ASSESSMENT OF SELECTED GEOHERITAGE ELEMENTS IN THE SLOVAK PART OF THE TOKAJ REGION

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Abstract
Natural heritage plays a key role when considering any type of nature-based tourism form development in any territory of the world. This paper discusses the assessment of abiotic natural heritage in the Tokaj region in Slovakia in order to set specific value to selected location of the territory and to, in more detail, know the geotourism development potential. Considering used methodology, not only the "overall" value was identified but some specific values, including scientific, economic, and educational, too. Assessment results indicate that the region of Tokaj includes significant geoheritage that, in combination with other values of this area such as cultural-historical heritage, represent admittedly strong basis for complex tourist experience.

Key words: geoheritage assessment, geotourism development, Tokaj, Slovakia

Introduction

In general, tourism is currently considered to be a socio-economic phenomenon and one of the most dynamically developing sectors. For many countries, tourism represents an important sector of the national economy, as it significantly affects their regional and/or national economics (Linderová 2013). Unfortunately, the mass development of tourism often negatively impacts the environment leading to efforts to transform tourism into a more sustainable and greener.
As reported by Gúčik et al. (2016), the sustainable development of tourism is based on the careful use of the natural and cultural values of the country, thus helping the long-term prosperity of the area. In this context, the following forms of tourism apply in particular: green tourism, rural tourism, nature tourism, agrotourism, geotourism, or ecotourism (Gregorová & Klaučo 2017).
When developing any of the above-mentioned forms of tourism, it is essential to know the primary offer of a particular area as well as its value. This article is focused on the assessment of selected elements of geological heritage in the Slovak part of the Tokaj region, which, from various perspectives, represents a specific area of international importance.

Methods

At present, it is possible to find several approaches to determine the value of geosite, as methodology of geosite assessment is a subject of interest to several authors. Although several methods of geosite assessment have been defined, universal use of any of them is not possible, as every method defined has its limits (Štrba et al., 2015). For the purpose of this study, authors use assessment of geological heritage defined by Štrba and Rybár (2015). Used assessment method includes 10 categories giving five types of results – total value, scientific value, educational value, economic value and added value. So, the assessment results give comprehensive insight onto value of individual locations of the geological heritage from various perspectives.

General characteristics of Slovak part of the Tokaj region

The Tokaj region is an extremely interesting area shaped by unique conditions and typical land use - cultivation of basic vine varieties - Yellow Muscat, Furmint, and Lipovina. The specific climatic conditions, the soil of volcanicorigin, long dry autumn, exposure of the slopes and their slope contribute to the cultivation of the vines.
Slovak part of the Tokaj region in its current form represents a small area in the southeastern part of the Slovak Republic (Fig. 1), on the border with Hungary and at the southwestern tip of the Zemplínske vrchy Mts. From an administrative point of view, the Tokaj region belongs to the Trebišov district within the Košice Self-governing Region. With its area of 908 ha, it is the smallest wine-growing area in Slovakia, but it is one of the few areas where grapes can be grown to produce naturally sweet wines. The Tokaj region includes seven municipalities, namely: Bara, Čerhov, Černochov, Malá Tŕňa, Veľká Tŕňa, Slovenské Nové Mesto and Viničky (Mitríková & Nadzon 2013).
Geologically, the Tokaj area was created by repeated volcanic activity and alpine orogenesis. It consists of rock fragments, solidified lava and ashes. Tertiary rhyolites, andesites, trachytes and their

tuffs are mainly represented in the volcanic complex (Vereš 2002). Part of the Tokaj vineyard hunts consists of fine-grained sands, clays, gravels and loess clays (the lowest positions of the vineyards, the least suitable for growing vines). Andesites, rhyodacities and dacitoandesites, which are most suitable for growing Lipovina, Furmint and Muscat Yellow, are located in the Piliš hunting grounds (cadastral area of Bara) (Žadanský 2009). The relief in the Tokaj region is relatively rugged due to the uneven weathering of various rock material.
In this region, a relatively large number of areas with the occurrence of protected species of flora and fauna related to exceptional territorial climatic and geological conditions is present, e.g., Latorica Protected Landscape Area and small-scale protected areas, e.g., Protected area Boršiansky les (forest) (protected under NATURA 2000) or law-protected Kašvár National Nature Reserve with the occurrence of thermophilic fauna communities and rare xerothermic and calcareous flora.

