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Geotouristic values of the Chochołowska Valley (Tatra Mountains, Poland) and their accessibility for people with physical disabilities

Dostępność walorów geoturystycznych Doliny Chochołowskiej (Tatry, Polska) dla osób niepełnosprawnych ruchowo

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Abstract: *The purpose of this contribution is to present the geotourist path in the Chochołowska Valley for the disabled with limited mobility, as well as for the elderly. The Chochołowska Valley is the most westward valley in the Polish Tatra Mountains (Western Tatras). It is the longest and largest valley in the Polish Tatra Mountains, with an area of 35 km² and 10 km in length. The highest peak located in the Chochołowska Valley is the Starorobociański Wierch at 2176 m a.s.l. The altitude at the end of the valley around Siwa Polana, is about 900 m a.s.l. (from 910 m a.s.l. to 920 m a.s.l.). At the Polana Huciska, where the geotoursit path ends, the altitude is about 1000 m a.s.l. The length of the path is 3.5 km, and the altitude difference over this distance is 100 meters. The Chochołowska Valley is developed in sedimentary rocks (limestones, marls, dolomites), belonging to two nappes: Choč Nappe (e.g. Siwiańskie Turnie outcrop) and Križna Nappe (e.g. Niżna Brama Chochołowska Rock Gate). The valley administratively belongs to the Witów village. A green tourist trail was marked through the valley. It start from the Siwa Polana to the mountain hut named after John Paul II on Polana Chochołowska. An asphalt road is from Siwa Polana to the Polana Huciska. The Chochołowska Valley is one of the most beautiful Tatra valleys with numerous rock outcrops and is considered to have a high geotouristic potential. The proposed geotourist path includes selected outcrops, which can be easily accessed by people with limited mobility, including people in wheelchairs. This path runs along a wide asphalt road, and any additional equipment (e.g. a freewheel for wheelchairs) is not required. A large car parking lot is available at the beginning of the proposed path (Siwa Polana), as well as sanitary and catering facilities.*

Keywords: *Tatra Mountains, Chochołowska Valley, geotourism, geosites, sedimentary rocks, tourism for people with physical disabilities*

Treść: *W niniejszym artykule została opisana propozycja trasy geoturystycznej w Dolinie Chochołowskiej dla osób niepełnosprawnych z ograniczonym stopniem poruszania się oraz dla osób starszych. Dolina Chochołowska jest najbardziej na zachód wysuniętą doliną walną w Tatrach Polskich (Tatry Zachodnie). Jest to najdłuższa i największa dolina w Tatrach Polskich. Jej powierzchnia wynosi 35 km², a długość 10 km. Najwyższym szczytem położonym nad Doliną Chochołowską jest Starorobociański Wierch (2176 m n.p.m.). Wysokość bezwzględna u wylotu doliny, w rejonie Siwej Polany, wynosi około 900 m n.p.m. (od 910 m n.p.m. do 920 m n.p.m.), a na Polanie Huciska około 1000 m n. p. m. Długość naszej ścieżki geoturystycznej wynosi 3,5 km, a różnica wysokości na tej odległości wynosi 100 metrów.*

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Dolina Chochołowska jest wypreparowana w skałach osadowych (wapienie, margle, dolomity) dwóch płaszczowin: choczańskiej (Siwiańskie Turnie) i križniańskiej (Niżna Brama Chochołowska). Dolina ta administracyjnie należy do wsi Witów. Dnem doliny został poprowadzony zielony szlak turystyczny do górskiego schroniska im. Jana Pawła II na Polanie Chochołowskiej. Do połowy doliny, do Polany Huciska, została doprowadzona droga asfaltowa. Dolina Chochołowska jest jedną z piękniejszych dolin tatrzańskich o wysokim potencjale geoturystycznym w związku ze znajdującymi się tu licznymi odsłonięciami skalnymi. W niniejszym artykule prezentujemy wybrane odsłonięcia łatwo dostępne, do których mogą dostać się bezproblemowo (płaska i szeroka nawierzchnia drogi) osoby z ograniczonym stopniem poruszania się, w tym również na wózkach inwalidzkich. Proponowana ścieżka geoturystyczna przebiega opisywaną drogą asfaltową, co nie wymaga konieczności używania dodatkowych sprzętów (np. freewheel w przypadku wózków). Na początku proponowanej trasy (Siwa Polana) jest duży parking dla samochodów i niezbędna infrastruktura sanitarno-gastronomiczna.

Słowa kluczowe*: Tatry, Dolina Chochołowska, geoturystyka, geostanowiska, skały osadowe, turystyka dla osób niepełnosprawnych ruchowo*

Introduction

Geotourism is defined as a form of qualified tourism that deals with the description, sharing and presentation of elements of inanimate nature in an accessible way (including Jenkins, 1992; De Bastion, 1994; Martini, 1994; Hose, 1995; Słomka & Kicińska-Świderska, 2004; Newsome & Dowling, 2010). Nowadays, geotourism is more recognised and cultivated all over the world as well as in Poland (e.g. Muskauer Faltenbogen Geopark, Haracz *et al.*, 2012; Karkonosze National Park, Knapik & Migoń, 2011; Geopark "Dolina Wisłoka – Polski Texas", Wasiluk, 2013; Podtatrze Region, Ptaszek, 2005; Krobicki & Golonka, 2008a, 2008b; Štrba & Kurtová, 2013; Chrobak, 2016). Geotourism for people with disabilities is actually treated marginally, mainly due to the limited availability of geotourism objects.

