functioning since 5 October 2015 when a formal cooperation agreement was signed between five local municipalities: Kielce, Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów (Fig. A14). The initial name of "Geopark Chęcińsko-Kielecki" was, at the request of some members of the agreement, changed to Geopark "Geoland Świętokrzyski", as more appropriate to the specific nature of the area that it covers.

Under this name, the Association of Municipalities has a statute, legal personality and is the organization responsible for managing the Geopark. According to the Polish law, the members of the Association are five local government units, of whom the representatives of the association's organs are elected: the General Assembly, the Management Board and the Audit Committee. It should be emphasized that in the Polish legislation key decisions and actions of the Association of Municipalities are subject to acceptance by means of resolutions adopted by the Councils of Municipalities, made up of representatives of local communities.

The main tasks of the Association defined in the statute include the planning and execution of public tasks of the Communes consisting of:

- 1) Support for the development of geo-tourism
- 2) Promotion of geological and cultural heritage
- 3) Promotion of the entire Geopark area, understood in holistic terms (geology - natural heritage - cultural heritage - local community)
- 4) Mobilizing and involving the local community to actively participate in the functioning process and the development of the Geopark
- 5) Development of cooperation between the Association and the science, business and non-governmental organizations



**Fig. A14 Formal cooperation between local municipalities: Kielce, Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów**



6) Other public tasks implementation (eg protection and conservation of geological, natural and cultural heritage, education, cooperation in local, regional, national and international).

### A.4.2. Head Office Structure



Fig. A15 Guide-educators in Geopark

The main office of the Geopark is its official headquarters and the information desk is located in the building of the Geo-Education Center in Kielce managed by The Geopark Kielce (a subordinate unit of the Kielce municipality, which is an informal urban geopark responsible for the management of geological reserves and the promotion of geological values of Kielce). The Geopark office is operated by 7 full-time employees of The Geopark Kielce, 6 of who also serve as guides-educators who speak Polish and English (Fig. A15).

### A.4.3. Geoland of Holy Cross Mountains Geopark Association Support

Geopark "Geoland Świętokrzyski" operation is based on a clear division of functions between the Association of Municipalities, as the governing body of the Geopark and the partner organizations that support Geopark's efforts in science, education, promotion, conservation and conservation of geological, natural and cultural heritage and local socio-economic development.

#### 1) Academic support

The Association's activities are supported by partnership agreements between academics and research institutes. There are two large universities in the Geopark area: the Jan Kochanowski University and the Kielce University of Technology, and a research and development unit in the form of the Świętokrzyski Branch of the State Geological Institute. These institutions support Geopark's activities under partnership agreements.

Among the key scientific partners supporting the Geopark's activities are the leading Polish universities and research institutes, whose staff conduct scientific and didactic activities in the Geopark area:

- Faculty of Geology, University of Warsaw,
- Institute of Nature Conservation of the Polish Academy of Sciences in Cracow,
- Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology in Cracow (including Department of General Geology and Geo-tourism),
- Faculty of Earth Sciences, University of Silesia.

Researchers of the above mentioned institutions support Geopark's activities mainly in the field of earth sciences as well as history and archeology.

#### 2) Administration-promotion support

An important element of Geopark's activity is the partnership with institutions and organizations functioning in supporting the development and promotion of regional tourism, supporting the development of the local community as well as preserving and promoting the natural, historical and cultural values and landscape values of the Geopark. In the above-mentioned scope, a decisive role is played by cooperation with three key partners:

- **Local Action Group, "Perły Czarnej Nidy"**, bringing together local community representatives, whose main goal is economic development related to the professional activation of the local community and the development of local entrepreneurship, the development of tourism based on specific natural and cultural values and to stimulate the social activity of the inhabitants to work for their own region and improve the lives of the local community;

- **the Regional Tourist Organization of the Świętokrzyskie Voivodship**, aimed at supporting the development and promotion of tourism in the Świętokrzyskie Region, with a total of 165 members, including local government units (including the Geopark, Geoland Świętokrzyski communes), associations and foundations, travel agencies, cultural institutions, museums and business companies. An important element of the organization's activities is the coordination of the network of certified tourist information points and the operation of the Regional Tourist Information Center operating in the Geopark area; Cooperation with Geopark is related to the promotion of Geopark's activities and the idea of the Global Geoparks of UNESCO at the regional and superregional level through the Regional Tourist Information Center and local tourist information points located in Geopark

- **Świętokrzyskie and Nadnidziańskie Landscape Parks** - a self-governmental organizational unit aimed at preserving and popularizing the natural, historical and cultural values and landscape values of Świętokrzyskie and Nadnidziańskie Landscape Parks (including the Chęciny-Kieleckie Landscape Park functioning in the Geopark area) under conditions of sustainable development; Geopark's cooperation with this organization is focused on promotional and educational activities related to the above mentioned purposes.

### 3) Collaboration with other independent groups

Geopark works with many institutions, non-governmental organizations or private entities that operate within its boundaries. Some of the most important partners are:

- Świętokrzyski Branch PTTK (an organization of licensed tourist guides operating in the Świętokrzyskie region, including the Geopark area),
- Świętokrzyskie Teacher Training Centre in Kielce (support and training of teaching staff, implementation of educational projects),
- Kielce Rural Museum (a cultural institution conducting activities in the field of conservation and promotion of local cultural heritage and folk traditions),
- National Museum in Kielce (cultural institution aimed at preserving and promoting regional cultural heritage as well as researching and publishing activities in this field),
- League of Nature Conservation in Kielce (ecological education of children and youth).

#### A.4.4. Budget and Finance

The Association of Communes "Geoland Świętokrzyski" has an independent budget and a financial management system resulting from formal and legal conditions of communes as local government units. The budget of the association comes from the contributions paid by the Communes - members of the Association. The amount of the budget and the amount of contributions determined for a given year is defined in the year preceding the date on which the Board of the Association presents the Municipality (members of the Association) the draft budget. The approved draft budget is the basis for the adoption at the beginning of the year, the budget of which is the relevant Resolution of the Association's General Assembly approving the amount of membership fee. Upon approval by the General Assembly, a resolution on the amount of contributions is sent to each of the municipalities - members of the association, for approval by the Council of Municipalities, made up of representatives of the local community. Approval by the Town Council constitutes the last formality which allows the transfer of funds by the Municipality to the Association account. It should be noted that the very low amount of funds constituting the Association's budget results from the fact that all investment activities related to the protection, conservation and use of local natural and cultural heritage, including the creation of tourist infrastructure in the areas of individual Communes - members of the Association are financed separately from the budgets of the Communes. It is similar with the large promotional activities of the areas of individual Communes. As a result, communes of the Geopark has independent budgetary resources dedicated to the above mentioned Geopark investments which are related to the statutory activity corresponding to the main assumptions of the Geopark.



Source of funds	2015	2016	2017	2018	2019	2020	2021	2022
I	-	-	3 324	10 542	2 165	2 165	2 165	12 636
II	166 219	171 789	211 554	344 614	263 439	263 439	263 439	263 439
III	630 549	162 898	81 869	2 143 220	1 063 290	-	-	-
<b>SUMMARY</b>	<b>796 768</b>	<b>334 687</b>	<b>296 747</b>	<b>2 498 376</b>	<b>1 328 894</b>	<b>265 604</b>	<b>265 604</b>	<b>276 075</b>

All amounts are in EURO. Currency converter from PLN to EURO based on the exchange rate of November 26, 2017

**I-** An independent budget (membership fees – first member contribution approved in 2017)

**II -** An independent budget of the municipalities – members of the Geopark's Association, related to C expenditures for the tourism and promotion of geological/natural/cultural heritage as well as the investment projects related to tourism (ex. tourism route and paths)

**III -** External funding constituting co-financing of projects related to tourism and promotion implemented by municipalities – members of the Geopark's Association

## A5. APPLICATION CONTACT PERSON

1) Mr. Michał Poros

Chairman of the Board of the Association of Communes, "Geoland Świętokrzyski"

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## B. GEOLOGICAL HERITAGE



## B1. GENERAL GEOLOGICAL DESCRIPTION OF THE PROPOSED GEOPARK

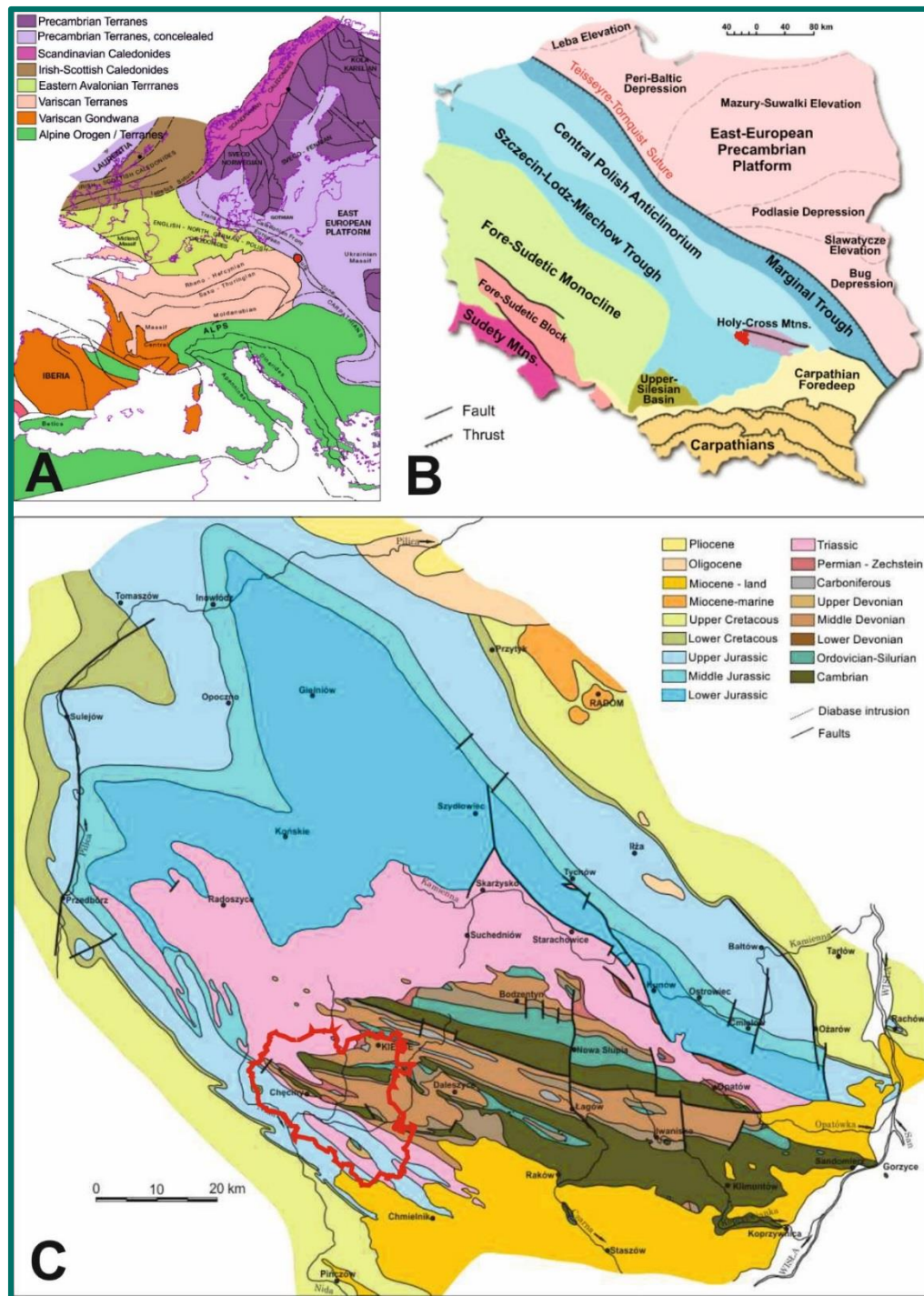


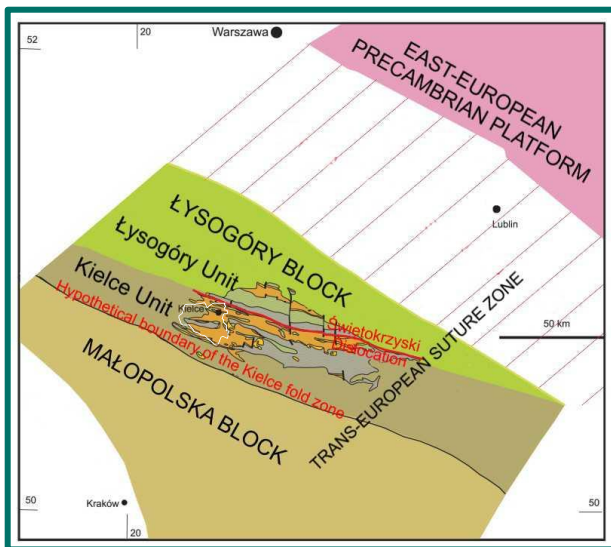
Fig. B1 Situation of the Geopark „Geoland Świętokrzyski” area (marked red point or line) against a background of the geological structures of Europe (A), as well as Poland (B) and Świętokrzyskie (Holy Cross) Mountains (C); source of maps: Polish Geological Institute, European Center of Geological Education; Geochemical Atlas of Europe; modified)



The Świętokrzyskie (Holy Cross) Mountains and the Geopark area are situated in specific place of the geological structure of Europe, because they are located within the great disruption of the earth crust called the Trans-European Suture Zone (TESZ), which is a boundary between three large geological units of the European crust: Variscan West-European Platform, Precambrian East-European Platform and orogenic belt of Alpine structures (Fig. B1). The Świętokrzyskie Mountains region (and the Geopark area) is the only segment of this zone (TESZ) where the sedimentary rocks representing the sequence of all geological period from Cambrian to the Quaternary are outcropped (Fig. B1). Therefore, the geological studies of this region are of fundamental significance for the understanding and reconstruction of the geological history of the European continent (Dadlez, 2001; Konon, 2008; Urban, Gagol, 2008).

In the context of the geological structure of Polish territory the Świętokrzyskie Mountains represent the south-eastern segment of the greater geological unit called Mid-Polish Anticlinorium (Fig. B1). This Anticlinorium is an elongated structure of the NW-SE direction crossing Polish area that is formed of sedimentary Mesozoic rocks. They were deposited within the basin of the similar (to the Anticlinorium) elongation and direction called Danish-Polish Through. During the Alpine tectonic movements, particularly intensive at the Cretaceous-Palaeogene turn, the rocks filled the Danish-Polish Through were uplifted and slightly/partly folded (forming the Anticlinorium), however, the greatest uplift occurred in the south-eastern part of the unit that constituted the Świętokrzyskie Mountains (Karnkowski, 2008; Konon, 2008). Consequently, this part suffered the most effective denudation (erosion) which brought about partial removal of Mesozoic rocks and emergence of rocks of so called Palaeozoic Core of the Świętokrzyskie Mountains. Present-day image of the geological structure of the Geopark, as an element of the Świętokrzyskie Mountains, is the result of these processes.

In the geological terms the Świętokrzyskie Mountains are composed of two regions: northern, Łysogóry Unit, situated within the earth crust block of the same name and southern Kielce Unit being the part of the Małopolska Block (Fig. B2). The Świętokrzyskie Dislocation, which is prominent disruption reaching the deep part of the lithosphere, is the boundary between these regions (Konon, 2008; Urban, Gagol, 2008). The whole „Geoland Świętokrzyski” Geopark is situated within the Kielce Unit.

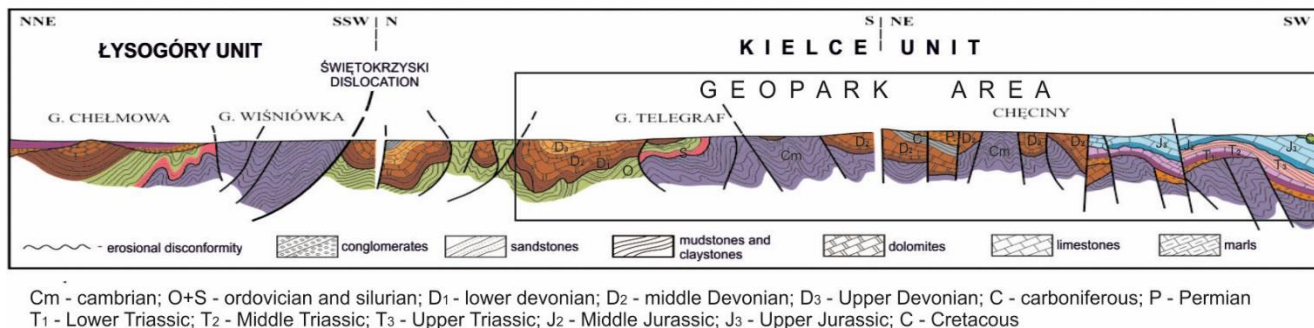
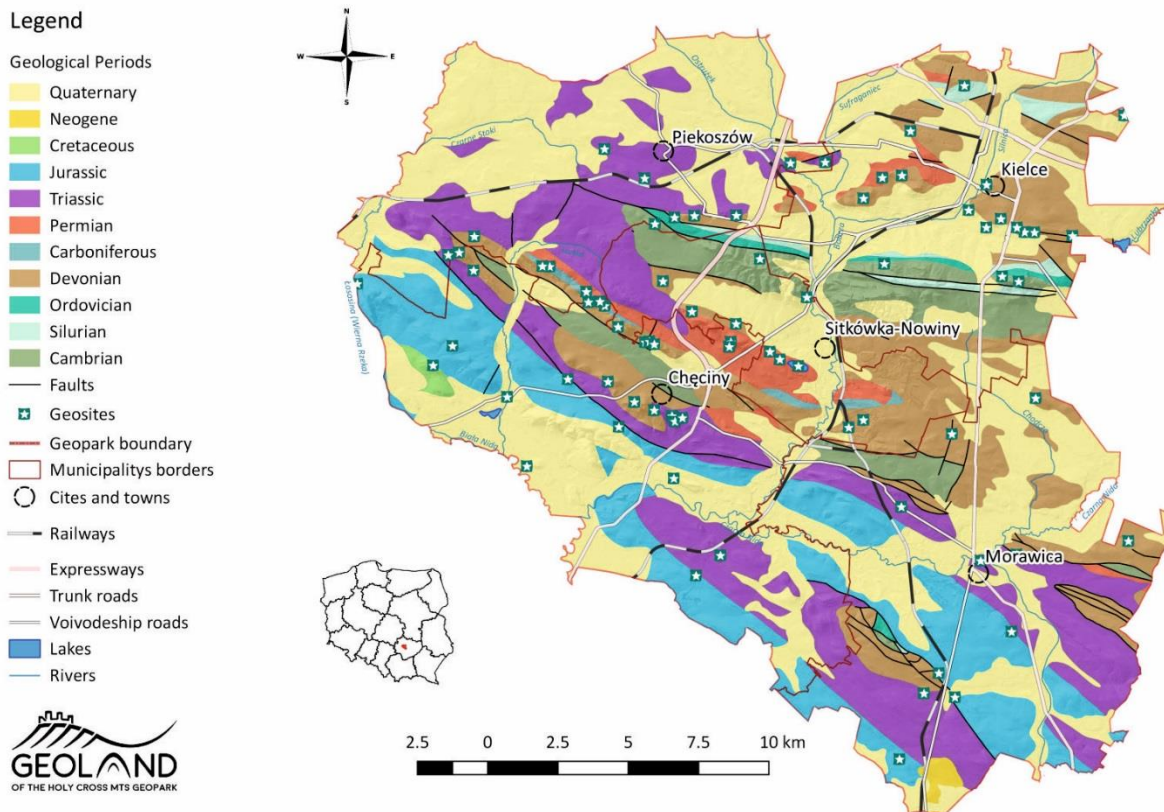


**Fig. B2 Location of the Geopark area (white line) on the background of tectonic structures of Central Poland; source of map: Polish Geological Institute, modified**

periods. The youngest, mainly fluvial sediments were deposited in the Holocene (Urban, Gagol, 2008; Urban, 2010).

