Selected geosites within a proposed new trans-border Pieniny Geopark (Polish-Slovakian)

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ABSTRACT
Only one geopark in Poland is on UNESCO list – Muskau Arc Geopark but one of the first propositions was very interesting cross-border Polish-Slovakia geopark Pieniny. The proposed geopark includes the central, most interesting part of the Pieniny Klippen Belt and the adjacent areas of the Central Carpathian Paleogene and Western Flysch Carpathians. The specificity of the Pieniny Klippen Belt is that it is a unique area with a complex geological structure resulting from its multi-stage history. The geopark's core belongs to the Polish Pieniny National Park (Pieniński Park Narodowy) and its Slovak equivalent the Pieninský Narodný Park. The primary task in the framework of Geopark project will be an inventory and valorization of geosites. The authors attempt to provide the review of the most important and significant geotouristic attraction within the proposed. The selected objects include The Rogoźnik Rock, the Białka River water gap at Krempachy, Snozka Pass, Wżar Mountain, the Czorsztyn Castle, the Red Monastery (Červený Kláštor - Czerwony Klasztor), the Dunajec River Gorge, Szczawnica, the Zaskalnik Waterfall, and the Homole Gorge.

Key words: Pieniny Mts., geotourism, geological inventory and valorization, geosites

INTRODUCTION

Identification of certain number of geological sites is one of the main values of geoparks (Zouros, 2008). Geosite/ geotope/geomorphosite are new terms in geological sciences and are subject of protection (geoconservation) and tourism development (geotourism). Every geosite have unique geodiversity (Gray, 2004) which can be part of scientific research in geotourism (Miśkiewicz, 2009). This kind of research was conducted in the Pieniny area for many years.

An initial list of proposed geoparks in Poland was made (Alexandrowicz, 2006) and is still expanding. One geopark in Poland is on UNESCO list – Muskau Arc Geopark (Koźma & Kupetz, 2008) but one of the first propositions was cross-border Polish-Slovakia geopark Pieniny. The major geological theme of this geopark is the Pieniny Klippen Belt (PKB), a strongly tectonized structure about 600 km long and 1-20 km wide, which stretches from Vienna in the West, to Romania in the East (Fig. 1). The area is composed mainly of several successions of mainly deep and shallow-water limestones, covering a time span from the Early Jurassic to Late Cretaceous. The proposed geopark includes the central, most interesting part of the PKB and the adjacent areas of the Central Carpathian Paleogene and Western Flysch Carpathians. In the framework of the Polish-Slovak cooperation, preparatory studies began for this region. The Pieniny Geopark covers the area of the Pieniny Klippen Belt both the