The practicing of geotourism is usually associated with people in good physical condition, equipped with appropriate equipment. Around the world, many geotouristic facilities are adapted for disabled people, e.g. Grand Canyon, Yellowstone National Park (including Seekins *et al.*, 1994; O'Connell, 2017; Mucivuna & da Glória Motta Garcia, 2018; www.frommers.com). However, these kinds of places that could be easily accessible and interesting with geological and geomorphological forms and processes are difficult to find in Poland, e.g. Szklarka Waterfall in the Karkonosze Mountains (Knapik & Migoń, 2011; Kołodziejczyk, 2013).

The aim of this paper is to propose a geotouristic path for people with mobile disabilities and elderly people in the Polish part of the Tatra Mountains. The Tatra Mountains are geomorphological young with alpine nature, so they are not popular for people with physical disabilities. There are only a few places, which can be potentially available for this kind of tourists, e.g. Chochołowska Valley (Ciurej *et al.*, 2018), Białka Valley and Kasprowy Wierch.

It this paper, the authors described the geotouristic path located in the Chochołowska Valley, of which the geological values have already been described earlier (e.g. Gawęda, 2010). The path shows a low level of difficulty; its length is 3.5 km and the height difference at this distance is 100 meters. The proposed geotouristic path runs along a wide asphalt road, and any additional equipment (e.g. a wheelchair) is not required. A large car parking lot is available at the beginning of the proposed path (Siwa Polana), withies. Numerous rock outcrops are visible, which will be presented in this article as geosites.

Geographical location of the Chochołowska Valley in the Tatra Mountains

The Tatra Mountains are located in the south of Poland. These are the highest Polish mountains with alpine sculptures. They are divided into the High Tatras (the highest peak – Rysy 2499 m a.s.l.) and Western Tatras (Starorobociański Wierch, 2176 m a.s.l.). In the Polish Tatras, the Chochołowska Valley is the most westward (Fig. 1). At the Polana Huciska, where the geotoursitic path ends the altitude is about 1000 m a.s.l. The valley administratively belongs to the Witów village. It is owned by the Community of Eligible Eight Villages (Ciche, Chochołów, Czarny Dunajec, Dzianisz, Witów, Wróblówka, Podczerwone and Koniówka), which was founded at 1819. Most of the land (forests) in the Chochołowska Valley belongs to this Community (Adamczyk *et al*., 1995).

The Chochołowska Valley is the longest (10 km) and the largest (35 km^2) valley of the Polish Tatras. It is called "walna" valley, because it reaches the main ridge of the Tatra Mts. Its direction is north-south.

Through the valley, a green tourist trail was marked from the Siwa Polana to the mountain hut named after John Paul II on Polana Chochołowska. From Siwa Polana to the Polana Huciska an asphalt road was brought.

