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## Valorization of Geosites in Western Tatra Mountains (Chochołowska Valley) with Focus on Tourist Activity of People with Physical Disabilities

**Abstract:** In this work, we present the results of valorisation of geosites for the geotourist path in the lower part of the Chochołowska Valley, with particular emphasis on tourist activity of people using wheelchairs and elderly people with motor disabilities. Five geosites were valorized: (1) Siwiańskie Turnie Outcrop, (2) Wielkie Koryciska Rock Gate, (3) Chochołowski Stream Riverbed, (4) Niżna Chochołowska Gate, (5) Chochołowskie Karst Spring. Selected geosites are easily accessible by people with limited mobility, including wheelchairs. They are located along a wide, flat asphalt road on the distance of 3.5 km and the altitude difference of 100 metres. Various sedimentary rocks, such as limestones, marls, and dolomites can be seen in geosites. These rocks represent two geological-tectonic structures, the so-called: Choć Nappe (geosites: Siwiańskie Turnie Outcrop, Wielkie Koryciska Rock Gate) and Krížna Nappe (geosite Niżna Chochołowska Gate). Two more characteristic phenomena can be observed: hydrogeological phenomena related to the karst processes seen in Chochołowskie Karst Spring, and geomorphological phenomena observed in Chochołowski stream riverbed. The results of valorisation showed that the evaluated geosites of the geotouristic path have very high geotouristic values. This indicates that the lower part of the Chochołowska Valley has a high geotouristic potential for people using wheelchairs and elderly people with motor disabilities who already are, or want to become active geotourists. Benefit of creating of this type of geotourist paths is the expansion of the tourist offer and the development of services in the Podhale region, with particular emphasis on the people with physical disabilities.

**Keywords:** Chochołowska Valley; geosites; geotourism; geotourism for people with physical disabilities; Tatra Mountains; valorisation

**Received:** 29 January 2019

**Accepted:** 9 May 2019

### Suggested citation:

Ciurej, A., Chrobak, A., Wolska, A., Kowalik, Sz. (2019). Valorisation of Geosites in Western Tatra Mountains (Chochołowska Valley) with Focus on Tourist Activity of People with Physical Disabilities. *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego [Studies of the Industrial Geography Commission of the Polish Geographical Society]*. 33(3), 148–158. doi: 10.24917/20801653.333.10

## INTRODUCTION

The Tatra Mountains are the highest range in the Carpathian range. They are located in Poland (small part) and Slovakia (larger part). In Poland they are the highest mountains of alpine character. They are divided into the High Tatra Mountains (the highest peak – Rysy 2499 m AMSL) and the Western Tatra Mountains (Starorobociański Szczyt – 2176 m AMSL). The most visited sites of the Polish Tatra Mountains are the Morskie Oko Lake, Chochołowska Valley, Kościeliska Valley, and the Valley of Five Lakes. For advanced mountain hikers the most popular peaks are Kasprowy Wierch, Giewont, Rysy and a group of peaks called the Czerwone Wierchy.

The development of tourism, as well as tourist services in the Podhale and Tatra Mountains has a long and rich history (Myga-Piątek, 2011). Recently, the authorities of the Tatra National Park have made efforts to make some parts of the Tatra Mountains available for people with motor disabilities (Kosut, 2012). However, the description of geotourism attractions for people with disabilities has so far been treated as marginal or even overlooked (Chrobak et al., 2018; Ciurej et al., 2018).

In our work, we present the results of valorisation of geosites for the geotouristic path in the Western Tatra Mountains, in the lower part of the Chochołowska Valley, with a focus on the activity of people with motor disabilities. This particular valley was selected, as one of the most beautiful valleys in Tatra Mountains, as well as for the fact that it is a very popular tourist trail, with adequate infrastructure and numerous rock exposures. For many years, the Chochołowska Valley has been a perfect place to rest and get satisfaction from communing with nature along the tourist trail. Due to these features this valley seems to be a very good area for the development of geotourist services for wide spectrum of tourists, including the people with physical disabilities.