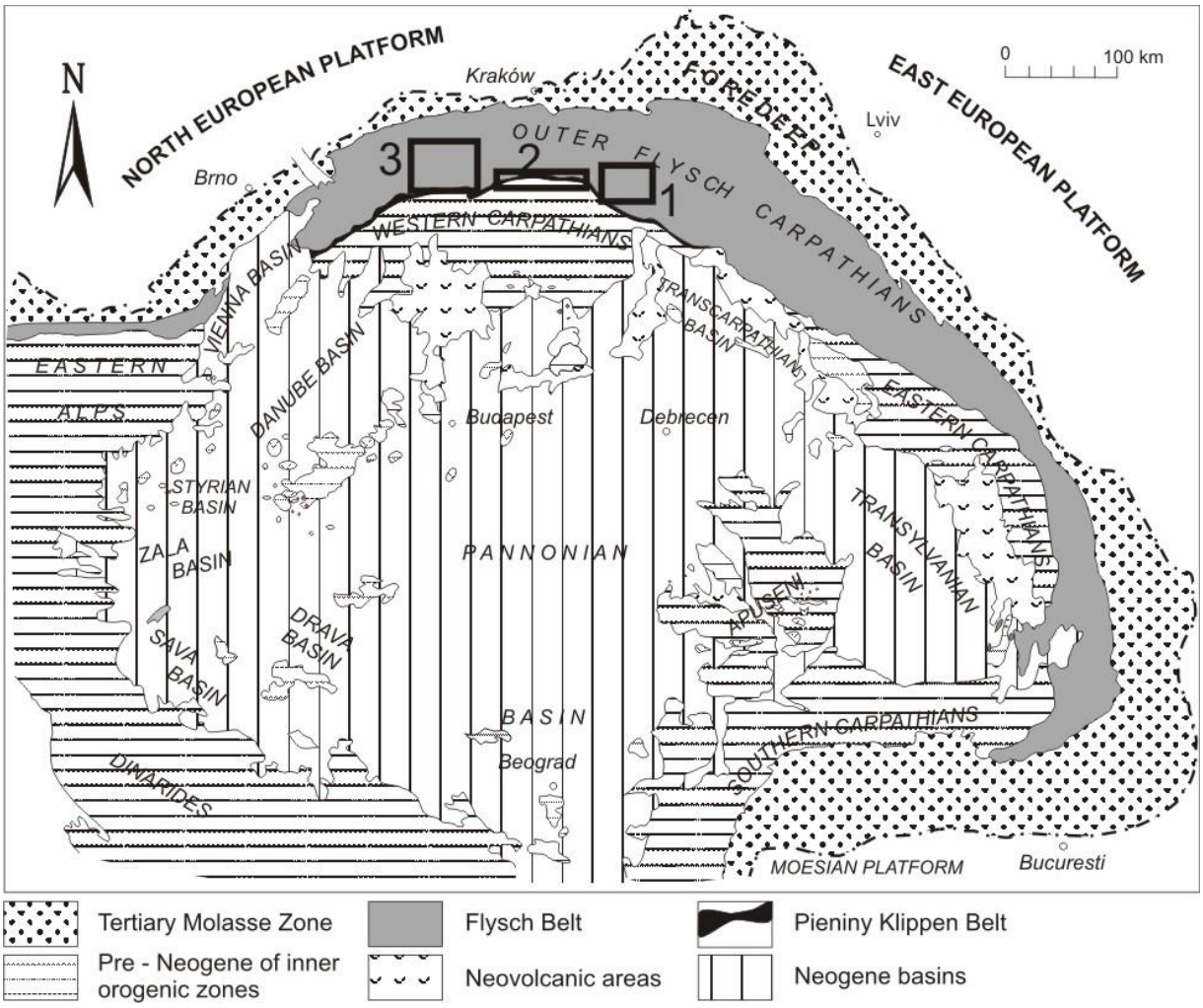

Fig. 1 The Carpathian map (according to Kováč et al., 1998) with proposed trans-border geoparks 1. The Outer Flysch Carpathians and their Mineral Waters Geopark, 2. The Pieniny Geopark, 3. The Beskidy-Orava-Kysuca Geopark.

Polish and Slovak side, together with adjacent areas namely: Pieniny, Little Pieniny, Spisian Pieniny, Podhale, Ljubovnianska Pahorkatina and Oravska Magura (Fig. 2). The specificity of the Pieniny Klippen Belt is that it is a unique area with a complex geological structure resulting from its multi-stage history.

The Pieniny Klippen Belt area can be treated as geological field laboratory, where the studied objects and processes help understanding whole complex history of Earth. Often the geology conditioned the location of the human culture objects; the Medieval castles in Czorsztyn and Niedzica for example. Pieniny attract millions of tourists. Well sculptured towering peaks, deep valleys and ravines, scenic river gorges and interesting outcrops of rocks containing fossils like ammonites, bivalves, crinoids and brachiopods represent the major attractions. It has been the destination of numerous geological excursions, ranging from school trips, general geology field courses for first year students organized by the Polish, Slovak and other European universities, and also special tours organized in the framework of the international geological congresses (Miśkiewicz & Golonka, 2010, Golonka et al., 2012). Tourists can admire an excellent illustration of the various processes of physical geology. It is possible to study the history of geological research and mining, rock and mineral resources, mineral waters elements of mineralogy and petrography,