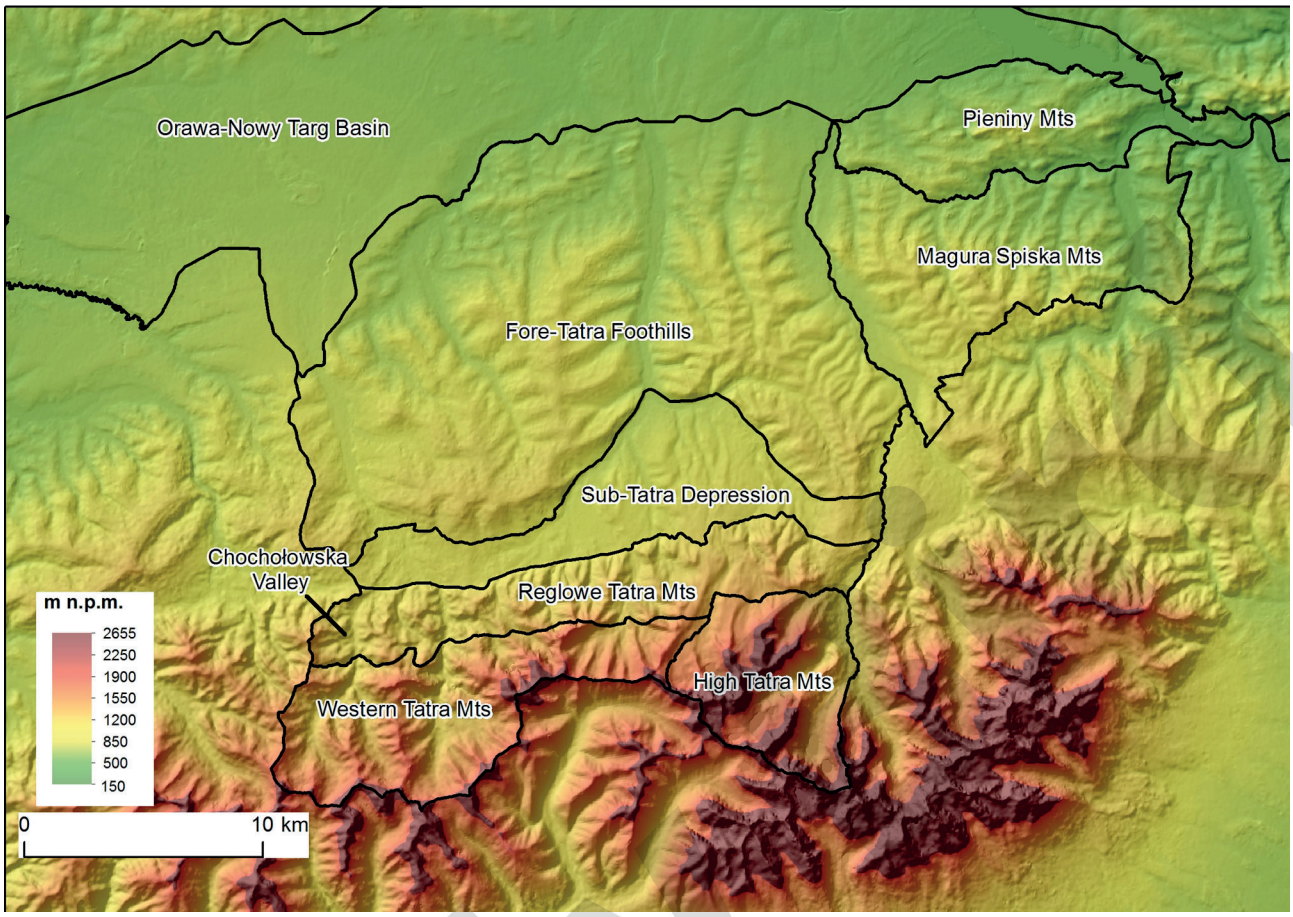

Fig. 1. Physical-geographical mesoregions of the Tatra Mountains, according to Solon *et al.* (2018), with the marked area of the geotouristic route (source: own study based on EU-DEM data, EC, 2013)

Geological structure of the Western Tatras, with particular emphasis on the geology of the Chochołowska Valley

In the lower part of the Chochołowska Valley (Siwa Polana – Polana Huciska) sedimentary rocks of Mesozoic age can be observed (Fig. 2). These rocks were deposited in two basins: the Choč basin (Hronicum) and the Križna basin (Fatricum), located on the border of a land and a shallow sea of the Tethys Ocean (probably shelf like a sebha conditions) (e.g. Kotański, 1971; Vozárová & Vozár, 1979; Maheľ, 1983; Plašienka, 2003; Bac-Moszaszwili & Jurewicz, 2010). These basins were located in the south of the Tatra area (Tatricum basin), and in geological nomenclature, they are known as "regle" (Sub-tatric) nappes: upper Choč Unit and lower Križna Unit. In the northern part of the Thethys Ocean (Tatricum basin) the sedimentary rocks of the "wierchy" (High-Tatric Nappe) and autochthonic cover were deposited. The sedimentation in these basins started in the Triassic and continued until the Late Cretaceous – Turonian (Kotański, 1971; Bac-Moszaszwili & Jurewicz, 2010). On the old, Paleozoic crystalline basement (Pangea supercontinent), these sedimentary rock sequences (autochthon cover, High-Tatric and Sub-Tatric units) were deposited (Vozárová & Vozár, 1979, 1988; Vozár, 1997).

During the Jurassic, the expansion of the Tethys Ocean proceeded further to the West. At that time, the Tatra area became one of the microcontinents (on Alpine-Carpathian Plate) located in the Tethys Ocean, which was formed during the breakdown of the Gondwana supercontinent. That microcontinent was flooded by a shallow sea, but periodically emerged above sea level (Jurewicz, 2005; Bac-Moszaszwili & Jurewicz, 2010).

The Choč Unit and the Križna Unit consist mainly of carbonate rocks: dolomites and limestones of Middle Triassic age. During the Jurassic, in the Choč Unit and Križna Unit basins sandy limestones, Mn and Fe-bearing crinoid limestones and deep sea sediments carbonate and siliceous rocks mudstones, grey pelitic limestones (Upper Jurassic) were deposited. In the Lower Cretaceous the deposits in the "regle" (sub-tatric) basin had deep-sea nature consisting of marls with intercalations of sandstones (Bac-Moszaszwili & Jurewicz, 2010).

