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Mining Landmarks in Štiavnické Bane in Old Postcards

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ABSTRACT
The article deals with the village named Štiavnické Bane that is of high recognition as the mining tourism destination. The village has its world primacies from mining point of view. In the 17th and 18th centuries the most complex technical works originated here exceeding the era itself. Huge dumps, water reservoirs as well as construction, sacral and secular landmarks became the most typical objects we shall present as follows. Depiction of mining location is completed with historical postcards in the gallery.

Key words: Štiavnické Bane, technical words, water management system, hereditary shafts, water reservoirs.

HISTORY

The village Štiavnické Bane is situated within the district of Banská Štiavnica and nowadays its population reaches up to 810 and its area 10,16km² (Štiavnické Bane, 2016).

Štiavnické Bane, originally the settlement called Sigelisberg (recorded also as Siglisberg) has gone through many stages of change related mainly to ownership rights. At first it belonged to the property of the town Banská Štiavnica but sometimes before 1352 it was taken over by a burgrave of the castle Šášov. The settlement, later a village, became a castle property part from the 80's of the 14th century and as of 17th century of the Chamber Earl's mansion Šášov. In 1830 the mining exchequer formed a new Chamber Earl mansion Dekýš-Vysoká, while its administration was set to Sigelsberg.

The name Siegelsberg was changed to Perg in the 16th century (the new name was already recorded as a part of Šášov mansion), later Pjerg. Up to 1526 the written documents preserved several forms of Perg. Some newer field works introduced explanations Štiavnické Bane were formed by unification of three units - Vindšachta, Piarg and Siegelsberg. Historical sources of 17th and 18th centuries state Siglisber, later recorded also as Siglisberg, formed the grounds of present village territories and contained two settlements (Čelko, 1996).

The second territorial section forming present Štiavnické Bane was definitely Vindšachta, the settlement situated in the area of Banská Štiavnica. Mining development undoubtedly had an impact on its origin. During Turkish raids in the 17th century they built a huge fortification system.

Sigelsberg and Vindšachta, as original parts giving grounds for Štiavnické Bane establishment, were undoubtedly centres of European significance. Particularly from a half of the 16th century, when mining got concentrated to the mentioned territory while Banská Štiavnica still kept its administration role. Later on headquarters of mining administration, measurement and a hospital were set here. In 1948 the village Piarg was renamed to Štiavnické Bane. Piarg was established by unification of two originally neighbouring territories with rather different medieval development. Due to its unique historical objects of mining technology and architecture the village was declared a historical preservation area in 1994. The aim of the declaration was to ensure appropriate protection and

Fig. 1 A postcard - coloured pen drawing of the village by J.Mohling from 1802 (source: Herčko)

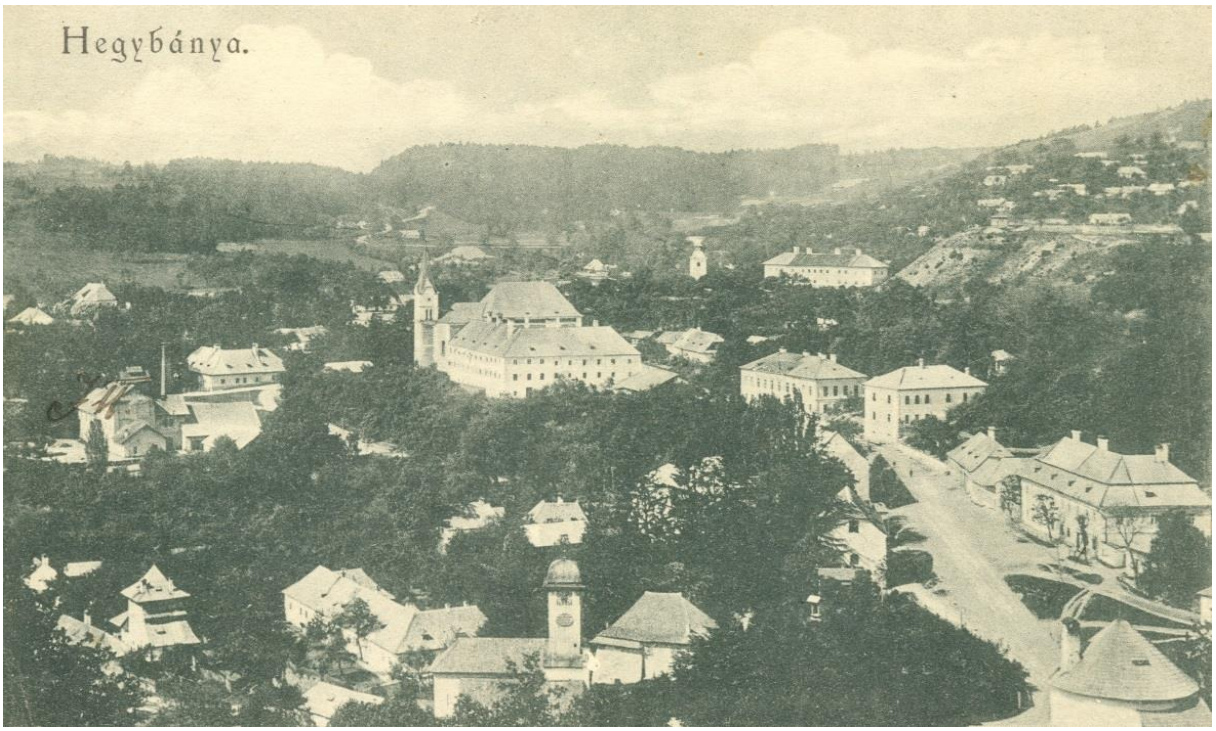

Fig. 2 A view on the village historical centre in about 1900 (source: Herčko)

The oldest more specific date on Piarg mining has been recorded in the oldest Banská Štiavnica Town Book so called Notationes iudiciariae (1364 - 1422) and 3rd Town Book including records on mining from 1470 - 1507. The data is so rare and issuing from it is not possible to form a more complex picture on topography of mining works and then production. In the late 16th century quite a more data documented mining in Fusloch (Horná Roveň), but the data on Piarg mining is still rare. In the late 16th century particular private entrepreneurs and several extraction

companies out of which Brenner's Enterprise was the biggest one and was established in 1571 as the initiative of Lower Austria Chamber initiative by unification of several smaller extraction companies owned mines (Lichner et al., 2002).

Remarkable moments in mining technology development in Banská Štiavnica occur from the late 17th century when the situation in mines got worsens. Deepening mines increased inflow of water into mining premises, ventilation deteriorated and transport routes were lengthened which resulted in the cost increase. Majority of mines in Banská Štiavnica and its surroundings belonged to mining exchequer already as of 1640 so from the fall of Brenner's Extraction Enterprise financing construction of efficient machinery in order to increase extraction and to make water pumping more efficient which ensured drainage of mines under hereditary shafts.

Actions they took in the 17th century to replace human energy by animal energy (horse capstans) and water (water wheels) were not sufficient any more. In the early 18th century the problem in Štiavnické Bane deteriorated. Due to high expenses for pumping mining water the existence of mines was endangered.

Thanks to water pumping machines for water run the danger was partly resolved. New and efficient running engines enabled cheap pumping of mining water and the increase of richer ore extraction that resulted in many other troubles. A number of shafts were deepened, new horizons and cross-corridors extracted, direction corridors were lengthened to make them accessible for silver and gold extraction. A numerous shafts operating in Štiavnické Bane and its surrounding could be deepened.

The mining technology in Štiavnické Bane but also in mining territories was highly advanced for its era and unique from the world scope. It was due to the Court Chamber in Vienna investing into technical progress of ore extraction in order to exploit mineral sources of Slovakia. Apart from extraction of precious metals, copper, lead or iron ore forming the grounds for metallurgy production and its related procession fields. The state presented its interest for their use by visitation of three Emperors in Banská Štiavnica ore district that took place in 1740, 1751 and 1783. Slovakia started to educate technical staff in specialised mining schools (Banská Štiavnica, Smolník) and mining technicians in the Mining Academy which created positive conditions for mining science and technology development enabling to resolve and get over many deteriorating natural obstacles in extraction and minerals procession.

Mining in Štiavnické Bane was halted in 1909. Many remarkable historical landmarks right in the village territory remained there (Kladivík, 1996)..

MINING

Mineral sources of Banská Štiavnica ore region enabled the territory to extract precious metals for several centuries. The minerals were extracted out of about 120 dikes and streaks. Due to deposit zonation and cementation of the surface zone precious metal minerals were found in surface sections. By penetration to depths they started to use extraction of other metals (lead, zinc, copper) forming a substantial part of extracted ores. Gold and silver was gained in smaller amounts. Mining had and impact on the countryside by its extraction, surface mining as well as building technical premises. Mining works - shafts and galleries - were created under the ground; extraction towers and procession facilities were built on the surface. Waste created in dumps and heaps, running mining devices needed building up an original system of water reservoirs also known as "tajchy". Some other premises were necessary for the mining needs - powder storages and knocking towers,

Fig. 3 Overview on village Štiavnické Bane (source: Herčko)

Fig. 4 A view on administration building of Upper Bieber Shaft Enterprise with Christina shaft dump (source: Herčko)

premises of mining surveyorship, mining hospitals and administration buildings (Kladivík, 1989).

WATERMANAGEMENT SYSTEM

Banská Štiavnica mining region used to belong to the world famous mining regions

mainly due to the introduction of remarkable mining devices and machinery that were constructed by dozens of significant masters, technicians and professors of the Mining and Forestry Academy. It was crucial particularly when mining works went to far depths and miners permanently faced troubles with water inflow. Pumping was even more difficult for the lack of surface water. Underground mining water was a significant factor the existence of Banská Štiavnica mining depended on. Its pumping was expensive and suffered because of staff lack and animals lack. Even though they resolved the lack of them, the shafts depth reached several tens of metres and there was so much of ground water they were not able to pump it out with then technical devices. Not manual pumps, winches, horse capstans nor hereditary shafts were sufficient. Hereditary shafts made in Banská Štiavnica ore region in 14th century at latest under the level of then mining extraction went under the level of new extraction by deepening shafts. Extraction of similar works would take several or even dozens of years and would cost a fortune so no exchequer and no private extractor could afford it (Lichner et al., 2002).

Although Banská Štiavnica mining outputs were enormous, expenses for mining water pumping during the 17th century began to grow and more often they exceeded mining activities income. We may introduce the example in 1687 in the main mining enterprise - Upper Bieber Shaft Enterprise - 720 workers and 196 horses were dealing with water pumping out of the overall number of 2173 mining staff. In 1696 the enterprise involved 600 horses for water pumping (some of them also for vertical transport). The same enterprise employed about 1000 people for manual water pumping in the consequent decade.

Replacement of by then insufficient and inefficient but highly energy consuming by a new energy source became a clue. The clue could be the use of waterpower that was for free if there was not a lack of it.