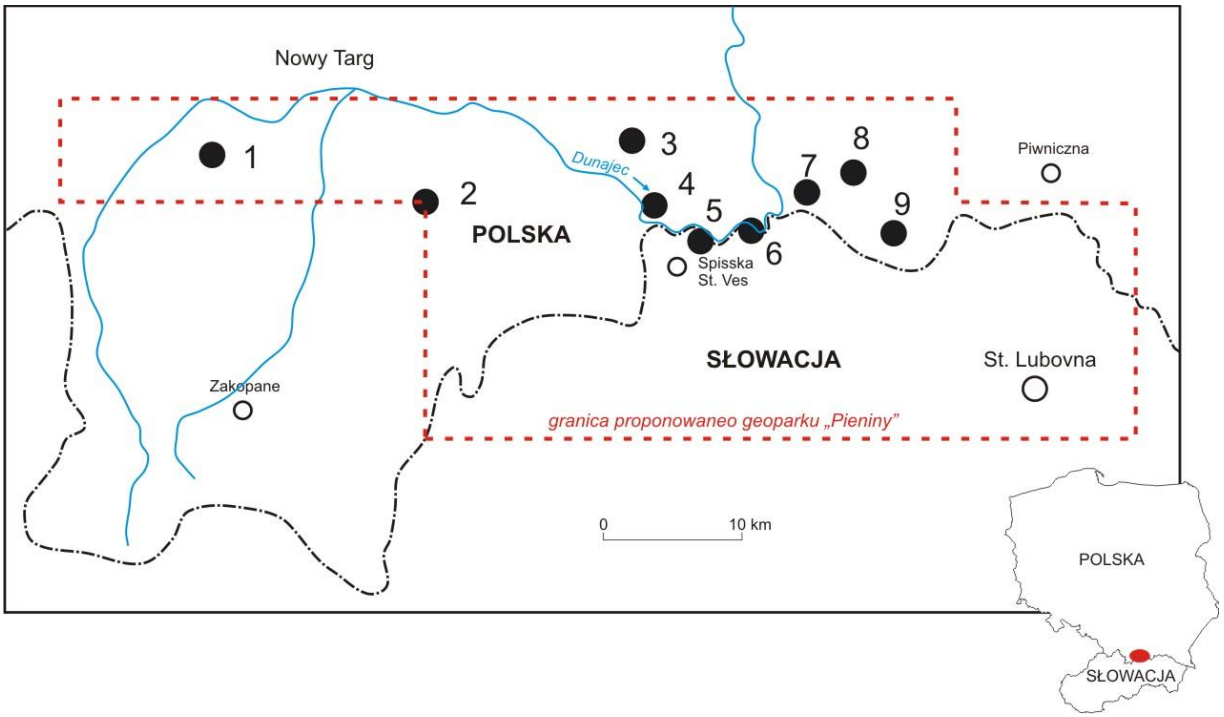

Fig. 2 Selected geosites within a proposed new Polish-Slovakian trans-border Pieniny Geopark. 1 – The Rogoźnik Rock. 2. The Białka River water gap at Krempachy, 3 – The Snozka Pass and Wżar Mountain, 4 – Czorsztyn Castle, 5 – Czerwony Klasztor (Červený Kláštor - Red Monastery), 6 – The Dunajec River Gorge, 7 – Szczawnica, 8 – The Zaskalnik Waterfall , 9 –The Homole Gorge

and the use of stone in architecture. The future management entity of the Geopark will be a consortium of the various entities, including universities, commons and foundations. The geopark's core belongs to the Polish Pieniny National Park (Pieniński Park Narodowy) and its Slovak equivalent the Pieninský Narodný Park (Miśkiewicz & Golonka, 2010, Golonka et al., 2012).

The idea of the National Park was provided by Władysław Szafer in 1921 after Poland gained her independence. The Park was established in 1932 in Poland and in 1967 in Slovakia. The Pieniny National Park area in Poland is 2231 ha and 3750 ha in Slovakia. One quarter of this area is devoted to special nature sanctuaries, the most important ones are: Macelowa Góra, Trzy Korony, Pieniński Potok valley, Pieninki and Bystrzyk. Sixty percent of the park area consists of forests, mainly beech woods; the rest contains meadows, agricultural areas and rocks. The Pieniny National Park fulfills its roles in nature conservation, scientific research, and in promoting educational and tourist activities (nature preservation role, conducting also scientific research, education and tourist activities). The main geotourist attraction is rafting through the Dunajec River Gorge, an excellent scenic and educational trip. Several important geosites are located outside the park, including Rogoźnik Rock Nature Reserve, placed on the UNESCO List of World Geological Heritage and Czorsztyn klippe, an interesting mixture of culture and geology. The primary task in the framework of Geopark project will be an inventory and valorization of geosites. The authors attempt to provide the review of the most important and significant geotouristic attraction within the proposed Geopark (Miśkiewicz & Golonka, 2010, Golonka et al., 2012).

THE ROGOŹNIK ROCK

The Rogoźnik Rock (Fig.3), a world-class scientific object is situated 1.5 km south of Rogoźnik village in the Podhale area. It constitutes a reserve covering an area of 0.26 ha. The rock lies far from tourist tracts and lacks any tourist infrastructure; only

Fig. 3 The Rogoźnik Rock

rare private accommodation opportunities exist in the nearby villages. However, we think that a large numbers of tourists, especially illegal fossil collectors may damage this place (Słomka et al., 2012). The collecting of fossils is prohibited with the reserve, but it is allowed in the nearby quarries.