The Palaeozoic Core, situated in the central part of the Świętokrzyskie Mountains is built of the sedimentary rocks that represent all Palaeozoic periods except for Permian and were tectonically modelled during the Caledonian and Variscan tectonic movements. Permian and Mesozoic sedimentary rocks, tectonically modelled during the Alpine movements, comprise so called the Permian-Mesozoic Marginal Zone of the Świętokrzyskie Mountains (Fig. B1) (Lamarche et al., 2003; Mizerski, 2004; Konon, 2008). The area of the „Geoland Świętokrzyski” Geopark covers the western part of the Palaeozoic Core and south-western section of the Permian-Mesozoic Marginal Zone (Fig. B1), however part of the Palaeozoic and Mesozoic structures are masked here by Quaternary (occasionally also Neogene) sediments that occupy depressed and part of sloped morphological elements (Fig. B3). Quaternary rocks represent glacial and fluvioglacial sediments deposited during the Pleistocene South-Polish Glacials as well as fluvial, slope and aeolian sediments deposited during the interglacial and periglacial periods.

## SIMPLIFIED GEOLOGICAL MAP OF THE HOLY CROSS MOUNTAINS GEOPARK



**Fig.B3 Simplified geological map and cross-section through the Geopark territory**

The geological history of the Świętokrzyskie Mountains, and the Geopark within this region, directly determines present-day situation of this area within the European continent and, consequently, is responsible for the morphology, climate, biodiversity and the development of colonisation and economy of this region (Urban, Gągół 2008). Very evident and apparent interrelation between the geological heritage and the development of colonisation, mining and agriculture is the feature distinguishing the Geopark region from neighbouring areas.

### B.1.1 Scientific Description of Geology

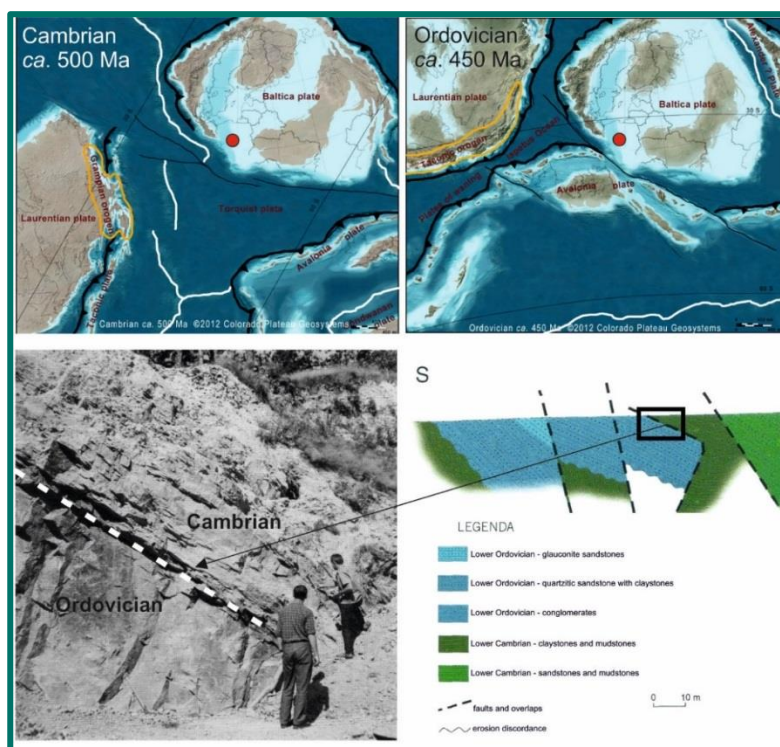
In the geological history of the Świętokrzyskie (Holy Cross) Mountains region recorded in the lithostratigraphical sequences available in the representative geosites within the area of the Geopark four structural stages – phases of sedimentation separated by tectonic movements, uplift and denudation – have been distinguished (Mizerski 2004; Urban, Gągół 2008; Urban, 2010). From the oldest to the youngest they are as follow:



- **Early-Caledonian (1) and Late-Caledonian (2) stages** that include sequences of the Older Palaeozoic (Cambrian, Ordovician and Silurian), tectonically deformed at the Cambrian-Ordovician turn as well as the Silurian-Devonian turn;
- **Variscan stage (3)** including the Devonian and Lower Carboniferous sedimentary sequences folded, faulted and uplifted during the Late Carboniferous and Permian;
- **Alpine stage (4)** including the Permian and Mesozoic rocks tectonically modified at the Cretaceous and Palaeogene turn and later.

During the subsequent, **Cenozoic stage (5)** of the evolution the present-day image of the geological structure as well as morphology and landscape of the Świętokrzyskie Mountains region (including the Geopark area) have been finally formed.

### 1) and 2) – Early- and Late-Caledonian structural stage: history of the Baltica palaeocontinent and its amalgamation with the Laurentia



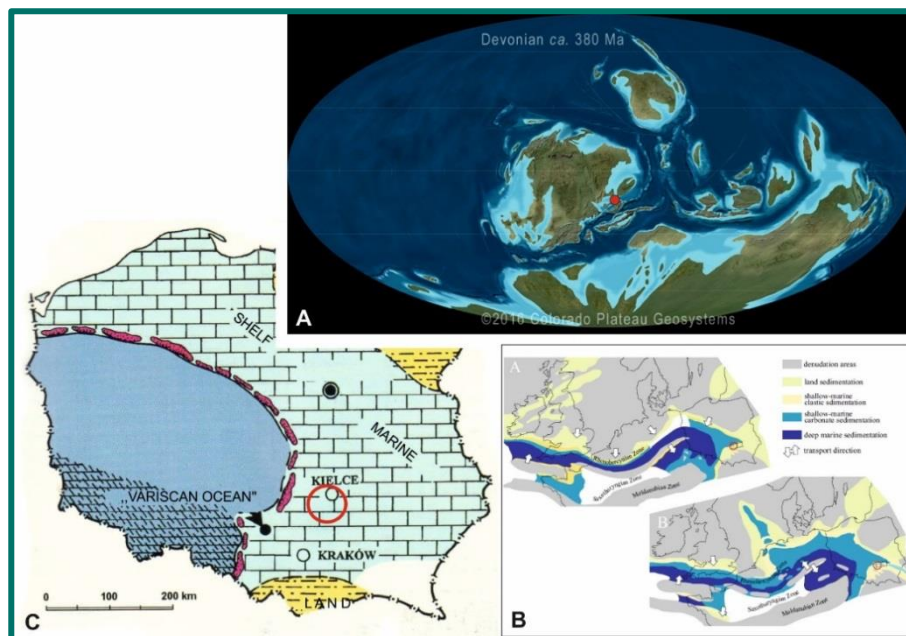
**Fig.B4 Cambrian – Ordovician paleogeography of Europe (after R. Blakey, 2012) with location of Geopark area (red point) and the Cambrian – Ordovician sequence in Biesak-Białogon geosite (No. G/KIE/006)**

Sandstones, siltstones and clayey shales of the Cambrian Middle Division (ca 500 MA) are the oldest rocks outcropped within the Geopark area. Apart from Middle Cambrian rocks the sequence of the Older Palaeozoic is constructed of sedimentary Ordovician and Silurian rocks represented by sandstones, siltstones, claystones and greywackes with inserts of pyroclastic rocks – bentonites. The sequence of these rocks is the record of marine depositional environment connected with the shelf of the Baltica palaeocontinent (Fig. B4), and its movement from the low geographical latitude of the southern hemisphere to the equatorial latitudes and collision and subsequent amalgamation with the Laurentia palaeocontinent (Befka et al. 2012). Processes and events connected with the oldest documented (Old-Caledonian) stage of the history of the Geopark area are recorded in the sequence of Cambrian and Ordovician rocks outcropped in the “Biesak-Białogon” Geosite (no G/KIE/006), (Fig. B4). The younger, Ordovician part of this sequence includes also the evidences of global and regional events related to the evolution of the Young-Caledonian structural stage recorded in other sequences of the world. The remains of Ordovician volcanism that are used for the reconstruction and correlation of palaeoclimatic and ecological events are represented in this site with the pyroclastic rock.

The geological sequence of the Silurian rocks that represent the Young-Caledonian structural stage, outcropped mainly in the northern and south-eastern parts of the Geopark area („Gruchawka” Geosite no GEO/KIE/016) includes the record of events (e.g. tectonic movements, marine regression and increased volcanism) associated with the tectonic Caledonian movements at the Silurian and Devonian turn, which brought about the closing of the Iapetus Ocean and the collision of two continents: Laurentia (present-day North America) and Baltica (present-day Eastern Europe). Due to the amalgamation of these continents the new continent of Laurussia (Euro-America) was formed. The destruction of the Young-Caledonian land (partly mountains) finalised the Caledonian stage in the Kielce Unit geological history and began the Variscan structural stage, represented by the marine rock sequence from Lower Devonian to Lower Carboniferous.

### 3) Variscan structural stage – tropical sea at the shelf of Laurussia, great extinction and Variscan mountains

The Variscan structural stage is represented by the Devonian-Lower Carboniferous sequence, deposited and recording global and regional events in the southern shelf basin of the Laurussia continent. At the beginning of the Devonian fragment of this shelf, including the Małopolska Block with the Kielce Unit, was still situated at the southern hemisphere, close to the equator (Fig. B5). The climate and its further changes were responsible for the depositional environments in this area during the Devonian and Carboniferous.



**Fig. B5 Paleogeographic position of Małopolska Block (including Geopark area) during the Devonian (A – Upper Devonian global paleogeography after Blakey, 2016; B – paleogeography and main sedimentary zones along the southern Laurussian shelf during the early stage (Emsian/EFelian) of Devonian transgression, after Wójcik, 2015; C – simplified paleogeography of Poland during Late Devonian (after Racki et. Al, 1999)**

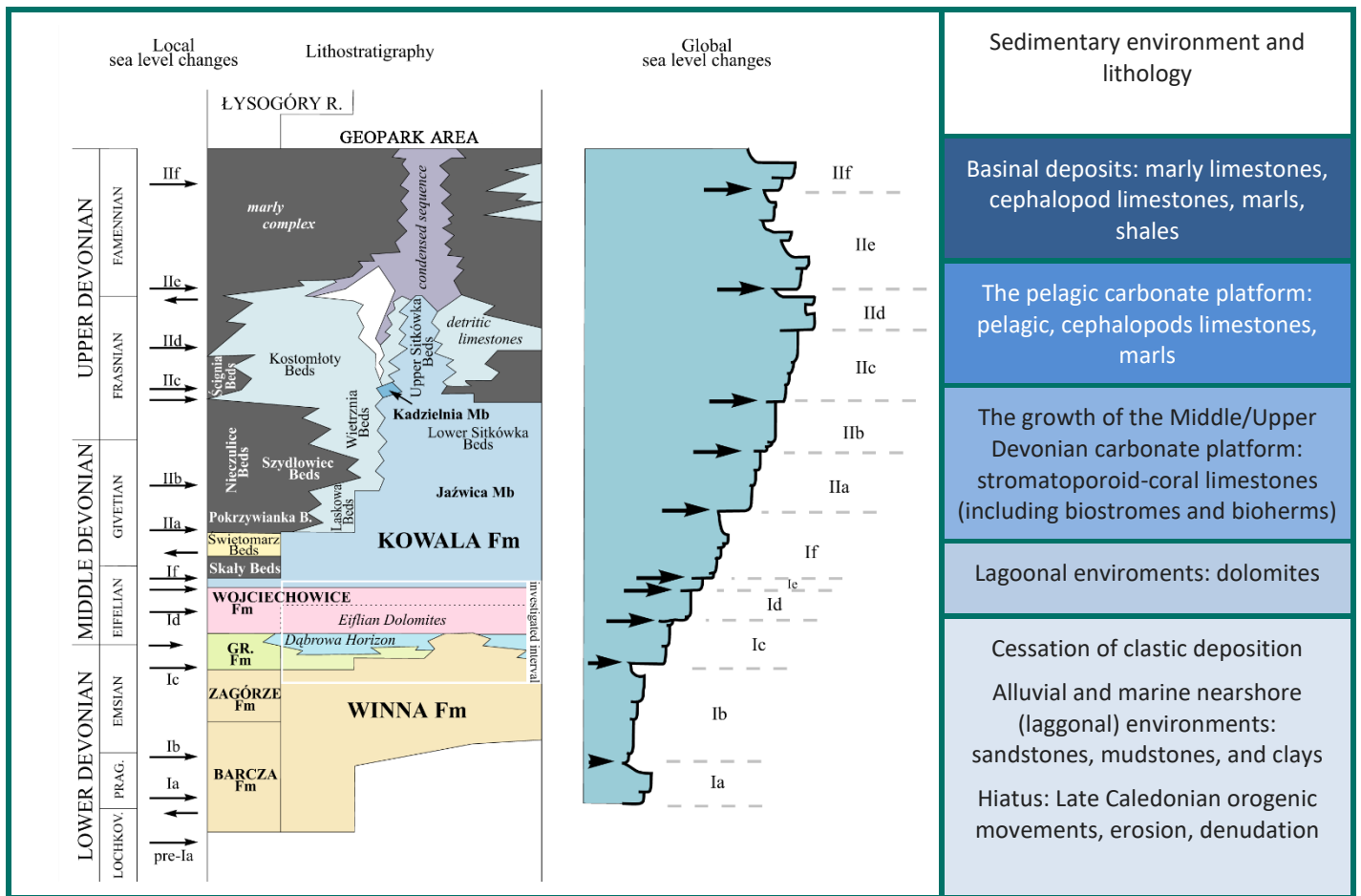
The Devonian and the Early Carboniferous make together a coherent chapter of a depositional history in the Geopark area, since the stratigraphic succession then originated is bounded with the major angular unconformities. They correlate with the late Caledonian and the Variscan orogenies. The succession records a steady sea-level rise since the Early Devonian till the Early Carboniferous, which correspond with global eustatic event (Fig. B6).

The main lithostratigraphical elements of Devonian succession on the Geopark area are presented at Fig. B6.

The global and regional events that controlled the deposition in the Świętokrzyski part of the Laurussia shelf are recorded particularly evident in the sequences outcropped in the central and northern part of the Geopark, at the following representative Geosites:

- Early Devonian (Emsian) terrestrial (fluvial, lacustrine) sequence: G/KIE/012 „Świnia Góra”
- Middle Devonian (Eifelian) lagoon: G/CHE/003 „Góra Rzepka”
- Middle/Upper Devonian (Givetian/Frasnian) carbonate platform with biohermal and biostromal limestones: G/KIE/001 „Kadzielnia”; G/KIE/005 „Wietrznia”; G/KIE/008 „Góra Słoneczna”; G/KIE/011 „Góra Cementarna”; G/CHE/025 „Sowie Górki”; G/SN/005 „Kowala – pomnik przyrody”; G/SN/007 „Kamieniołom Bolechowice”
- Upper Devonian (Frasnian) pelagic carbonate platform: G/KIE/001 „Kadzielnia”; G/KIE/002 „Ślichowice”, G/CHE/002 „Góra Zamkowa – zachód”; G/SN/006 „Kowala-kamieniołom”
- Upper Devonian (Fammenian) basinal deposits: G/SN/006 „Kowala-kamieniołom”; G/PIE/008 „Kamieniołom Ostrówka – Todowa Grząba”
- Lower Carboniferous basinal deposits: G/SN/006 „Kowala-kamieniołom”; G/PIE/008 „Kamieniołom Ostrówka – Todowa Grząba”





**Fig. B6 Devonian lithostratigraphy of Geopark area compared with local and global sea level changes (after Sandberg et. al. 2002; Narkiewicz et al. 2006; Bełka and Narkiewicz, 2008; Wójcik, 2015)**

The carbonate rocks of the Stromatoporoid-Coral Limestone-Dolomite Kowala Formation (Givetian-Frasnian) are predominant and most characteristic geological lithostratigraphic unit of the Devonian sequence in the area of the Geopark. The thickness of this formation ranges up to 800 m in the western part of the Kielce Unit and are commonly outcropped (Narkiewicz et. all. 1990). This is why the rocks of the Kowala Formation play principal role in the geological structure, morphology and history of human activity (economy) of the Geopark area (Fig. B7, B8, B9)