The water management system built in the 18th century rescued Banská Štiavnica mining. While in 1710 extraction was thought to be stopped because of high costs of pumping mining water, in a half of the 18th century extraction itself got increased

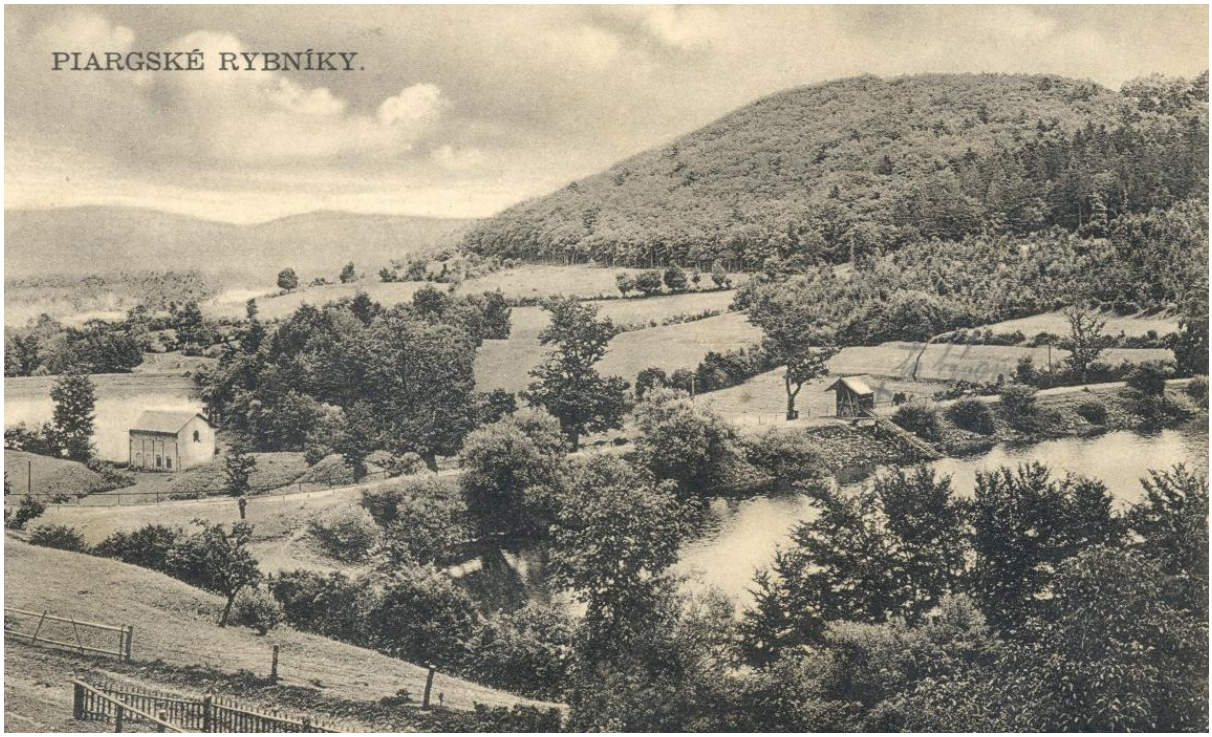

Fig. 5 A view on Vindšachta and Evička water reservoir (source: Herčko)

as never before or after due to newly built water pumping devices using water from new or extended water reservoirs and sufficiency of water energy for tens of stamp mills.

The most efficient water pumping mechanisms in the world (water column, beam and air mechanisms) were invented in Banská Štiavnica ore region in a half of the 18th century based on water use principle, out of which mainly water column pumping device was gradually distributed also to other mining centres in Europe, mostly to Bohemia, Germany, France, England, Norway etc. The way of ore extraction - water pumping, processing and metallurgy technology was definitely the most advanced both in Europe and in the world in those times. Its high advancement was achieved thanks to the Hells family, particularly Matej Kornel Hell and his son Joseph Karol Hell who continued in his father's restoration programme. In 1738 he constructed his own beam-pumping device and two mentioned devices were inbuilt in the Siglisberg shaft. Hell's beam pumping devices were operating only for a short time and did not achieve success, as they deserved.

So J.K.Hell started to construct his water column pumping devices in 1749 but used high pressure of water column causing movement of working piston. The new devices were inbuilt in the Leopod shaft in the level of Bieber Hereditary Shaft. Later they were used for upgraded constructions of water column pumping devices adapted by Jozef Shittko (1828) and Ferdinand Hellwig (1857 and 1860).

Atmospheric steam (fire) pumping devices were built above shafts in Štiavnické Bane for pumping water. English mechanic Izák Potter built the first two of them in 1734 above the Joseph shaft and a year later two similar were launched in the Magdalena shaft. The fifth most advanced and biggest fire device was built in December 1738 above the shaft named Königsegg (Lichner, 1997).

ARCHITECTURAL SIGHTS

In Štiavnické Bane there are found also artistic objects apart from technical mining landmarks. In a half of the 18th century

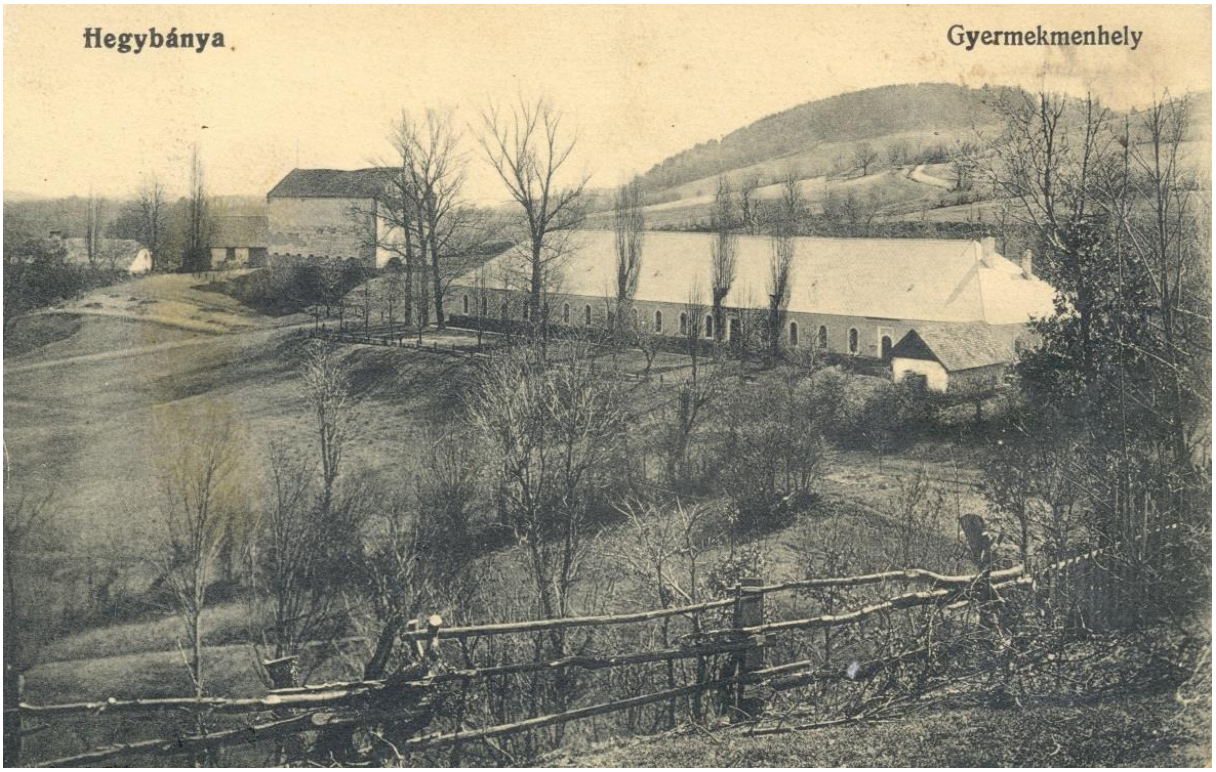

Fig. 6 A view on premises of water pumping devices on the left. (source: Herčko)

there was built a monastery complex behind Saint Joseph Church with the help of mining exchequer, the Main Chamber Earl Office and hieronymites (order Sancti Hieronymi). Chamber Earl F.X.Sternbach invited technically gifted brother of hieronymites in 1733. The church was built in 1736 and consecrated in 1754. Its contains with its main altar and the painting of Saint Joseph by French painter working for the court of Francios Vidon from 1745 (1703-1785), a mining countryside with adoring miners and donors are depicted in its lower section.

Four side altar paintings by A.Schmidt contain the most precious one - the altar of Saint Anna with water pumping device of J.K.Hell from 1749 at the back. The baroque organ with tin engraved pipes with a mining symbol (the symbol of the Mining Chamber) and sculptures of two miners (probably made by Dionýz Stanetti, the most remarkable sculpturer of mining towns in baroque).

The one nave church is connected to the three-winged object of the monastery with its paradise court and a well in the middle. Unfortunately, the monastery and church were rebuilt in the 19th century and especially in the 70's of the 20th century. Even before hieronymites arrival there was a section of Jesuits in Vindšachta who built Saint Joseph Church in the 17th century - torn down in the 19th century. It was situated in the Chapel of Saint John Nepomucký with precious sculptures of adoring miners - lower management staff - from 1855 (Čelková, 1996).

Some other preserved objects worth mentioning are definitely bastions from the 17th century, a building of the oldest mining hospital from 1650 and a mining school, the Chamber Court building (nowadays the seat of the village management), buildings of mining measurement, a drugstore, a pumping device, a bell tower with sun clock or a monastery school (Chovanová & Vošková, 1996). The village is connected with the world primacies of mining practice. Apart from those already mentioned we could also introduce the first lightening conductor fixed in the warehouse of gunpowder in 1871 according to the proposal of Anton Ruprecht (Herčko, 2002). Štiavnické Bane had a core impact on the history of shaft transportation when in the Christina shaft and upon the proposal of Ferdinand Landerer, the main

Fig. 7 Historical centre and a view on the monastery (source: Herčko)

Fig. 8 The mining Chapel of Saint John Nepomucký (source: Herčko)

Fig. 9 A gunpowder warehouse with a lightening rod by professor Ruprecht. (source: Herčko)

mining administrator and inspector of stamping mills in the Upper Bieber Shaft from 1839, they built the first plaited steel hoist rope was made in hemp ropes way (Blázy, 1979).

CONCLUSION

The article tried to present the village history of Štiavnické Bane and its primacies. We took a closer look onto Štiavnické Bane and its surroundings history. We divided landmarks into mining and water management system with the most significant objects and architectural sights. Historical postcards from the private archive of Ivan Herčko complete its overall survey.

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Gorges as potential geotourism attractions of Serbia - comparative analysis of Ovčarsko – Kablarska Gorge and Grdelička Gorge by using M-GAM Model

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ABSTRACT
Serbia is a country with rich geodiversity in various aspects, it disposes of a great potential for development in terms of geotourism. Serbia is one of the countries with a rich geodiversity in various aspects by means of which it disposes of large potential for the development of geotourism. Gorges represent one of the major factors for the development of this form of tourism. There are several gorges in Serbia, which have huge potential for the development of geotourism such as Ovčar-Kablar Gorge and Grdelica gorge. The basic aim of the research paper is to show, by comparative analysis, the current state tourism potential of these two sites, main obstacles of the geotourism development and, also, the possibilities for improving the stated areas by M-GAM model. Furthermore, to show by comparative analysis, the current state of tourism potential of these two sites, main obstacles of the geotourism development and, also the possibilities for improving the stated areas. M-GAM model provides the expert's assessment of both Main and Additional Values of the sites in accordance to the importance of each sub-indicator in the assessment model given by tourists.