These two neighboring abandoned quarries (Fig. 4) contain strata rich in mollusks fauna. The ammonite fauna indicate earliest Tithonian (Late Jurassic) up to the Berriasian (Early Cretaceous) age so the limestones were deposited around 140-150 million years ago. The fossils are chaotically distributed within sparite or micrite matrix (Słomka et al., 2012). .

The Rogoźnik Rock and quarries belongs to the geological structure known as the Pieniny Klippen Belt. It is an olistolith (Golonka et al, 2014). The limestone block, which includes Jurassic and Lower Cretaceous strata, lies within the Upper Cretaceous flysch matrix like raisin in the dough. The limestone blocks protrude in the landscape as isolated klippen or their groups (Słomka et al., 2012). The Rogoźnik Rock illustrate well the geological and he stratigraphy of the Jurassic and Cretaceous periods 150 containing a lot of well-reserved fossils. Ammonites, brachiopods, belemnites, bivalves, corals and crinoids are abundant contributing to the name „Rogoźnik coquina" or Rogoźnik Coquina Member (Birkenmajer, 1977) within the Czorsztyn Limestone Formation). History of paleontological research is linked to this geosite. Fossils were studied since the 19th century. Importance of this geosite lead to the position of the Rogoźnik Rock in the UNESCO World Geological Heritage List. This list includes high-ranking scientific object of international paleontological and stratigraphic importance among the others (Słomka et al., 2012).

THE BIAŁKA RIVER WATER GAP AT KREMPACHY

This extremely picturesque water gap (Fig. 5) and is situated in the Białka River valley, about 1.5 km to the southwest of the

Fig. 4 The quarry in Rogoźnik, visible thick-bedded, red, micritic, ammonite-brachiopod coquinas.

Fig. 5 The Białka River gap in Krempachy – view from the top of the Obłazowa Rock

center of Nowa Biała village. The unusually clear and cold mountain braided river cuts through two high klippen: Obłazowa (670 m a.s.l., 50 m high) in the west and Kramnica (688 m a.s.l., 68 m high) in the east. These klippen are built up of carbonate rocks that belong to the Czorsztyn Succession of the Pieniny Klippen Belt (Słomka et al., 2012).

The stratigraphic column of the Obłazowa klippe exposes a thick complex of white, partly yellowish or purple crinoid limestone of Bajocian age (Smolegowa Limestone Formation), bearing well visible fragments of crinoids, more rarely ammonites and brachiopods. Up the section, the ca. 3 m thick red crinoid limestone appears (Krupianka Limestone Formation), and then red nodular limestone (Czorsztyn Limestone Formation), which is overlain by purple-white calpionellid limestone (Dursztyn Limestone Formation) (Birkenmajer, 1977; Słomka et al., 2012).
The Białka River water gap at Krempachy is well known among archeologists. The small 9 m long cave is rich in artefacts documenting prehistorical settlement of Cro Magnone people. These artefacts (were subject of the radiocarbon dating. They are around 30 thousand years old and belong to Pavlov Culture, well known from Moravia, Czech Republic. The oldest boomerang was made of mammoth tusk. The oldest human bones found in the Poland belong to the mammoth hunters. The remnants woolly rhinoceros, Eurasian cave lion or cave hyena, were also identified here (Słomka et al., 2012).

The Kramnica Klippe is located on the right, eastern side of the Białka River. It exposes complex block- and slice-type tectonic structure deforming white and red crinoid limestones, red nodular limestones and red limestones and siltstones of Tithonian and Berriasian ages (Dursztyn Limestone Formation) Birkenmajer (Birkenmajer, 1977, Bartuś et al., 2012).

Well rounded boulders and cobbles fill The Białka River bed. These cobbles were transported from the Tatra Mountains. The grey granites originated in the Tatra batholith dominate.

The private parking lot is located near the rocks. The geosite is annually visited by great numbers of tourists, climbers, hikers and holiday-makers. Landscape values of this place are also attractive to film makers. It is exactly here where scenes used in Polish films "Janosik", "Trzecia granica" [*The third border*] and "Karol – człowiek, który zostal papieżem" [*Karol – the man who became the pope*] were filmed (Słomka et al, 2012).