**Fig. B7 Geosite G/KIE/001 „Kadzielnia”**



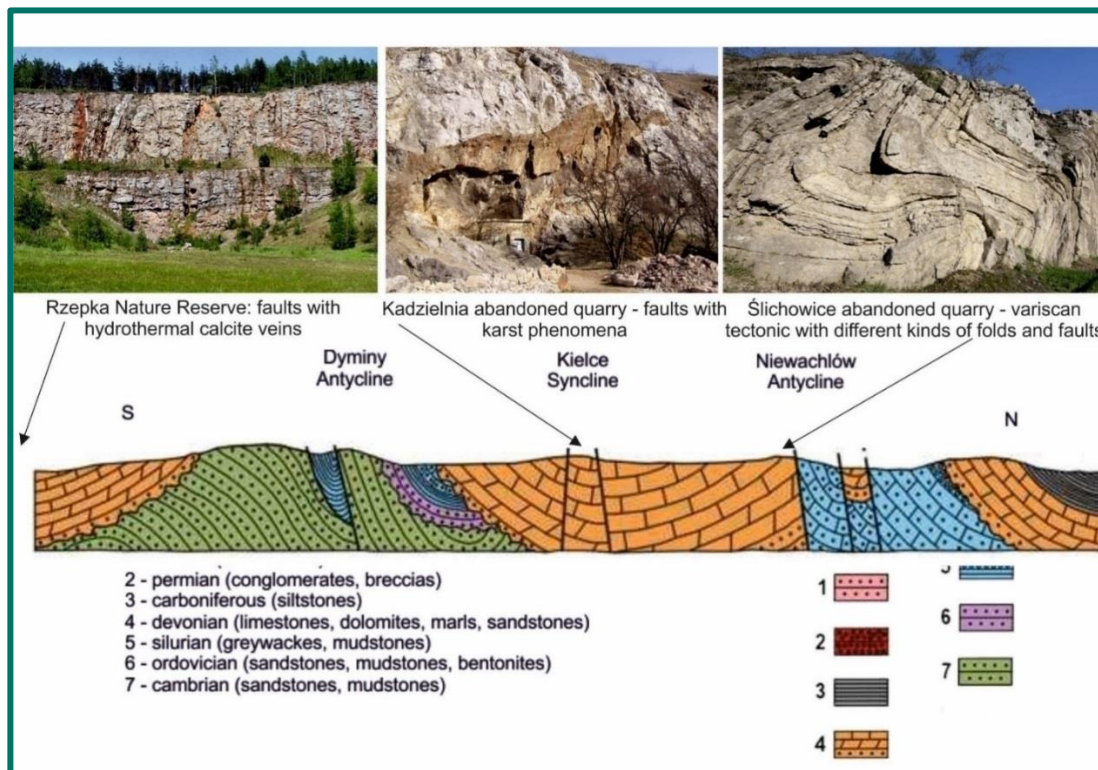
**Fig. B8 Geosite G/CHE/010 Góra Miedzianka**



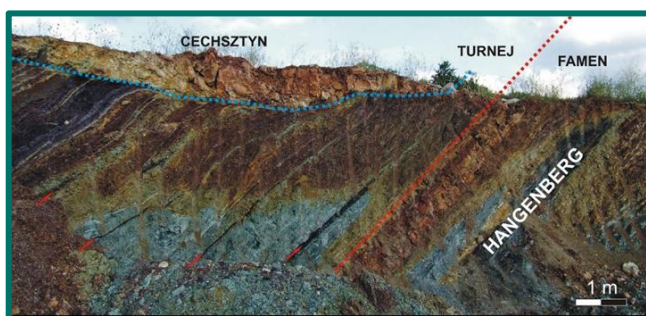
**Fig. B9 Geosite G/SN/007 Bolechowice quarry**

At the Early and Late Carboniferous transition (ca 320 million years ago) the collision of moving to the north Gondwana and northern continent of Laurussia (Euroamerika) generated tectonic movements called Variscan orogenesis, which were the most intensive in the Late Carboniferous and Early Permian. The Variscan movements played the principal

role in the tectonic formation of the Palaeozoic Core of the Świętokrzyskie Mountains. These movements are responsible for the development of main structural elements of this region: vast anticlines and synclines as well as system of longitudinal and transversal faults (Konon, 2007, 2008; Urban, 2010). These elements are shown in the cross-section of the western part of the Kielce Unit (including the Geopark area) below (Fig.B10).



**Fig. B10** Cross-section of the northern part of the Geopark area with the examples of a record of the Variscan tectonic movements (after Urban et. al., 2011)



**Fig. B11** „Kowala – kamieniołom” Geosite (no G/SN/006) with a sequence of the late Devonian and Early Carboniferous (Variscan structural stage), discordantly overlain with Permian rocks (Alpine structural stage) – blue dotted line indicates Variscan-Alpine unconformity (after Filipiak, Racki, 2005)

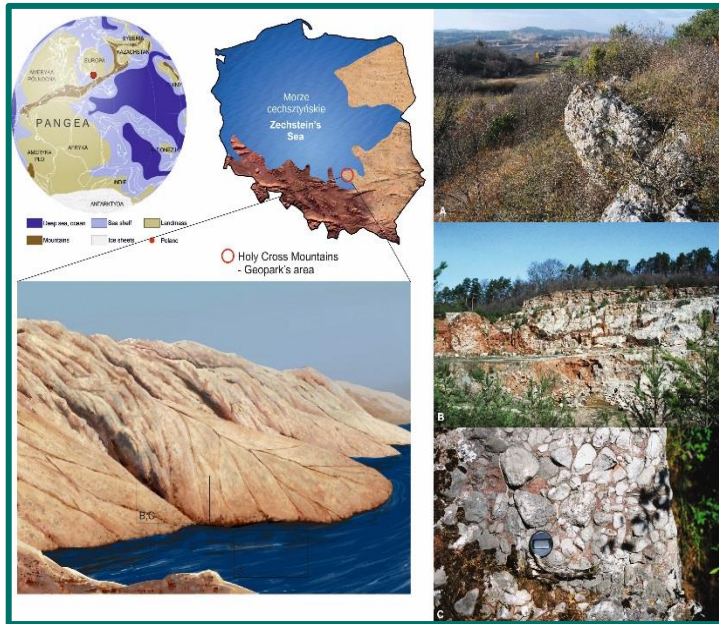
The records of collision of the continents and subsequent Variscan movements, such as folds (Fig. B10), faults and joints (Fig. B10) as well as calcite veins lead and copper sulphide minerals, can be observed in numerous Geosites of the Geopark („Góra Zelejowa – grań” no G/CHE/006, „Góra Miedzianka” no G/CHE/010), (Rubinowski 1971; Migaszewski et al. 1996).

The denudation (erosion, karstification) of the mountainous land built of tectonically deformed Palaeozoic rocks (up to the Lower Carboniferous) finalizing the Variscan tectonic stage and subsequent deposition (on these deformed rocks) of terrestrial or shallow marine sediments that commenced the Alpine structural stage are perfectly recorded at the Geosite no G/PIE/002 “Jaworzna” and “Kowala – kamieniołom” Geosite no G/SN/006 (Fig.B11) (Kuleta, 1999; Urban, 2007, 2013).



#### 4) Alpine structural stage – history of the Permian-Mesozoic lands and sea basins as well as tectonic movement at the end of the “Dinosaur Era”

##### *At the Permian seashore*



**Fig. B12 Paleogeography, reconstruction and geological record of Permian in Geopark area**

During the Mesozoic Era the area of the Świętokrzyskie Mountains was situated in the south-eastern segment of the Danish-Polish Through, in which the subsidence predominated and the deposition of thick marine complexes prevailed (Świdrowska et al. 2008). At the beginning of the Late Permian the Variscan mountainous land became seashore of the Zechstein Sea of the German-Polish basin. This seashore was very irregular with numerous gulfs that dissected the land into many mountainous peninsulas (Fig. B12). The landscape of the Permian seashore of the Świętokrzyskie Mountains area resembled in that time the landscape of current Dead Sea region (Migaszewski et al., 1995; Zbroja, 1995; Zbroja et al., 1998; Kuleta, Zbroja, 2006). Such a morphology conditioned natural coexistence of marine and terrestrial depositional systems, which are recorded in geological sequences outcropped in few representative Geosites of the Geopark (Geosites no: G/CHE/015 „Zygmuntówka”; G/PIE/015 „Góra Skałka”; G/PIE/002 „Jaworznia”) and composed of breccias, conglomerates, marly limestones and marls (Fig. B12).

##### *At the margins of the Triassic land and within the Triassic marine basin*

At the beginning of the Triassic, similarly to the Permian, all continental blocks were combined in one large super-continent of the Pangea. Most water resources was still incorporated into the ice-sheet in the southern part of this continent, which resulted in very low ocean water table. The climate of the Europe area was still hot and arid. These environmental conditions are recorded in numerous sequences of Lower Triassic sediments of the world and also within the Geopark area, which in that time comprised western and north-western marginal zone of large land that partly suffered denudation (Urban 2007, 2013). The deposition of characteristic red (rich

in iron oxides) sediments of the Lower Buntsandstein (just commenced) firstly occurred in marine lagoons, swamps and playa basins and then in riverbeds and alluvial plains of braided rivers. Therefore, the lower part of the sequence is formed of series composed of sandstone-siltstone-claystone and even conglomerate interbeddings, while the upper part is represented by red quartzose thick-bedded sandstone series. Sediments of both lower and upper series are characterised by numerous and various depositional structures: wave ripples, horizontal and cross lamination, desiccation fissures and polygons etc. (Fig. B13), as well as vertebrate footprints (Geosite no G/PIE/002 „Jaworznia”) (Kuleta 1999; Kuleta, Zbroja, 2006; Urban 2013).

The global marine transgression at the Early and Middle Triassic transition was caused by the thawing of the ice-sheet in the southern



**Fig. B13 Lower Triassic sandstone with ripplemarks and Middle Triassic limestone with rich invertebrate fossils**

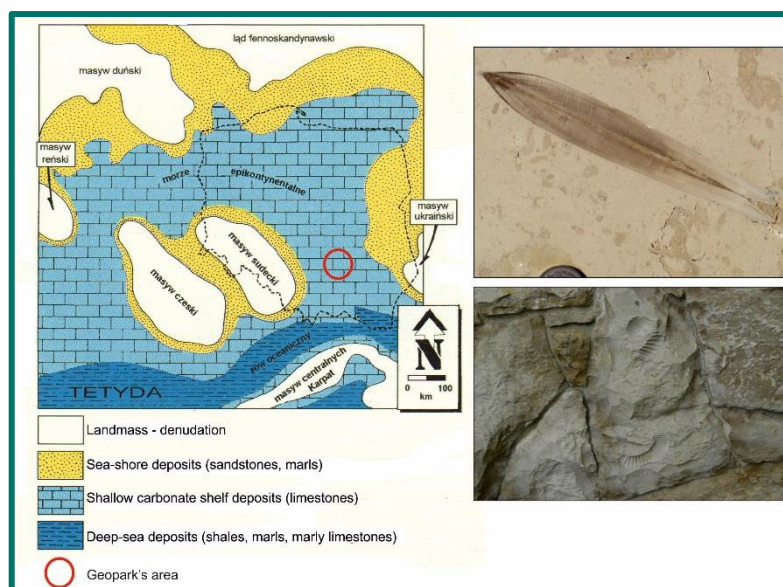


Pangea. The sequence of carbonate and marly-carbonate rocks of so called Muschelkalk is a record of this transgression in the Świętokrzyskie Mountains region (Szulc 2000). The Muschelkalk lithostratigraphic unit in the Geopark area consists of usually thin-bedded limestone-dolomite-marl series that bears fossils of molluscs, crinoids, brachiopods, ammonites as well as marine vertebrates (mainly fish) which is outcropped in southern and north-western parts of the Geopark area (**Geosite no G/CHE/009 “Kamieniołom w Wolicy”**) (Trammer, 1975).

In the late Triassic the southern part of the Świętokrzyskie Mountains area was covered by shallow sea, periodically brackish basins alternated with vast and plain lowlands. These different depositional environments are recorded by sandstones, siltstones and claystones with marl, limestone and breccia inserts of fluvial, marsh and marine origin (Geosite no G/CHE/008 „Wolica-przekop”).

### **History of the Jurassic “Great Flood”**

In warm and humid climate of the Jurassic period the global upraising of water table generated gradual but constant marine transgression. This transgression, were progressing from the Tethys Ocean from the south (Fig. B14), reached the south-western part of the Świętokrzyskie Mountains region in the late Middle Jurassic, therefore the depositional gap (hiatus) within the Geopark area includes the Triassic and Jurassic turn as well as the Early and part of the Middle Jurassic. The Middle Jurassic sequence comprises clayey-siltstone and sandstone series grading upward to marly and carbonate rocks (Świdrowska et al., 2008; Złonkiewicz, 2009). The representative geosites that record the beginning of the Jurassic “Great Flood” are situated in the southern and south-eastern segment of the Geopark area (Geosite no G/CHE/008 “Wolica – przekop”).



**Fig. B14 Paleogeography of Central Europe (including Poland) in Late Jurassic and geological record of Late Jurassic sea from Geopark area (map afetr Racki et. all, 1999)**

The overlying sequence of the Upper Jurassic (Oxfordian, Lower Kimmeridgian) carbonate rocks that ranges a thickness of ca 800 m, is characteristic element of geological structure and morphology of the southern part of the Geopark area („Milechowy” Natural Site). It is composed of light limestones, marly limestones and marls, which are occasionally rich in fossils of invertebrates: ammonites, belemnites, brachiopods, molluscs, sponges and echinoids (Fig. B14), (Złonkiewicz 2009). This series plays significant role in the structural relief of the south-western segment of the Geopark area forming hill ranges in which some short caves and palaeokarst forms occur (Zlonkiewicz 1994, Urban 2010; Urban, Kasza 2010). Upper Jurassic limestones are also stone materials which have been quarried as marbles as well as materials for the construction and road industry (balast, concrete, lime and cement) for several hundred years (Jędrychowski, 2014).

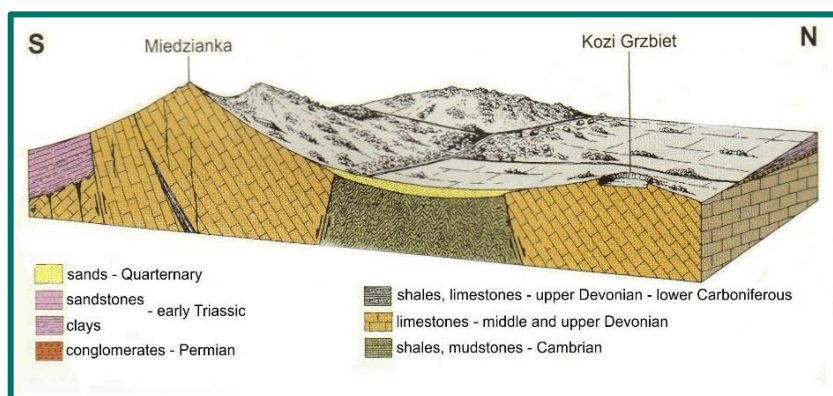
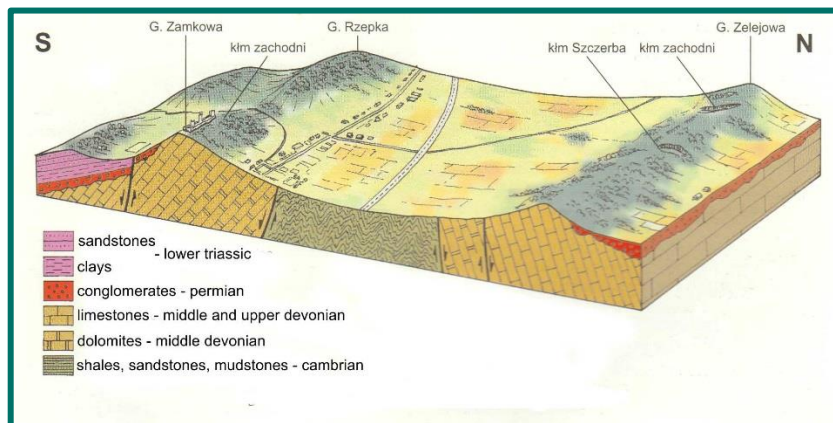
### **History of the Cretaceous, “Great Flood” and great extinction at the end of the “Dinosaur Era”**

The Jurassic decline is a period of the next global marine regression and expansion of lands resulted in hiatuses in geological sequences that are also recorded in the Świętokrzyskie Mountains. The global Late Cretaceous transgression brought about the highest water table in the geological history of the Earth and is usually recorded by thick carbonate depositional sequences. This marine transgression that progressed toward the north-east along the Danish-Polish Trough (Świdrowska et al., 2008), reached the western part of the Świętokrzyskie Mountains (including the Geopark area) in the late Early Cretaceous. This transgression is recorded by relatively thin sandstone series (Geosite no G/CHE/019 „Odślonięcie piaskowców w Bolminie”), which grades upward to the several hundred thick sequence of Upper Cretaceous marl-limestone series that is outcropped practically out of the area of the Geopark (Urban 2010).

**5) The Cenozoic period of the geological and geomorphological evolution of the region – emergence of the Świętokrzyskie Mountains, large glaciations and current morphological processes**

Since the tectonic movement at the Cretaceous-Palaeogene turn the central part of the Świętokrzyskie Mountains region (including the Geopark area) was a land of hilly or low mountainous relief, which suffered gradual denudation (mostly chemical weathering and karstification as well as fluvial erosion) (Urban, 2010; Urban, Kasza 2010), however Alpine tectonic movements related to the Carpathian orogenesis still affected the area and its morphology, particularly in the Early Miocene (Stupnicka 1972; Jarosiński et al. 2009).

Due to the intensive denudation in a hot and humid climate of the Palaeogene and warm climate of the Neogene thick (ranging several kilometres) cover of the Mesozoic rocks was removed from the present-day outcrop of the Palaeozoic Core of the Świętokrzyskie Mountains (Głazek, 1989). The tectonic processes of the Alpine stage, including uplifting of crust blocks, as well as denudational processes were the principal factors controlling the morphogenesis of the area and producing the Świętokrzyskie Mountains in their present-day sense (relief) (Urban 2014).



**Fig. B15 Structural relief of the Dolina Chęcińska depression (central part of the Geopark) – visible on cross-sections complex geological structure is perfectly reflected in the morphology (draw B. Waksmundzki, source: Góry Świętokrzyskie. 25 najważniejszych odsłonieć geologicznych, Wydział Geologii UW, Warszawa, 2012)**

with these events played principal role in morphological shaping of Polish territory, including Świętokrzyskie Mountains region. The Świętokrzyskie Mountains and the Geopark area were covered by ice-sheets of South-Polish Glacials (Marks et al. 2016). Sheets of glacial and fluvioglacial clays, silts and sands are the records of these glacials, while other glacial periods are documented by periglacial slope covers as well as fluvial and aeolian sediments (Lindner, Kowalski 1974; Urban 2010). The sequences of karst and cave fills are important records of climate changes, fauna assemblages and prehistoric human (Neandertals) activity (Geosites: “Jaskinia Raj” no G/CHE/011; “Kozi Grzbiet” no G/PIE/006 and “Kadzielnia” no G/KIE/001) (Studies ... 1972; Głazek et al. 1976; Marks et al. 2016). The calcite crystals described for the first time in the Chelosiowa Jama-Jaskinia Jaworznicka cave system (“Kamieniołom w Jaworzni – Chelosiowa Jama” Geosite no G/PIE/002) and then found in many other caves all over the world, have become an important evidence of permafrost and climate fluctuations in the Pleistocene (Żák et al., 2004, 2012).