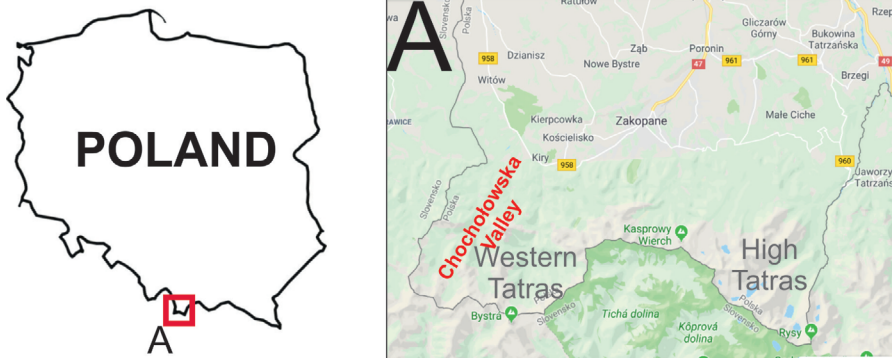
## GEOTURISM AND PEOPLE WITH PHYSICAL DISABILITY

Geotourism is a form of qualified tourism (e.g. Jenkins, 1992; De Bastion, 1994; Martini, 1994; Hose, 1995; Słomka, Kicińska-Świdarska, 2004; Newsome, Dowling, 2010). It is practiced mainly by people interested in natural Earth sciences (e.g. geology, geomorphology, hydrology), in rather good physical health and with appropriate equipment. On the other hand, geotourism should not be limited only to the able-bodied, as people with motor disabilities also show increasing interest in this form of tourism. Such a development is the result of popularisation of this kind of tourism for people with physical disabilities in various places in the world, e.g. the Grand Canyon, Yellowstone National Park (Seekins, Clay, Ravesloot, 1994; O'Connell, 2017; Mucivuna, da Glória Motta Garcia, 2018) and only few in Poland (Knapik, Migoń, 2011; Kołodziejczyk, 2013; Chrobak et al., 2018; Ciurej et al., 2018).

## STUDIED AREA

Chochołowska Valley is the longest and largest valley in the Polish Tatra Mountains (Solon et al., 2018) (Figure 1). The area of the valley is more than 35 km<sup>2</sup>, and its length is 10 km. The highest summit located above the valley is Starorobociański Wierch 2176 m AMSL. Chochołowska Valley is one of the most beautiful valleys and one of the most popular tourist trails in Tatra Mountains. The valley administratively belongs

Figure 1. Location of Chochołowska Valley in Western Tatra Mountains

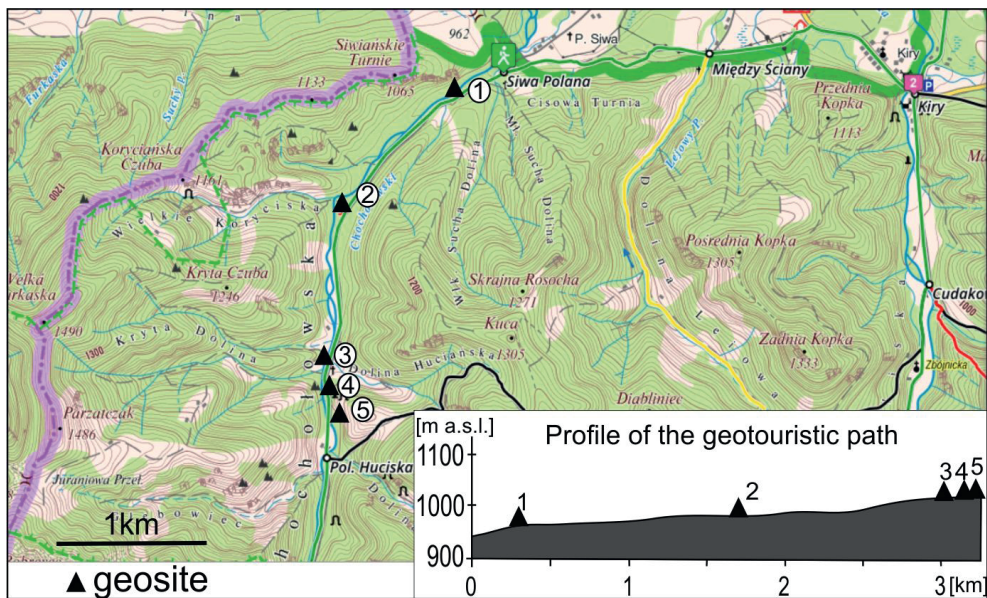


Source: based on <https://www.google.pl/maps/@49.2703685,19.8161085,11z>

to the village of Witów. A green tourist trail runs from the bottom of the valley to the mountain hut named after John Paul II located on the Chochołowska Polana Gate.