SNOZKA PASS AND WŻAR MOUNTAIN

The Snozka Pass can serve as a gateway to the Pieniny region and is well known among tourists travelling toward the Dunajec river rafting, Pieniny Mountains as well as Kreościenko and Szczawnica towns. The monument (Fig. 6) designed by the famous artist Władysław Hasior is located near the parking lot. This monument site provides a magnificent view of the Gorce, Tatra Mountains, Pieniny Mountains and Czorsztyn reservoir (Golonka, 2006a). The shepherd cabin (local term "Bacówka") is located between parking lot and monument. Excellent and famous sheep cheese known as "oscypek", Podhale regional product is available here.

The Wżar mountain geosite is located north of the monument and parking. The Neogene igneous rocks, known as andesites crops out here (Fig. 7). The term andesite is not correct, suggesting a volcanic origin of the rock. From modern petrological point of view it is rather microdiorite. The amphibole and augite crystals are visible in the rock. The magma crystalized well below the Earth surface forming an intrusion within the Gorce Mountains flysch rocks. The magnetic anomaly illustrate well the magma cooling process. This anomaly shows the Earth magnetic reversal. The compass needle shows the magnetic North outside the intrusion. It

Fig. 6 Memorial of World War II soldiers in the Snozka Pass

Fig. 7 The quarry in the Wżar Mountain Andesites

changes slightly its direction in the outer part of the intrusion. The change increases toward the intrusion center. Finally the compass needle shows the magnetic South inside the intrusion. Birkenmajer & Pécskay (1999) investigated the intrusion

radiometric age using K-Ar method. They distinguished two generation of dykes. The older yield 12.5-12.8 Ma age, while the younger is 10.8-12.2 Ma old (Birkenmajer & Pécskay, 1999; Golonka, 2006a).

THE CZORSZTYN CASTLE

The Czorsztyn Castle (Fig. 8) was built in the fourteenth century by King Casimir the Great. Almost all Polish kings visited this site. The castle was important fortification guarding the Polish-Hungarian border. It was the largest Polish defensive stronghold on the southern fringe of the country. The castle was besieged several times and seriously damaged during peasant upheaval in XVII century. Today, only ruins ascend to the top of the castle 53 m above the surface of Lake Czorsztyn. Defensive wall of the upper castle with a massive tower was preserved. The lower castle is represented only by remains of the walls.

In 1921 the castle was included into the protected reserve. Since 1966 it has been an integral part of the national park. The castle can be visited every day from 1.05 to 30.09 and from 10 to 15 Tuesday to Sunday in the remaining months (Krobicki et al., 2006).

The rock on which the Czorsztyn Castle was built belongs to the most important geosites within. It was visited by numerous geologists and paleontologists since beginning of the XIXth century. The geologists visited type locality of the Czorsztyn Succession containing Middle Jurassic to Upper Cretaceous limestones. This rock is known as Czorsztyn or Sobótka Klippe (Krobicki et al., 2006).. It is the limestone ollistolithic block, which lies within the Upper Cretaceous- Paleogene flysch matrix like the Rogoźnik Rock (Golonka et al, 2015, in press).. The limestone blocks protruding in the landscape as the isolated klippe is well distinguished in the landscape being more erosion-resistant than the surrounding flysch matrix.

The numerous fossils such as ammonites, brachiopods, crinoids, calpionellids, foraminifers, were collected here. Today the great part of rock is covered by the water of Czorsztyn Lake. The upper part of the rock composes very well with the castle walls, while the lower part is accessible by boat. The red nodular limestone is very well visible castle and within the walls of the lower castle. This limestone is known as the Czorsztyn Limestone Formation (Birkenmajer, 1977). In the Pieniny Klippen Belt. Similar limestone is known as "Ammonitico Rosso Veronese" in Italy. The famous Juliette (character in the Shakespeare play Romeo and Juliette) balcony in Verona contains this "Ammonitico Rosso Veronese" limestone. The half of this beautiful town also contains red nodular limestone walls and pavements (Krobicki et al., 2006).