The denudation during the Palaeogene and Neogene instead of the deposition is the principal reason of the lack of typical geological sequences that record a geological history of these periods in the region. Nevertheless, apart from rare gravel-sand-clay sheets of terrestrial sediments devoid of fossils, the Palaeogene-Neogene periods are documented by fills (clays, sands) of karst conduits and dolines developed in Devonian and Jurassic carbonate rocks, such as Chelosiowa Jama-Jaskinia Jaworznicka cave system at the „Jaworzni” Geosite no G/PIE/002 (Urban, Rzonca 2009; Urban, 2010, 2013). The selective denudation in hot and then warm climate of the Palaeogene and Neogene produced typical structural relief extremely well expressed in the central part of the Geopark area (Fig. B15), where due the intensive tectonic deformation (folding and faulting) very different lithological types of rocks crop out (Fig. B15), (Urban, 2010, 2014).

Significant global climate cooling at the beginning of the Quaternary (ca 2,6 million years ago) changed the environmental conditions of morphogenesis. During last 900 000 years at least eight times ice-sheet expanded the large parts of the northern hemisphere (glacials) and then were melted during the warmer periods of interglacials. Consequently, processes connected

## B.2. LISTING AND DESCRIPTION OF GEOLOGICAL SITES WITHIN THE PROPOSED GEOPARK

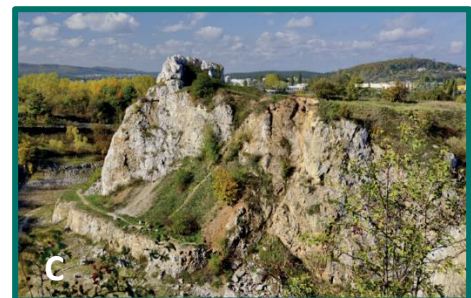
The complete list of geosites is presented in an Annex no 1 to the Application Dossier. Hereafter, the most interesting geosites are presented, in particular, the sites of international and national relevance. The key features responsible for these ranking (relevance) are emphasized in their description. Most of these geosites were evaluated and then selected on the basis of the Polish Database of Representative Geosites which contains the sites proposed to the European List of Geological Sites in a frame of the "Geosites" Project coordinated by IUGS in a cooperation with ProGEO Association (Wimbledon, 1999; Alexandrowicz, 1999, 2006)

NO	CODE	NAME OF GEOSITE	PRINCIPAL STRUCTURAL STAGE	DESCRIPTION
1	G/KIE/001	Kadzielnia	Variscan, Alpinian, Cenozoic stage	Abandoned quarry (partly protected as Nature Reserve) with exposures of the Upper Devonian limestones, marls and shales. Outcrop of typical Devonian bioherm (the largest known in Poland) and facies (fauna assemblages) in its vicinity, useful for interregional paleogeographic analyses. Outcrop of representative profile of Frasnian/Famennian boundary. Site of Cenozoic karst, which can be compared e.g. with paleokarst of Kraków-Częstochowa Upland. Numerous paleokarst forms (26 caves on 2-3 levels) developed mainly in Neogene and Pleistocene, although Permian-Triassic age of sinkholes was also gealously argued. Karst fills with the Early Pleistocene and Late Pleistocene vertebrates.
2	G/KIE/002	Ślchowice	Variscan	Abandoned quarry with exposure of the Devonian limestones, marls and shales. Ślchowice site is the most illustrative outcrop of fold documenting Variscan tectogenesis in Poland; as an instructive form, the fold is quoted (shown in pictures) in manuals of tectonics and geological guidebooks. Outcrop of representative profile of Frasnian/Famennian boundary.
3	G/KIE/003	Wietrznia - Międzygórz Wschodni	Variscan, Alpinian, Cenozoic	Three abandoned quarries protected as Wietrznia Nature Reserve. One of the best recognized continuous lithostratigraphic sequence ranges from the Middle Devonian (Givetian) to the Upper Devonian (Famennian), in the northern margin of the Polish-Moravian platform with characteristic facies and fossils, used for regional and interregional paleogeographic analyses. Outcrop of representative profile of Frasnian/Famennian boundary. The rocks are abundant with fossils such as corals, brachiopods, goniatites, molluscs, stromatoporoids, crinoids, ostracods, trilobites, foraminifers, conodonts and fish, which have been investigated since the 19th century. These studies resulted in: a) description of new taxa, b) analyses of anatomy and evolution, c) stratigraphy of the sequence (Givetian-Frasnian boundary), d) reconstruction of the evolution of faunal assemblages and their reaction on the Devonian global events. Numerous outcrops of Post-Variscan, Permian-Triassic and Cenozoic terrestrial and paleokarst forms and phenomena unique at the interregional scale.
4	G/KIE/004	Wietrznia - Międzygórz Środkowy		
5	G/KIE/005	Wietrznia - Wietrznia		
6	G/KIE/006	Biesak-Białogon	Early and Late Caledonian	Abandoned quarry protected as Biesak-Białogon Nature Reserve. Unique outcrop of the most probably Caledonian compression – reversed fault formed in the Lower Palaeozoic sedimentary rocks (Cambrian, Ordovician), illustrating scale of tectonic movements in the Małopolska Caledonian massif (Kielce Unit)
7	G/CHE/005	Góra Zelejowa - Kamieniołom zachodni	Variscan, Alpinian	Hill with geological outcrops (including abandoned quarries), karst forms and natural rocky relief. The site with well exposed forms and phenomena representative for geo(morpho)logical evolution of the region: Variscan and post-Variscan hydrothermal forms, Variscan tectogenesis and Cenozoic morphogenesis.
8	G/CHE/006	Góra Zelejowa - Grań		
9	G/CHE/007	Góra Zelejowa - Szpara		
10	G/CHE/009	Kamieniołom w Wolicy	Alpinian	Abandoned quarry protected as „Wolica Nature Reserve”. Site representative for the lower part of the Muschelkalk of the Świętokrzyskie (Holy Cross) Mts, located in peripheral part of the Middle Triassic German basin; used in analysis of the peri-Tethys basin development (comparative studies with other regions, especially Upper Silesia and Germany).
11	G/CHE/010	Góra Miedzianka	Variscan, Alpinian	Hills with historical mines and quarries, karst forms and natural crags, partly protected as „Góra Miedzianka” Nature Reserve. Góra Miedzianka is a hill formed of the Frasnian massive limestones, which are strongly disintegrated by faults and contain tectonic scales of the Famennian marls. Calcite veins with sulfide and sulfo-salt minerals of Cu,



## B. Geological heritage

				Fe, Zn, Pb and Ni occurring within the limestones, represent original Variscan hydrothermal mineralization. Very irregular ore bodies were mined since the Middle Ages to the first half of the 20th century. It resulted in the occurrence of many kilometers of mine galleries, which partly followed paleokarst conduits (some opened to the surface) and numerous surface remnants of mining. The hill ridge is crowned with the natural limestone crags of high landscape value.
12	G/CHE/011	Jaskinia Raj	Variscan, Cenozoic	Nature reserve "Jaskinia Raj" (since 1968), very well accessible for public (show cave, touristic trails and infrastructures). Raj cave is one of the most important paleontological site of the Late Pleistocene vertebrates and Mousterian Culture (Neanderthals) in Poland that plays significant role in public education of geo(morpho)logy and archaeology; it's also one of the most beautiful show caves in Poland.
13	G/SN/005	„Kowala” - pomnik przyrody	Variscan	Artificial outcrop (Kowala – pomnik przyrody - „Kowala – nature monument”) and active quarry („Kowala – kamieniołom” - “Kowala – quarry”). One of the best outcrop of the Upper Devonian sequence (especially Frasnian biohermal limestones and Frasnian/Famennian boundary) and Devonian-Carboniferous boundary with the sequence of sediments which illustrates evolution and drowning of the northern margin of the Polish-Moravian Middle-Upper Devonian platform, useful for interregional analyses. One of the most important Upper Devonian (Famennian) paleontological sites in central Europe: „Kowala Lagerstätte”
14	G/SN/006	Kowala - kamieniołom	Variscan	
15	G/PIE/002	Jaworznia	Variscan, Alpinian	Hill with abandoned quarry partly protected as “Chelosiowa Jama” Nature Reserve. The site is a hill built of the Devonian limestones overlain by the Lower Triassic clastic-clayey series (Buntsandstein). The angular unconformity between the Devonian and Triassic is outcropped in the abandoned quarry. The site represents: 1) sequence of the Devonian shallow marine sediments with emergence remnants; 2) one of the most interesting (in Poland) outcrop of the post-Variscan, Devonian-Triassic unconformity; 2) the most illustrative sequence of karst generations since the Devonian to the Quaternary, useful for interregional studies; 3) one of the longest cave systems in Poland; 4) site of unique cryogenic calcite crystals (CCC) occurrence (such crystals are used for palaeo-climatic interpretations).
16	G/PIE/006	Kozi Grzbiet	Variscan, Cenozoic	Quaternary paleontological site connected with the karst deposits
17	G/PIE/008	Kamieniołom Ostrówka - Todowa Grząba	Variscan	Active quarry and other artificial outcrops. One of the best outcrop of the Upper Devonian- Lower Carboniferous boundary with the sequence of marine sediments which illustrates evolution and drowning of the northern margin of the Polish-Moravian Middle-Upper Devonian platform, useful for interregional analyses; the best exposure of Devonian syndepositional karst in Poland. Important paleontological site of Upper Devonian and Lower Carboniferous fossils.



**Fig. B16 Geology in the landscape of Geopark: A – Góra Miedzianka (G/CHE/010); B – Kadzielnia – east wall of the quarry with the view on Zamkowe Hill in Kielce; C – Kadzielnia – central part of the quarry with the Rock of Geologist**

### B.3. DETAILS ON THE INTEREST OF THESE SITES IN TERMS OF THEIR INTERNATIONAL, NATIONAL, REGIONAL OR LOCAL VALUE

**INTEREST:** (Str) Stratigraphy, (Sed) Sedimentology, (Gm) Geomorphology, (Pal) Paleontological, (Tec) Tectonic, (Pet) Petrography, (Min) Mining, (Mir) Mineralogy, (Hyd) Hydrogeology and hydrology, (Ar) Archeology

**MAIN USE:** (C) Scientific, (D) Didactic/educational, (H) Historic-artistic, (S) Sport, (G) Geoturistic, (R) Recreation, (L) Landscape – observation point

**VALUE:** (1) International, (2) National, (3) Regional, (4) Local

**PROTECTION CATEGORY:** (N2000) Nature 2000; (R) Nature reserve; (M) Nature monument; (D) Documentary site; (N-L) Nature – Landscape Complex; (L-P) Landscape Park; (P-L) Protected Landscape Area

NO	CODE	GEOSITE NAME	INTEREST	MAIN USE	VALUE	PROTECTION CATEGORY
1	G/KIE/001	Kadzielnia	Str, Pal, Gm	C, D, S, G	(1)	R
2	G/KIE/002	Ślichowice	Tec, Str, Sed	C, D, G	(2)	R
3	G/KIE/003	Wietrznia - Międzygórz Wschodni	Str, Sed, Pal	C, D, G	(1)	R
4	G/KIE/004	Wietrznia - Międzygórz Środkowy				
5	G/KIE/005	Wietrznia - Wietrznia				
6	G/KIE/006	Biesak-Białogon	Tec, Str, Sed	C, D	(2)	R
7	G/KIE/007	Góra Hałasa	Pet	R, D	(4)	D
8	G/KIE/008	Góra Słoneczna	Str, Sed,	C, R	(2)	D
9	G/KIE/009	Grabina	Str, Sed, Min	C, D, G, R	(3)	N-L
10	G/KIE/010	Dalnia	Str, Sed	C, G, R	(3)	N-L
11	G/KIE/011	Góra Cmentarna	Str, Sed, Pal	C, D, G	(4)	N-P
12	G/KIE/012	Świnia Góra	Pet	R, G, L	(4)	N-P
13	G/KIE/013	Źródło Biruty	Hyd	R, H, G	(4)	N-P
14	G/KIE/014	Góra Brusznia	Min, Gm	S, H, R	(4)	P-L
15	G/KIE/015	Góra Telegraf	Gm,	S, R, G	(4)	L-P
16	G/KIE/016	Gruchawka	Str, Sed	C, R	(4)	N-P
17	G/KIE/017	Zagórze	Str, Sed	R,L	(4)	N-P
18	G/CHE/001	Góra Zamkowa - wschód	Str, Sed, Gm	R, D,L	(4)	L-P
19	G/CHE/002	Góra Zamkowa - zachód	Str, Sed, Pet	C, D, G,L	(3)	L-P
20	G/CHE/003	Góra Rzepka	Tec, Mir, Pet, Min	C,D,G,L	(2)	R
21	G/CHE/004	Piastowskie piaskowce	Str, Sed, Pet	D	(4)	L-P
22	G/CHE/005	Góra Zelejowa - Kamieniołom zachodni	Gm, Tec, Mir, Min	C, D, G, S, L	(2)	R
23	G/CHE/006	Góra Zelejowa - Grań				
24	G/CHE/007	Góra Zelejowa -Szpara				
25	G/CHE/008	Wolica - przekop	Str, Sed,	C	(2)	N-P
26	G/CHE/009	Kamieniołom w Wolicy	Str, Sed, Pal	C, R	(2)	R
27	G/CHE/010	Góra Miedzianka	Gm, Mir, Tec, Min	C, D, G,L	(2)	R, N2000
28	G/CHE/011	Jaskinia Raj	Gm, Ar,	C, D, G,	(1)	R

## B. Geological heritage

29	G/CHE/012	Jaskinia Piekło	Gm, Min	G, R	(4)	M, L-P, N2000
30	G/CHE/013	Wrzosey - odsłonięcia skalne	Gm, Pet	D	(4)	M
31	G/CHE/014	Urwisko skalne i jaskinia na Czerwonej Górze	Gm,	D	(4)	M
32	G/CHE/015	Kamieniołom Zygmuntówka	Str, Sed, Pet, Min	C, D, G	(2)	L-P
33	G/CHE/016	Jaskinia Piekło Milechowskie	Gm, Pet	C, D, G, R	(3)	R
34	G/CHE/017	Góra Bzowica w Mostach	Gm	C	(4)	L-P
35	G/CHE/018	Kamieniołom Góra Leśna	Str, Tec	C	(3)	L-P
36	G/CHE/019	Odsłonięcie piaskowców w Bolminie	Str, Pet	C	(4)	L-P
37	G/CHE/020	Łysa Góra w Korzecku	Gm, Pet	L	(4)	L-P
38	G/CHE/021	Łom wapieni na Laskowej Górze w Polichnie – Stawkach	Str, Sed, Tec	C	(3)	L-P
39	G/CHE/022	Przełom rzeki Hutki	Gm	R	(4)	L-P
40	G/CHE/023	Sosnówka	Gm, Min	D, R	(4)	L-P
41	G/CHE/024	Grząby Bolminskie	Gm	R,L	(4)	L-P, N2000
42	G/CHE/025	Sowie Górki	Str, Sed, Mir	C, R, L	(3)	L-P
43	G/SN/001	Kamieniołom Szewce,	Min, Pet, Str	C, G, R	(4)	L-P, M, N2000
44	G/SN/002	Góra Żakowa	Min, Gm, Tec	C, R	(2)	R, L-P, N2000
45	G/SN/003	Góra Berberysówka	Min,	D	(4)	P-L
46	G/SN/004	Kamieniołom „Zgórsko”	Str	R,L	(4)	N-P
47	G/SN/005	„Kowala” - pomnik przyrody	Str, Sed, Pal, Mir	C, D, G	(1)	M
48	G/SN/006	Kowala - kamieniołom				N-P
49	G/SN/007	Kamieniołom Bolechowice	Str, Sed, Pal, Min	C, D, G,	(2)	N-P
50	G/SN/008	Ołowianka nad Szewcami	Str, Min	D	(4)	L-P
51	G/SN-KIE/009	Przełom rzeki Bobrzy	Gm	D,R	(4)	L-P, N2000
52	G/SN/010	Wąwóz Jaworzniński	Gm	R	(4)	L-P, N2000
53	G/PIE/001	Moczydło	Min, Tec, Mir	C, D	(2)	R, L-P, N2000
54	G/PIE/002	Jaworznia	Gm, Str, Sed, Pet	C, D, G	(1)	R, L-P, N2000
55	G/CHE-PIE/003	Kamieniołom Stokówka	Min, Gm, Mir	G, S, R, L	(3)	L-P, N2000
56	G/CHE-PIE/004	Stokóweczka	Gm, Mir	R	(4)	L-P, N2000
57	G/PIE/005	Skała w Zajączkowie	Gm	C	(4)	L-P, N2000
58	G/PIE/006	Kozi Grzbiet	Pal, Str	C	(2)	M, P-L
59	G/PIE/007	Zagłębienie krasowe Jaworznia Zagórze	Gm	C	(4)	L-P
60	G/PIE/008	Kamieniołom Ostrówka - Todowa Grząba	Str, Sed, Pal	C, D, G	(1)	N-P
61	G/PIE/009	Góra Rębowa w Wincetowie	Str, Pal	C	(4)	N-P
62	G/PIE/010	Kamieniołom w Piekoszowie	Str	C	(4)	N-P
63	G/PIE/011	Góra Jankowa	Gm, Min	C,R	(4)	L-P, N2000
64	G/PIE/012	Góra Machnowica	Gm, Min, Mir	C,R	(4)	L-P
65	G/PIE/013	Besówka i Besóweczka	Str, Pal	C	(3)	L-P, N2000
66	G/PIE/014	Góra Plebańska	Gm, Str	C	(4)	L-P, N2000



67	G/PIE/015	Góra Skałka	Str, Sed,	C	(3)	N-P
68	G/MOR/001	Wzgórze Kapliczne	Gm	C,L	(4)	P-L
69	G/MOR/002	Kamieniołom w Błczy	Str	R	(4)	P-L
70	G/MOR/003	Kamieniołom w Brzezinach	Str	R	(4)	P-L
71	G/MOR/004	Kamieniołom w Dębskiej Woli	Str	R	(4)	P-L
72	G/MOR/005	Źródło w Dębskiej Woli	Hyd	R	(4)	P-L
73	G/MOR/006	Góra Gojść	Gm	R,L	(4)	P-L
74	G/MOR/007	Wola Morawicka	Str, Sed	C	(3)	P-L
75	G/MOR/008	Kamieniołom w Łabędzowie	Str	R	(4)	P-L
76	G/MOR/009	Piaskowce w Radomickim Lesie - Diabelski Kamień	Gm	R	(4)	P-L
77	G/MOR/010	Babia Góra	Gm	R	(4)	P-L
78	G/MOR/011	Kamieniołom w Chałupkach	Str	R	(4)	P-L

## B.4. LISTING AND DESCRIPTION OF OTHER SITES OF NATURAL, CULTURAL AND INTANGIBLE HERITAGE

The complete list of geosites that present natural biotic features and cultural heritage (including industrial history) is listed in the Appendix no 2 (Natural sites) and Appendix no 3 (Cultural sites) of the Application Dossier. The selected, most important such sites that illustrate the key features of natural-cultural heritage as well as the relationships between these elements and geological heritage are shown hereafter. Most these sites co-exist with the geosites mentioned in the part B.2, which additionally emphasises their values as the sites illustrating interrelations between animate and inanimate nature. This is why in the list of natural biotic sites the geosites with valuable elements of animate nature described in the part B.2. are not described hereafter.