Key words: geotourism, geosite assessment, M-GAM model, comparative analysis, Ovčar-Kablar Gorge, Grdelica gorge, Serbia

INTRODUCTION

The tourism market constantly grows and changes. Mass tourism and large groups of tourists disappear slowly and the offer adjusts to the demands of individual tourists. Numerous forms of tourism appeared by segmentation of tourism market by which geotourism developed. A large number of countries lay the foundation of their tourism offers just by promoting geological heritage. Besides world-known geological sites, tourists want to visit less promoted sites which can offer a similar impression and which are not exploited massively. One of the basic parameters for the development of such destinations, besides natural potential, is an untouched environment without overwhelmingly built touristic facilities, i.e. tourists tend to visit more and more places which are not marked on the world tourist maps. Serbia represents one of those countries which have not yet differentiated themselves on the world tourism map. Its rich geodiversity lies in the fact that it possesses approximately 650 distinctive geosites (Djurović & Mijović, 2006).

Landscapes of geotourism interest include mountain ranges, rift valleys, great escarpments, volcanoes, karst landscapes and arid environments. Within these landscapes, there may be characteristic landforms or an array of landforms. For example, within a particular mountain range, there may be glacial and fluvial geomorphic features. Moreover, a hierarchy of features of geotourism interest may be identified within a landscape; these may range from individual landforms through to

geological materials such as rocks, sediments, and fossils. Geotourism is tourism that sustains or enhances the geographical character of a place, including its environment, culture, aesthetics, heritage, and the well-being of its residents (Boley et al., 2011).

Serbia is a country with rich geodiversity in various forms. It largely values and places great importance on geosites, and is acknowledged by the Institute for the Environment Protection of Serbia which has protected about 80% of geological heritage so far, mainly those of speleological nature (Djurović & Mijović, 2006).

The idea is to determine the list of geologically and geomorphologically important markers in Serbia by geoconservation to represent them in the best possible way for scientific purposes, but also to determine their potential for the development of tourism. The development of geotourism represents one of the potentials of the faster economic development of a rural environment in Serbia. Although it has not been significantly positioned so far as a tourist destination in the world, Serbia has included geotourism as an important component of its offer besides urban and river tourism. Although there are plans to valorize touristic geomorphological sites, everything is still without a concrete solution. There are no brochures, maps, written tourist guide books, adequately trained guides, visitor centres, and built tourism infrastructure. Besides several large tourism attractions where it is possible to organize the reception of tourists, tourists are most often left on their own at other sites.

STUDY AREA

Serbia is a country situated in south-east of Europe. It has a large number of gorges; the most known ones are: Grdelica, Ovčar-Kablar, Sićevac and Đerdap gorges. The first two mentioned gorges will be analyzed as places with a large potential for the development of tourism.

Ovčar-Kablar Gorge is a part of a composite valley of the Zapadna Morava river. The gorge is 20 km long and 50-100 m wide. It links Čačak basin with Požega basin. Carved between the Ovčar and Kablar mountains composed from schists. Two dams were also built producing artificial lakes and preventing the fast flow of the Zapadna Morava river. The gorge starts with an immediate closeness to the Tucakova village and finishes upstream from the confluence of the Kamenica river. It is the deepest in the central parts, where is reaches approximately 710 m. The main morphological characteristic of the Ovčar-Kablar Gorge is steep, craggy hillsides of mountains and meander, which represent exceptional esthetical importance. The spectacular fluvial landscape can be viewed as the main geomorphological tourism attraction.On the sides of the gorge there are numerous viewpoints. The most attractive one is at the Kablar Mountain top (885 m). There are also some geological forms interesting for tourists who are engaged in the collection of rocks and fossils. On the left side of the Zapadna Morava River, opposite the Kađenica Cave, is the bend that has been built from pure calcite - a crystalline form. Slightly upstream, in a small limestone quarry, interesting fossils of marine organisms can be found. There are also several remains of debris cones, slumps, and rockslides throughout the gorge. In the Rapajlovača village, on the left bank, in the area of the curving meanders, there is an open profile which should be an essential point for all professional tours (Božić & Tomić, 2015).

Ovčar-Kablar gorge has a complex natural and cultural offer. The touristic value of the gorge is fulfilled by ten monasteries. Therefore, Ovčar-Kablar Gorge is also known as Serbian Holy Mountain. More than 130 kinds of birds have been recorded in the protected area of Ovčar-Kablar Gorge. Thanks to this, the

birdwatching is held in this place. Ovčar spa is situated in the gorge as well, as one of the potential pillars of tourism of this part of Serbia. It is situated in the very centre of the Ovčar-Kablar gorge at sea-level of 279 metres (Discover Čačak, 2016). The government of the Republic of Serbia has protected Ovčar-Kablar gorge by a decree as the area of exceptional forms and natural good of exceptional importance and it is included in the "Ist category" (Institute for Nature Conservation of Serbia, 2016).

Grdelica gorge is situated in the valley of the South Morava river, in the south-east of Serbia and it stretches in the direction of the north-south. It is 34 km long and it is 550 m deep. Grdelica gorge links Vranje and Leskovac basins. The gorge starts with the narrowing near Mala Kopušnica where the hillsides of the mountains Čemernik and Kukavica almost touch each other. The river basin of the South Morava rivers the area of Serbia with the most evident erosion. The causes are a mountainous relief, steep sides of Grdelica gorge, but also uncontrolled forest cutting in this area. The narrowing of the gorge near Prosečenica, the widening and elbow of the South Morava river near Predejane, the Repiški canyon, the widening near the confluence of the Džepska river into Morava, then the narrowing and tunnels on the highway and railway near the villages Manajla and Kalimanca. The interesting landscape which does not leave lovers of nature indifferent. The towns of Vladičin Han, Predejane and Grdelica is situated in the gorge. The Sarajevo bridge and Moma stone is enlisted as a touristic attraction site. A large potential is also insufficiently explored archeological sites from times of ancient Rome (MAEP, 2016; Center for the Development of Jablanica and Pcinja Districts, 2016).

METHODOLOGY

The M-GAM represents a modification of GAM model created by Vujičić et al., (2011). To present day, several approaches on how to determine the value of a specific geosite have been introduced (Hose, 1997; Pralong, 2005; Serrano & González-Trueba, 2005; Bruschi & Cendrero, 2005; Coratza & Giusti, 2005; Hose, 2007; Pereira et al., 2007; Zouros 2007; Reynard et al., 2007; Hose, 2007; Reynard, 2008; Tomić, 2011; White & Wakelin-King, 2014; Tomić et al., 2015; Boškov et al., 2015a; Boškov et al., 2015b; Bruno et al., in press). GAM consists of two key indicators: Main Values and Additional Values, which are further divided into 12 and 15 indicators respectively, each individually marked from 0 to 1. This division is made due to two general kinds of values: main - that are mostly generated by geosite's natural characteristics; and additional - that are mostly human-induced and generated by modifications for its use by visitors. The Main Values comprise three groups of indicators: scientific/educational, scenic/aesthetical values and protection while the Additional Values are divided into two groups of indicators, functional and touristic values. The Main and Additional Values are more detailed presented in Table 1. In total sum, there are 12 subindicators of Main Values, and 15 subindicators of Additional Values which are graded from 0 to 1 that define GAM as a simple equation: GAM = Main Values (VSE+VSA+VPr) + Additional Values (VFn+VTr) (Tab. 3). While in GAM all grades for each subindicator are given by experts M-GAM, focuses not only on the expert's opinion but also on the opinion of visitors and tourists regarding the importance of each indicator in the assessment process. The importance of the subindicators in the model should be strongly related to the specific need of a specific segment of geotourists. The structure and size of tourist segments is changeable over time. It may be that in certain periods of time visitors of a geosite are mostly interested in the scientific value of a geosite, but later on, a large part of visitors can belong to a segment of tourists

Tab. 1 The structure of Geosite Assessment Model (GAM)

Indicators/Subindicators	Description
Main values (MV)	
Scientific/Educational value (*VSE*)	
1. Rarity	Number of closest identical sites
2. Representativeness	Didactic and exemplary characteristics of the site due to its own quality and general configuration
3. Knowledge on geoscientific issues	Number of written papers in acknowledged journals, thesis, presentations and other publications
4. Level of interpretation	Level of interpretive possibilities on geological and geomorphologic processes, phenomena and shapes and level of scientific knowledge
Scenic/Aesthetic (*VSA*)	
5. Viewpoints	A number of viewpoints accessible by a pedestrian pathway. Each must present a particular angle of view and be situated less than 1 km from the site.
6. Surface	The whole surface of the site. Each site is considered in quantitative relation to other sites
7. Surrounding landscape and nature	Panoramic view quality, the presence of water and vegetation, the absence of human-induced deterioration, vicinity of urban area, etc.
8. Environmental fitting of sites	Level of contrast to the nature, the contrast of colors, appearance of shapes, etc.
Protection (VPr)	
9. Current condition	Current state of geosite
10. Protection level	Protection by local or regional groups, national government, international organizations, etc.
11. Vulnerability	Vulnerability level of geosite
12. Suitable number of visitors	Proposed number of visitors on the site at the same time, according to surface area, vulnerability and current state of geosite
Additional values (AV)	
Functional values (*VFn*)	
13. Accessibility	Possibilities of approaching to the site
14. Additional natural values	Number of additional natural values in the radius of 5 km (geosites also included)
15. Additional anthropogenic values	Number of additional anthropogenic values in the radius of 5 km
16. Vicinity of emissive centers	Closeness of emissive centers
17. Vicinity of important road network	Closeness of important road networks in the radius of 20 km
18. Additional functional values	Parking lots, gas stations, mechanics, etc.
Touristic values (*VTr*)	
19. Promotion	Level and number of promotional resources
20. Organized visits	Annual number of organized visits to the geosite
21. Vicinity of visitors centers	Closeness of visitor center to the geosite
22. Interpretative panels	Interpretative characteristics of text and graphics, material quality, size, fitting to surroundings, etc.
23. Number of visitors	Annual number of visitors
24. Tourism infrastructure	Level of additional infrastructure for tourist (pedestrian pathways, resting places, garbage cans, toilets etc.)
25. Tour guide service	If exists, expertise level, knowledge of foreign language(s), interpretative skills, etc.
26. Hostelry service	Hostelry service close to geosite

