VIEWPOINT GEOSITES AND THEIR POTENTIAL FOR GEOEDUCATION AND GEOTOURISM

Lucie Kubalíková[1,2], Karel Kirchner[1], František Kuda[1]
[1]Institute of Geonics of the Czech Academy of Sciences, Drobného 28, 602 00 Brno, Czech Republic
[2]Department of Geology and Soil Science, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czech Republic

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Abstract
Viewpoint geosites are locations which allow observation of the surrounding landscape and comprehension of geodiversity (or Earth history recorded in rocks, structures and landforms) visible from this locality. The sites themselves don't have to be attractive from the Earth-sciences point of view, so they may be both natural (e.g. rock outcrops, mountain tops) and man-made objects (e.g. watchtowers, view terraces). These sites represent a very important resource for geotourism and geoeducation as they allow understand landscape, its history and relationships between its components. In this paper, we present examples of viewpoints from Podyjí National Park (both natural and man-made structures) that allow to observe geodiversity of the area. For an effective management and rational use of these specific and important sites, it is necessary to identify their characteristics and potential, so the guidelines for inventorying and method for assessment their potential are proposed. These procedures can contribute to the development of geotourist and geoeducational activities and above all, they enable better understanding of geodiversity's position within landscape and justify its conservation and sustainable use.

Key words: Geodiversity; Inventory; Assessment; Landscape; Viewshade analysis

Introduction

The viewpoints has been always perceived as fascinating sites from where the landscape (including its non-living and living components and cultural aspects) could be observed. Already in the past and in the early development of tourism, they represented a favourite destinations of tourists and visitors. However, within the geodiversity and geoheritage studies, they rather stood aside in comparison with "traditional" geosite-oriented research and they obtained only limited attention and have been explored rather in a conceptual way (Migoń and Pijet Migoń 2017, Mikhailenko and Ruban 2019).

Generally, the issues of viewpoint geosites are often discussed in relation to perception of the landscape (Giusti et al. 2013). Reynard (2004) briefly mentions the viewpoint geosite in Encyclopedia of Geomorphology, Pereira and Pereira (2010) distinguish "panoramic viewpoints" as a category of geosites, introducing them as sites from which large landforms can be best perceived. According to Migoń and Pijet Migoń (2017), viewpoint geosites are understood as localities which offer a wider look at the surrounding landscape and hence, better understanding of its history, spatial relationships between rock types and landform categories (i.e. geodiversity), and ongoing environmental change. Viewpoint geosites may be classified as following: **1) Sites with an intrinsic value**: usually natural viewpoints, attractive from Earth-science point of view, e.g. hill, rock outcrop, mountain, rim. They are often included in geosite inventories and assessed by methods used for classical geosites (existence of a view or scenic beauty of the site's surrounding are evaluated within added values as an "aesthetic value" or "scenic value" and increase the overall value of the site). **2) Sites without any intrinsic value (or a very low intrinsic value)**: sites where different geodiversity and landscape elements can be observed, but the sites themselves are not attractive from Earth-science point of view, e.g. bridge, the roof of a building or any other construction (Figure 1).

Viewpoint geosites are very important for geoeducation especially in the fields of general geology, geomorphology, land use patterns and landscape interpretation (Rodrigues 2013, Migoń and Pijet Migoń 2017). There are several studies that include the assessment of viewpoint geosites, but usually, this type of geosite is not in the centre of attention (Pereira and Pereira 2010, Tessema et al. 2021). Practically, assessment of geotourist and geoeducational potential of geosites can contribute to balance the geotourism/education needs with nature conservation (Kubalíková et al. 2021). This paper represents a pilot study where we apply a set of criteria on selected viewpoints in Podyjí National Park to assess their geotourist potential. This is accompanied with an analysis of visibility. Based on this, effective management and specific activities can be designed.