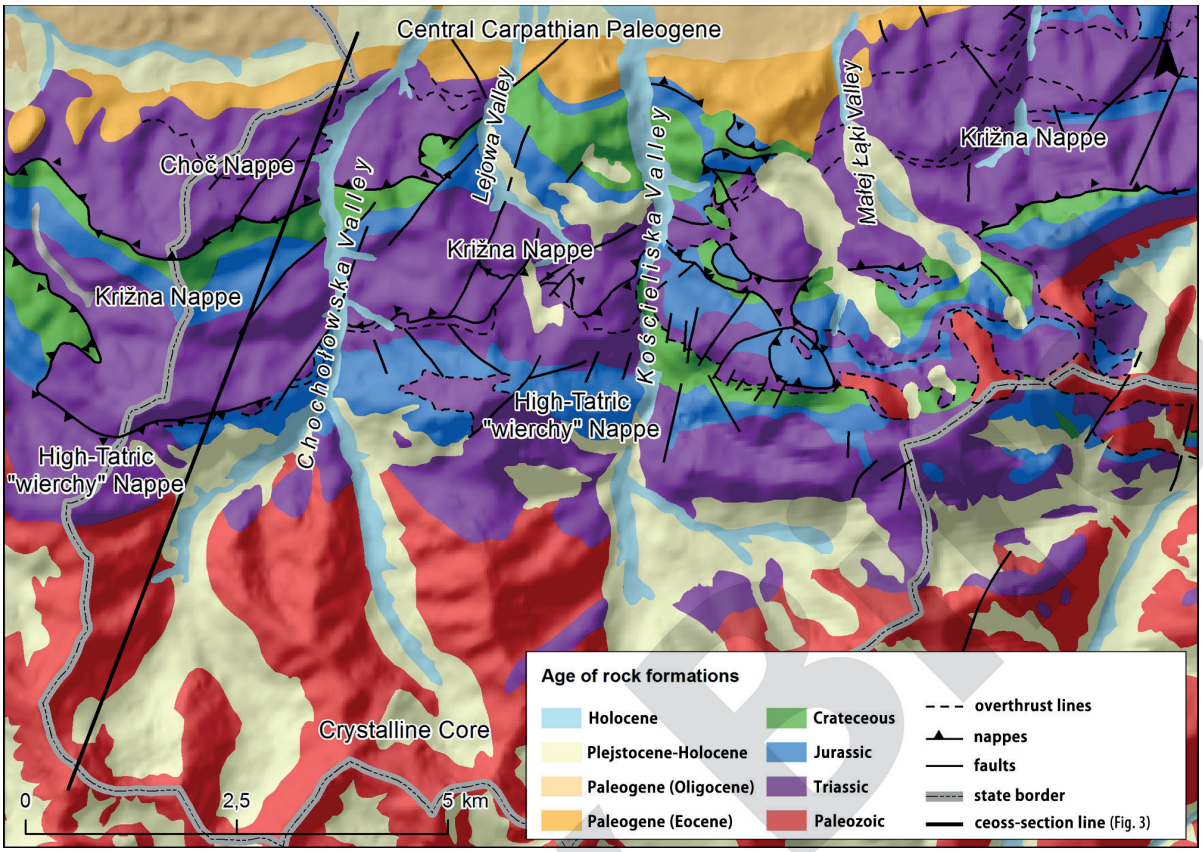

Fig. 2. Simplified geological map of the Tatra Mountains, with location of the Chochołowska Valley. (source: own study based on a geological map by Lexa *et al*. (eds.), 2000)

In the Late Cretaceous, the Alpine-Carpathian Plate was considerably reduced/decreased. On the plate, numerous overthrusts formed, which included both Paleozoic crystalline basement and Mesozoic sedimentary rocks. The sedimentary rocks werestripped off the basement and formed the nappes (High-Tatric-"wierchy" nappe, Sub-Tatric-"regle" nappes: upper Choč Nappe and lower Križna Nappe).

The subduction zone was formed at the south from the Tatra area (Tatricum basin). During the Albian, there was a decollement and thrusting of the Choč Nappe over Križna Nappe and after that, in the Turonian, both nappes were decollement over the autochthonous sedimentary cover and High-Tatric "wierchy" Nappe (Kotański, 1971; Jurewicz, 2005; Bac-Moszaszwili & Jurewicz, 2010).

The Tatra Mountains are characterized by a nappes geological setting. The "wierchy" nappes are a younger tectonic structures than the "regle" nappes, because they formed later. The geological rock sequence from south to north is as follows: the crystalline basement (core), sedimentary rocks of the autochthonous sedimentary cover, High-Tatric-"wierchy" nappe, and Sub-Tatric-"regle" nappes (lower Križa and upper Choč) (Fig. 3).

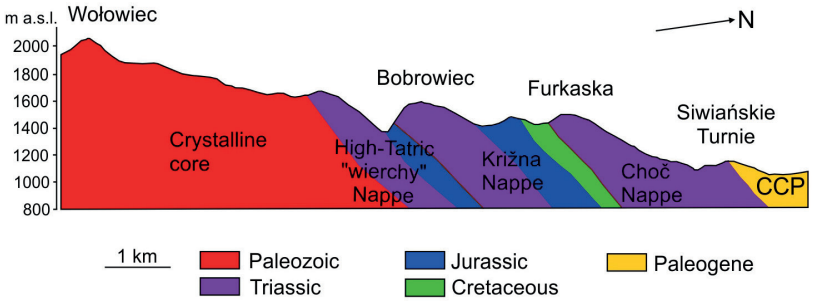

Fig. 3. Geological cross-section through the Chochołowska Valley. CCP – Central Carpathian Paleogene (source: own study based on Bac-Moszaszwili & Jurewicz, 2010)

The overlap nappes occurred under the sea level (Bac-Moszaszwili & Jurewicz, 2010), when they formed the nappes connected with the subduction zone in the south, during tectonic processes from Late Cretaceous and Early Neogene (Alpine Orogeny).