27. Restaurant service			Restaurant service close to geosite		
Grades (0.00-1.00)					
	0.00	0.25	0.50	0.75	1.00
1.	Common	Regional	National	International	The only occurence
2.	None	Low	Moderate	High	Utmost
3.	None	Local publications	Regional publications	National publications	International publications
4.	None	Moderate level of processes but hard to explain to non experts	Good example of processes but hard to explain to non experts	Moderate level of processes but easy to explain to common visitor	Good example of processes and easy to explain to
5.	None	1	2 to 3	4 to 6	More than 6
6.	Small	-	Medium	-	Large
7.	-	Low	Medium	High	Utmost
8.	Unfitting	-	Neutral	-	Fitting
9.	Totally damaged (as a result of human activities)	Highly damaged (as a result of natural processes)	Medium damaged (with essential geomorphologic features preserved)	Slightly damaged	No damage
10.	None	Local	Regional	National	International
11.	Irreversible (with possibility of total loss)	High (could be easily damaged)	Medium (could be damaged by natural processes or human activities)	Low (could be damaged only by human activities)	None
12.	0	0 to 10	10 to 20	20 to 50	More than 50
13.	Inaccessible	Low (on foot with special equipment and expert guide tours)	Medium (by bicycle and other means of man-powered transport)	High (by car)	Utmost (by bus)
14.	None	1	2 to 3	4 to 6	More than 6
15.	None	1	2 to 3	4 to 6	More than 6
16.	More than 100 km	100 to 50 km	50 to 25 km	25 to 5 km	Less than 5 km
17.	None	Local	Regional	National	International
18.	None	Low	Medium	High	Utmost
19.	None	Local	Regional	National	International
20.	None	Less than 12 per year	12 to 24 per year	24 to 48 per year	More than 48 per year
21.	More than 50 km	50 to 20 km	20 to 5 km	5 to 1 km	Less than 1 km
22.	None	Low quality	Medium quality	High quality	Utmost quality
23.	None	Low (less than 5000)	Medium (5001 to 10 000)	High (10 001 to 100 000)	Utmost (more than 100 000)
24.	None	Low	Medium	High	Utmost
25.	None	Low	Medium	High	Utmost
26.	More than 50 km	25–50 km	10–25 km	5–10 km	Less than 5km
27.	More than 25 km	10–25 km	10–5 km	1–5 km	Less than

Source: adapted from Vujičić et al. (2011)

who are mostly interested in the socio-cultural meaning of a geosite. Hence, the market value of a geosite (estimated by the number of visitors) depends on many variables.

This is why the value of a geosite should be a product of both expert opinion and visitors' opinion also. One way of achieving this is to include the visitors/tourists in the assessment process. Visitors should play an important role in the assessment process and determine how important each subindicator is for them because, after all, they are the ones that will make the final decision to visit or not to visit a certain geosite (Tomić & Božić, 2014). The Im factor was taken from the research paper Božić & Tomić (2015) for the purpose of this research paper. They conducted a survey where each respondent was asked to rate the importance (Im) of all 27 subindicators (from 0.00 to 1.00) in GAM (Tab. 1). The importance factor (Im) gives visitors the opportunity to express their opinion about each subindicator in the model and how important it is for them when choosing and deciding between several geosites that they wish to visit. Afterwards, the value of the importance factor (Im) is multiplied by the value that was given by experts (also from 0.00 to 1.00) who evaluate the current state and value of subindicators (Tab. 1). This was done for each subindicator in the model after which the values were added up according to the already mentioned equation but this time with more objective and accurate final results due to the addition of the importance factor (Im). This parameter is determined by visitors who rate it in the same way as experts rate the subindicators for Main and Additional Values by giving them one of the following numerical values: 0.00, 0.25, 0.50, 0.75 and 1.00, marked as points. The importance factor (Im) is defined, as:

$$Im = \frac{\sum_{k=1}^{K} Iv_k}{K}$$

where Iv_k is the assessment/score of one visitor for each subindicator and K is the total number of visitors. Note that the Im parameter can have any value in the range from 0.00 to 1.00. Finally, the modified GAM equation is defined and presented in the following form:

$$M - GAM = Im(GAM) = (MV + AV).$$

RESULTS AND DISCUSSION

For the purpose of this study, by the analysis of Ovčar-Kablar Gorge (GS1) and Grdelica gorge (GS2) which have been estimated by the stated methodology (M-GAM) from the Tables 2 and 3, as well as from the Figure 1, the results make it possible for someone to notice the differences between two stated sites. From the Table 3 one can see a significant difference in the main value of the geosites. The main values are much greater for Ovčar-Kablar Gorge (6.5) in comparison to Grdelica Gorge (4.71). According to the results, the differences in scientific value between the stated sites is significant, especially that of the Ovčar-Kablar Gorge (1.83) in comparison with Grdelica Gorge (0.78). A large difference is noticed mostly in the fact that Ovčar-Kablar Gorge is known for numerous carved meander, which among other things, implied to protect this area as the natural good and to put it into the first category by which its authenticity is verified as expected. The mass variety of birds that inhabit the gorge has also contributed to the large difference in the results. In all stated categories, the Ovčar-Kablar gorge is better valued than Grdelica gorge. One of the characteristics of Grdelica gorge is richness in various kinds of fish.

When considering a degree of protection of the stated sites, there is an interesting fact that the obtained results are almost identical. Both sites are under the country's protection. Large amounts of money are

invested in Grdelica gorge after the floods in 2014 when the South Morava river flooded and caused great material damage. The erosion problem in this area has been neglected for a long time, and the whole area is degraded, taking into account the fact that the recovery of Grdelica gorge is intensively being worked upon. Additional, values are also to the benefit of Ovčar-Kablar Gorge. Ovčar-Kablar Gorge is known for numerous monasteries, built on the banks of the Zapadna Morava river. Therefore, it is in advantage than Grdelica gorge because tourists are also offered the possibility of visiting anthropogenic sites.

Both sites are easily reachable. Ovčar-Kablar Gorge (GS1) is near larger towns (Čačak, Užice, Kraljevo) while Grdelica gorge has a better connection because the important traffic routes Belgrade-Thessaloniki, and railway Belgrade-Skopje were built through it. The closeness of larger towns of Niš, Vranje and Leskovac, is an additional value of this site. The advantage of a good road connection to Grdelica gorge (GS2) is not adequately used and it has a great potential to valorize itself as the resting place for tourists travelling to some resort at the Ionian or the Aegean Sea.

According to the analysis of touristic values (VTr) produced by the research, the offer of Ovčar-Kablar Gorge is more complex (1.97) while Grdelica gorge has a significantly lower touristic values (1). Neither site has a visitor center which represents a large problem in the development of tourism in the mentioned areas. Tourists do not have the opportunity to inform themselves about the sites which they are visiting. Therefore, there are no tourist guides either, so individual tourists can seek help only from local people while organized groups come with tourist guides. The promotion of Grdelica gorge, as a tourist destination, almost does not exist either in national, or in international tourism.

The number of organized visits is very small. They are mostly school trips. The tourism infrastructure almost does not exist, except built motels and restaurants which are open to the fullest extent with the aim to attract local people. The tables with the maps for giving information to tourists about where they can go have not been set up on either analyzed site, nor can they be bought. There are no marked paths for the movement of tourists. Furthermore, due to a small number of tourists, there are not any souvenir shops. Thanks to the monasteries of the Ovčar-Kablar Gorge, tourists can buy souvenirs; but only those with religious motives. The budget of which the areas of Ovčar-Kablar and Grdelica gorge dispose is not enough to finance marketing which would attract national and international tourists to come. Therefore, the promotion is mainly at local and regional level. Besides their own great potentials, both gorges are not promoted, and it cannot be claimed that there is a huge interest of governing authorities in their advancement.

The final results can be best viewed according to the position in the matrix (Figure 1). The matrix consists of main and additional values represented on the X and Y axes. The matrix (Fig. 1) is divided into nine fields marked by Z (i, j) (i, j = 1, 2, 3) based on the grade they received in the previous evaluation process. When we compare the position of the viewed sites in the matrix, we can see that Ovčar-Kablar Gorge (G_{S1}) is much better positioned than Grdelica gorge (G_{S2}).

Although both sites are currently positioned in the square Z_{21}, it could be put into the square Z_{22} with smaller investments in tourism infrastructure, interpretative panels and the improvement of tour guide service thanks to much higher grades of additional values. Larger investments in the Ovčar-Kablar Gorge (G_{S1}) have resulted in its better position in relation to Grdelica gorge (G_{S2}). Viewed from this perspective, all sustainable investments which do not degrade geosites and the environment are profitable because both scientists and

tourists have noticed that there is a significant difference between stated sites. According to the results, the main values of the Ovčar-Kablar Gorge in relation to Grdelica gorge are more attractive to both scientists and tourists. Therefore, Ovčar-Kablar Gorge (G_{S1}) represents a higher touristic potential.

The M-GAM methodology is currently one of the most comprehensive and objective geosite assessment models. With the addition of the Importance factor, it provides geosite management with the necessary information for the improvement

Tab. 2 Values given by experts and visitors for each subindicators in the M-GAM model

Main Indicators/ Subinidcators	Im		Total		
I Scientific/Educational values (VSE)					
1. Rarity	0.5	0.25	0.89	0.45	0.22
2. Representativeness	0.5	0.25	0.79	0.40	0.20
3. Knowledge on geo-scientific issues	0.75	0.25	0.45	0.34	0.11
4. Level of interpretation	0.75	0.25	0.85	0.64	0.21
II Scenic/Aesthetic values (VSA)					
5. Viewpoints (each must present a particular angle of view and be situated less than 1 km from the site)	0.75	0.25	0.79	0.59	0.20
6. Surface (each considered in quantitative relation to other)	0.75	0.25	0.54	0.40	0.14
7. Surrounding landscape and nature	1	0.75	0.95	0.95	0.71
8. Environmental fitting of sites	1	1	0.68	0.68	0.68
III Protection (VPr)					
9. Current condition	0.75	0.75	0.83	0.62	0.62
10. Protection level	0.75	1	0.76	0.57	0.76
11. Vulnerability	0.75	0.75	0.58	0.44	0.44
12. Suitable number of visitors	1	1	0.42	0.42	0.42
I Functional values (VFn)					
13. Accessibility	1	1	0.75	0.75	0.75
14. Additional natural values	0.75	0	0.71	0.53	0
15. Additional anthropogenic values	0.75	0.25	0.70	0.53	0.18
16. Vicinity of emissive centres	0.5	0.75	0.48	0.24	0.36
17. Vicinity of important road network	0.5	1	0.62	0.31	0.62
18. Additional functional values	0.5	0.75	0.59	0.30	0.44
II Touristic values (VTr)					
19. Promotion	0.75	0	0.85	0.64	0
20. Annual number of organised visits	0.25	0.25	0.56	0.14	0.14
21. Vicinity of visitors centre	0	0	0.87	0	0
22. Interpretative panels (characteristics of text and graphics, material quality, size, fitting to surroundings, etc.)	0.25	0	0.81	0.20	0
23. Annual number of visitors	0.50	0.25	0.43	0.22	0.11
24. Tour guide service (expertise level, knowledge of foreign language(s), interpretative skills, etc)	0.25	0	0.87	0.21	0
25. Hostelry service	0.5	0.5	0.73	0.36	0.36
26. Restaurant service	0.25	0.5	0.78	0.20	0.39
27. Tourism infrastructure (pedestrian pathways, resting places, garbage cans, toilets, wellsprings etc.)	0.75	0	0.73	0.55	0