The authors selected for further analysis the lower part of the Chochołowska Valley, between the Siwa Polana Glade and Huciska Polana Glade. Five geosites located have been valorized: 1 – Siwiańskie Turnie Outcrop, 2 – Wielkie Koryciska Rock Gate, 3 – Chochołowski Stream Riverbed, 4 – Niżna Chochołowska Gate, 5 – Chochołowskie Karst Spring (Figure 2). A detailed description of these geosites can be found in a paper by Chrobak et al. (2018), therefore in this paper only general information will be given.

Figure 2. Location of valorised five geosites on the geotouristic path in the Chochołowska Valley with hypso-metric profile for geotouristic path. Marked geosites: 1 – Siwiańskie Turnie Outcrop, 2 – Wielkie Koryciska Rock Gate, 3 – Chochołowski Stream Riverbed, 4 – Niżna Chochołowska Gate, 5 – Chochołowskie Karst Spring



Source: based on tourist map: [mapy.hiking.sk](http://mapy.hiking.sk) and computer simulation of profile using the Geographic Information System (GIS) ArcMap 10.6.1

Valorised geosites are located on the geotouristic path, on a distance of 3.5 km. The altitude at the lower part of the valley range from about 900 (from 910 to 920) m AMSL (in the Siwa Polana Glade area) to about 1000 m AMSL (the Huciska Polana Glade). Selected geosites are exposed along (located directly or near) the asphalt road with flat (generally with no holes) and wide surface. The road runs relatively flat, because the height difference is 100 m. All of this makes the geosites accessible to people with limited mobility, including those in wheelchairs. Along the route there is also the necessary sanitary and gastronomic infrastructure, which is easily accessible for people with physical disabilities. In analysed geosites, sedimentary rocks (the Triassic – the Upper Cretaceous age), such as limestones, marls, dolomites are visible. These rocks represent two geological/tectonic structures formed during Alpine orogeny. The first one is the Choč Nappes whose rocks are seen in Siwiańskie Turnie Outcrop and Wielkie Koryciska Rock Gate. The second is Krížna Nappe, whose rocks are seen in Nižna Chochołowska Gate. In addition to the geological structures, some geological phenomena/processes can be seen: the first phenomena related to the karst in Chochołowskie Karst Spring and the second with geomorphological phenomena observed in the Chochołowski Stream Riverbed. Detailed geology of the studied area has already been presented in numerous publications (e.g. Kotański, 1971; Lukniš, 1973; Jurewicz, 2005; Uchman, Chowaniec, 2009; Bac-Moszaszwili, Jurewicz, 2010; Bezák et al., 2011).

## METHODS

During last 20 years, when geotourism was developing, many valorisation methods of geosites were also created (Alexandrowicz et al., 1992; Serrano, González-Trueba, 2005; Panizza, Mennella, 2007; Reynard et al., 2007; Koźma, 2008; Pereira, Pereira, 2010; Rybár, 2010; Dmytrowski, Kicińska, 2011; Fassoulas et al., 2012). All of them are based on the point bonitation method which defines the appropriate point value for strictly defined criteria, but they are also characterised by a high degree of subjectivity.

For the purpose of this article, the authors used a valorisation method developed by P. Rybár (2010). This method provides the possibility of rating two types of geosites: natural and anthropogenic. In this article authors used only criteria for the natural geosites: primary geological properties, uniqueness of the object, object accessibility especially for people with physical disabilities, existing scientific and professional publications, conditions of observation (research), safety criteria, availability of information about the object, visual value of the object, value of provided services, objects in the tourist area (Table 1). The method has a 0–8 point scale where each criterion has defined point value for each component, for example: the uniqueness criterion has six components: object unique within Europe – 8 points, object unique within The Western Carpathians – 6 points, object unique within orographic unit – 5 points, object unique within hiking distance – 4 points, object typical for the region – 3 points, and other object – 0 points (Rybár, 2010). In order to make the results of valorisation more objective, the authors independently valorised geosites, and the final result was the arithmetic mean.

The authors also made attempts to determine the proper geotouristic potential of valorised five geosites. Geotouristic potential is defined as a (geo)tourist attractiveness of the geographical environment, taking into account tourist capacity and optimal periods of using (geo)tourist values (Wykrzykowski, 2010). To obtain these the authors

applied for each geosite a method developed by the J. Warszyńska (1970). This method is based on calculating the quotient of the sum obtained from the valorisation by the maximum value possible to obtain by the geosite. The obtained result allowed to classify surveyed geosites into a group with I – very high (0.7 – 1 point), II – high (0.4–0.69), III – medium (0.2–0.39) and IV – low (0–0.19) geotouristic values.