### B.4.1. Natural heritage

1) “Milechowy” nature reserve (Nature Site N/CHE/001) – forest nature reserve established in 1978, situated in the western part of the Geopark area. One of the most important site of natural heritage that comprises differentiated forest communities growing on calcareous substrate. Within the reserve the following forest communities occur: mixed broadleaved forest, upland mixed coniferous forest, hornbeam-linden forest, Euro-Siberian steppic woods with oak – the most valuable and most differentiated in floristic terms forest community within the Geopark area (see part A.2.5., point 3). Within the reserve occur also the sites of dry and semi-dry (xerothermic) grasslands and shrubs with numerous species legally protected. Abiotic nature is also very valuable element of the reserve. The reserve area covers hill range of evident structural origin, formed of strong and folded Upper Jurassic limestone-marl complex.

2) “Radomice” nature reserve (Nature Site N/MOR/001) – forest nature reserve of acreage of 27.15 ha, established in 1953 and situated in the eastern part of the Geopark area. It includes valuable forest fragment situated in the picturesque marshy valley located within the Natura 2000 “Dolina Czarnej Nidy” area. The reserve is the only natural site of protection of European yew (*Taxus baccata*) – a species rare and vanishing in Polish forests, although it was frequent and permanent component of forests in the past. This species is considered to be the Neogene relict in the European plant communities. Due to hard and springy wood since the prehistoric time it was used to make bow, especially longbows, as well as arrows, wooden parts of rifles and later also tables and other pieces of furniture. A yew tree grows very slowly, therefore in the 15<sup>th</sup> century Polish king Władysław Jagiełło issued a decree establishing its protection. In folk culture this tree is related to many traditions, religious rites, beliefs and legends. Present-days European yew, as a very rare species is commonly protected in a whole Europe. The Radomice site of this species occurrence is the largest in the whole Małopolska macro-region (covering large part of south Polish area).

3) “Pasma Zgórskie” proposed nature reserve (Nature Site N/SN/002) – proposed forest nature reserve situated in the northern part of the Geopark area, in the highest segment of the Pasma Zgórskie (Zgórsko Hill Range) formed of strong sandstones and quartzitic sandstones of Cambrian. Significant hill range height and acid substrate that comprises an area of the occurrence of original hornbeam-oak forests and floristically abundant mixed coniferous forests.

4) Natura 2000 „Dolina Bobrzy” Area (Nature Site N/KIE/059) – special area of conservation located in the northern part of the Geopark along the section of the Bobrza River valley, where Bobrza River meanders among limestone hills of the western segment of the Pasma Kadzielniańskie (Kadzielnia Hill Range). In this section the river forms picturesque oxbow lakes and other water pools within a floodplain, which is thus convenient place for marshy meadows, riparian forests, and transitional peat-bogs with patches of swampy coniferous forests. The southern slopes of the limestone hills included to this area are occupied by plant communities of dry and semi-dry (xerothermic) grasslands, shrubs as well as hornbeam-oak forest. The water pools of the Bobrza River and old Białogon Lake, situated in the southern part of this area, are among of the most important sites of rare and protected bird species occurrence.

6) Natura 2000 „Dolina Czarnej Nidy” Area (Nature Site N/MOR/003) – special area of conservation located in the eastern part of the Geopark (area of communities: Morawica, Chęciny and Sitkówka-Nowiny). The area covers the section of the Czarna Nida River valley of attractive landscape and interesting nature that include valley floodplain and adjacent areas, also hillslopes. Floristically abundant oxbow lakes, as well as plant communities of marshy shrubs and meadows with some rare species are the most valuable natural elements of this area, however, forest communities, such as riparian forests with patches of hornbeam-oak forests also occur here. The Czarna Nida River valley comprises important wildlife corridor of a national relevance, as well as area of the occurrence of priority habitats and flora and fauna species of European relevance that are listed in the Habitats and Birds Directives (9 priority habitats and 33 bird species).

### B.4.2. Cultural and intangible heritage

The largest concentrations of historical objects that constitute a relevance of the cultural landscape are included into the zones of special conservation. Within the area of the Geopark, there are four such zones: Chęciny, Karczówka, Wzgórze Zamkowe (Palace Hill) in Kielce and Białogon. Ethnographic Park in Tokarnia, which exposes the most valuable monuments of rural and small town buildings and economy of the Świętokrzyskie Mountains region, is a special object corresponding with these zones of historical objects' conservation.

1) Chęciny – ruins of the Medieval king castle and historical part of the town (Cultural Sites: C/CHE/001, C/CHE/002, C/CHE/003, C/CHE/004, C/CHE/005, C/CHE/006, C/CHE/007) – key element of the cultural heritage and – with the surrounding area – the symbol of the “Geoland Świętokrzyski” Geopark. The conservation zone comprises whole urban-landscape (castle and town) system that includes architecture elements built between the 13<sup>th</sup> and 19<sup>th</sup> centuries among which the most important are ruins of the medieval castle constructed in the 13<sup>th</sup> century and partly in the 14<sup>th</sup> and 15<sup>th</sup> centuries. This king castle is built of local types of limestones that form the Castle Hill. This castle as well as historical churches and monastery complexes, Central Square with surrounding constructions, synagogue and some other historical buildings in the town are ones of the most attractive touristic elements within the Geopark area. The Chęciny town has long and substantial traditions of lead-silver mining, as well as marble quarrying and processing.

2) “Karczówka” nature reserve and conservation zone (Cultural Site C/KIE/014) – landscape nature reserve since 1953, which covers 26.55 ha of the Karczówka Hill (320 m a.s.l.) that is formed of Upper Devonian limestone and occupied by beech-pine forest. Apart from the nature reserve, the site includes also the zone of conservation of historical post-Bernardine Baroque church-monastery complex built in the 17<sup>th</sup> century. The Karczówka Hill comprises a unique (in the national scale) site of natural-historical-cultural heritage that perfectly illustrates the relationships between: (a) abiotic elements (outcrops of Devonian limestones bearing calcite and calcite-galena veins), (b) biotic nature (plant communities typical of the calcareous substrate), (c) historical-industrial heritage (numerous remnants of historical ore mining built between Middle Ages and the beginning of the 20<sup>th</sup> century, which illustrate various and unique for the region mining techniques), (d) historical-cultural and architecture heritage (church-monastery complex with unique Saint Barbara statue sculptured in the 17<sup>th</sup> century in one block of galena), as well as intangible heritage (legend about a local miner, Hilary Mala, who found and extracted in his mine three large blocks of galena – each were used for statue sculpturing, one of them is just mentioned Saint Barbara statue). The remnants of historical ore mining and Devonian rock outcrops in the Karczówka Hill are accessible by the educational (“geological-ore-mining”) trail.

3) Palace Hill in Kielce (Cultural Sites: C/KIE/001, C/KIE/002) – apart from the Chęciny, Tokarnia and Karczówka sites, it is the most important complex of cultural heritage of the Geopark, situated in its northern segment, in the central part of Kielce city. The architectural-landscape complex of the Palace Hill is composed of the following objects: Cathedral Basilica (C/KIE/002) dated back to the 12<sup>th</sup> century, Palace of Cracow Bishops built in the 17<sup>th</sup> century (C/KIE/001) and set of constructions owned in the past (and partly nowadays) by the Church. In the past these buildings formed so called

“church town” („urbs Ecclesiae”) that belonged to the Cracow bishops up to the first half of the 18<sup>th</sup> century and was connected with the “burghers’ town”. The geological structure and consequent structural morphology played significant role in the origin and history of the settlement, because the “church town” was founded at the top of highest hill of ancient Kielce town (280 m a.s.l.) formed of Devonian limestones. The lower, marshy areas formed of Upper Devonian and Lower Carboniferous marls and shales were the places of the “burghers’ town” location.

4) Park Etnograficzny w Tokarni (Cultural Site C/CHE/011) – Ethnographic Park in Tokarnia is an element of the Muzeum Wsi Kieleckiej (Museum of the Kielce Village) founded in 1976, which exposes in an area of ca. 65 ha the most valuable examples of wooden village and small town construction built since the 18<sup>th</sup> century. Typical settlement complexes from various sub-regions of the Świętokrzyskie Mountains, as well as regions in its vicinity (Kraków-Częstochowa Upland, Sandomierz Upland, Nida Basin) are reconstructed in the Park area. The lifestyle, agriculture, craft as well as construction style were very often conditioned by geological structure and relief, which is emphasized in the Park by the distinction of the following sectors: the Świętokrzyskie Mountains region, other upland regions and loess areas. The Park is now the only place in the region where one can get acquainted with the architecture and lifestyle of dwellers of villages and small towns in the 18<sup>th</sup>, 19<sup>th</sup> and first half of the 20<sup>th</sup> centuries. Yearly folk ceremonies and other events referring to the local religious, art, culinary and industrial traditions, such as: Bread Day, Agro-touristic Market, Lead Production Day, Summer Reception, Sycamore – at a source of culture, are important aims of the activity of the Park.

5) Podzamcze Chęcińskie (Cultural Site C/CHE/008) – one of the rare remained fortified manor houses from the first half of the 17<sup>th</sup> century. Restored and accessible for public, Baroque complex is composed of the following elements: Chęciny District Head House, ditch, historical farm buildings, triumph gate, and park. Perfectly outcropped Upper Jurassic massive limestones that served as natural substrate of the main house are the principal element of the geological; heritage of this site. The stones used for the construction of the buildings, which represent various types of local rocks (e.g. “Chęciny marbles”) are also the elements of this heritage. The renovated manor house with new, modern buildings constructed in its vicinity, including Centrum Nauki Leonarda da Vinci (Leonardo da Vinci Scientific Centre), now constitute the Regionalne Centrum Naukowo-Technologiczne (Regional Scientific-Technological Centre), which functions as a scientific-business centre and touristic attraction within the Geopark area.

6) Białogon (Cultural Site C/KIE/015) – present-day industrial quarter of Kielce town (separated settlement in the past), in which historical industrial complex of the Zakłady Białogońskie (Białogon Factory, called also Alexander Metallurgy Factory) and associated with it housing development from the 19<sup>th</sup> century and wooden church are situated. This site (factory and settlement) is one of the key evidence of industrial traditions of the region, connected with the mining centre developed by Cracow bishops in the 16<sup>th</sup>-17<sup>th</sup> centuries and then with the Staropolski Okręg Przemysłowy (Ancient Polish Industrial Centre) existing in the 19<sup>th</sup> and 20<sup>th</sup> centuries. Since the beginning of its history Białogon was a place of copper and lead factory where ores extracted in the Kielce and Chęciny areas were processed. The remnants of Alexander metallurgy factory from the first half of the 19<sup>th</sup> century, in which copper tools and silver coins were produced, is the oldest currently existed industrial construction in this site. In the middle of the 19<sup>th</sup> century the Białogon factory was one of the largest such companies in the Polish Kingdom.

## C. GEOCONSERVATION



### C1. CURRENT OR POTENTIAL PRESSURE ON THE PROPOSED GEOPARK

The protected sites within the area of the “Geoland Świętokrzyski” Geopark exist in the vicinity of urbanised and industrialised areas. As a consequence, the principal factors affecting the Geopark area are often environmental and landscape (including cultural landscape) hazards that are generated by human impact. Apart from anthropogenic pressure, natural factors, such as geological outcrop overgrowing by plants, should be mentioned here.

The principal hazardous factors are defined in the Protection Plan of the Chęciny-Kielce Landscape Park as well as in similar plans or protection obligations for smaller protection categories (e.g, nature reserves) which cover, in total,



almost 70% Geopark area. The list of principal and existing and potential hazards and the methods of their elimination or reduction is given in Table C1. Most these hazards have been successively reduced or eliminated.

**Table C1 Principal factors affecting the natural environment and landscape within the area of the “Geoland Świętokrzyski” Geopark and methods of their elimination/reduction**

O.N	IDENTIFICATION OF HAZARDS: I – EXISTING HAZARDS, P – POTENTIAL HAZARDS	METHODS OF THE ELIMINATION OR REDUCTION OF EXISTING OR POTENTIAL HAZARDS AND THEIR EFFECTS
1.	Gradual, successive overgrowing of scientifically valuable geological outcrops as well as protected rocky ridges and cliffs (I/P)	Removing of plant covers from the outcrops, and rock forms. Monitoring of the state of these geosites.
2.	Building development (urbanisation and industrialisation) that penetrate valuable geosites or other (cultural, landscape) sites (I/P)	Limitation and restriction of building development in the areas situated next to the geosites and other valuable sites
3.	Destruction of roads, trails, paths and trails by quads, motorcycles, bikes that accelerates erosion and contributes to plant deterioration (I/P)	Recommendation of some roads for such activity, and prohibition it in other areas where this ban will be strictly observed and its breaks will be punished
4.	Water and aeolian erosion generating soil destruction, changes in relief and, in this way, contributing to the degradation of the areas (I)	Adaptation of area management to the environmental conditions, including: afforestation or keeping the grassland/meadow communities in the areas easily suffered erosion
5.	Contamination of soils and a menace of groundwater contamination caused by soil fertilisation and a use of pesticides (I)	Rational use of fertilizers and pesticides, promotion of ecological agriculture and agri-environmental packages
6.	Degradation of organic soils due to their burying and building development (I/P)	Reduction of an investment.
7.	Illegal storing waste (I/P)	Liquidation of existing illegal rubbish dumps; ecological education
8.	Lowering of groundwater table and drying of swamps, bogs and marshy meadows due to the improper water management, high water take off in individual intakes and the development of artificial surface drainage systems (I/P)	Building or restoration of damming installations and their proper management; development of public, communal systems of water supply and synchronous liquidation of individual intakes
9.	Groundwater contamination due to the sewage and contaminated (in cultivated and urban areas) surface water free supply to the ground (I/P)	Regulation of water supply and sewerage system within the park area and its vicinity; arrangement of buffer zones along the river/stream banks and introduction of plant buffer zones; reduction of the use of fertilizers and pesticides
10.	Littering of the Park area due to the public use, e.g. in sites of tourist concentration and recreation (I/P)	Increasing of efficiency of rubbish management (e.g. larger numbers of rubbish containers); ecological education
11.	Appearance of disharmonic elements in the natural or cultural landscapes, which intrude panorama axes of natural or historic-cultural complexes and their expositional values (I/P)	Accommodation of the elements of protection plans in local area development plans
12.	Expansion of architectonically alien, styleless and unsightly housing and recreational or service constructions (I/P)	Application of regional construction standards in local area development plans and other planning decisions; raising public awareness in a field of historical monument protection through their popularisation and education
13.	Increasing road traffic during summer seasons close to the touristic sites, and insufficient number of parking places (I/P)	Arrangement of sufficient number of parking places and simultaneous clear definition of zones of forbidden parking
14.	Extraction of mineral resources within the Geopark area (P)	The extraction of mineral deposits must be preconditioned by the assessment of natural values of areas of their occurrence
15.	Quarrying that generates dust emission, increase in concentration of exhaust fumes and/or noise within the Geopark area (I/P)	Water spraying of quarries and equipment processing mineral material in order to decreasing dust emission
16.	Soil drying due to the groundwater lowering in the vicinity of active quarries or in valleys with fast lowering streambeds (I/P)	Reduction of water outflow through implementation of proper cultivation system as well as damming bars
17.	Urban pressure in the Geopark areas causing further fragmentation of open areas, decrease in biodiversity and increase in contamination load within the Geopark area (I/P)	Implementation of geological, natural and cultural heritage protection needs in local area development plans; rational development of settlement units within the Geopark area; arrangement of environmental protection structures

## C2. CURRENT STATUS IN TERMS OF PROTECTION OF GEOLOGICAL SITES WITHIN THE PROPOSED GEOPARK

Within the Geopark area various legal protection categories occur that provide preservation of animate and inanimate nature elements, areas and sites. The total legally protected acreage within the Geopark ranges 381.87 km<sup>2</sup>, which yields 72.6% of its area. The most valuable geosites as well as elements of cultural landscape, which comprise extraordinary combination of abiotic and biotic nature as well as cultural heritage, are protected by various forms of legal conservation. Nature reserve is the most restrictive category of protection of a state rank, which is applied in the Geopark. Within its area 15 nature reserves were established, 12 of them are inanimate nature (geological) reserves and in 3 others important geological elements are also protected. Complete list of nature reserves is placed in the part I point 2.2 of the Annex to the Self Evaluation Form. It should be emphasised that the activeness connected with the protection of the geosites within the nature reserves are related to three key aspects:

- Legal: creation of proper recommendations concerning a protection of abiotic and biotic nature in protection plans and protection obligations for these nature reserves;
- practical: protection and conservation of natural valuable sites, as well as construction of touristic infrastructure in the way providing the reduction of human pressure on the most relevant elements of these reserves;
- Educational: education of local societies in a field of needs and methods of protection of such sites.

During the last two years the communities participating in the Geopark project and partner institutions have performed many such activities, among which the conservation of the geosites and construction of infrastructure have been the most important. Large part of the Geopark area (ca. 30% of total acreage) is protected as the Chęciny-Kielce Landscape Park of an acreage of 20 505 ha (Fig.C1). Landscape park is a less restrictive (than a nature reserve) protection category and differs from a nature reserve also with much larger area, According to the Polish Nature Protection Act landscape park protects an area due to its natural, historical and cultural relevance, as well as landscape values in order to their conservation and popularisation in terms of sustainable development. The Chęciny-Kielce Landscape Park is the first landscape park in Poland, in which the extraordinary geological heritage and its relationships with biotic elements and historical-cultural heritage is the principal matter of the protection. Due to the unique values of abiotic and biotic nature, as well as historical-cultural heritage, which, combined, constitute the natural-cultural landscape that distinguishes this area from the neighbouring areas, the Chęciny-Kielce Landscape Park comprises the crucial, key part of the „Geoland Świętokrzyski” Geopark.