Tab. 3 Overall ranking of the analyzed geosites by using M-GAM model

Geosite Label			Values		
Main		**Additional**		Field	
	VSE+VSA+VPrΣ		VFn+VTr		Σ
Ovčarsko-Kablarskaklisura – GS1	1.83 + 2.62 + 2.05	6.50	2.66 + 1.97	4.63	Z21
Grdelička – GS2	0.74+ 1.73 + 2.24	4.71	2.35 + 1	3.35	Z 21
Mean	-	5.60	-	3.99	-

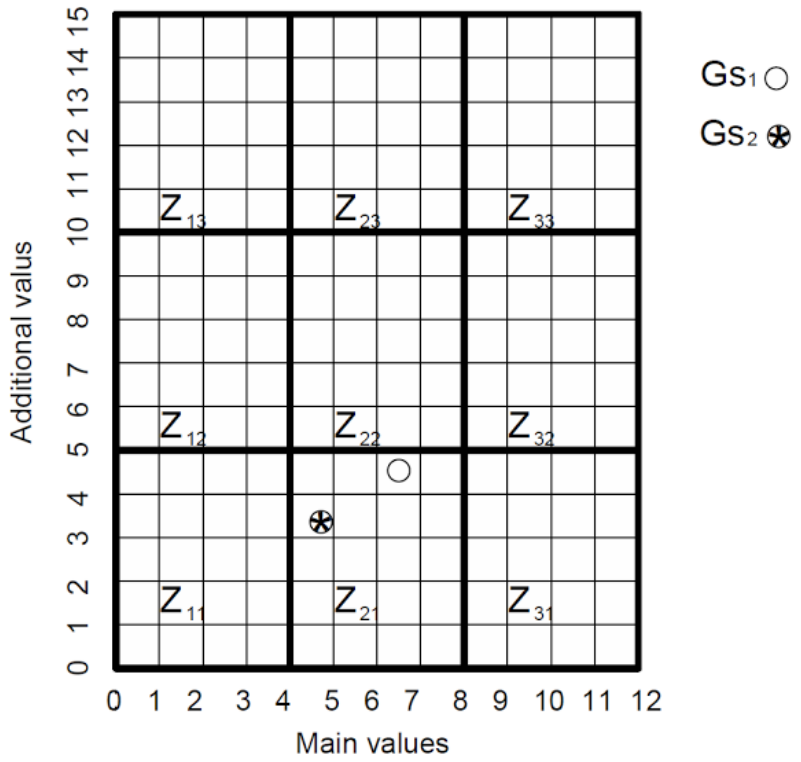

Fig. 1 Position of the assessed geosites in the M-GAM matrix

of the overall geosite tourism offer and it is also a useful tool for indicating potential gaps between what is important for visitors and the current level and quality of those activities and services. This can greatly assist management in planning future tourism activities and improving the tourism offer.

CONCLUSION

The main aim of this research paper was to compare the current state and touristic potential of the two analyzed geosites. From the all mentioned, one can conclude that both sites have a great touristic potential which is founded on their basic values but that both sites are not promoted enough and that enough attention is not paid to their development and valorization. Although Ovčar-Kablar gorge is somewhat valorized touristically due to numerous monasteries, its natural values are not promoted in a larger measure.

According to the results, one can conclude that the considered sites have significantly different values, both basic

and additional, and for that reason, their valorization should be dealt with differently. The basic values are natural, and it is almost impossible to influence on them, but additional values are certainly at the disposal of an individual and the society as a whole. There are numerous instances where tourist destinations of modest natural potentials are valorized due to people's effort and nowadays they occupy a significant place on tourist maps.

In order to be valorized adequately, the effort of local authorities is necessary, as well as the effort of the governing authorities so as to build up a necessary following tourist infrastructure. Hiring the local population in the development of these areas would reduce unemployment which is large in these regions and, therefore, would increase a standard of living of the local population. This would also prevent huge migrations of the population from these regions who are leaving their villages and going to larger towns or moving outside Serbia in pursuit of a better life.

During the strategy formulation of the development of the considered regions, huge attention would have to be paid to the strategy formulation which is in accordance with the sustainable development so as not to ruin natural beauties possessed by the stated sites. Although both sites are under the country's protection, it goes with no notices that no one deals with the problem area of these two gorges. With regard to the fact that there is no built infrastructure, not even travel agencies want to include any of these sites with priority into their offer. If the promotion of the gorges is done with marketing, it would attract a large number of tourists who are lovers of nature. What is a large and unused advantage of Grdelica gorge is certainly its position on the traffic map not only of Serbia but of the whole Balkans as well. (Grdelica gorge serves as a great touristic advantage in terms of its position on the traffic map for not only Serbia but for the entire Balkan region, however, this advantage is not utilized.) It's the advantage of the closeness to the main traffic routes passing through Serbia and connecting Central and Western Europe with Southern and Southeast Europe is a large potential for development, with smaller investments.

Before drawing up the development plan, it would be necessary to define whether it is desired to attract a large number of tourists on the destinations or to carry out the segmentation and the policy of development to be directed only to specific groups. Grdelica gorge (GS1) is, in this case, more suitable for the development of mass tourism due to its closeness to large traffic routes and, therefore, large frequency of passengers passing there while Ovčar-Kablar (GS2) gorge is more suitable for segmentation because of a large number of plant and animal species inhabiting it and which could be endangered by mass tourism.

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Preliminary assessment of the post-mining geotourism potential of the Plateau tin fields, Nigeria

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ABSTRACT
Field assessments of the geotourist potential of the Plateau tin fields were carried out with the aim of qualitatively and quantitatively highlighting their tourism potential. The results show that mining on the Plateau has extensively devastated the environment leaving a landscape that pose a serious danger to life and property ranging from pits, mining ponds and steep dissected earth cuts. The categorisation of these pits and ponds show that in the light of associated variables, nearly 50% of the ponds and earth cuts can be utilized for geotourism with minimal geo-stabilisation procedures. The cost of maintenance can be transferred to wealth generation for socio-economic benefits when properly managed.

Key words: Post-mining, geotourism, Plateau tin fields, Nigeria

INTRODUCTION

Tourism is increasingly becoming a very lucrative economic venture even to the point of sustaining medium level economies. Geotourism has become a recent type of tourism with considerable growth potentials (Alexandrowicz 2006; Gordon 2012; Hose, 2000, 2007, 2008, 2010; Newsome & Dowling, 2010; Radwanek-Bąk 2012).

According to Hose (1995), geotourism, first defined in England, has two viewpoints which include a purely geological and geomorphologically-focused Sustainable Tourism as abiotic nature based tourism which is the definition followed in most part of the world. The second viewpoint is the geographically sustainable tourism, the most common definition in the USA which emphasises preservation of the geographical sense of a place in general, beyond simple geological and geomorphological features, as a new charter & concept in the sustainable tourism.

There are basically four major definitions of geotourism in geological sense (abiotic nature based tourism). The first is when the major attraction is the geological patrimony, the interpretation and the promoting of its popularisation leads to the development of the Earth Sciences including their conservation.

The second is when "Geotourism is a knowledge-based tourism, an interdisciplinary integration of the tourism industry with conservation and interpretation of abiotic nature attributes, besides considering related cultural issues, within the geosites for the general public" (Sadry, 2009).

The third is a form of natural area tourism that specifically focuses on landscape and geology. It promotes tourism to geosites and the conservation of geo-diversity and an understanding of Earth Sciences through appreciation and learning. This is achieved through independent visits to geological features, use of geo-trails and viewpoints, guided tours, geo-activities and patronage

of geosite visitor centers (Ruchkys, 2007)

The fourth involves the provision of interpretative and service facilities for geosites and geomorphosites and their encompassing topography, together with their associated in-situ and ex-situ artefacts, to constituency-build for their conservation by generating appreciation, learning and research by and for current and future generations (Gordon, 2012; Hose, 2010).

The summary of all the above definitions is that geotourism can exploit both the geological landscape artefacts as well as the associated cultural and geographical attributes. In all cases, the aspect of interpretation and conservation keeps coming up. However, the definition of geotourism in Nigeria hardly touches on geo-heritage related to mining except for natural geo-artefacts. If any at all, proponents of tourism in Nigeria involve the utilization of the mining ponds by hoteliers.

Geotourism is considered an extended form of tourism which originally focuses on geosites covering geological and geomorphological aspects. Now mining sites and associated heritage sites are included as sites for tourism. Geotourism explores monuments associated with mining activities such as mining works, mining museums, archives mining, trade routes of transporting commodities obtained from collectors and mining activity, and the technical and cultural heritage associated with historical mining activities, which could be included under the term mining tourism (Rybar & Carvajal, 2014; Pavolová et al., 2014). Mining tourism therefore is now firmly accepted as a component of geotourism whose potential is projected in this paper. Newsome and Dowling (2012) however pointed out that if geotourism is not properly managed, it can pose a threat to the geo-heritage sites.

Mining has been of age-long economic benefit to man and his environment. It involves the location and exploitation of mineral deposits from deep down the bowels of the earth, often utilising mechanized techniques that dig deep into the ground. Consequently, deep pits and unwanted soil materials are exposed and brought to the surface. If and when not properly managed, these pits constitute extensive nuisance to man and his cosmic environment. It has therefore become necessary to devise methods of mining that cause the least damage to the environment or means of managing the scars left by mining. This wishful thinking however is practically impossible since the need for exploitation is often more needful than whatever consideration that may suggest leaving the ground untouched. The devastation of the ground sadly will continue and pits, ponds, hips and other hazardous 'leftovers' consequentially cannot be prevented. Their preservation and conversion to tourism artefacts appear to be the best way for now to attempt to make them environmentally friendly.

The main aim of this paper is to highlight the neglected post-mining history of the Plateau tin fields and to proffer solutions and ways for safe utilization of the artefacts as against the present trend of costly reclamation of the landscape.

TOURISM IN NIGERIA AND GEOTOURISM POTENTIALS OF THE JOS PLATEAU

In Nigeria, according to the tourism master plan developed in 1990, five major tourism clusters have been identified. These include the Sahara gateway, Scenic heartland, Capital conference centre, South east and Atlantic gateway clusters (Fig. 1). Three of these five clusters, which include Scenic Heartland, Capital Conference and South East, are geotourism based.