THE RED MONASTERY (ČERVENÝ KLÁŠTOR - CZERWONY KLASZTOR)

The Red Monastery (Červený Kláštor buildings are located in Slovakia between the Pieninský národný park) Pienap and Červený Kláštor village. Ancient linden trees spread out between the monastery and Dunajec River. The statue of St. Anthony dating from the eighteenth century is located between these trees. The monastery and village name is derived from the red roof of the complex, the original name was Lechnicki (Golonka & Krobicki, 2007). The monastery construction, which started in 1330 was finance by Hungarian noble Kokos Berzevici as well as by Polish king Kazimierz and Queen Jadwiga. The Camelot order constructed new houses, hospital and famous apothecary in XVIIIth century. The brother Cyprian (Franz Ignatz Jäschke) belonged to the Camelots. He was known as flying monk, because the Pieniny Highlanders believed that he was a sorcerer, which could fly. He used the home-made wings to fly from Trzy Korony Mountain to the Red Monastery (Golonka & Krobicki, 2007). In reality he was very good scholar

and pharmacist. He collected famous herbarium containing 282 plants from Pieniny, Tatra Mountains, Podhale and Spis regions. The herbarium guide was written in Greek, Latin, Polish, Slovakian, and German languages. (Golonka 2006b; Golonka & Krobicki, 2007). Today, the Red Monastery complex includes buildings of the post-monastery, museum, restaurant and resort. The museum contains historical exhibitions, ethnographic collections and pharmacy. The mineral waters are known from Červený Kláštor Kupele (Śmierdzonka) hamlet south of the monastery.

THE DUNAJEC RIVER GORGE

The antecedent Dunajec River Gorge, which cut through the Pieniny mountain range represent the main attraction. The Dunajec River is meandering among the several hundred meters high cliffs. Rafting down the river is an unforgettable experience (Golonka 2006b; Golonka & Krobicki, 2007).

At Sromowce Niżne village Dunajec River is entering Pieniny Klippen Belt. Here below the magnificent limestone walls of Trzy Korony Mountain (982 m), the highest mountain group of the Pieniny Mts. (Fig. 10), begins the most beautiful part of the Pieniny Mountains – the Dunajec River Gorge (Golonka 2006b, Golonka & Krobicki, 2007).

The magnificent panorama from the Trzy Korony (Three Crowns) Mountain allows to access tote Southern Poland and Slovakia mountain ranges: Pieniny Mountains, Tatra Mountains, Spiska Magura, Sądecki Beskid and Gorce. This site is formed by very strongly folded usually vertical cherty Pieniny Limestone limestones (Maiolica or Biancone), Trzy Korony were visited by thousands of tourist every year (Golonka 2006b; Golonka & Krobicki, 2007). The Dunajec River constitutes the border between Poland and Slovakia within the gorge .

The river depth is about 8m at the Zbójnicki Skok or Janosikowy Skok (Janosik's or highland robber's jump), the narrowest fragment of the gorge Fig. 11. The place was named after Janosik, legendary chief of highland robbers. He is famous and known in Poland and Slovakia being compared to Robin Hood and depicted in numerous books, plays and movies, the musical "Na Szkle Malowane (Painted on the Glass)" by Katarzyna Gertner among the others, this musical was played without break for over thirty years in Bratislava in XX^{th} century. It is perhaps the world record accomplishing result better than that achieved by Broadway theaters.. According to legends, Janosik was chased by hayduks (policemen) and escaped by jumping across Dunajec River in XVIII century (Golonka 2006b; Golonka & Krobicki, 2007).

The Dunajec River is meandering due to the antecedent character of the gorge. The boat pilots ask visitors to figure the direction of the river bends. The large peninsula surrounded by meandering river is known as the Facimiech Mountain the rocks visible from the boat displays shapes resembling the Polish Eagle and a nun. The 20 m long cave was formed below the Eagle cliff (Golonka & Krobicki, 2007). The next scenic rocks (Fig. 12) is known as Siedem Mnichów (Seven Monks). These monks were trying to visit the nun and for their adultery turned into rocks (Golonka 2006b; Golonka & Krobicki, 2007).

Another famous cliff known as Sokolica Mountain (435 m above sea level or 312 n above the river level) is located close to Szczawnica on the Polish side of the river. It is offering a magnificent view on the Dunajec gorge and therefore is frequently visited by thousands tourists every year (Golonka, 2006b; Golonka & Krobicki, 2007). The tourists must buy a ticket and often wait in line to visit tops of Sokolica and Trzy Korony Mountains. Two rocks Sama Jedna (Lone or Spinster Rock) and Wylizana (Licked Rock) frame the scenic valley of Leśnica River on the Slovak side. The boats reach the end of their trip at the

Fig. 8 Czorsztyn Castle on Lake Czorsztyn

Fig. 9 Former monastery buildings in the Czerwony Klasztor (Červený Kláštor - Red Monastery)

Fig. 10 Trzy Korony (Three Crowns) Mountain

Fig. 11 Zbójnicki Skok or Janosikowy Skok (Janosik's or highland robber's jump), the narrowest place of the Dunajec Gorge

Fig. 12 Seven Monks Rocks at the turn of the Dunajec River

harbor on the right bank of the River in Szczawnica (Golonka, 2006b; Golonka & Krobicki, 2007).. The excellent fresh trout is available in the restaurants close to this harbor.