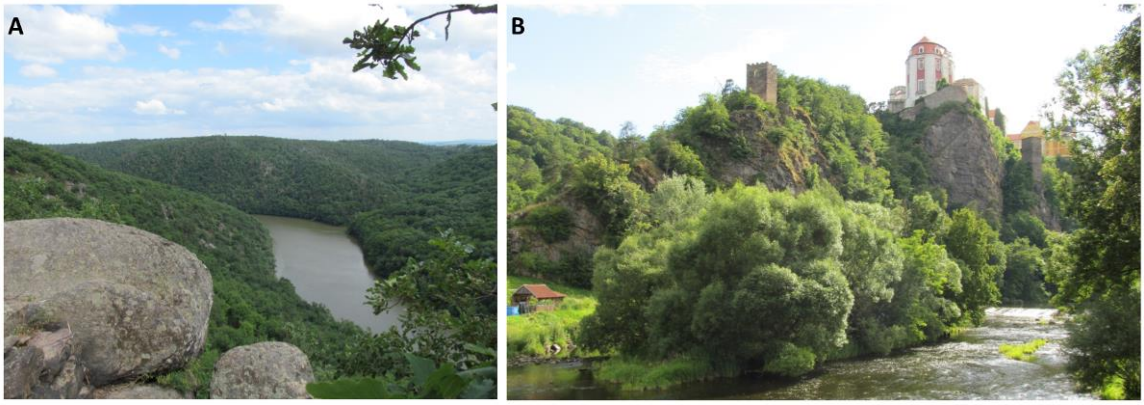

Fig. 1: A – Viewpoint geosite with high intrinsic value: Králův stolec (a rocky outcrop above the Dyje River showing the specific forms of granite weathering); B – Bridge in Vranov as an example of viewpoint geosite with no intrinsic value, but offering a representative view on Bíteš ortogneiss promontory with visible plastic deformations (folds, faults etc.) and with important geo-cultural aspect (a suitable landform for building a fortress and castle)

Methods and study area

The first step when recognising the potential of viewpoint geosites for geotourism and geoeducation, is inventorying, mapping and describing the proper sites. For the qualitative assessment of geotourist and geoeducational potential, selected criteria already proposed and discussed by Migoń and Pijet-Migoń (2017) and Mikhailenko and Ruban (2019) were used. The semi-quantitative approach has been be also proposed and applied (see Results).

Podyjí National Park is situated in the SW part of the South-Moravian Region in the Czech Republic. The canyon-like valley of the Dyje River is deeply incised into the original peneplenized surface and forms the axis of the study area between the towns of Znojmo and Vranov nad Dyjí. The area has been used by humans since Medieval times (border castles, forts, agriculture, wineyards, use of water resources). Due to Iron Curtain established after WWII, the economic activities in the area were limited, so the natural values were preserved. In 1991, National Park was declared. Geologically, the study area is built of Bíteš orthogneiss, two-mica schist of the Lukov unit and granite of the Dyje Massif. The main landforms are represented by fluvial landforms (incised meanders, alluvial plains and terraces), cryogenic landforms (frost cliffs, blocky accumulations, debris flows, rock towers) and anthropogenic landforms, e.g. mill races, agricultural terraces, defensive military constructions or castle moats (Kirchner 2016). In the study area, 35 viewpoints were identified (Figure 2).

Results

As a case study, two viewpoint geosites were chosen for evaluation: Devět mlýnů and Elias' Chapel. Table 1 presents brief characteristics of these sites and assessment of their geotourist and geoeducational potential based on selected criteria.

The description and assessment are accompanied by analysis of visibility (Figure 3). Fig. 4 then presents examples of geodiversity elements that may be observed from a geosite viewpoint.