The Scenic heartland is almost entirely covering the Jos Plateau, the wisdom and concept of the developers essentially based on climatic, cultural and scenic beauties of the Plateau. Then, little attention was given to core geotourist values and features partly because of the late emergence of

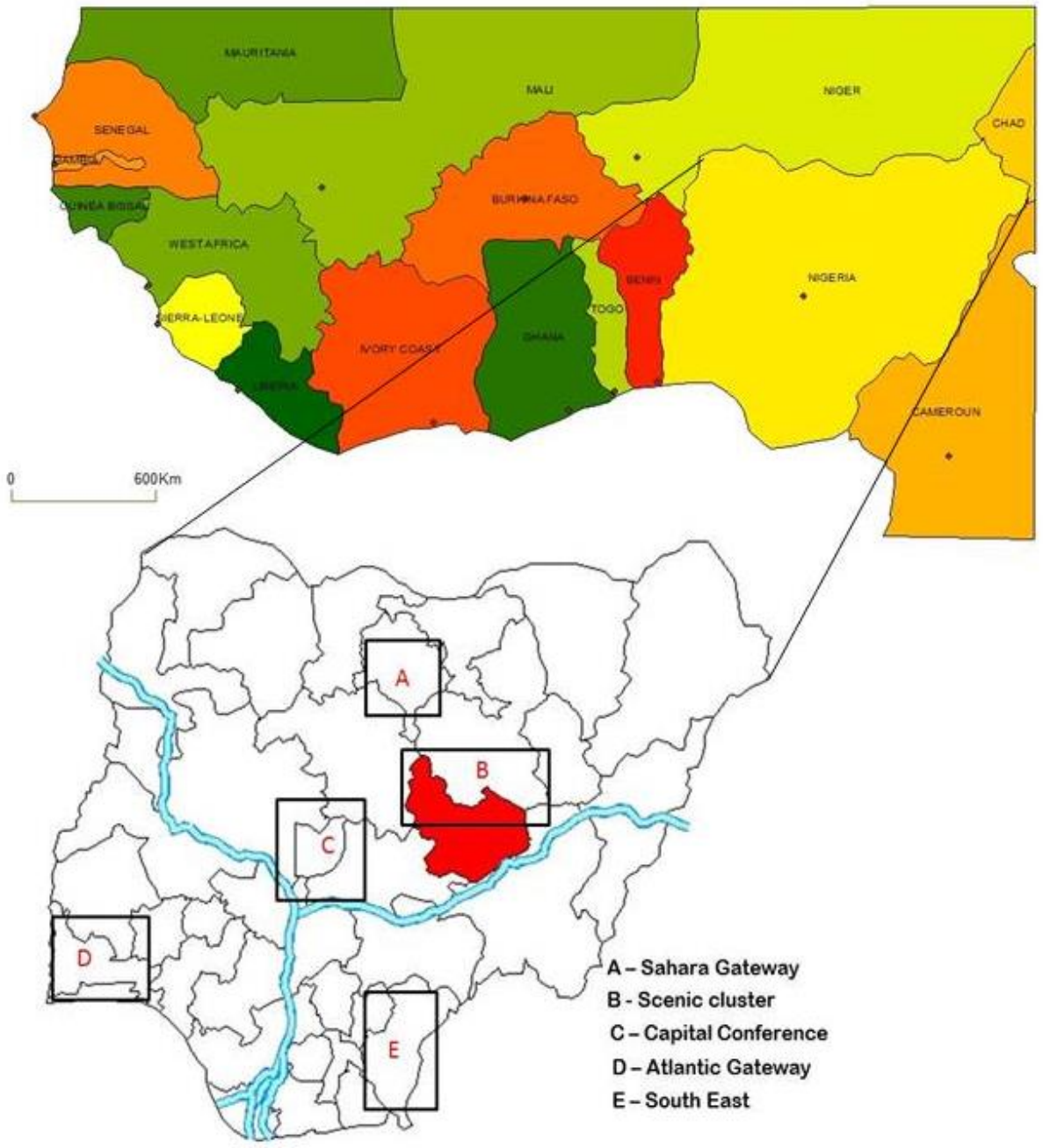

Fig. 1 Map of Nigeria showing the tourism clusters, location of Plateau state and in set West Africa.

geotourism and utilization of geosites in sub-Saharan Africa.

Ogezi et al. (2010) highlighted that Plateau State has the most striking physical features in Nigeria with the high lands rising from 1,200 meters above sea level and the low lands to a peak of 1,829 meters above sea level. Some of these classical geotourism landmarks of the Plateau include Wase Trachyte-Phonolite Plug, Kurra and Assop Water Falls, Surra Volcanic Line, Luham Rock, Riyom Rock, Kwi Conical Hill and Kerang Volcanic Hill, Shere Hills, Pankshin Hilltop, The Pudong ("Pidong") Crater Lake, Gahwang and Yembe Fall Columnar Basalts. More than half of the tourist landmarks in Plateau state are geological in nature such that the acronym home of "peace and geotourism" for the state would still have been

appropriate.

Aside from Wase rock, all the tourist landmarks are directly related to the uplift due to the emplacement of the Younger granites which form the core of the Jos Plateau. The Falls are also caused by the steep gradients generated by the uplift of the Plateau. The Kwi hills were possibly formed by lateritization of the Lower Cenozoic – Upper Cenozoic basalts in Nigeria (Woakes et al., 1989) while the Gahwang columnar basalts belong to the Younger flow volcanics of Nigeria.

From the foregoing, very little has been considered and or mentioned about the mining heritage as a potential for tourism. The major focus when the ponds are referred to is reclamation, the cost of which is exorbitantly huge that even the statutory Ecological Fund that comes from the Federal Government to states in Nigeria can hardly be sustained. A typical example of which outlived the two-term tenure of the immediate past administration (2007-2015) is the pond in the centre of the Ring road that connects Angwan Doki through the Yelwa Club Bukuru and the Bukuru-Jos Expressway (Fig. 2).

Economic realities premised on the present fall in oil prices are becoming increasingly clear that budgetary allocations for reclamation though according to environmental assessment prescriptions remain the best, may not be sustainable. Cheaper and easier ways therefore seem the best alternative.

GEOTOURIST HERITAGE

Remains of Former Activity

Madziarz (2013) documented that mining activity constitute a precious source of knowledge about the development of deposit mining technology, providing the evidence of knowledge and skills of the generations of miners connected over the centuries with the area of Lower Silesia. The treasures in mining does not only lie in the products themselves but also in the history that their extraction carry both during and after the mining. Mining on the Plateau at present has left traces of what at best can be referred to as historical artefacts of mining. All over the plateau, ponds and disturbances dot the landscape (Fig. 3).

Fig. 2 Photograph showing an attempt to artificially stabilize a pond around Yelwa Club Bukuru.

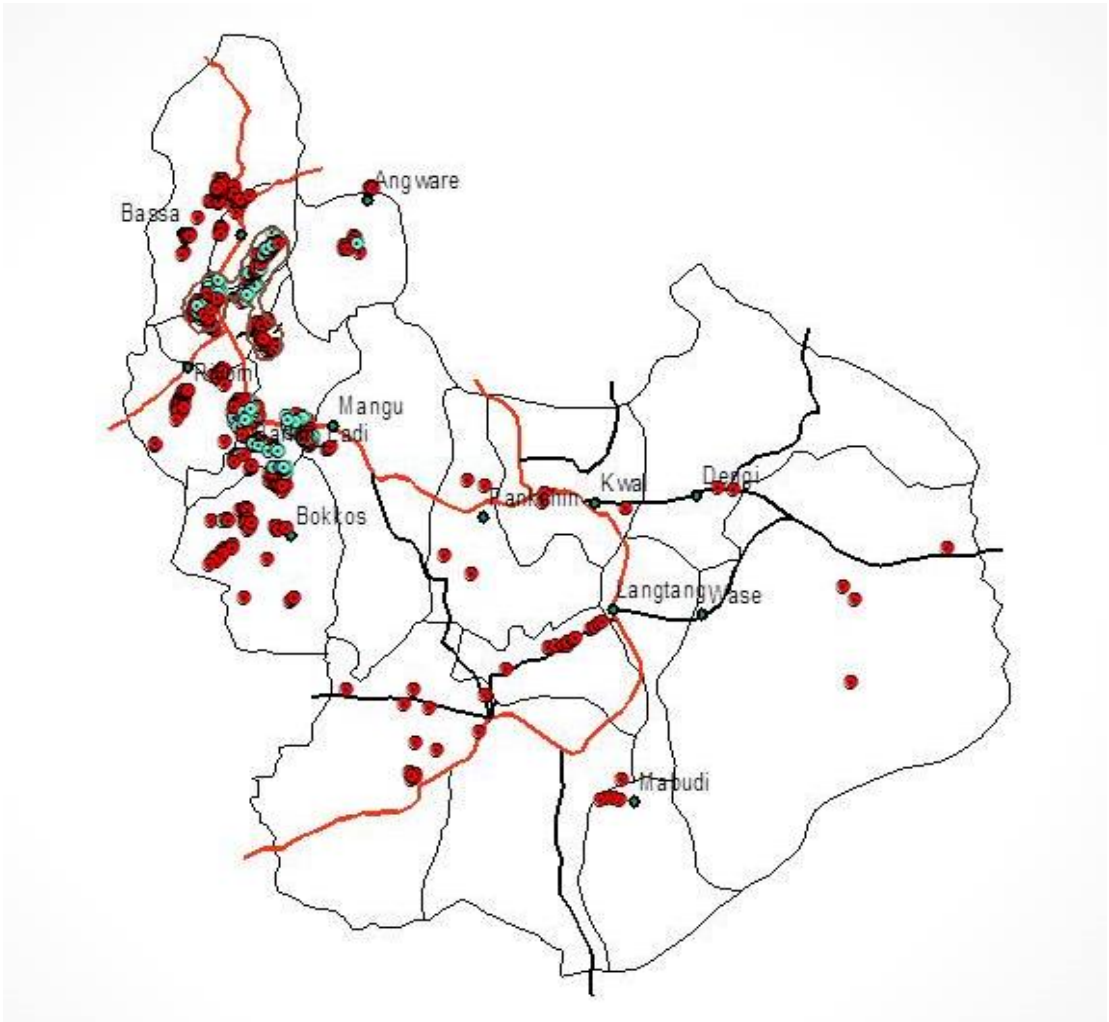

Fig. 3 Map of Plateau state showing locations of mining ponds (red dots) and mining disturbances (light greenish dots).

Though these ponds are concentrated along highways posing great risks to road users, such proximity makes utilization for recreation very excellent.

Along the major highways where urban development has not caught up with these ponds, dissected cuts are rampant. While the majority are endangered and left at the mercy of the current resurgence in artisanal mining for tin and columbite, they provide extensive history of the over one century long mining activity on the Plateau. The cultures of the inhabitants of Jos, Barkin Ladi and Bassa areas have largely been modified or affected by these activities. The history of mining on the Plateau therefore is an opportunity for historians. Abandoned equipment also provides opportunity for post mining tourism.

Ponds for Recreational potentials

When the mining pits are filled with water, they are referred to as mining ponds. In a good number of the mining sites visited, the pits are deep enough to store water perennially (Figs. 6 - 9). Though the depths of a good number of the ponds are very deep and can be dangerous, the design of the mines through benching for safety of the miners has reduced the slopes of the hanging walls such that they appear very stable and have survived over fifty years without collapse since mining activity stopped in the late 1970s to early 1980s. The real and major threat to these ponds is the recent activity of man through artisanal mining, dry season vegetable farming, fishing and local laterite mining in that order.