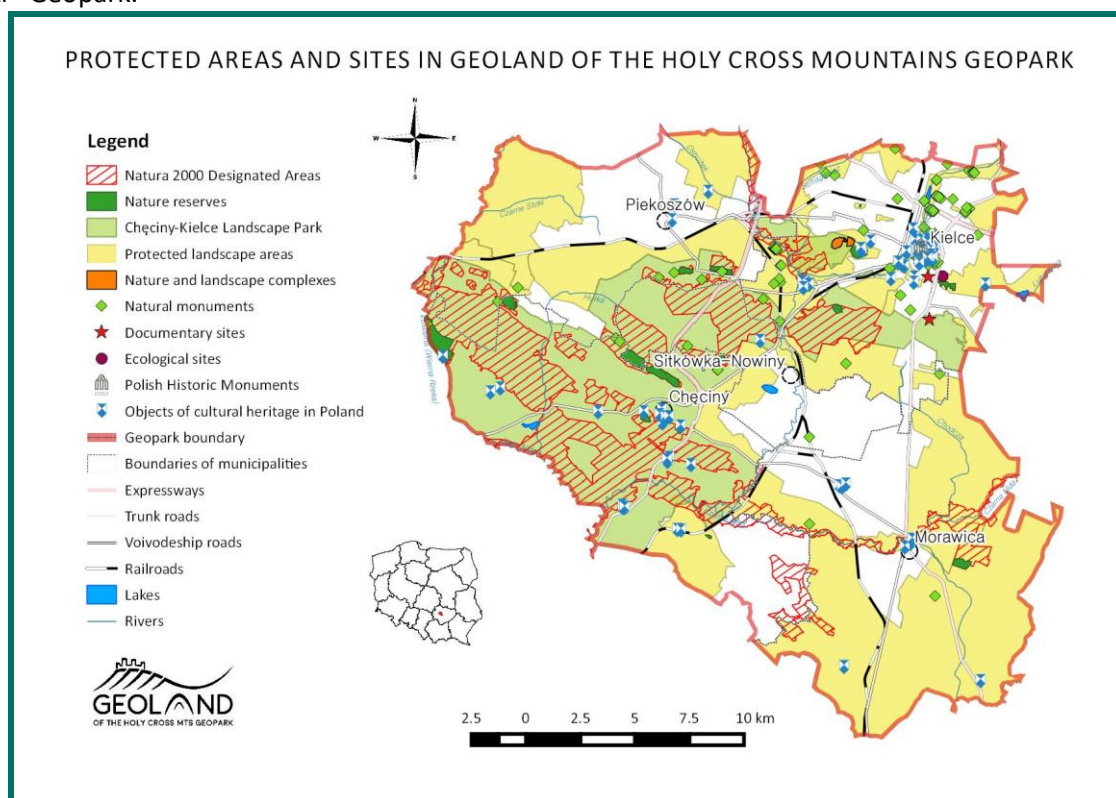


Fig. C1 Protected areas and sites in the Geoland of the Holy Cross Mountains area



In a scope of general spatial (not restrictive) protection, the conservation provided by the Chęciny-Kielce Landscape Park is supplemented by the areas of landscape protection which covers 43% of the Geopark acreage. In a context of protection of the geological heritage and cultural landscape the most important such areas are: Kielce Landscape Protection Area) and Chęciny-Kielce Landscape Protection Area), which both function as buffer zone of the Chęciny-Kielce Landscape Park). Apart from the mentioned above legal conservation categories the following other ones have been established within the Geopark area: nature monuments, documentary sites, nature-landscape complexes and ecological sites. The collective table of these forms of protections is presented below (Tab C2):

**Table C2 Other than landscape parks, areas of landscape protection and nature reserves forms of a legal nature protection which have been established within the „Geoland Świętokrzyski” Geopark**

CONSERVATION CATEGORY	SCOPE AND SPECIFICITY OF PROTECTION ACCORDING TO THE POLISH NATURE PROTECTION ACT	NUMBER OF PROTECTION FORMS WITHIN THE GEOPARK AREA
<b>Nature monument</b>	Single animate or inanimate nature elements or their concentrations of particular natural, scientific, cultural or landscape values, and distinguished from other elements with individual features	66 nature monuments (including 13 ones protecting inanimate sites)
<b>Documentary site</b>	Not visible on the ground surface or possible to distinguish, important in scientific and educational terms, sites of the occurrence of geological formations, concentrations of fossils or mineral aggregates, including caves and their sediments and paleontological sites	2 documentary sites in the areas of abandoned quarries, which function as geosites
<b>Ecological site</b>	Remnants of ecosystems of an importance for biodiversity which still deserve protection, such as lakes and natural water pools, swamps, bogs, dunes, etc.	1 ecological site „Wietrznia”
<b>Nature-landscape complex</b>	Fragments of natural (original) and cultural landscape which deserve a protection due to their aesthetic values	1 nature-landscape complex “Dálnia-Grabina

All mentioned above conservation categories are established by the Polish Nature Protection Act. In the context of directives of the European Union (Bird and Habitat Directives) Natura 2000 areas comprise a distinct category of protection. Natura 2000 is a project of network of nature protection areas within the territory of whole the European Union. The objective of this project is conservation of particular types of habitats and species which are considered to be valuable and threatened in European scale.

The Geopark area overlap with fragments of 7 Natura 2000 areas, among which the Natura 2000 “Chęciny-Kielce Hills” area, which covers 13.28% of the Geopark area, is the most important for the protection and conservation of its geological heritage. Apart from this one, the Natura 2000 “Czarna Nida River Valley” and „Bobrza River Valley” areas, which include habitats with rare and protected species of the European relevance, are of significant importance for the Geopark. These Natura 2000 areas have legally established protection plans in which are laws referred to the protection of geological heritage.

### C3. DATA ON THE MANAGMENT AND MAINTENANCE OF ALL HERITAGE SITES (GEOLOGICAL AND NON-GEOLOGICAL)

The responsibility for the protection and conservation of geological sites and non-geological (natural and cultural) sites within the Geopark area is directly referred to the bodies/institutions which administrate the particular area or object (including possession and management rights) as well as to state administration units, which supervise the activity mentioned above in the case of legal protection of the objects or areas (Tab C3).

**Table C3 Schedule of management and conservation of geoheritage sites as well as other sites legally protected within the Geopark area**

<b>SITES CONNECTED WITH THE NATURAL HERITAGE (ANIMATE AND INANIMATE NATURE) LEGALLY PROTECTED</b>	Management and conservation by owner of the land: communities (members of the Geopark association), State Forests or private entities (companies, village associations, private persons)
	Above mentioned activities are supervised by public administrative unit – the Regional Directorate for Environmental Protection managed by the Regional Director for Environmental Protection
<b>SITES CONNECTED WITH THE CULTURAL HERITAGE, PROTECTED AS HISTORICAL MONUMENTS</b>	Management and maintenance by owner of the land: communities (members of the Geopark association), national institutions, non-governmental organisations (NGO) or private persons
	Above mentioned activities are supervised by the Provincial Office of Monument Preservation

The geosites connected with objects protected by law are very often situated in the areas managed by local, community offices. The communities (members of the organisation that manages “Geoland Świętokrzyski” Geopark) in a frame of their statutory obligation ought to conserve, protect and to organise touristic accessibility of such sites. The cleaning, keeping order and construction of necessary touristic infrastructure are included into this activity.

Sites of natural heritage (animate and inanimate) situated within forested areas managed by the State Forests) are conserved by the Forest Districts responsible for their areas. Most of forests within the Geopark area are managed by the Kielce Forest District office; however, the south-eastern part of the forested area belongs to the Daleszyce Forest District. Apart from a forest management, the State Forest administration is active in fields of nature protection and ecological education – the education centre is associated with the Kielce Forest District. The Geopark management plans a close cooperation with the offices of these forest districts and to sign letters of intends with them in 2017-2018.

Regional Directorate for Environmental Protection in Kielce, which cooperates with the Geopark management, is responsible for the realization of the environmental protection policy in a scope of nature conservation management, including e.g. the Natura 2000 areas protection and the supervision of activeness connected with maintenance and conservation of legally protected geosites. It should be emphasised that the communities constituting the “Geoland Świętokrzyski” Geoland cooperate with the Regional Directorate for Environmental Protection in order to the protection of natural heritage, in particular, geoheritage.

The Complex of the Świętokrzyskie and Nadnidziańskie Landscape Parks), which is Geopark partner organisation, plays a significant role in the system of nature protection. Its activity concentrates in the conservation and popularisation of natural, historical and cultural values in the area of landscape parks, including the Chęciny-Kielce Landscape Park. Among the obligations of landscape park administration and service is e.g. the identification and verification of existing and potential, outer and inner hazards, and conclusive activity in order to the elimination or reduction of these hazards and their effects, as well as other operations so as to improve a functioning and conservation of landscape parks. Communities constituting the “Geoland Świętokrzyski” Geopark cooperate with the Complex of the Świętokrzyskie and Nadnidziańskie Landscape Parks both in geoheritage protection and ecological education.

Within the area of the “Geoland Świętokrzyski” Geopark, there are situated sites of historical-cultural heritage protected by law due to the Polish Historical Monuments’ Protection and Conservation Act. These sites/objects are recorded in the List of Historical Monuments kept by the Provincial Office of Monument Preservation) and are strictly protected and supervised (in the investment activities) independently on a property state (national or private) of a site.

## D. ECONOMIC ACTIVITY & BUSINESS PLAN



### D1. ECONOMIC ACTIVITY IN THE PROPOSED GEOPARK

The analyzes prepared for the development strategy of the communes belonging to the Geopark "Geoland Świętokrzyski" show the different character of the geopark area due to their economic activity and economic structure. The Kielce urban municipality, which is the largest center in the Geopark area, presents features of an urban economy with a low 2% share of agriculture in the working structure. In the case of other communes of the Geopark (Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów) many areas still have agricultural land status, but actually agricultural production is maintained by few people only. This is due to the employment structure of the population in which the services and industry sectors dominate. Municipalities of the Geopark command mineral resources where mining is a long tradition at this place. This is not only an important local heritage, but a resource that still largely determines the nature of the area. There are mines and cooperating with them companies that increase the income of the communes and give employment to many residents. In the context of Geopark's development, tourism-related services are important. High tourist values and attractive natural and cultural areas provide great potential for the development of sustainable forms of tourism (including geo-tourism). Thanks to many investment and promotional projects, as well as pro-social initiatives implemented in the last 10 years by the Geopark's Communes, tourism (including geo-tourism) is becoming increasingly prominent in local economic development. This is reflected in the increase in the number of companies engaged in activities related to accommodation and catering, including agro-tourism farms, in recent years. Still, the share of tourism




in the overall employment structure is relatively low. Despite the above-mentioned fact, it is a sector of great development potential. Besides, it has an important role for the local community, due to the creation of new jobs and the promotion of sustainable development based on local resources of geological, natural and cultural heritage.

In the perspective of Geopark's activity there is cooperation in the field with existing institutions and non-governmental organizations, activities aimed at stimulating local tourism-related business. Geopark's business in this area can be one of the solutions to the problem of the low level of social entrepreneurship development in Geopark.

## D2. EXISTING AND PLANNED FACILITIES FOR THE PROPOSED GEOPARK

### Main centers for geological education.

In the area of Geopark "Geoland Świętokrzyski" there are many places attractive to tourists, where people can gain knowledge about the history, geology or cultural heritage of the Świętokrzyskie region. The strong point of Geopark is the location of its large educational centers, museums and smaller centers directly linked to education and geological tourism (Tab D1.).

FACILITIES RELATED TO GEOLOGICAL EDUCATION	KEY FEATURES AND DESCRIPTION OF THE FACILITY
 <p data-bbox="156 1088 582 1122">GEO-EDUCATION CENTER IN KIELCE</p>	<ul style="list-style-type: none"> <li>• Main Information and Promotion Center, headquarter of Geoland Świętokrzyski</li> <li>• The object along with the neighbouring geological reserve "Wietrznia" is the main centre for geological education of children and teenagers in Geopark.</li> <li>• Within the facility there are: permanent exhibition presenting geological heritage of the region; educational rooms hosting the Geologic Lover Club; temporary exhibition hall; conference room; administrative offices and tourist information of the Geopark</li> </ul>
 <p data-bbox="143 1487 600 1552">EUROPEAN CENTRE FOR GEOLOGICAL EDUCATION IN CHĘCINY</p>	<ul style="list-style-type: none"> <li>• Modern scientific research center and conference center managed by the Faculty of Geology, University of Warsaw</li> <li>• Facility aimed at geological education at the academic level and support of large conferences related to Earth sciences and associated fields.</li> <li>• Along with the neighbouring geological reserve Rzepka Mountain and surrounding areas of Chęciny, the facility is one of the best research and education campuses for scientists and students of geological courses on a national level.</li> <li>• The available laboratory database provides the opportunity to conduct professional geological surveys and to educate high-level professionals in both geology and related sciences.</li> </ul>
 <p data-bbox="65 1904 678 2004">NATIONAL GEOLOGICAL INSTITUTE - NATIONAL RESEARCH INSTITUTE, ŚWIĘTOKRZYSKI BRANCH BY NAME OF JAN CZARNOCKI IN KIELCE</p>	<ul style="list-style-type: none"> <li>• Regional Department (Świętokrzyski) of the State Geological Institute - State Research Institute conducting statutory service and scientific activity connected with all specializations of geology as well as popularization activities related to geological education and geo-tourism. Within the facility there are:</li> <li>• Geological Museum presenting a scientific exhibition on the geology of the Świętokrzyskie Region, available for organized groups and individual tourists</li> <li>• A lapidarium showing the characteristic rocks of the region</li> <li>• Świętokrzyskie 'Preparatory of Fossils' called "Pod Tetrapodem", with laboratory equipment and laboratories for paleontological research</li> <li>• Geological Reading Room</li> </ul>





MUSEUM CHAMBER OF OREL MINING IN  
MIEDZIANKA (CHĘCINY COMMUNE)

- Museum object located at the geological reserve "Miedzianka" Mountain, the most important place connected with the historical copper mining in Geopark
- Exposition presenting the geological structure of Miedzianka and the history of copper mining in this site
- Exposition of characteristic rocks, fossils and minerals from the Świętokrzyskie region
- Exposition of mining tools and other items related to ore and rock mining
- The site organizes educational tours and geo-tourism events referring to the geological and mining heritage of Miedzianka



NEANDERTHAL CENTRE AT PARADISE CAV

- First Neanderthal Center in Poland located at one of the most important tourist sites in Geopark - Paradise Cave, where traces of Neanderthal camps were found 50,000 years ago
- Popular science exhibition was established in cooperation with the Association of Polish Archeologists and the National Archaeological Museum in Warsaw
- Exhibit available for tourists for both organized and individual tourists, equipped with an audio-guide system for visiting in English and German

#### Other museums, educational centers and tourist facilities (Tab D2)

Geopark also has facilities in other fields of science and culture aimed at displaying the natural, cultural and industrial heritage as well as the traditions and customs of the local community. The National Museum in Kielce and the Kielce Rural Museum (including Ethnographic Park in Tokarnia and Laszczyków Mansion in Kielce) are of the greatest importance. Both institutions play a key role in preserving and presenting the cultural heritage of the Świętokrzyskie region, while also providing an important educational and tourist function. It is worth noting that the National Museum in Kielce also has an archaeological exhibition. There are two important educational centers: the Leonardo da Vinci Science Center in Podzamcze Chęciny and the Energetic Science Center in Kielce which perform functions connected with the popularization of non-geological studies.

Table D2 List of key objects in this category below

LP.	NAME	MUNICIPALITY	TOPICS
1	National Museum in Kielce	KIELCE	history, culture
2	Kielce Rural Museum (includes Ethnographic Park in Tokarnia and Laszczyków Mansion in Kielce)	KIELCE,	history, culture
3	the Museum of Toys and Play in Kielce	KIELCE	history, traditions, customs
4	Stefan Żeromski School Museum in Kielce	KIELCE	history, literature
5	Kielce History Museum	KIELCE	history
6	Museum of Dialogue of Cultures in Kielce	KIELCE	culture
7	Diocesan Museum in Kielce	KIELCE	religion
8	Centre of Patriotic and Civic Reflection	KIELCE	history
9	Energy Science Center in Kielce	KIELCE	entertainment
10	Leonardo da Vinci Science Center	CHĘCINY	science, man, entertainment
11	Starost Court in Podzamcze	CHĘCINY	history
12	Ethnographic Park in Tokarnia	CHĘCINY	traditions, entertainment,
13	The Center of Pottery Tradition in Chałupki	MORAWICA	tradition, customs

### Tourist information centers

The main point of information and at the same time Geopark's office of "Geoland Świętokrzyski" is The Geo-Education Centre in Kielce. Basic information about the geopark, its attractions, monuments, accommodation and catering can be obtained in the above mentioned place. In addition there are also publications, leaflets and maps published by "Geoland Świętokrzyski".

There is also a network of certified tourist information centers in the geopark, with the Regional Tourist Information Centre (RCIT) which provides brochures concerning the region and necessary information (also in English, German, and French). An important role in the network of tourist information centers is also the Chęciny Tourist and Historical Information Centre located in a historic 16th century tenement building in Chęciny. The weak point of Geopark, which will be refined in the near future, is the lack of information and brochures about the Geopark in the mentioned tourist information points. The Geopark management intends to solve the problem by cooperating with the Regional



**Fig. D1 Geological and mining trails in the northern part of the Geopark**

Tourist Organization of the Świętokrzyskie Voivodeship which manages a network of tourist information points and implementing a system of identification and information (folders, informers), and which would also be included in the mentioned points. Additional information about the Geopark is planned to be included in Geopark's "Geoland Świętokrzyski" municipal and district offices.

### Marked road routes, hiking, biking and educational trails

Marked road routes, hiking, biking and educational trails of the Geopark area characterizes a well-developed network of trails and paths for hiking, road, bicycle and special forms of tourism (horse riding or cross-country skiing).

In the Geopark area there are the following types of hiking trails connecting the most important objects related to geological, natural and cultural heritage (Tab D3).