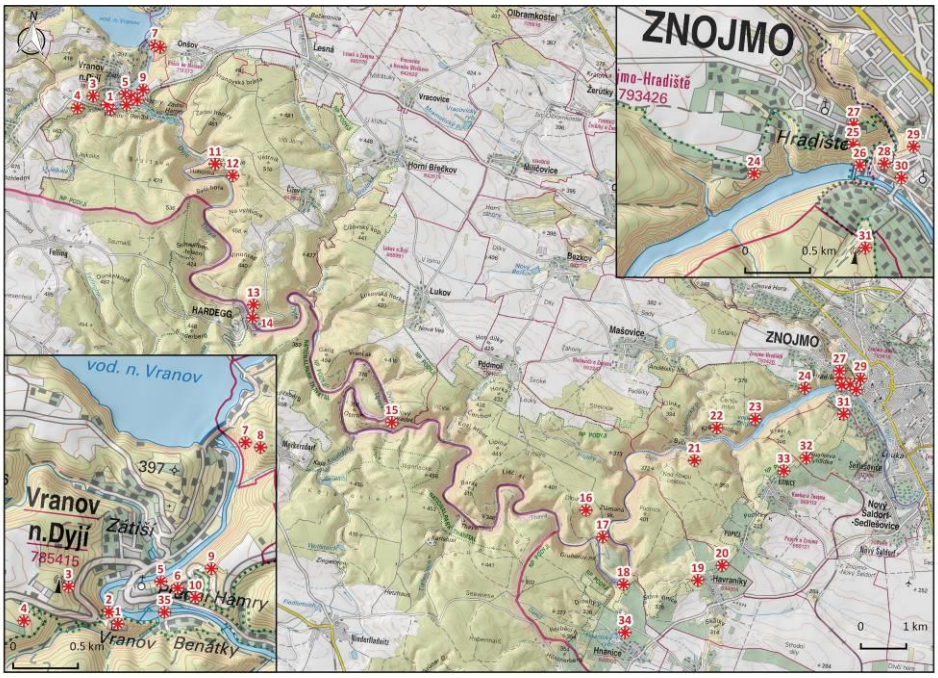

Fig. 2: Viewpoint geosites at Podyjí National Park: 1 – Vranov zámek, 2 – Halamasskova vyhlídka, 3 – Tanečnice, 4 – Nad Felicitinou studánkou, 5 – Švédský příkop, 6 – Mniszkův kříž, 7 – Claryho kříž, 8 – Claryho okruh, 9 – Nejsvětější Trojice, 10 – Vyhlídka zamilovaných, 11 – Obelisk, 12 – Pašerácká stezka, 13 – Hardeggská vyhlídka, 14 – Vyhlídka u splavu, 15 – Nový Hrádek, 16 – Železné schody, 17 – Šobes, 18 – Devět mlýnů, 19 – Havraníky, Sv. Cyril a Metoděj, 20 – Havraníky Nad kaplí, 21 – Sealsfieldův kámen, 22 – Králův stolec, 23 – Dlouhá řeka, 24 – Nad lomem, 25 – Eliášova kaple, 26 – Krammerova villa, 27 – Sv. Antonín Paduánský, 28 – Znojemský hrad, 29 – Znojmo, museum, 30 – Vyhlídka pod hradbami, 31 – Kraví hora, 32 – Špalkova vyhlídka, 33 – Konice, sever, 34 – Hnanice, kaplička, 35 – Bridge in Vranov.

Tab. 1: Viewpoints description and assessment based on selected criteria

Viewpoint:	Devět mlýnů	Elias' Chapel
Characteristics		
Coordinates	48.8107919N, 15.9812075E	48.8564908N, 16.0384539E
Characteristics of the site	rock outcrop on the right bank of the Dyje Valley, accessible via marked path	situated on the steep hill on the left bank above the Znojmo Reservoir
Criteria for assessment		
1. Panoramic view: up to 90° (1 point), 90-180° (2 points), 180-270° (3), 270-360° (4)	180-270° (3 points)	180-270° (3 points)
2. Diversity or number of Earth-science elements visible from viewpoint (1 point for each element, max. 5 for each subcriterion)		
2a. geology (lithology, tectonics, stratigraphy...)	lithology (granite) (1 point)	lithology (granite) (1 point)
2b. geomorphology (cryogenic landforms, glacial landforms, karst, fluvial landforms…)	deeply incised valley, peneplenized surface, meandering, frost cliffs, alluvial plain, block accumulations (5 points)	deeply incised valley, peneplenized surface, frost cliffs, meandering, gullies (5 points)
2c. hydrological components (water bodies, rivers…), soils	Dyje River (1 point)	Znojmo Reservoir (1 point)
3. Geo-cultural features: anthropogenic landforms incorporated in landscape, buildings from local material, small sacral objects (1 point for each feature, max. 3)	agrarian terraces (Šobes) (1 point)	agrarian terraces, castle, church, small chapels (3 points)
4. Overall landscape aesthetic (contrasts and structuration): 1 - low, 3 - average, 5 - high	high contrasts, varied landscape mosaic, deep valley (5 points)	high contrasts, varied landscape mosaic, harmonic environment (5 points)