Methods

In this paper, the authors selected five geosites (outcrops) in the Chochołowska Valley. These are: 1) Siwiańskie Turnie outcrop, 2) Wielkie Koryciska-rock gate, 3) Riverbed of the Chochołowski Stream, 4) Niżna Chochołowska Brama outcrop, 5) Chochołowskie Karst Spring (Fig. 4).

In order to achieve the purpose of this article, the following methods were used: 1) scientific references about the geological setting and tectonic structures of the Chochołowska Valley in the Western Tatra Mountains and selected geosites; 2) observation of the quality and potential accessibility for disabled persons; 3) photographic documentation of the proposed geosites and the elements of tourist infrastructure; 4) the computer simulation of high profile for proposed geotourist path using the Geographic Information System (GIS) ArcMap 10.6.1.

Results

The geotourist path (Fig. 4), which was proposed in the lower part of the Chochołowska Valley (Siwa Polana at 910–920 m a.s.l. – Polana Huciska at 980–1050 m a.s.l.), is 3.5 km long. The path runs through two geological units called nappes: Choč Nappe and Križna Nappe, which are built of sedimentary rocks of the Triassic, Jurassic and Cretaceous (e.g. Kotański, 1971, Bac-Moszaszwili & Jurewicz, 2010). The geoturist path starts at the Siwa Polana, where a parking lot can be found. This glade is about 900 m long and about 350 m wide.

The first proposed geosite is the rock outcrop Siwiańskie Turnie (Fig. 5). It is around 500 m further from the parking lot on the Siwa Polana. The best point for the observation of the Siwiańskie Turnie is form an asphalt road, which is around 200 m from the outcrop. It is impossible to approach the outcrop directly. The altitude of this outcrop is 1065 m a.s.l. It forms a characteristic rocky wall of 100 meters above the bottom of Chochołowski Stream. The wall is made of light gray thick-bedded Triassic (Wetterstein) dolomites, strongly deformed tectonically. These dolomites create a characteristic morphology and resemble a kind of cliff. The dolomites belong to the Choč Nappe (Kotański, 1971; Bac-Moszaszwili & Jurewicz, 2010; Gawęda, 2010). The Choč Nappe is a higher „regle" nappe (see the section on Geology of the Chochołowska Valley). The main European watershed between the Baltic Sea and the Black Sea passes through the Siwiańskie Turnie (Małecka *et al.*, 2002). This geosite is one of the most southerly locations of a relict pine (*Pinus sylvestris L.*) (Skrzydłowski, 2017).