Fig. 1: Location of the Tokaj region

Geological heritage of the Tokaj region
The area of the Slovak part of the Tokaj region includes diverse geological phenomena creating geological heritage of this territory. Following text brings overview of the most significant of them based on review of publications of Gazdačko (2016), Kobulský et al. (2016), and Liščák and Antalík (2018) and the information from the State Nature Conservancy of the Slovak Republic (available in Slovak language at www.sopsr.sk).
Nature Reserve Tarbucka, with an area of 146.98 ha, is an area of European importance. It is located in the cadastral areas of Veľký Kamenec and Streda nad Bodrogom. The territory was declared a nature reserve in 1986. It includes a rare geomorphological phenomenon in Europe - andesite ridges with heaving sands. Sandy substrate and suitable microclimatic conditions are a prerequisite for the development of rare sand-loving fauna and flora.
Ladmovce limestone occur within an area of European importance located in the village of Ladmovce with an area of 337.7 ha, for which the relief of non-karst plains is typical from a geomorphological point of view. In some parts, the original xerothermic oak and cerium-oak forests have been preserved. The occurrence of xerothermic and calcareous vegetation is known. Important species include, for example, the large-flowered iris (*Pulsatilla grandis)*, the Hungarian leafless iris (*Iris aphylla* subsp*. hungarica*), and the Siberian bellflower (*Campanula sibirica)*.
Below the Roháč hill (161.7 m above sea level) about a kilometer northeast of the village of Streda nad Bodrogom is the famous **Tajba National Nature Reserve**. The size of the reservation is 27.36 ha. The area has been protected by law since 1966 and represents a valuable example of the last remnants of swamps, in which the endangered European pond turtles (*Emys orbicularis*) occur and regularly reproduces.
Malá Bara-Stredný vrch represents a still unextracted deposit of perlite located near the middle hill elevation in the north of the Borsuk extrusion body. Surface perlite is crumbly, crumbling, light gray and gray in color. The area is characterized by the occurrence of porous spherulitic and non-perlitized felsic rhyolites. Non-hydrated obsidians in the form of marekanites are also present.
Ladmovce - Babský vrch is an abandoned quarry in the southeastern part of the Šomoš hill, located west of the village of Ladmovce. The quarry contains muddy Mesozoic limestones with unique shale positions and calcite veins. Various fossils have been found in the limestones, including foraminifera, crinoids, ostracods, and lamellibranchiates.
Ladmovce - Šomoš is located west of the village Ladmovce about 400 m southeast of the Šomoš hill. The quarry, which was extracted in the past, represents the highest part of the Triassic Ladmovce

Formation (thick layers of dolomitic limestones and dark gray limestones) based on layers of brightly colored clayey and sandy shales.
In the forest above Veľká Tŕňa there are **fossilized remains of various Carboniferous plants**. The locality is the heaps of tailings that remained here after the trial mining of hard coal. Mining was not carried out and the mines closed. Here we can find the remains of tree horsetails (*Calamites*), imprints of the bark of *Lepidodendron*, small, rose-shaped leaves of the *Sphenophyllum*, or the roots of *Sigillaria*. The plant fossils are white and clearly visible in a dark gray sandstone base.
In an abandoned quarry on the southern slopes of **Šimonov vrch** hill**,** well-layered rhyolite - dacite pyroclastics of the Tŕňa Formation are exposed. Thin shards of shale, rich in clastic mica, appear between the thick and evenly developed layers of volcanoclasts. Volcanoclastics have been redeposited into the lake environment, documented in some places by the well-preserved horizontal lamination and rare relics of ostracods.
Viničky is a classic locality with a natural occurrence of three types of volcanic glass - pumice, obsidian and perlite. The presence of obsidian is genetically associated with rhyolite volcanism in the immediate area. The autochthonous occurrences of obsidian are concentrated on the surface on the southern slopes of the extruding body above the village of Viničky in the area of the road and in the area of the vineyards on an area of approximately 500 x 200 m. The second concentrated occurrence is in the basement of the cellars of the private company Tokajská spoločnosť Viničky.