5. Disturbing elements: 0 - elements affecting or obscuring the view (large constructions, industrial plants), 2 - several disturbing elements not obscuring the view, 4 - no disturbance	no disturbances (4 points)	the dam construction of Znojmo Reservoir, anthropogenic transformation of terrain and some buildings in the city of Znojmo (2 points)
6. Tourist and educational characteristics (use characteristics)		
6a. overall visibility: 1 - low (view obscured by trees or other elements), 2 - average (some obstacles), 3 - very good visibility)	several trees partly obscuring the view, but not very much (2 points)	no obstacles (3 points)
6b. readability of Earth-science elements: 1 - low (a need for explication or information provided on site), 2 - average (possible to read and recognize, usually with brief information), 3 - high (easy to read the features)	some geomorphological features need explanation or interpretation by a professional guide or information panel (2 points)	some geomorphological features need explanation or interpretation by a professional guide or information panel (2 points)
6c. safety: 1 - access at own risk, 2 - access with specific issues that may affect the safety (e.g. lack of the fences, poor paths), 3 - no safety issues	limited access for disabled persons, a visitor has to be careful when stepping at the terrace, not suitable for small children (2 points)	no safety issues (3 points)
6d. accessibility: 1 - accessible by walk, 2 - accessible by car (parking near the viewpoint), 3 - accessible by public transport	accessible on foot or bike, car can be parked approximately 1 km away (2 points)	accessible by car and public transport (parking in proximity, bus stop approximately 700 m far) (3 points)
6e. infrastructure: 1 - no infrastructure, only a path leading to the site, 2 - marked paths, information available e.g. on websites, 3 - well equipped site, tourist marked paths leading to it, information panels on-site	tourist marked path, the site is easy to find, information about the site available on internet or tourist maps, on site, there is no information about Earth-science elements (2 points)	tourist marked path, the site is easy to find, information about the site available on internet or tourist maps, on site, there is no information about Earth-science elements (2 points)
7. Current status: 1 - site not very attractive (damaged, overused), 3 - some disturbances (vandalism, destruction of tourist infrastructure), 5 - site managed well, even if visited frequently	site relatively well managed, but suffers from overcrowding during season (vandalism, littering) (5 points)	site managed well, not disturbed, not very frequently visited by tourists (5 points)
TOTAL SCORE	33	38

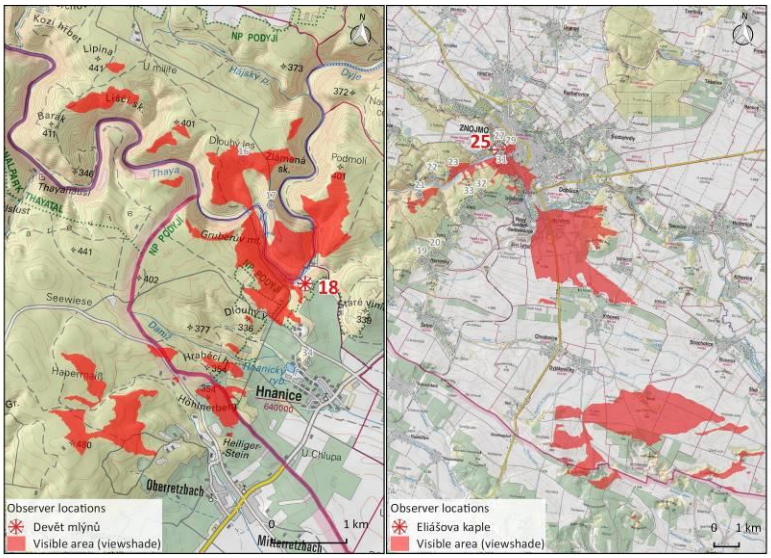

Fig. 3: Analysis of visible area of the Devět mlýnů and Elias' Chapel viewpoint geosites (by using a viewshade method)

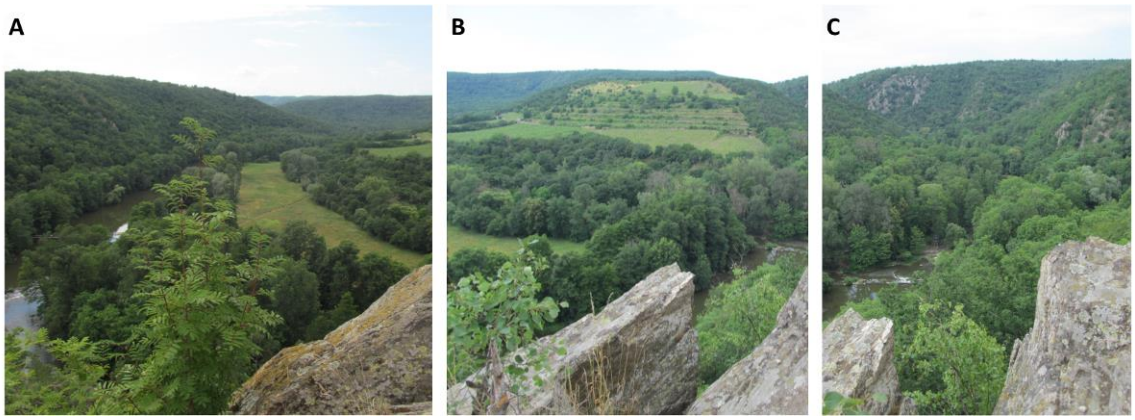

Fig. 4: Devět mlýnů viewpoint geosite and geomorphological features that can be observed: A – deeply incised valley into the peneplenized surface, alluvial plains; B – anthropogenic terraces (Šobes wineyard); C – river bottom, frost cliffs, block fields, rocky outcrops.