**Table D3 Marked road routes, hiking, biking and educational trails.**

TYPE OF HIKING TRAIL	CHARACTERISTICS
<b>MARKED TOURIST TRAILS FOR WALKING</b>	7 marked tourist trails administered by the partner organization Świętokrzyski Branch of the Polish Tourist and Sightseeing Association; These routes provide the most representative and protected geo-stations in Geopark
<b>MARKED WALKING TRAILS</b>	4 walking trails located in the northern part of the Geopark in the municipality of Kielce (including the red city route)
<b>DIDACTIC/THEMATIC TRAILS</b>	<ul style="list-style-type: none"> <li>- geological and mining trails located in the northern part of the Geopark and providing valuable objects of historical ore mining and architecture located in the Karczówka Mountain Reserve and the Dalnia-Grabina Natural-Landscape Complex</li> <li>- educational trail in Radomice Nature Reserve</li> <li>- Monk Path in Chęciny providing valuable cultural heritage sites</li> <li>- 3 natural and forest paths administered by the partner organization - Kielce Forest District</li> <li>- geological paths in geological reserves in the municipality of Kielce: Wietrznia, Kadzielnia and Ślichowice</li> </ul>
<b>CYCLE PATHS AND TRAILS</b>	Cycle paths and trails within the Geopark, there are fragments of three long-distance cycling trails: Green Velo, the Defense Architecture Trail, and the Cycle-Pilgrimage Trail, "Power Locations"; The Green Velo Trail is the longest (over 2000 km), coherently marked bicycle route in Poland. It runs mainly on asphalt public roads with low traffic density, through the area of five voivodeships located in the eastern part of the country.
<b>ROADS</b>	<ul style="list-style-type: none"> <li>- west section of the "Świętokrzyski Archeological Trail" combining representative objects of geological and cultural heritage with special signs and descriptive tables.</li> <li>- the part of Świętokrzyski Wooden Architecture Trail leading through unique cultural facilities (churches, chapels, manor houses) with preserved wooden architecture.</li> </ul> <p>Both listed routes as linear tourist products have separate web pages with maps and descriptions of individual facilities.</p>
<b>EQUESTRIAN TOURISM TRAILS (HORSE RIDING)</b>	Świętokrzyski Mountain Equestrian tourism Trail PTTK - There is a final section of the trail in Geopark, an integral part of which is the MAAG Recreation and Hippo therapy Centre in Kielce

The administration of key road, bicycle and pedestrian routes is under the responsibility of partner organizations: the Regional Tourist Organization of Świętokrzyskie Province and the Świętokrzyskie Branch of PTTK. The above mentioned organizations also carry out key activities related to the promotion of the entire region (including Geopark) at the national and international level.

The weak point of the Geopark, which will be gradually improved at a later stage of activity of the Association, "Geoland Świętokrzyski" is almost lack of educational tables in other than Polish version.

### Accommodation and catering

There is a large number of accommodation and catering facilities in the Geopark area, and their location is uneven. Relatively best-developed accommodation and gastronomy is associated with communes: Kielce and Chęciny. This is due to the high concentration of tourist attractions and good transport accessibility, which generates large tourist traffic. In other communes the accommodation and gastronomic base is mainly connected with agro-tourism farms and a few inns.

Standard of the facilities and their prices are adjusted to different requirements of tourists. In the area of Geopark "Geoland Świętokrzyski" the gastronomic base is quite well developed. From the point of view of local culinary traditions, agro-tourism farms and special places serve traditional dishes associated with Polish cuisine (including Świętokrzyskie cuisine) Kuźnia Smaków restaurant at the Ethnographic Park in Tokarnia, the 'Okraglak' restaurant in Korzecko, the 'Poziom Smaku in Chęciny' and the 'Zalewajka' restaurant in Kielce. An important role in promoting local traditions and culinary products is the Świętokrzyska Kuźnia Smaków, which also includes facilities and producers of traditional products located in the area of the Geopark.

### Major events inspired by geological, natural and cultural heritage

There are a number of thematic events inspired by the local geological, natural and cultural heritage in the Geopark area. Since the cooperation in 2015, Geopark's communes have organized a number of events related to geological-mining issues. The most important ones include: Kielce Geological Picnics (Fig. D3) (Kielce Commune - Geopark's main information centre - Geo-Education Centre), Melting Lead event in Tokarnia (Chęciny Municipality), Mining Picnic in Miedzianka (Fig. D4) (Chęciny Commune), Mining Picnic in Nowiny (Sitkówka-Nowiny commune). The Open Days of the Mine "Nordkalk Miedzianka", which took place on 2 October 2017 on the occasion of the European Minerals Day, were an important initiative in the context of the promotion of the geological heritage and the cooperation of the mining industry with the local government and the local community. The visiting of the mine was connected with a popular science lecture organized by the Piekoszów Commune and the Nordkalk Company in cooperation with the 'Phacops' association.

In the Geopark area there are also events related to the broadly understood cultural heritage (including culinary). The most attractive offer of this type of events is the Ethnographic Park in Tokarnia and the Royal Castle in Chęciny (both located in the Chęciny Commune). In the area of the open-air museum there are already mentioned Melting Lead (Fig. D2) (the event is accompanied by folk handicrafts and regional dishes). In the year 2017 the XXV edition of this event took place. Since the launch of the geopark initiative in 2015, the following events have taken place: I Festival of 'Świętokrzyskie Flavors' (an event promoting local culinary traditions), Agro-tourism Fair (an event promoting local community initiatives related to the creation of tourist offer), Świętokrzyski Fair, Bread Festival, Film Open-air museum, Welcome Summer or Jawor Festival- at the source of culture.



Fig. D2 Melting Lead in Tokarnia



Fig. D3 Kielce Geological Picnics



Fig. D4 Mining Picnic in Miedzianka

Major cultural events organized on a regular basis in the communes of Kielce, Chęciny and Morawica are of great importance. The most significant of these are: Kielce (Kielce Commune), Chęciny - Medieval Chęciny (Chęciny Commune),



the Night in the Castle (Chęciny Commune), Jewish Culture Festival (Chęciny Commune), Chałupkowe Garnczyki (Morawica Commune).

### Planned facilities for the proposed Geopark

The planned activities of the Geopark "Geoland Świętokrzyski" related to the improvement of tourist accessibility of the Geopark will be focused on two aspects: (1) modernization of the existing and construction of new tourist infrastructure, including adaptation of infrastructure to foreign tourists (including the development of geo-tourism boards, brochures and tourist guidebooks of Geopark in English language); (2) improving the visual identity of the Geopark in the field (design and implementation of the visual identification system, including the setting of information panels in the tourist information points and the main tourist attractions).

In the scope of modernization of the existing and construction of new tourist infrastructure, two major investment projects have been launched this year, which will significantly contribute to improving the accessibility Geopark tourism: and attractiveness of the Project "Extension of educational infrastructure in valuable natural areas administered by Geopark Kielce" (Geopark Kielce is a unit of the Kielce Commune managing the mining areas within the city of Kielce; as part of the Kielce Commune, it is part of the Geopark "Geoland Świętokrzyski"); The project is planned to include modernization of the permanent exhibition and construction of the Geological Experimental Garden in the Geo-Education Center in Kielce as well as the development of the educational infrastructure in the geo-stations of Kadzielnia and EasternCross.

- Project for the establishment of the Old Polish Mining Center in Miedzianka (Chęciny Commune); the project will create a geo-touristic facility of a supra-regional level including an underground tourist route in the former copper mining tunnels and modernization of the Ore Mining Chamber presenting the geological structure and the history of mining in the Miedzianka deposit.

In addition, as part of Geopark's activities, special education programmes for schools and geo-tourism related to the organization of events, picnics and field activities related to education and geological tourism are planned.

## D3. ANALYSIS OF GEO-TOURISM POTENTIAL OF THE PROPOSED GEOPARK

From the point of view of tourists, Geopark Geoland Świętokrzyski has a great potential, which is evidenced by the growing number of visitors to this region. Tourism potential is based primarily on the natural values and cultural heritage of the region, so the development of tourism must respect these values. The Świętokrzyskie Region (including the Geopark area) is a region of varied terrain and rich geological values - it is one of the most ecologically clean regions of Poland. It is also characterized by a great activity of traditional farms and agro-tourism farms, as well as a high concentration of traditional industries related to the extraction and processing of mineral resources.

At the same time, the region has a poorly developed accommodation, tourist and road infrastructure. Inadequate promotional, informative and educational activities in terms of tourist attractions and Geopark activities are also insufficient. As a result, there is a low public awareness about the natural and cultural values of the region.

The Geopark does not have a strictly defined customers - it attracts tourists of all ages, with different backgrounds and different economic status. Emphasis is also placed on providing attractions for disabled and seniors. The majority of visitors to the Geopark are national tourists. Entering the UNESCO Global Geopark Network will be an opportunity for the entire region to increase the popularity among foreign tourists.

**Table D4 Analysis of tourism potential**

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>- A large number of geo-stations</li> <li>- Clean Environment</li> <li>- Large number of hiking trails</li> <li>- Bicycle trails (Greenvelo)</li> <li>- A large number of cultural facilities and museums</li> <li>- A large number of historic buildings</li> <li>- Large number of agro-tourism farms</li> <li>- Rich cultural heritage</li> <li>- Cultivating traditions by the local population (numerous folk groups, sculptors, painters, poets)</li> <li>- Cyclical events inspired by cultural heritage (eg Harvest Festival)</li> </ul>	<ul style="list-style-type: none"> <li>- Insufficient identification of the Geopark in the territory</li> <li>- Inadequate local community initiatives (including business initiatives) inspired by geological heritage</li> <li>- Insufficiently developed accommodation</li> <li>- Poor communication infrastructure</li> <li>- Inadequate and inconsistent signs of tourist attractions and geo-stations</li> <li>- Inadequate promotion of tourist attractions and geo-stations in the media and among the local community</li> <li>- Not enough publications, folders, leaflets, especially in foreign languages</li> </ul>

<ul style="list-style-type: none"> <li>- Organic food production</li> <li>- Cyclical events inspired by geological heritage (Kielce Geological Picnic, Melting Lead event in Tokarnia, Mining Picnics in Miedzianka)</li> <li>- Running classes, geo-educational workshops and outdoor workshops (Geo-Education Center in Kielce, European Center for Geological Education in Chęciny)</li> <li>- Activity of the Geologic Lovers Club in the Geo-Education Center in Kielce</li> </ul>	<ul style="list-style-type: none"> <li>- Poor cooperation between tourist institutions in Geopark</li> </ul>
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> <li>- Development of organic farming and eco-tourism</li> <li>- Better signs of tourist attractions</li> <li>- Increasing the amount of information materials, especially in foreign languages</li> <li>- Developing and implementing an effective promotional campaign targeting potential tourists and investors</li> <li>- Development of local product sales network</li> <li>- Closer cooperation between tourist institutions Geopark - Geopark's cooperation with travel agencies</li> </ul>	<ul style="list-style-type: none"> <li>- Insufficient funds for renovation and protection of monuments</li> <li>- Lack of funds to modernize museum exhibitions in order to increase their accessibility and interactivity</li> <li>- Lack of will to cooperate with tourist agencies and travel agencies</li> <li>- Lack of funds for a coherent system of tourist attractions</li> </ul>

## D4. OVERVIEW AND POLICIES FOR THE SUSTAINABLE DEVELOPMENT OF GEO-TOURISM, GEO-EDUCATION AND GEO-HERITAGE

### D.4.1. Geo-tourism

The natural predispositions of the Geopark area for the development of geo-tourism in the form of a unique geological heritage connected with the natural and cultural heritage have been one of the main elements determining the tourist attractiveness of the region for a long time. The lack of adequate tourist infrastructure to increase the accessibility and attractiveness of individual visitor of geo-stations, as well as the lack of a separate geo-tourism offer, led to the fact that geo-tourism was a less-known tourist destination for tour operators.

For the past five years the investment activities realized by the municipalities forming the Geopark "Świętokrzyski" Geopark have made geo-tourism more and more important as an element of the region's sustainable economic development. Non-investment activities (promotion, creation and realization of the geo-tourism offer) contributed to better advertising of geo-tourism among the local community as well as among the visitors of the Świętokrzyskie region. It should be emphasized that prior to the launch of Geopark Świętokrzyski in 2015, the communes undertook a number of preparatory actions to create a suitable infrastructure for the development of geo-tourism in the region (including the Geopark area). These actions also created favorable conditions for the creation of the Geopark.

It should be emphasized that the additional result of implemented investment activities is to stimulate local entrepreneurship related to the creation of geo-products and geo-tourism services (in particular guides). Examples of such activities and their effects on the development of geo-tourism in the Geopark border area are presented in Table D5.

YEARS	TYPE AND SCOPE OF INVESTMENT AND NON-INVESTMENT ACTIVITIES	EFFECTS ON THE DEVELOPMENT OF GEO-TOURISM IN THE AREA COVERED BY THE GEOPARK
2010-2012	Construction and making available the geological-mining and ore mining route providing geostation sites: Karczówka, Dalnia and Grabina (Kielce Commune)	Creation of a geo-tourist product generating tourist traffic and the possibility of providing additional guiding services in the area of geo-tourism
2010-2012	Implementation of the partnership project and the creation of a linear tourism product of supra-regional importance: the Świętokrzyski Archeology Trail (including the Centre of Geoeducation in Kielce)	Including in the offer of commercial travel agencies and organizations associating tour guides of the geo-tourism offer based on the infrastructure within the framework of the project, in particular the offer of the Geo-Education Center in education and geological tourism

2012	Opening of the Underground Tourist Route and modernization of tourist infrastructure in Kadzielnia Geo-database (Kielce Commune)	Creation of a geo-tourism product "Caves in Kadzielnia" available within the geo-touristic service connected with the guiding services provided by the Geopark partner organization - Speleoklub Świętokrzyski
2012-2017	Preparation and implementation of the geo-tourism offer within the framework of the Geo-Education Center in Kielce (geo-tourism events and picnics, guided tours, guiding geological trainings)	Increasing the recognition of geo-tourism as an important element of the region's promotion and its socio-economic development
2015	<b>ESTABLISHING GEOPARK INITIATIVE IN COOPERATION BETWEEN COMMUNES: KIELCE, MORAWICA, SITKÓWKA-NOWINY AND PIEKOSZÓW</b>	<b>Increasing local awareness (authorities and residents) regarding the need to protect, preserve and use geological, natural and cultural heritage for the development of geo-tourism</b>
2015	Construction of a geo-touristic pathway in the geo -site "Ślichowice" (Gmina Kielce)	Increasing the availability of geo-tourism geo-station "Ślichowice"; stimulation of activities related to the use of the object in geo-tourism (trips, hikes, special geo-tourism events)
2015	Opening of the European Center for Geological Education in Chęciny (Faculty of Geology, Warsaw University in cooperation with the Commune of Chęciny);	Local geo-tourism stimulation; incorporation of the offer of the European Center for Geological Education as a component of tour operators offering tours to the Świętokrzyskie Mountains

The most important planned investment and non-investment activities related to the development of geo-tourism in the Geopark area are described in section D.2 in the part: Planned facilities for the proposed Geopark. Among the most important planned investment activities related to geo-tourism is an extension of educational infrastructure in geostationary areas: Kadzielnia and Miedzygórz East along with Modernization of permanent installation and construction of the Geological Experimental Garden in the Center of Geo-education (Kielce Commune) and the Project of Establishment of the Old Polish Mining Center in Miedzianka (Chęciny commune). Among the planned non-investment activities to influence mostly on stimulation of the development of geo-tourism is to mention:

- GEO-GUIDE project - continuation of a specialist course in geology and geo-tourism for guides with the possibility of expanding the scope of customers on tour operators and employees of tourist facilities,
- continuation of geo-tourism initiatives related to the organization of hikes, trips and field workshops as part of the activities of the Geo-Education Center,
- elaboration and distribution of a special geo-tourism offer dedicated to the Geopark area, licensed tour guides and tour operators.

Principles and main directions of action for sustainable socio-economic development based on geo-tourism using the potential of geological and natural heritage resources and cultural geopark will be defined in the Geopark development strategy. The "Geoland Świętokrzyski" Association management of the Geopark plans to create such a document in the first half of 2018. This document will refer to the directions of actions identified in the numerous existing strategic documents that have been developed for the needs of local government units (cities, municipalities and counties) and the organizations in which they participate. These documents also refer to sustainable tourism based on the unique resources of the geological, natural and cultural heritage of the Geopark boundary. The key documents of this type are:

- Strategy for the development of tourism in the Świętokrzyskie Voivodship for the years 2015-2020
- Strategy for Integrated Territorial Investments of the Kielce Functional Area for the years 2014-2020
- Local Development Strategy 2014-2020 (strategy prepared for the communes of Chęciny, Morawica and Sitkówka-Nowiny communes within the framework of the Local Action Group "Perty Czarnej Nidy".
- Kielce Development Strategy for the years 2007-2020 (strategy prepared for the Kielce municipality area)
- Local Development Strategy for the years 2014-2020 (strategy prepared by the Local Action Group, "Bobrza River Basin", which also covers the area of the Piekoszów Commune, which is a part of the Geopark)
- Programme of Revitalization of Piekoszów Commune for the years 2017-2023.

#### D.4.2. Geo-education

Geological education is aimed at the general public and is one of the main activities of the Geopark, implemented through the activities of the Geopark information and education center and the Center for Geo-education, as well as through the activities of partner organizations and institutions. It is worth emphasizing that the area of the Geopark, due to its unique geological heritage, has been used in geological didactics for more than 100 years, especially related to the training



of geological employees at universities. These conditions have influenced numerous initiatives related to geological education / training, which were implemented in this area long before the establishment of the Geopark. The most important are:

- Geological practices organized by universities,
- Scientific conferences organized by universities and research institutes,
- educational and popularization activities of the Świętokrzyski Branch of the State Geological Institute (since 1937),
- Geological Technical college activities in Kielce (including geological practices and educational activities of Young Geologists' Circle), (since 1953),
- Establishment as well as educational and popularization activity of Geopark Kielce - Kielce Commune units established to promote and manage geological objects of Kielce (since 2003); Within the framework of the unit was established in 2005 Geologists Lovers Club, and in 2012 the Geo-Education Center was built, in which the Club was also included
- local social initiatives in the field of geological education and popularization of the geological heritage of the region ,among children and youth: from 2005 Barbara and Jerzy Jędrychowscy; since 2007 Katarzyna and Grzegorz Pabianowie.

Geologic 'Geoland Świętokrzyski' Geopark's current activity in geological education is largely based on the experience and good practical activities developed within the above mentioned initiatives as well as new innovative solutions developed in the last five years by the Geo-Education Center (from 2012 to 2017). Since Geopark Geoland Świętokrzyski established in 2015 many geological education activities have been undertaken by the Geo-Education Center as the main information and education center of the Geopark. The most important initiatives undertaken so far in geological education are:

**Geologic Lovers Club** - a geologic and geologic practice (family with children, seniors, local geology enthusiasts) based on regular activities throughout the year, every Tuesday (children) and Thursday (young people and adults); The participants of the meetings co-create a programme of geological classes and workshops as well as create their own didactic collections; Geological Lover Club is the most important place for consulting the educational offer and Geopark's activities with the local community (Fig. D5, D6, D7)



Fig. D5 Workshop in Geological Lover Club



Fig. D6 Geological field workshop



Fig. D7 Rocks grinding workshop

**Periodic educational events** - every year the Geoeducation Center organizes Kielce Geological Picnics exhibiting the most interesting elements of the geological heritage of the Geopark area (Fig. D8)



Fig. D8 Kielce Geological Picnics

**Special educational programmes for children and adolescents** - a permanent, all-year educational offer for kindergartens, primary and secondary schools, including visits to the permanent exhibition at the Geo-Education Center and special fixed and field activities with diverse themes referring to the geological, natural and cultural heritage. In addition to the regular educational offer special education programmes targeted at school children were implemented;

Examples of such programmes implemented in the years 2014-2017 include: Geo-School Educational Program, "Paleo-Education Project", "GEO-LAB Project" (Fig. D9).