The Pieniny Road run along the Slovak bank of the river. This road connecting Polish Szczawnica and Slovak Czerwony Klasztor is frequently visited by tourists on foot and on bikes.

SZCZAWNICA

The spa town Szczawnica (Fig. 13) is famous for its mineral waters known already in medieval times (Golonka, 2006b; Golonka & Krobicki, 2007). The name Szczawnica is derived from word szczawa – mineral water with natural carbon dioxide. First written remarks about these waters are known from XVIth century. Jozef Salay turned the highland village into health resort in XIX century. The architecture monuments originate from the XIXth century, beautiful parks and mineral water springs makes Szczawnica a famous destination for thousands of tourists, vacationers and patients. The largest part of the town is in the low and medium mountains between Beskid Sądecki and Małe Pieniny ranges (Golonka, 2006b; Golonka & Krobicki, 2007). It is easy to reach the Małe Pieniny by the chair lift. This lift brings visitor to the top of Palenica hill known for excellent mountain bike trails. The peaks Dzwonkówka (990 m), Skałka (1163 m), Przehyba (1175 m), Złomisty Wierch (1181 m) and Radziejowa (1262 m), belonging to the Beskid Sądecki mountain range framing the town to the North. The northern part of the town is located within flysch rocks of Magura Nappe, mainly Eocene-Oligocene Magura Formation. This formation crops out frequently within the Beskid Sądecki Mountains. Andesitic intrusion cut these flysch rocks. These andesites crop out at the Bryjarka Hill close to the Szczawnica town center the occurrence of mineral waters is related to the andesitic intrusions. Their circulation is going through joint cracks in andesites and flysch sandstones of the Beskid Sądecki Mountains. These waters are known for their medical properties. The

Fig. 13 Szczawnica general view

ore occurrences associate the andesitic intrusions. Prospectors visited this area looking for gold, silver ore and other minerals in ancient times. The remnants of mining activity are scattered around Szczawnica. The boat harbor is located in the lower Szczawnica the boats end famous rafting down the Dunajec River, a world-class tourist attraction at this harbor (Golonka, 2006b, Golonka & Krobicki, 2007, Słomka et al., 2012).

THE ZASKALNIK WATERFALL

The Zaskalnik Waterfall (Fig. 14) belongs to the highest waterfalls within the Polish Outer Carpathians. It is located on the Sopotnicki stream at Sewerynówka hamlet in Szczawnica), -This four meters high waterfall developed within the flysch rocks of Beskid Sądecki Mountains in the Poprad Landscape Park. These flysch rocks belong to the Magura Nappe, the largest tectonostratigraphic unit of the Outer Carpathians in Poland. The boundary between two formations is well visible within the waterfall limits. The upper part was formed in the thick sandstones of Magura Formation, Piwniczna Sandstone Member. The lower part of the waterfall belongs to Zarzecze Formation thin- to medium-bedded distal turbidites, typical flysch strata of the Outer Carpathians. Way. These distal turbidites were formed during periods of more quiet sedimentation, while sandstones belong to proximal turbidites, which originated during a greater supply of coarser, caused by high-energetic turbiditic currents on the flysch basin slope and rise. This basin existed during Eocene times, more than 50 millions of years ago. It belongs to the large Alpine Tethys Ocean. This ocean turned into highly tectonically deformed Carpathian orogene during Miocene times14 million years ago. The flysch deposits belong to the imbricated nappe, they dip at ca. 45º northward. (Słomka et al., 2012).

The Zaskalnik Waterfall represents an unquestionable geotouristic attraction. It is poorly marked, however, and there are no

information boards. It is accessible by car, and a small parking lot is located nearby. The "Czarda" restaurant, offering local specialties is located around 200 m from the geosite. The hikers can reach the Zaskalnik waterfall following a blue-marked tourist track starting in Szczawnica town center. It takes around half hour. The tail leads to Przehyba (1175 m), and Radziejowa (1262 m) mountains, which belong to the, the main ridge of the Beskid Sądecki Mts. (Słomka et al., 2012).