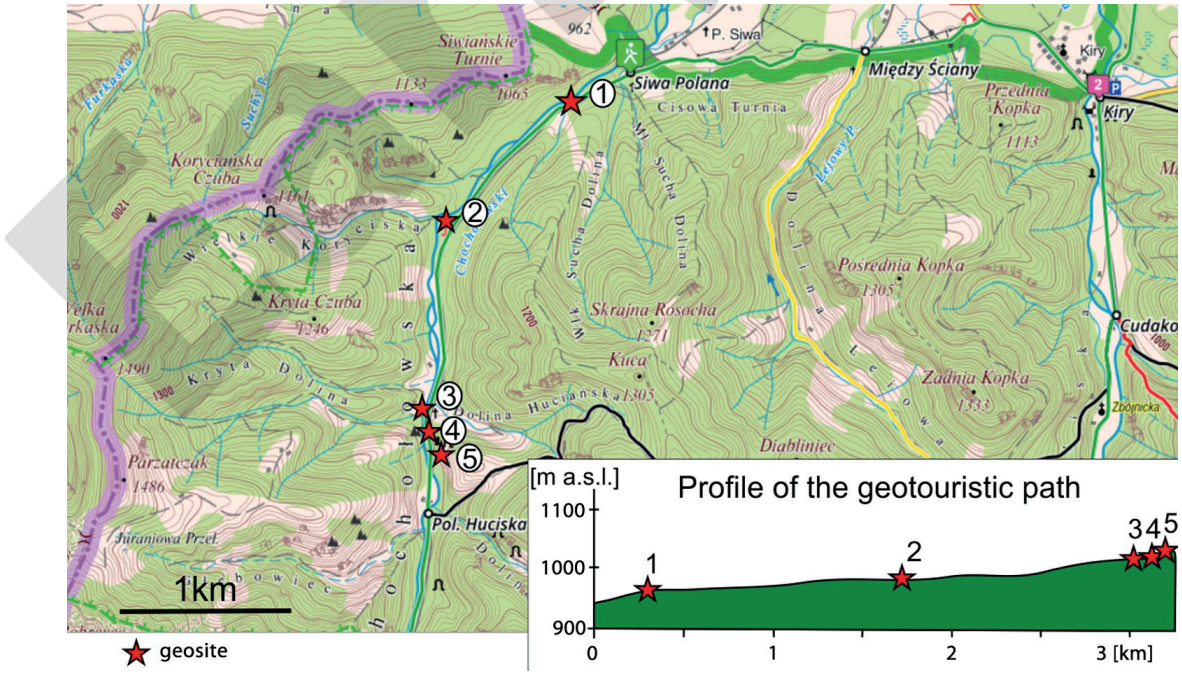

Fig. 4. The course of the proposed geotouristic route in the Chochołowska Valley with marked geosites: 1 – Siwiańskie Turnie Outcrop, 2 – Wielkie Koryciska-rock gate, 3 – Chochołowski Stream Riverbed, 4 – Niżna Chochołowska Brama Outcrop, 5 – Chochołowskie Karst Spring. (source: own research based on tourist map: mapy.hiking.sk)

Fig. 5. Geosite no. 1: Siwińskie Turnie Outcrop with cliffs up to 100 meters high, Triassic dolomites of the Choč Nappe, photo A. Chrobak

The second geosite is the rock gate located at the end of the Wielkie Koryciska Valley (Fig. 6), which is on the left side of the Chochołowska Valley. This gate is built by light gray Triassic (Ramsau) dolomites of the upper "regle" nappe – the Choč Nappe (Kotański, 1971; Bac-Moszaszwili & Jurewicz, 2010; Gawęda, 2010). The rocks in the lower part of the gate, are washed and eroded by the waters of the Chochołowski Stream, which is deep (approximately 0,5 m) and with a strong current. Direct access to these geosites is possible only by passing through the stream, which is a great difficulty for any tourist. The path after this geosite, runs through well visible structural flattening, called Polana Huciska (height 980–1050 m a.s.l.). Just before this glade, there is a tectonic contact between the dolomites of the Choč Nappe (upper "regle" nappe) and the chalky green marly shales and marly limestones, belonging to the Križna Nappe (lower "regle" nappe) (Kotański, 1971; Bac-Moszaszwili & Jurewicz, 2010). The flattening of the valley is re-laid with basement rocks (Triassic red shale, Lower Jurassic – mainly marly limestones and green marl), which are less resistant to karst and weathering processes. In the slopes of the Polana Huciska, the old mining drifts (18th and early 19th centuries, for example Huciańskie Banie) are seen. This is related to the hematite iron ores, developed in this area in the red Jurassic limestones (Kutaś, 2005). Because of this historical mining and smeltering, the Polana Huciska, owes its name Huciska (Smelters) in Polish language.

Fig. 6. Geosite no. 2: Wielkie Koryciska – rock gate built of Triassic dolomite belonging to the Choč Nappe, photo A. Ciurej

The third geosite is the fragment of the riverbed of the Chochołowski Stream located in the area of the Polana Huciska. From here, one can observe the diversity of the alluvial (Holocene) riverbed at the bottom of the channel. Convenient observation is possible from a wooden bridge, which is accessible for people with physical disabilities. The bridge is located on the right side of the Chochołowska Valley, close to the end of the Długa Valley (Fig. 7a). The observed alluvial deposits consist of rock pebbles of sedimentary (dolomites, sandstones, limestones, marls,) and crystalline rocks (gneisses, amphibolites, migmatites, quartzite sandstones) (Fig. 7b).

The fourth geosite is the Niżna Chochołowska Brama outcrop (also known as Kmietowicz Gate) (Fig. 8). At an altitude of 987 m a.s.l., it can be observed as a characteristic gorge dissected in the dolomites (Middle Triassic), belonging to the Križna Nappe. The dolomites are strongly cracked and cut by numerous faults. This gate was named in honor of Józef Leopold Kmietowicz, who was a priest in Chochołów Village and one of the leaders of the Chochołowskie Uprising in 1846. A bronze plaque commemorating the Uprising was placed on a rock. There is also a commemorative medallion informing about the visit of Pope John Paul II in Chochołowska Valley in 1983. The characteristic small caves are prepared in the walls of the Niżna Chochołowska Brama outcrop (Fig. 9). They were formed because of the karst processes on the carboniferous rocks during the Neogene period (Bac-Moszaszwili & Jurewicz, 2010; Gawęda, 2010). As a result of intensive erosion processes, the carbonate rocks appeared on the surface, and they formed the characteristic relief of the rock walls.