Results of the assessment
Selected geoheritage sites were assessed using the methodology defined by Štrba and Rybár (2015). Results of assessment are summarized in Table 1.
As assessment results show, many of identified geoheritage locations in the Tokaj region are of significant value form various points of view. The most important sites are: Viničky, Tarbuca NR, Tajba NNR, Malá Bara-Stredný vrch, and Ladmovce-Babský vrch. From the scientific perspective, the most valuable sites are Tarbucka NR and Viničky. These two sites, together with Tajba NNR, are of the highest educational importance also. The highest economic and added value has the location Viničky.
Results of the assessment show that the most valuable geosite in the region of Tokaj is location Viničky-obsidian. It is caused by the fact that this site is located directly in tourist attractive location of the Viničky village.
In general, assessment results show that the geological heritage located in the Slovak part of the Tokaj region is of significant value. In this regard, appropriate attention and management should be adopted in order of preservation and potential use for, e.g., diversification of tourism products in the area. For this purpose, the knowledge of the geoheritage value is an important information source for effective and sustainable tourism development based on natural resources of the area.

Tab. 1: Assessment of geological heritage located in the Slovak part of the Tokaj region after Štrba and Rybár (2015)

Geosite name	Assessment criteria										Assessment score				
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	Total	Sci	Edu	Eco	Add
Tarbucka NR	4	6	6	6	5	5	6	6	0	4	48	0,72	0,58	0,44	0,47
Ladmovce limestone	4	2	6	6	5	0	4	6	0	0	33	0,53	0,43	0,31	0,19
Tajba NNR	4	6	6	6	5	5	6	6	0	4	48	0,72	0,58	0,44	0,47
Malá Bara-Stredný vrch	4	2	6	6	5	5	4	6	0	4	42	0,53	0,43	0,44	0,47
Ladmovce-Babský vrch	4	2	6	6	5	5	4	6	0	4	42	0,53	0,43	0,44	0,47
Ladmovce-Šomoš	4	2	6	6	5	0	4	6	0	4	37	0,53	0,43	0,44	0,31
Veľká Tŕňa fossils	4	4	6	6	8	0	2	6	0	0	36	0,63	0,50	0,31	0,19
Šimonov vrch	4	2	6	6	5	0	4	6	0	2	35	0,53	0,43	0,38	0,25
Viničky - obsidian	4	2	6	8	8	8	4	6	6	6	58	0,63	0,70	0,75	0,81

Explanations: Sci – scientific value, Edu – educational value, Eco – economic value, Add – added value, assessment categories C_1-C_{10} adopted from Štrba and Rybár (2015)

Conclusion
Tokaj region is internationally recognized territory, especially due to production of the Tokaj wines. Cultural and historical heritage of this region, which in many cases attracts the visitors to visit this area, plays the primary role in the development of various tourism products in the area. However, long-term viniculture history directly depends on the natural conditions, including specific geological

features. Some of them, as presented in this paper, can be considered as significant geological heritage. Assessment results indicate that geoheritage located in the study area has potential to be a part of future, e.g., geotourism based, sustainable tourism products. However, an assessment, as presented in this paper is only the very first step in the whole process.

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Souhrn

Cestovní ruch je v současnosti považován za socioekonomický fenomén a jedno z nejdynamičtěji se rozvíjejících odvětví. V poslední době se v rámci udržitelného cestovního ruchu uplatňují zejména tyto formy cestovního ruchu: zelený cestovní ruch, venkovský cestovní ruch, přírodní cestovní ruch, agroturistika, geoturismus či ekoturismus. Tento článek je zaměřen na zhodnocení vybraných prvků geologického dědictví slovenské části Tokajské oblasti, mimořádně zajímavé oblasti formované unikátními přírodními podmínkami a typickým využitím krajiny - pěstováním základních odrůd révy - Muškát žlutý, Furmint a Lipovina. Výsledky hodnocení ukazují, že mezi devíti vybranými lokalitami je několik velmi významných. Obecně výsledky hodnocení naznačují, že geologické dědičství nacházející se ve studované oblasti má potenciál stát se součástí budoucích produktů udržitelného cestovního ruchu založených napr. na principech geoturismu. Samotné hodnocení, jak je prezentováno v tomto příspěvku, je však pouze prvním krokem v celém procesu rozvoje přírodních forem cestovního ruchu.

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