THE HOMOLE GORGE

The Homole Gorge, deeply indented V-shaped rocky valley in the Małe Pieniny Mountains is one of the biggest attractions of the Pieniny Klippen Belt very often visited by tourist (Figs. 15-17). The length of the gorge is about 800 m. The surrounding rock walls are built of white and red crinoid limestones, and their height reaches up to 120 m. The stream with numerous waterfalls is flowing on the gorge rocky bottom. The gorge is protected as a nature reserve. It is accessible by short walk from the large parking lot in the Jaworki village, part of the Szczawnica town hold. This village was inhabited before the Second World War by Lemko, Ruthenian ethnic group. The tourist can an also admire cultural heritage of this region, while geological structure provides an excellent educational field laboratory illustrated complex history of the Pieniny Klippen Belt and is frequently visited by students, geotourists and experienced geologists (Słomka et al., 2012).

The hiking trail leads to Wysokie Skałki Mountain (slov. Vysoké Skalky, 1050 m n.p.m.), the highest peak within the Pieniny Klippen Belt in Poland and Slovakia. Numerous walking and bicycle tourist tracts exist within the Małe Pieniny Mountains. The Homole Gorge belong to the Jan Wiktor reserve, covering an area of 58.6 ha, and protecting landscape as well as abiotic nature objects (Słomka et al., 2012).

The rocks exposed in the Homole Gorge belong to the Czorsztyn Succession. This succession was deposited in the Alpine Tethys Ocean on the shallow mid-oceanic ridge. They were deposited during Jurassic and Early Cretaceous time. The cliffs of the gorge are built mainly by Middle Jurassic crinoid limestones of the Smolegowa Limestone Formation (Birkenmajer, 1977). They are overlain by red nodular limestones of the Czorsztyn Limestone Formation, similar to those exposed below the Czorsztyn Castle. The rocks of the Niedzica Succession are exposed south of the gorge within the Czajakowa Skała cliff Fig. 17). This succession is represented by radiolarites and cherty limestones forming the recumbent fold. The Niedzica Succession are thrust over the Czorsztyn Succession. Both successions belong to the Homole block This block represent the huge olistolith which was gravitationally slided from the ridge into the Magura flysch (Golonka et al., 2014; Słomka et al., 2012). In the uppermost part of the gorge the so-called "Stone Paper" - layered limestone is exposed (Fig. 16). The local legend says that the human lot is written in this rock..

CONCLUSION

The identification and description of potential geotourist attractions of Pieniny is a basic task but not sufficient to create a geopark, which must meet the criteria of UNESCO (Bartuś et al, 2010). These criteria relate primarily to methods of management of the area, its promotion, economic development and protection. It is worth emphasizing that the geopark is not another category of conservation, however, protects natural and cultural values through education, controlled sharing of geosites to tourists explore whether the development of methods of geoconservation. With the support of UNESCO geopark area is identified in the international arena, is increasing its prestige, and thus it is possible tourist success. Geoparks stimulate

Fig. 14 Zaskalnik Waterfall in Szczawnica

Fig. 15 The Homole Gorge

Fig. 16 Stone Paper in the Homole Gorge

Fig. 17 The Czajakowa Skała cliff, above the Homole Gorge

regional development, including traditional and new products i.e. the geo-products (Farsani et al., 2012). The participation of the local community is extremely important, and strategy development must be based on the principles of sustainability. The area of the proposed "Pieniny" geopark has huge potential, and the first contacts with local activists in Polish side were initiated.

Established geopark can be considered as a complex and comprehensive geotourism product (Dryglas & Miśkiewicz, 2014) of regional character. Geosites described in the article are not a product, but after appropriate preparation and accessibility can become a part of it. Potential geotouristic attractions of geopark "Pieniny" is both natural objects with rich geodiversity and cultural objects that exist thanks to geological heritage e .g. stone in architecture, spas, adits, cultural landscape etc. Concept of geotourism product assumes types and categories of geo-products, which are part of a complex marketing structure (Dryglas & Miśkiewicz, 2014). Typical geo-products of the Pieniny region are the printed materials like geotourism map of the region (Borecka et al. 2013), few geotourism panels and geological exhibition at the headquarters of the national park for example. Many geo-products need to be supplemented and even new ones create. There is no popular geotourism guide of the Pieniny or catalogue of geosites. There is need to design and make more geotourism panels in the field, plan and mark geo-path, make promotional events in the geopark i.e. geo-picnic, mineralogical and paleontological exhibitions or other geo-events. Many geosites already operate as tourist attractions, but their geological information is lacking.

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