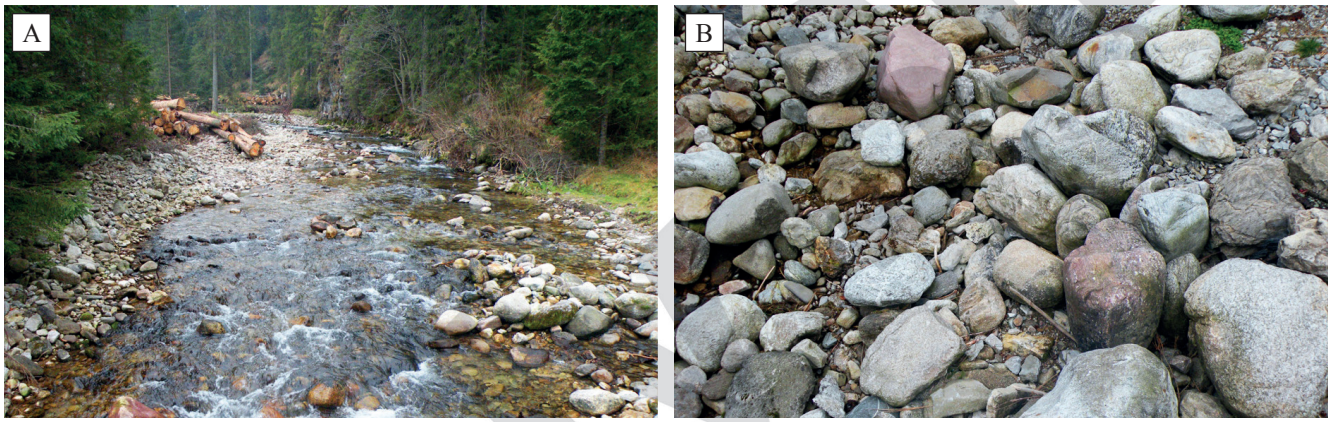

Fig. 7. Geosite no. 3: A – The fragment of the Chochołowski Stream Riverbed at the Polana Huciska, B – pebbles (e.g. gneisses, quartzite sandstones, amphibolites) in the riverbed as a material originating from the upper part of the Chochołowska Valley; photo A. Ciurej

Fig. 8. Geosite no. 4: Niżna Chochołowska Brama Outcrop (on the west bank of the stream) built of dolomites (middle Triassic) belonging to the Križna Nappe, photo by A. Chrobak

Fig. 9. Niżna Chochołowska Brama Outcrop – karst and karst caves, photo A. Chrobak

The last, fifth proposed geosite is the Chochołowskie Karst Spring at the height of 988 m a.s.l. (Fig. 10). People with physical disabilities cannot get closer directly to the spring, but it is perfectly visible from the road on the lefts side hand. On the East slope of the valley, water flows out, as a fissure-karst spring (Fig. 10a). This flow creates a small lake, 10 m in diameter (Fig. 10b). The depth of the spring is about 1.5 m. The water temperature is constant, about 5–6.3°C. Water flows out from the Triassic dolomites, which belong to the Križna Nappe. This is a very efficient water spring (the outflow of water is about 400–600 l/s) depending on the season (Bac-Moszaszwili & Jurewicz, 2010). This spring mainly reinforce the Chochołowski Stream, which is clearly visible at low water levels (Fig. 10c). The water source area is the massif of the Kominiarski Wierch and the Wyżnia Chochołowska Brama Gate (Barczyk, 2013).