**Special educational programmes for students (with emphasis on students from geology-geography-environment protection - geo-tourism)** - cooperation with leading Polish academic centers educating geologists and geographers in the field of student practice and presentation of good practice in preparation and implementation of the offer related to education and geological tourism; in particular cooperation with the Department of Geology and Geotourism of AGH University of Science in Cracow, Faculty of Earth Sciences at University of Silesia, Faculty of Geology at University of Warsaw (Fig. D11, D12)

**Special educational programmes for seniors** - periodic senior geography classes run in cooperation with the local third-age universities (on average 8-9 stationary and outdoor educational activities each year) (Fig. D10)



Fig. D9 "GEO-LAB project" in Geo-Education Center



Fig. D10 Education programmes for seniors



Fig. D11 Geotourism conference



Fig. D12 Cooperation with Polish academic centers

**Special education programmes for people with disabilities (mostly blind and visually impaired)**

- cooperation with the *Chance for the Blind* Foundation in terms of the consultation, preparation and implementation of the first innovative geological education project in Poland for the blind and visually impaired. Within consultations with the Foundation, there were also educational aids dedicated to the blind: typhlomap, typhloguidebook, special educational aids and mini-exposition, for example Świętokrzyska Geological Timeline containing rock specimens intended for recognition with touch with descriptions in Brail (Fig. D13)

**Training programmes and conferences for teachers** - cooperation with the Świętokrzyskie Teacher Training Center and selected local primary and secondary schools in the field of project implementation and training for teachers in the use of geological education in formal school education; Three initiatives have been implemented within the cooperation: Geo-seminar for geography / science teachers (June 2015); Educational workshops for teachers "Geo-Świętokrzyskie" (November 2016); Educational Workshops, "Mathematics in Nature" (September 2016); It is worth pointing out that Geopark is working closely with the Primary School in Kowala (Sitkówka-Nowiny Commune) to support school and non-school activities related to geological education and raising children's awareness of geological heritage in their commune.

**Educational competitions aimed at local schools** - Geo-Education Center in Kielce is the initiator of two geological competitions, which have been implemented since 2013 and have already reached five editions (GEO-Genius and Geo-



Fig. D13 Exhibition for blind people in the Geo-Education Center



sites in Your Neighborhood). Since the launch of the geopark initiative, a total of 6 competitions have been held (3 editions of each of the above competitions) (Fig. D14, D15)



Fig. D14 Geological competition „GEO-genius”



Fig. D15 Geosites in your Neighborhood

**Field trips and outdoor workshops** - Within the functioning of the main information and education center of the Geopark - the Center for Geo-education offers guided tours of the permanent exhibition on the geological heritage of the region and the geo-tourism route the Wietrzna Reserve, including the geo-stations of Wietrzna, Międzygórze and Międzygórze East. Qualified geo-tour guides' staff also runs permanent geo-educational workshops and activities that go beyond the Wietrzna Reserve and Geo-Education Center and cover topics related to geological, natural and cultural heritage:

- Kielce Geological Tournee (Kadzielnia, Ślichowice, Wietrzna),
- Kielce Geological Races (geological, natural and cultural heritage sites located in the Kielce municipality, in the northern part of the Geopark) (Fig. D16)
- Geological field games (Fig.D17)
- Geo-tourism programmes in the Geopark area "Geoland Świętokrzyski" implemented by Geologic Lovers Club (including visiting geo-stations in active quarries, organized in cooperation with mining companies)
- Days of Kadzielnia, Wietrzna and Ślichowice organized as one-day field workshops aimed at organized classes of children and school children;



Fig. D16 Kielce Geological Races”



Fig. D17 Geological Field games



**Educational Exhibitions** - As part of Geopark's operation, the Geo-Education Center organizes on average 4-5 educational exhibitions per year, focusing on the geological heritage and its connections with the animate nature, cultural heritage, art as well as other fields. The Chęciny Commune organizes educational exhibitions related to the geological and mining heritage within the Museum Chamber of the Mining Industry in Miedzianka; an important example of this type of initiative is educational exhibitions related to geological heritage organized by partner organizations / institutions: Świętokrzyski Branch of the State Geological Institute in Kielce and the National Museum in Kielce (Fig. D18, D19, D20)





**Fig. D18 Geological exhibition in the Geo-Education Center**



**Fig. D19 Palentological exhibition in Geological Institute in Kielce**



**Fig. D20 Minerals exhibition**

**Geological courses for guides** – Geopark performs an active role in contributing to the geo-tourism offer, as well as prepares and delivers specialist geological trainings and courses for guides and guides. Examples of such activities are:

- annual geological courses (fixed and field courses) for candidates for guides associated in the Świętokrzyski Branch of the Polish PTTK

- GEO-GUIDE specialist course developed by Geopark (Center for Geo-Education) and developed in cooperation with Świętokrzyski Branch of Polish Tourist and Sightseeing Association and scientific institutions: State Geological Institute and Institute of Nature Conservation of Polish Academy of Sciences as a part of the future activity of the Geopark "Geoland Świętokrzyski".

Activities aimed at increasing the scope of the educational offer as well as more interesting links of the geological heritage with its animated nature and its cultural heritage.

Among the most important initiatives planned are: (1) expanding the range of special education programmes for people with disabilities; (2) creating interdisciplinary educational programmes that highlight the links between geological, natural and cultural heritage; (3) implementation of special projects and educational programmes co-financed from external funds (eg local and regional environmental protection funds and water management); (4) Engaging in the creation and realization of the educational offer of representatives of the local community

- greater exposition in the Geopark educational offer of local traditions and customs (cooperation with partner institutions specializing in the promotion of cultural heritage).

### D.4.3. Geo-heritage

The strategy for the protection and preservation of geological, natural and cultural heritage in the Geopark area is realized primarily through actions resulting from national laws relating to facilities / areas under legal protection. In the case of the most important geological sites in the Geopark, protected as geological reserves, protective and maintenance activities are carried out in accordance with the conservation plans or in the absence of such documents, the protective tasks established for such facilities. Protective plans and tasks define the scope and direction of protective and maintenance activities, including: the possibility of cutting down vegetation to expose geological profiles, limits concerning rock sampling and conducting geological surveys, as well as the possibility of creating tourist infrastructure in order to provide a geostation and direct tourism movement.

The activities of Geopark's communes have been focused on conservation and making geo-stations or their fragments available in the context of creating conditions for the development of tourism as an element of local sustainable socio-economic development. Among the most important actions are the following:

- use of research and scientific expertise to plan, protect and make available geo-stations in the municipality of Kielce and the commune of Chęciny (geostation of Kadzielnia, Wietrzna, Ślichowice)
- creation of infrastructure to secure valuable natural areas (including geological reserves) against undirected tourist traffic
- regular monitoring of selected geo-stations for possible threats (Kadzielnia, Wietrzna, Ślichowice, Chelosiowa Jama, Paradise Cave).

Protection and development activities also apply to conservation reserves and conservation areas, where geological heritage elements play an important role. Examples are: the Royal Castle in Chęciny with its surroundings and the Karczówka Reserve. In both cases, revitalization projects related to the construction and / or modernization

of existing infrastructure and monuments have been carried out in order to protect and preserve the above mentioned buildings as well as improving their accessibility for tourism.

Non-investment activities related to the conservation and preservation of geological heritage focus on the following elements:

- activities / projects related to environmental education aimed at the local community in the context of raising ecological awareness, including the need to protect the geological heritage (incl. ecological education tasks accomplished by the Geo-Education Center)
- cooperation of the Geo-education Center with the Nature Conservation League, the Świętokrzyskie and Nadnidziańskie Landscape Parks, and the Regional Directorate for Environmental Protection, in terms of initiatives promoting the protection of the geological and natural heritage in the Geopark area
- public consultations on the sharing of geological heritage facilities for geo-tourism purposes (including consultations on projects for Kadzielnia geo-stations development and Międzygórz East)
- publications related to the promotion of the geological heritage and the necessity of its protection (incl. Monograph of the Chęcińsko-Kielecki Landscape Park, the core of the Geopark, "Geoland Świętokrzyski")

Geopark's planned activities for the protection and preservation of geological, natural and cultural heritage will mainly focus on greater involvement in this process of public consultations and involvement in the above-mentioned community activities. An important aspect of the planned activities will be the inclusion in the Management Plan of the Geopark the records concerning the development of the model of protection and conservation of the geological heritage in cooperation with the Geopark with partner institutions including academic institutions and the public administration sector (Regional Directorate for Environmental Protection in Kielce and the Świętokrzyskie and Nadnidziańskie Group of the Landscape Parks).

## D5. POLICIES FOR, AND EXAMPLES OF, COMMUNITY EMPOWERMENT IN THE PROPOSED GEOPARK

Having signed in 2015 the agreement between the communes to establish a Geopark aspiring to the UNESCO Global Geoparks Network has benefited from local cooperation and interest in the geopark. Involving the local community in the process of preparation, creation and operation of the geopark initiative took different forms and scope at different stages.

At the preparation stage, representatives of the Kielce Commune ( the Geopark Kielce) being the initiator of the Geopark project, representatives of selected municipalities (Fig. D21) and representatives of scientific institutions, public administration or non-governmental organizations played a key role.

These meetings, which took the form of panel discussions, seminars and conferences, focused on presenting the ideas of the Global Geoparks of UNESCO and examples of geoparks on the internet, as well as models of good practice in the protection, promotion and usage of geological, cultural and natural heritage for the sustainable socio-economic development of the regions. It was important to present the Geopark idea at three large national conferences on geosourism, geo-diversity and geoparks: the Geo-Expo-Tour Conference, Geo-tourism Conference and the Polish nationwide Geo-Product Forum.

The stage of formalization of the geopark initiative was related to consultations and acceptance of representatives of the local community of the Councils of individual Communes of the Geopark. The authorities of each of the communes participating in the Geopark Initiative presented the idea, scope and goals of the Geopark aspiring to UNESCO Global Geoparks to the Council. The accession of each of the communes to the geopark initiative involved the approval of the Council.

The stage of functioning of the geopark initiative and its formalization as the Association of Communes is also related to consultations at the level of Councils of the Municipalities. They take place in the case of strategic decisions influencing the direction of development of a given commune (member of the Association) or in case of involvement of funds from the commune budget for statutory activities.



**Fig. D21 Meeting with the representatives of selected municipalities**

In the context of the preparation and implementation of initiatives related to geological education and tourism, which are the basis of Geopark's activities, local community representatives are involved in the following activities:

- Geology Lovers Club (meetings and consultations with children and adults on educational activity plans); residents of the region (children, adolescents and adults) participating in meetings and activities become members of the Club, who co-create programmes of meetings and educational workshops, run selected meetings and lectures as well as create their own educational collections (Fig. D22)
- public consultations on projects related to the construction of educational and tourist infrastructure financed from external funds (incl Development of Educational Infrastructure Project in valuable natural areas managed by Geopark Kielce, implemented by Kielce municipality)
- consultation with teachers in relation to specific projects and educational programmes, (Fig. D24) in cooperation with the Geopark with the Świętokrzyskie Teacher Training Center
- cooperation and consultation with senior citizens within the University of the Third Age
- cooperation and consultation with people with disabilities in the implementation of special projects and educational programmes (cooperation with the Foundation *Opportunity for the Blind*)
- cooperation with local tourist guides in preparation and implementation of geo-tourism events (Geopark cooperates with the Świętokrzyski Branch of the PTTK Polish Tourist and sightseeing Society in the organization of geological hikes and geological Outdoor Game) (Fig. D23)



**Fig. D22 Geology Lovers Club (meetings and consultations with children and adults on educational activity plans**



**Fig. D23 Cooperation with local tourist guides**



**Fig. D24 consultation with teachers in relation to specific projects and educational programmes**

The Geopark's planned activities in the local community's involvement in the functioning of the Geopark is primarily related to the organization of a series of meetings with the inhabitants of the various municipalities, in which the subject of the consultation would be the needs and expectations of residents related to the Geopark's activities. An important aspect of the planned activities is also stimulating local entrepreneurship related to the creation of geo-products. At present, the Geopark does not have many examples in terms of the above-mentioned activities, hence one of the most important future directions of the Geopark's activity is promoting geo-products among local communities (including entrepreneurs). These activities also involve the planned involvement of business entities in Geopark's geo-tourism and educational projects.

## D6. POLICIES FOR, AND EXAMPLES OF, PUBLIC AND STAKEHOLDER AWARENESSES IN THE PROPOSED GEOPARK

Geopark's efforts to raise awareness of the local community in the protection, promotion and usage of local geological, natural and cultural heritage for sustainable socio-economic development since the launch of the Geopark Initiative in 2015 focus on the following activities:

- Geological Lover Club (a form of all-year meetings, workshops and educational activities available to children, youth and adults and held at the Geopark headquarters - Geo-Education Center in Kielce)
- Geological games, workshops and outdoor hikes for the inhabitants of the Geopark community, during which the participants and their guides visit particularly interesting places from the geological, natural and cultural point of view (eg Terrain Geological Game organized annually in the Kielce Commune )
- Theoretical and practical workshops for school children, during which the participants learn about their surroundings through fun, art and experiments, among others: they learn about the processes that occur in the natural environment



and which people influence them; learn botanical curiosities or learn to recognize the value of geological resources of the region – special programmes and educational projects related to environmental education of children and youth implemented in cooperation with schools, non-governmental organizations and business entities (eg GEO-EKO-PICNIC in the Geo-Education Center in 2017, GEO-LAB educational project organized in cooperation with the Mini-Lab or the project of geological education of blind people organized in cooperation with the Foundation for Opportunity for the Blind) - Contests of knowledge related to geology and protection of geological heritage addressed to local primary, secondary and secondary schools (Knowledge of the Earth Contest 'Geo-Genius', and Geosites in Your Neighborhood Contest; 6 such competitions were organized since Geopark was created).

- Events and picnics, during which the traditions of the mining and processing of mineral and metal industries are cultivated, as well as the tradition of local folk crafts (including Melting Lead in Tokarnia, Chałupkowe Garncyki, Copper Mining Picnic, Geological Picnic in Sitkówka-Nowiny Commune, Geography Picnic in Kielce) - Collaboration with local media (radio, press, television) to promote initiatives related to the protection, promotion (Fig. D25) and use of local geological, natural and cultural heritage in sustainable tourism and geological education (incl. permanent co-operation of the Geo-Education Center with Kielce Internet Television in the context of promoting of educational and investment activities)



**Fig. D25 Promotion geology with local media**



**Fig. D26 Establishing contact with the OKI Island Geopark**

- Establishing contact with the OKI Islands Geopark, which through the local media has been introduced to the local community as a model to follow (Fig. D26) In the context of building public awareness on the protection and using of geological heritage, including geopark creation on a national scale, the Geopark Polish nationwide Geo-Product Forum launched in 2015 possesses a crucial meaning. The initiative of the Polish Geo-Product Forum prepared by the Geopark in co-operation with the Department of Geology and Geo-tourism of AGH University of Science and Technology in Cracow is the first such cyclical initiative in Poland, which brought together the scientific, local, business and non-governmental circles in a common debate on geoproducts, geo-tourism, geoparks, and conservation and preservation of geological heritag

## E. INTEREST AND ARGUMENTS FOR BECOMING A UNESCO GLOBAL GEOPARK



The idea of creating a Geopark applying to the UNESCO Global Geoparks Network was formalized by a cooperation agreement between the municipalities of Kielce, Chęciny, Morawica, Sitkówka-Nowiny and Piekoszów in 2015 and is a result of many years of activities undertaken since 2000 by local governments and research institutions interested in exploiting the heritage potential of geological, natural and cultural region for sustainable socio-economic development. These actions were geographically expressed in different names and forms of the Geopark initiatives undertaken in the following examples: Geopark Kielce Plus (2008), Geopark Świętokrzyski (2009-2011), Geopark Chęcińsko-Kielecki (2011), renamed in Geopark Geoland Świętokrzyski in 2015 and formalized on the agreement between the five communes.

The arguments for joining the Global Geopark Network are primarily based on the need to improve the socio-economic situation of the region. Secondly, they focus on the contribution of the aspiring Geopark to the functioning of the geopark network and the promotion of the geopark in Poland.

In the first case, one of the key arguments is the following:

- 1) **Świętokrzyskie Region, within which Geopark is situated, "Geoland Świętokrzyski" is one of the regions with the highest unemployment rates in Poland and the highest proportion of migrants in search for other voivodeships or countries; The establishment of a Global Geopark in UNESCO can be an important factor in the development of local entrepreneurship and the creation of new jobs in the tourism sector;**
- 2) **The creation of a UNESCO Global Geopark in the western part of the Świętokrzyskie Mountains may also contribute to raising the profile of the region in the eyes of its inhabitants, especially the part of the community that perceives the region in terms of areas without prospects, which they need to leave for other regions or countries with better prospects.**
- 3) **Building a sense of pride in your local community and identifying your own culture and traditions is one of the most important arguments for joining the network. Progressive globalization and significant civilization progress in recent years has led to the fact that a significant proportion of the population (especially urbanized and industrialized areas) has ceased to identify with the region and local traditions. Familiarizing with traditions linked to local geological, natural and cultural heritage as part of Geopark's international operations may improve the situation.**
- 4) **A sense of pride in "small homeland", supported by opportunities for developing individual entrepreneurship tourism and related sectors based on the unique geological, natural and cultural heritage of the Geopark are another of the key benefits of integrating the Geopark into the GGN.**

In addition to the arguments relating to the socio-economic development of the Geopark boundary, arguments related to the role of the aspiring geopark as a potential member of the global network and the contribution it would make to the network. As a geopark aspiring to membership in the Global Geopark Network, we want to bring our experiences and good practices to the geopark network, on the basis of which we would like to develop cooperation with other geoparks in the following areas of activity:

- 1) reclamation and revitalization of post-mining areas for tourism, education and recreation
- 2) creating interactive educational exhibitions presenting geological heritage
- 3) preparation and implementation of special education programmes for the elderly and the disabled (with special emphasis on the blind and partially sighted)
- 4) preparation and implementation of interdisciplinary educational programs linking geology to other fields of knowledge
- 5) preparation and implementation of special training programmes for tourist guides.

As an applying Geopark, we hope not only to learn from the experience of geophysics already existing in the Network, but also to share their experiences and good practices in a networking cooperation. By joining the Global Geopark Network we expect an extensive partnering cooperation and the opportunity to use our past experience in international projects.