## RESULTS

Five geosites from the Chochołowska Valley – three rock outcrops, a fragment of the stream riverbed and a karst spring – have been categorised and valorised using P. Rybár (2010) valorisation method (see Table 1). All experts are specialists in natural sciences but they evaluated from the point of view of people with physical disabilities. According to this method the geosite with the highest point score (the highest geotouristic potential) is Siwiańskie Turnie Outcrop (68 points). It also received the highest point values from all experts. It is natural exposure within Chochołowski Stream valley where a light gray thick-bedded Triassic (Wetterstein) dolomites, strong tectonic deformations, belonging to a tectonic structure, the so-called Choč Nappe can be seen (e.g. Passendorfer, 1971; Kotański, 1971; Gaździcki, Michalík, 1980; Bac-Moszaszwili, Jurewicz, 2010; Gawęda, 2010). Additional, educational values of this geosite are the occurrence of the main European watershed between the Baltic Sea and the Black Sea passing through the top of the Siwiańskie Turnie (Małecka et al., 2002); moreover this is also a place of the most southern location of a relict pine (*Pinus sylvestris* L.) (Skrzydłowski, 2017). Slightly lower scores were obtained by Niżnia Chochołowska Gate, Wielkie Koryciska Rock Gate and Chochołowski Stream Riverbed, which gained 65, 62.5 and 58.5 points, respectively. The Niżnia Chochołowska Gate is the best example to see the gorge developed in the dolomites (Middle Triassic), belonging to the tectonic structure (Křížna Nappe), which are severely cracked and cut by numerous faults (e.g. Kotański, 1971; Bac-Moszaszwili, Jurewicz, 2010). Additional value of this outcrop is the occurrence of the small caves which were formed during the karst processes on the calcareous rocks (the Neogene period) (Bac-Moszaszwili, Jurewicz, 2010; Gawęda, 2010). The Wielkie Koryciska Rock Gate is built by light gray Triassic (Ramsau) dolomites of the Choč Nappe (e.g. Kotański, 1971; Bac-Moszaszwili, Jurewicz, 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 has a strong current. This geosite has a lower accessibility point score, because direct access to these geosite is possible only by passing through the stream, so it is unreachable for people with physical disabilities.

The example of the geomorphological geosite (geomorphosite; Reynard et al., 2011) is the fragment of the Chochołowski Stream Riverbed in the Huciska Glade, where the diversity of the alluvial (Holocene) riverbed at the bottom of the channel can be observed. The alluvial deposits (pebbles) present consist of sedimentary rocks (dolomites, sandstones, limestones, marls) and crystalline rocks (gneisses, amphibolites, migmatites, quartzite sandstones). This geosite also has lower accessibility point score, because convenient observation is possible from a wooden bridge, which could be difficult to access for people with physical disabilities.

The lowest rated was the Chochołowskie Karst Spring with 53.5 points, an example of a hydrological geosite. This spring creates a small lake. It is characterised by constant



Table 1. Valorisation of five geosites in the Chochołowska Valley (Western Tatra Mountains) with focus on tourist activity of people with physical disabilities, using the valorisation method by P. Rybár (2010) (modified)

	Siviankie Turmie Outcrop			Wielkie Koryciska Rock Gate			Chochołowski Stream Riverbed			Niżnia Chochołowska Gate			Chochołowskie Karst Spring			
	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No	Expert No		
Primary geological properties	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Uniqueness	5	5	6	3	5	5	5	5	5	5	5	3	6	5	6	3
Object accessibility	6	8	5	3	5	8	4	3	4	6	3	3	5	5	4	3
Existing scientific and professional publications	8	8	5	8	7	8	5	8	7	7	4	5	8	7	5	8
Conditions of observation	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Safety criteria	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Availability of information on the object	8	8	8	8	5	6	8	8	5	5	5	8	5	8	8	8
Visual value of the object	6	6	8	8	3	8	8	8	3	8	5	8	6	6	8	6
Value of provided services	4	4	2	4	0	0	0	0	2	4	2	2	2	4	0	2
Object in the tourist area	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
The sum of expert evaluations	69	71	66	66	57	67	62	64	54	60	59	61	64	67	63	66
Average of expert ratings	68.0			62.5			58.5			65.0			53.5			
The value of the indicator according to Warszńska (1970)	0.85			0.78			0.73			0.81			0.66			
Group	I			I			I			I			II			

Source: own work based on P. Rybár valorisation method (2010)

water temperature (5–6.3°C), efficient outflow of water (ca. 400–600 l/s) which is typical for karst springs (Bac-Moszaszwili, Jurewicz, 2010). Water flows out from the Triassic dolomites of the Križna Nappe. The water source area is the massif of the Kominarski Wierch and the Wyżnia Chochołowska Brama Gate (Barczyk, 2013). The spring is perfectly visible from the path, but direct access for the people with physical disabilities is impossible, so the accessibility point score is the lowest from all valorised geosites (only 2 points).