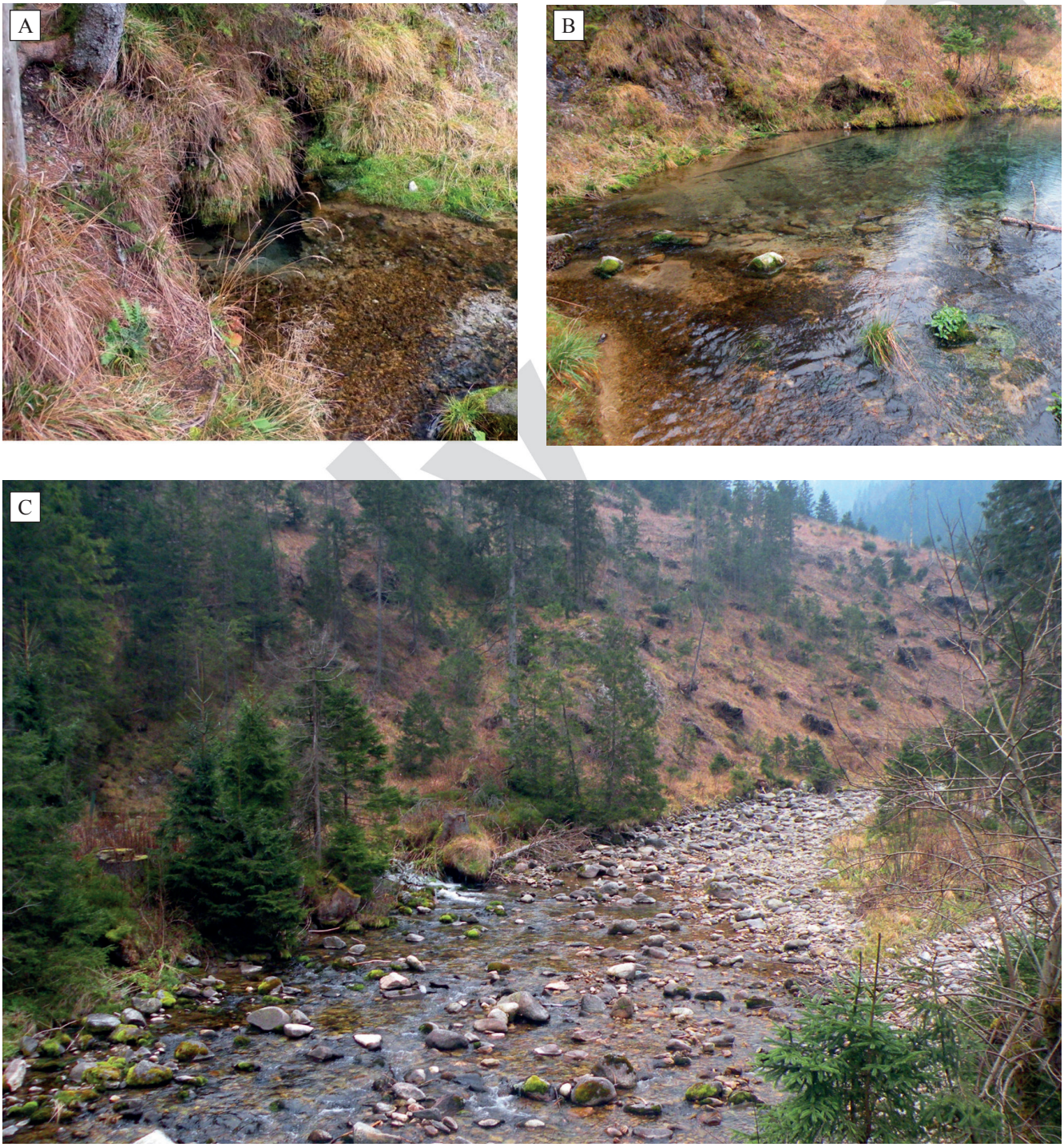

Fig. 10. Geosite no. 5: Chochołowskie Karst Spring. A – main water outflow, B – lake, C – water supply from the stream (observed at low water level); photo A. Chrobak

Tourist infrastructure

The lower part of the Chochołowska Valley is very well adapted for tourists with mobility disabilities. There is an asphalt road with a good surface (without holes) on the entire length of the proposed path from the Siwa Polana to the Polana Huciska. At the beginning of the proposed geotouristic path, on the Siwa Polana there is a car parking lot, however its gravel surface, might pose some kind of difficulties for wheelchair users. The numerous gastronomic points, sanitary facilities, huts and shops with regional souvenirs are also located in this area (Fig. 11). At the entrance to the Chochołowska Valley, near to the car parking lot, there is a toll point for entry to the Chochołowska Valley (which belongs to the Forest Community of the Entitled Eight Villages). In the middle part of the proposed geotourist path, near the end of the Wielkie Koryciska Valley (geosite no. 3), there is a traditional, highlander style, wooden shed with a table and benches for resting. Similarly, at the end of the proposed geotourist path, Polana Huciska is also well adapted to the tourist traffic of disabled people, as the comfortable wooden tables with benches and sanitary facilities are available (Fig. 12).

Fig. 11. Siwa Polana – the beginning of a geotouristic route with a view on: A – parking lot, B – catering outlets and huts; photo A. Chrobak

Fig. 12. Toilets for disabled people at Polana Huciska, photo A. Chrobak

There are additional tourist attractions, like a shepherd's hut and ruins of an old shelter, located on the Polana Huciska. Also, there is a possibility to take a tour from Polana Huciska to Siwa Polana by the railway miniature train called "Rakoń" railway, (available from May to September) or by horse carriages (whole year). This can also be an option for mobility through the valley.

Discussion

The Chochołowska Valley, especially its lower part, from the Siwa Polana to the Polana Huciska is a place for walking with children and elderly people, as well as with people with disabilities (also wheelchairs), due to its very easy accessibility (a wide road with a slight inclination with a good asphalt surface) (Fig. 13).

The Chochołowska Valley is very popular for seeing crocuses bloom in the spring and for summer and winter holidays. It has unique natural and cultural – historical values (the route of John Paul II, an indulgence at Polana Chochołowska). These attractions from year to year attract about 500 thousand tourists, including people with disabilities.

In the lower part of the Chochołowska Valley, there is easy access to catering and sanitary facilities and parking spaces on a large parking lots, which can also have a positive impact on access for the people with disabilities.

The occurrence of numerous rock exposures within various lithological units, interesting forms created as a result of geomorphological processes, especially fluvial and karst, which can be observed directly from the asphalt road presented in this paper and a geoturist path all give the Chochołowska Valley high geotouristic potential.

Fig. 13. A disabled tourist in the company of his friends on the proposed geotouristic path, photo A. Chrobak

Summary and Conclusion

The Chochołowska Valley (its lower part) has high geotourist values that are accessible for people with limited mobility, including wheelchairs. Apart from the Chochołowska Valley, there are only two more places (Białka Valley and Kasprowy Wierch in the Polish part of the Tatra Mountains, which can be easily accessible for tourists with physical disabilities. The proposed geotourist path will give such people not only the satisfaction of traveling through this tourist path, but also communing with nature and enriching their geological knowledge.

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