The numerical assessment enable a more objective assessment, however, the discussion of results make sense and is possible only when applied on a higher number of the sites. In this case, the numerical assessment is rather a pilot test of the proposed approach (or illustration). Thus, proper interpretation is out of the scope of this paper and it is a subject of further research.

Conclusions

The proposed method is aimed to assess the geotourist and geoeducational potential based on "view" criteria and other characteristics of the site (use characteristics and current status) regardless of the Earth-science value of the proper site. Thus, it may be used both for geosites with and without intrinsic values. Of course, for a complex estimation of geotourist and geoeducational potential of a viewpoint geosite, an evaluation of intrinsic characteristics should be done (i.e. classical geosite assessment based on already used geosite methods). The results of the qualitative and quantitative assessment help to recognize geotourist and geoeducational potential of particular sites, however, when planning and managing them, every site needs to be treated individually. The proposed assessment is rather indicative, but if applied and verified for higher number of viewpoints in different areas, it may contribute to the more effective management of geotourist and geoeducational resources with regard to geoconservation.

References

Giusti C et al. (2013). Géotope, géofacies et géosystème : une grille de lecture des paysages géomorphologiques ? Le cas de la Réserve naturelle nationale des Aiguilles Rouges, Chamonix-Mont-Blanc (Haute-Savoie, France). In: Collection EDYTEM 15: 17-32; https://doi.org/10.3406/edyte.2013.1235

Kirchner K (2016). The Dyje Canyon-like Valley: Geomorphological Landscape of Deep Valley at the Eastern Part of the Marginal Slope of Bohemian Massif. pp. 233-247. In: Pánek, T., Hradecký, J. eds.: Landscapes and Landforms of the Czech Republic, pp 233-247, https://doi.org/10.1007/978-3-319-27537-6_19

Kubalíková L et al. (2021). Urban geotourism development and geoconservation: Is it possible to find a balance? Environmental Science & Policy 121, 1-10, https://doi.org/10.1016/j.envsci.2021.03.016

Migoń P, Pijet-Migoń E (2017). Viewpoint geosites — values, conservation and management issues, Proceedings of the Geologists' Association, 128 (4): 511-522, https://doi.org/10.1016/j.pgeola.2017.05.007.

Mikhailenko AV, Ruban DA (2019). Environment of Viewpoint Geosites: Evidence from the Western Caucasus. Land 8, 93; https://doi.org/10.3390/land8060093

Reynard, E., (2004). Geosite. In: Goudie, A.S. (Ed.), Encyclopedia of Geomorphology 1. Routledge, London p. 440.

Rodrigues J (2013). Geosite management in Geopark Naturtejo da Meseta Meridional, Portugal: geomorphological viewpoints. In: Collection EDYTEM. Cahiers de géographie 15: 65-70; https://doi.org/10.3406/edyte.2013.1240

Tessema GA et al. (2021). Inventory and Assessment of Geosites for Geotourism Development in the Eastern and Southeastern Lake Tana Region, Ethiopia. Geoheritage 13, 43. https://doi.org/10.1007/s12371-021-00560-0

Souhrn
Vyhlídkové geolokality jsou místa, která umožňují pozorování okolní krajiny a pochopení geodiverzity (nebo historie vývoje Země, zaznamenané ve skalních formacích, geologických strukturách a tvarech reliéfu). Samotné lokality nemusí být atraktivní z hlediska věd o Zemi. Může se jednat jak o přírodní (skalní výchozy, vrcholky hor), tak o uměle vytvořené objekty (rozhledny, vyhlídkové terasy). Tyto lokality představují důležitý zdroj pro geoturismus a geovzdělávání. Pro efektivní management a racionální využívání těchto lokalit byla navržena metodika hodnocení jejich geoturistického potenciálu. V zájmové oblasti bylo vybráno 35 vyhlídkových lokalit, podrobně zhodnoceny byly dvě: Devět mlýnů a Eliášova kaple, a to jak kvalitativními, tak numerickými metodami, přičemž numerické hodnocení je v tomto případě spíše pilotním testem navrženého přístupu a bude aplikováno v dalším výzkumu na větším počtu lokalit. Prezentované postupy mohou přispět k rozvoji geoturistických nebo geovzdělávacích aktivit a umožní lépe porozumět postavení geodiverzity v krajině a zdůraznit nutnost její ochrany a udržitelného využívání.

Contact
RNDr. Lucie Kubalíková, Ph.D.
E-mail: Lucie.Kubalikova@ugn.cas.cz