According to Warszzyńska method, four of valorised geosites belong to the first group of geosites with very high geotouristic potential. Those are: Siwiańskie Turnie Outcrop, Niżnia Chochołowska Gate, Wielkie Koryciska Rock Gate and Chochołowski Stream Riverbed. Just one geosite – Chochołowskie Karst Spring – belongs to the second group of geosites with high geotouristic values (Table 1).

The discrepancies in expert assessments are varied. The smallest occur in the assessment of geotourism values of the Niżnia Chochołowska Gate and the biggest in the assessment of Wielkie Koryciska Rock Gate.

## DISCUSSION

The evaluation of geosites in the Chochołowska Valley provided curious outcomes. Siwiańskie Turnie Outcrop received the highest point value in the opinion of all four experts. Slightly lower, but also very high, point values were obtained by other three geosites, i.e. Niżnia Chochołowska Gate, Wielka Koryciska Rock Gate, and Chochołowski Stream Riverbed. High point values of these geosites may result from their detailed and comprehensive description in scientific and tourist literature (Kotański, 1971; Uchman, 2004; Bac-Moszaszwili, Jurewicz, 2010; Piotrowska, 2015). In addition, these good results can be also related to their good observation conditions, as well as availability and safety criteria of valorised geosites. The latter, i.e. the safety criteria, are especially important for people with physical disabilities. It also seems that the effect on the number of points received was due to the fact that these geosites are marked on the maps and described in detail on tourist portals.

The lowest ranked was the Chochołowskie Karst Spring geosite. This is a very interesting site in terms of karst phenomena which is the subject of scientific research (Barczyk, 2013) and is indexed in geological database of the Polish Geological Institute ([geostanowiska.gov.pl](http://geostanowiska.gov.pl)). On the other hand, the availability of this point for the disabled is limited, which had a clear impact on the number of points received, as seen in Table 1. Discrepancies in assessments are varied. Generally, they result from the state of knowledge, interests, specialisations and preferences (maybe also taste) of experts. The biggest discrepancies in the assessment of the Wielkie Koryciska Rock Gate are interesting. These discrepancies were observed in criteria such as: uniqueness, object accessibility, availability of information on the object. These criteria are quite subjective and it may have influenced the results.

When comparing the obtained results of the valorisation of geosites from the lower part of Chochołowska Valley with other ones described in the literature and valorised according to the same method (e.g. Štrba et al., 2014; Chrobak, 2016), it can be concluded that all geosites presented in this paper have very high geotouristic potential.

## SUMMARY

The valorisation of five geosites in the lower part of the Chochołowska Valley shows that they have a high geotouristic values for people with physical disabilities who are or who want to be active geotourists. Additionally, the study also shows that this part of the valley has a high geotouristic potential. The lower part of the Chochołowska Valley can be a perfect place to rest and get satisfaction from communing with nature along the tourist trail. Described and valorised geosites may be a source of geological knowledge available to people with reduced mobility, including people using wheelchairs.

Selection and promotion of the places in the Tatra Mountains that are easily accessible to people with motor disabilities and additionally have a high geotouristic values, is an important point in further development of tourist services in this area. The benefit of creating this type of geotourist paths is the expansion of the tourist offer and the development of services in the Podhale region, with particular emphasis on people with physical disabilities.

The authorities of the Tatra National Park, took an important step to make certain places in the Tatra Mountains available for people with motor disabilities (Kosut, 2012). However, the promotion of geotourist attractions for people with motor disabilities is still marginal in the tourist industry and should be gradually developed alongside the proper services<sup>1</sup>.

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<sup>1</sup> **Acknowledgments.** The research was financed from the statutory research of the Pedagogical University of Krakow, No. BS / 452 / G / 2018. The authors are very grateful to Paulina Łysiak, MD for her important remarks on this paper.



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