Fig. 4 Remains of mining activity on the Plateau (a) colonial artefact in Kuru, (b) shaft for molybdenum in the Kigom complex, (c) mined out pit showing the ancient benching overtaken by recent mining for tin in Bassa and (d) recent mining activity distorting the historical site in Rayfield-Laminga bye-pass Jos.

Fig. 5 Benching in an open pit mining for tin in Bassa during the colonial mining era of the pre-1960s

Fig. 6 Naturally landscaped scenery after tin mining along Barkin Ladi – Bokkos road.

Fig. 7 One of the numerous mining ponds used for irrigational purpose

Fig. 8 A pond currently exploited by the Rayfield Resort Jos

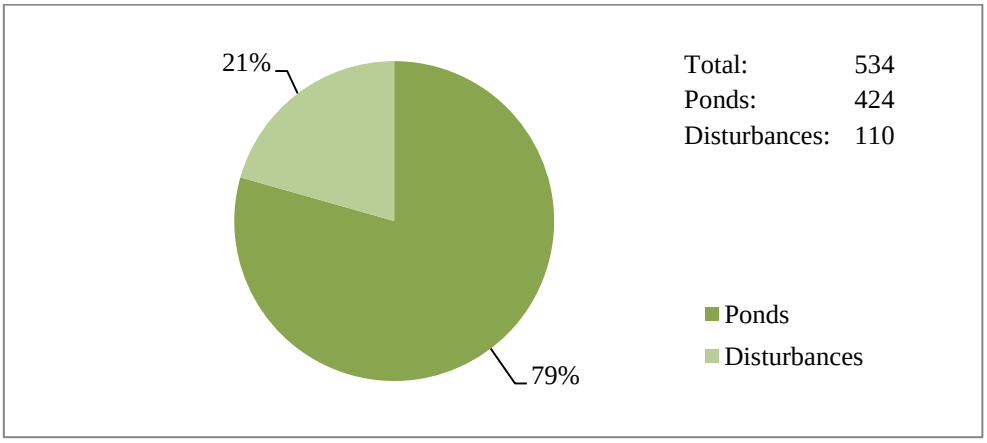

Fig. 9 Pie chart showing the percentage of the pits filled with water

The distribution of the pits visited shows that 79% are filled with water mostly around Barkin Ladi – Bokkos road, Dorowa, Du, Dilimi and Bukuru. These shows the great danger posed to life and property if left unattended to. Statistical analyses using area proportion shows that the most impacted area spans from Bokkos, Barkin Ladi, Riyom, Jos South, Jos North and Bassa covering about 494,426 square meters of land.

PROSPECTS AND POTENTIALS

The concept of mining tourism exploits mainly the relic landscape preserved from mining activities, ranging from shapes from the terrains, whether on the surface or underground, buildings and technical equipment. The focus here is mostly historical. Many developed and developing nations make good of such historical assets. Slovakia, Hungary and many western and eastern European nations (Conlin & Jolliffle, 2011; Drebenstedt et al., 2011; Hroncek & Liga, 2014), as well as Chile (Lopez & Perez, 2013), Spain (Perez et al., 2016) have many medieval, early Modern Age and recent mining sites that are useful tourist sites.

Geotourism is an emerging field where natural and for the sake of our discourse, geological and mining related landscapes

are harnessed for tourism purposes. The utilisation of the devastated landscape due to mining activities for recreation becomes not just the cheapest in terms of cost effectiveness for the mining companies, but also becomes the safest option since it attempts to not just beautify the scenery, but restores natural condition through planting of flowers and trees and artificial landscaping.

Mining being a profit driven venture, investing heavily in managing the after effects of mining can add to the cost itself and most mining companies shy away from that resulting in the majority of the industrial and environmental disharmonies that presently plaque mining areas. Environmentalists also raise the question of environmentally safe and friendly management techniques, all without recourse to the increasing budgets to the miners.

The present state of the Nigerian economy requires that States look inward for Internally Generated Revenues (IGR). Most States have started to vigorously exploit and tap from the natural endowments from their States. Plateau State has additional advantage of not just attracting investors to the mineral resources she is endowed with, but also scooping from the history left by the exploited resources as well. The cold weather and favourable climate makes it attractive. The choice of the scenic tourist cluster by the Nigerian Tourism Board should therefore be complimented by the State. Emerging avenues like the building of the Minerals Museums is a step in the right direction which should not be neglected by the State Government.

Additional prospects also exist in the area of collaboration with archaeological work especially with the proximity of the Institute of Archaeology which is situated in Jos. Such collaborations exist in countries like Poland in other to preserve and manage the mining heritage sites, the Institute of Archaeology and the Institute of History of the University of Wrocław is exploiting.

CONCLUSION

Plateau tin fields of central Nigeria was extensively devastated without proper reclamation leaving pits, ponds and steep dissected earth cuts.

Nearly 50% of the ponds and earth cuts can be utilized for geotourism with minimal geo-stabilisation procedures. The cost of maintenance of these ponds can be transferred to wealth generation for socio-economic benefits when properly managed. The geotourism potential of the Plateau Tin fields can exploit the historical remains of the mining activity and the utilization of the ponds for recreational activity.

The conclusion therefore is that a vast potential for utilizing the post-mining history of the Plateau tin fields exist. Rather than utilizing money for reclaiming the devastated landscape through the statutory Ecological Funds given to State Governments by The Federal Government of Nigeria) which often has been misdirected, the cost can be transferred to investors for use as wealth generating avenues through leases for personal or corporate recreational outlets.

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Tourist attractiveness of mineralogical-petrographical and paleontological collections in the museums of Vojvodina (North Serbia)

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ABSTRACT

On the territory of the Autonomous Province of Vojvodina, there are five museums that possess mineralogical-petrographical, and nine museums that possess paleontological collections. Also, the Provincial Institute for Nature Conservation, within its Natural History collection, possesses these collections. The main aim of this paper is to present the mineralogical-petrographical and paleontological collections in the museums of Vojvodina, as well as to evaluate their tourist attractiveness. Aims are also to explore the extent of visits and to identify main problems related to the inclusion of these collections in current tourist offer. Research results indicate the need for better planning, promotion and upgrading of collections in order to attract more visitors.

Key words: mineralogical-petrographical collections, paleontological collections, museums, tourism, Vojvodina, Serbia

INTRODUCTION

According to a definition of the International Council of Museums (ICOM): "Museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment" (ICOM Statute, 2007).

The rich cultural and historical past of Vojvodina lead to the emergence of a large number of museums in this area. The first museum on the territory of Vojvodina was founded in 1877 in Bela Crkva (Kumović, 2001). The first geological collection is even older. It was formed by Andreas Wolny (1759-1827), director of the Gymnasium in Sremski Karlovci. Of the initial 800 specimens, in the first half of the 19th century, it has grown to 2000 specimens, but after that it was neglected, and slowly disappeared (Jović, 2008).

In addition to their cultural importance, museums in Vojvodina have a certain educational and touristic function. Among other things, these institutions store movable geological heritage that represents not only the geodiversity of Vojvodina, but the geodiversity of the entire country. At the moment, on the territory of the Autonomous Province of Vojvodina, there are nine museums that own mineralogical-petrographical and/or paleontological collections. In addition, it is necessary to mention the Provincial Institute for Nature Conservation which is included in the survey because within its Natural History collection, the Institute owns rich mineralogical-petrografical, as well as a paleontological collection.

The main aim of this paper is to present mineralogical-petrographical and paleontological collections in the museums of Vojvodina, as well as to evaluate their tourist attractiveness. For this purpose, it is necessary to explore the extent of visits and to identify main problems related to the inclusion of these collections in current tourist offer.

METHODOLOGY

In order to assess the attractiveness of a tourist product (in this case, mineralogical-petrographical and paleontological collections in the museums of Vojvodina) it is not enough just to perceive its value (attractiveness, cultural, educational, historical value etc). A very important issue in assessing the attractiveness of a tourist product is examining the attitudes of tourists. It is necessary to investigate what it is that people are most drawn to, what they expect from certain tourist product, what is that satisfy them, or not.
This research consisted of two parts. The first part is field research, which was conducted during September of 2015. Residents from all parts of the Republic of Serbia were included in the survey. The second part of a research is an analysis of the completed questionnaires.

Sample

The sample included a total of 100 respondents whose place of residence is the Republic of Serbia. More than half of the respondents (57%) belong to urban, while the rest (43%) belong to rural population. Sample characteristics are further described in Table 1.

Instruments

The questionnaire consisted of two parts. The first part involved questions related to the socio-demographic profile of respondents (age, gender, occupation, education level, place of residence). The second part of the questionnaire consisted of different questions related to the attendance of museums and their mineralogical-petrographical and paleontological collections, as well as respondents' opinions about their tourist importance and the problems they face.

Procedure

The research was carried out between the 1st and 25th of September 2015. Partly, it was conducted in the field where each of the respondents filled out the questionnaire with the assistance of the authors, and partly by using a program software called E-surveyspro. The respondents were informed of the general purpose of the study and that participation is voluntary and anonymous.

STUDY AREA

Vojvodina is a region in northern Serbia, located in the south-eastern part of the Carpathian (Pannonian) Basin. It covers the total area of 21,500 km² and has a population of about 2 million (about 27% of Serbia's total). The region is divided by the Danube, Tisza and Sava rivers into: Bačka in the northwest, Banat in the east and Srem in the southwest (a small part of the Mačva region is also located in the Srem District) (Dodić et al., 2010).

Vojvodina has a significant traffic importance (international roads E-75 and E-70, european main railway lines E-85, E-70 and E-66). When it comes to domestic and international traffic, the Danube River has the biggest importance with the length of its flows through Vojvodina of about 360 km. The Sava, Tisza and Tamiš rivers are also navigable, as well as the main channel Danube-Tisza-Danube (Bugarčić, 2007; www.pkv.rs/node/105).

Museums included in the survey are mainly located in major urban centers, but there are also those that are located in smaller communities (e.g. museums in Senta and Čerević).

Tab. 1 Socio-demographic characteristics of respondents

Gender		Age		Level of education		Place of residence	
	%		%		%		%
Male	59	< 21	4	primary	0	town	57
		21-35	46	secondary	62		
female	41	36-55	34	higher	7	village	43
		over 55	16	high	31		

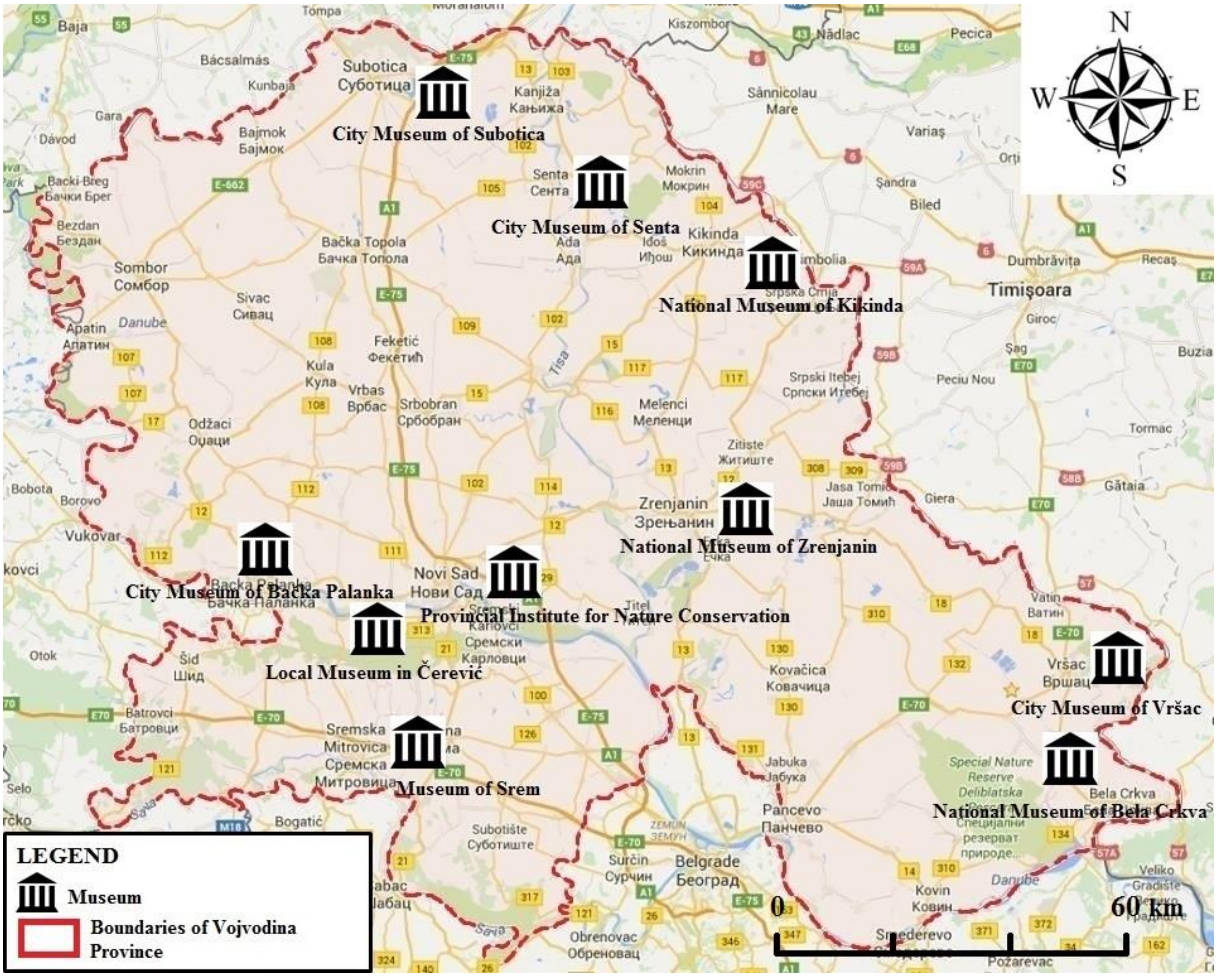

Fig. 1 Geographical position of museums covered by the survey (Source: Google maps, modified)

MINERALOGICAL-PETROGRAPHICAL AND PALEONTOLOGICAL COLLECTIONS IN MUSEUMS OF VOJVODINA

In this part of the paper all the mineralogical-petrographical and paleontological collections in museums of Vojvodina are presented. Except those that are exposed, collections that are not part of the permanent museum settings are also presented.

Mineralogical-petrographical and paleontological collections of the National Museum of Zrenjanin together constitute a unique geo-paleontological collection. Formation of this collection started in 1978. The material for the paleontological collection was created mostly by drilling the ground for oil exploration (Deak, 2011). At the moment, the total number of samples of the geo-paleontological collection is 449. It

contains zoo and phyto paleontological material, as well as various types of loess, sandstone and volcanic rocks with fossil remains (Archives of the Zrenjanin National Museum). Within the permanent exhibition of the Museum currently there are only 25 exposed specimens, among them: fossil remains of the woolly mammoth, steppe bison, wild (European) cattle and giant deer (Boškov, 2015). The most valuable, and in the same time the most interesting showpiece for visitors are the fossil remains of the woolly mammoth (*Mammuthus primigenius)* that were found in 1952 during the excavation of the Danube-Tisza-Danube channel, near Novi Bečej. The woolly mammoth (*Mammuthus primigenius)* is an extinct genus of the proboscidean family, whose occurrence is linked to the Pleistocene, about 135 000 years ago (Spinar, 1985).

Mineralogical-petrographical and paleontological collections of the National Museum of Kikinda are within the Department of Natural History. These collections were obtained from the Gymnasium of Kikinda in 1993, and were created since the establishment of the Gymnasium in 1858, until 1941. The number of samples is approximately 300, but within the permanent exhibition only 15 of them are exposed. The most important showpiece in the Museum are the mammoth fossil remains. These fossil remains were found in 1996, during the extraction of clay, and are keept in the Museum since 2006. About 90% of bone mass is preserved. This animal (named Kika) lived 500 000 years ago, and belongs to a species Mammuthus trogontherii, also known as steppe mammoth (www.kikinda.co.yu). Within the permanent exhibition a multimedia presentation is available for all visitors who want to find out more about Kika and her life.

Paleontological collection of the National Museum of Bela Crkva has not been exhibited since 2012. The forming of this collection started before the establishment of the museum. In 1877, agriculturist and city representative Karl Spang donated mammoth bones to the city. These bones were found in 1875, near Dupljaja village. Spang donated them to the city for further storage in the City Hall. Soon, the representative body of Bela Crkva at its regular eighth session, on the initiative of the donor, designated a special room for the Museum (Kumović, 2001). During the Second World War a large part of the paleontological collection fund was destroyed. Today it is the humblest collection of its kind in Vojvodina and includes only 10 remnants: four mammoth bones, five mammoth teeth and part of a buffalo skull with a horn (Archives of the National Museum of Bela Crkva). As noted, paleontological collection of the National Museum of Bela Crkva is not exposed since 2012, but its presentation is planned in the following period, as part of thematic exhibitions.

Mineralogical-petrographical and paleontological collections of the City Museum of Vršac are parts of the Natural History Department, whose total collection contains more than 5 000 samples. The largest is the paleontological collection, but it has not been exhibited for a while, the same as the mineralogical-petrographic collection.

The formation of the collections began in the late 19th century. Geologist and volcanologist Rudolf Mileker brought first specimens of minerals to the Museum and was most deserving for the formation of these collections. The mineralogical-petrographical collection of the City museum of Vršac is in a very bad condition. All items are stored in the museum depot. There is no inventory of the collection and the documentation is incomplete. Similar situation is also with the paleontological collection. Samples originate mostly from the teritorry of southern Banat, and a part of them was found on the teritorry of Romanian Banat. The collection contains 84 bones of prehistoric animals (mainly mammoth) and 71 fossils that originate

from the period between Carboniferous and Holocene. The oldest sample in the Museum is 362 million years old (Rašajski, 2007/2008).

Mineralogical-petrographical and paleontological collections of the Museum of Srem arose from the private collection of an engineer Dušan Kostić from Kupinovo, and in 1947 were donated to the Museum. The collection was officially put into operation in 1996, when the workplace of curator of Natural History collection was opened. It contains significant paleontological, mineralogical-petrographical, archaeozoological and anthropological material. Mineralogical-petrographical part of the Natural History collection contains minerals, igneous, sedimentary and metamorphic rocks that comprise the geological base of the Fruska Gora mountain, as well as rare specimens originating from other parts of the country. The paleontological part of the Natural History collection contains vertebrates (Quaternary large mammals) and invertebrates (Miocene microfauna, fauna from archaeological sites). Fossil remains of large mammals include parts of skulls, teeth and other parts of mammoth, woolly rhinoceros, giant deer, elk and bison skeletons. The aforementioned species lived on the territory of Srem during the Pleistocene and became extinct more than 10 000 years ago. All remnants were found in the alluvial sediments of the Sava River. Of special importance is the skull of a giant deer (*Megaloceros giganteus*), which has been legally protected as a unique natural monument on the territory of Serbia, since 1973. The museum holds the original, but a replica is exhibited. Also, one replica is exhibited in the Provincial Institute for Nature Conservation in Novi Sad (Nedeljković, 2004). Numerous fossils of shells, snails, sea urchins and corals indicate a great diversity of fauna from the former Pannonian Sea.

Paleontological collection of the Local Museum in Čerević was formed in 1980, at a time when the Museum was founded. It contains fossilized remains of flora and fauna of Fruška Gora, and the total number of samples is approximately 100. There is no inventory of the collection, so the origin, age, as well as the exact location where the objects were found are unknown. However, it is known that specimens of molluscs originate from the Čerević stream valley. Famous Hungarian geologist Antal Koh collected and determined these specimens in the second half of the 19th century (Koch, 1864, according to Petho, 1906). Most of these findings are exhibited in the Hungarian Natural History Museum in Budapest, and only a small part of them is still in Čerević.

In comparison with other museums in Vojvodina, the Local Museum of Čerević lags behind, due to its content, equipment, organization and presentation of paleontological collection. It is understandable, given the fact that this is a small museum, located in a smallish rural area.

Paleontological collection of the City Museum of Bačka Palanka contains approximately 50 specimens, 20 of them are exposed, while the rest are stored in the depot. The most numerous are bones and teeth of mammoths and bisons. These items were mostly found at the site Krstur and in the area of Mladenovo. Among the oldest and most interesting exhibits are the remains of shells, as well as teeth of sharks that lived in the former Pannonian Sea, which dissapeared during the Pleistocene, ie. more than 600 000 years ago. These fossils provided numerous scientific discoveries and information about the former Pannonian Sea (Rodić and Pavlović, 1994).

Paleontological collection of the City Museum of Senta. Formation of the collection began in Senta Grammar School, at the end of the 19th century, and it was transferred to the Museum immediately after its opening. Today there are approximately 250 items within this collection, and only 15 of them are exhibited (fossil remains of the woolly

mammoth, bison and giant deer). In addition, in the Museum's depot there is a large number of items such as vertebrae, ribs, tusks, teeth and thigh bones of prehistoric animals.

Mineralogical-petrographical and paleontological collections of the City Museum of Subotica are parts of the Natural History Department, together with the zoological and botanical collections. Formation of these collections began simultaneously with the establishment of the Museum, however they were never exposed. The mineralogical-petrographical collection contains approximately 100 items of different origin. Paleontological collection contains between 150 and 200 specimens, mainly remains of animal bones. Also there is a small number of botanical fossil remains - approximately 15 fossils. This fossils were mainly found in the vicinity of Subotica. In 2014 the collection was complemented by the animal remains, sent from the Archaeological Department of Faculty of Philosophy in Belgrade. The Museum is currently working on the preparation of permanent exhibitions, and according to the staff, the paleontological collection is the first that will be prepared.

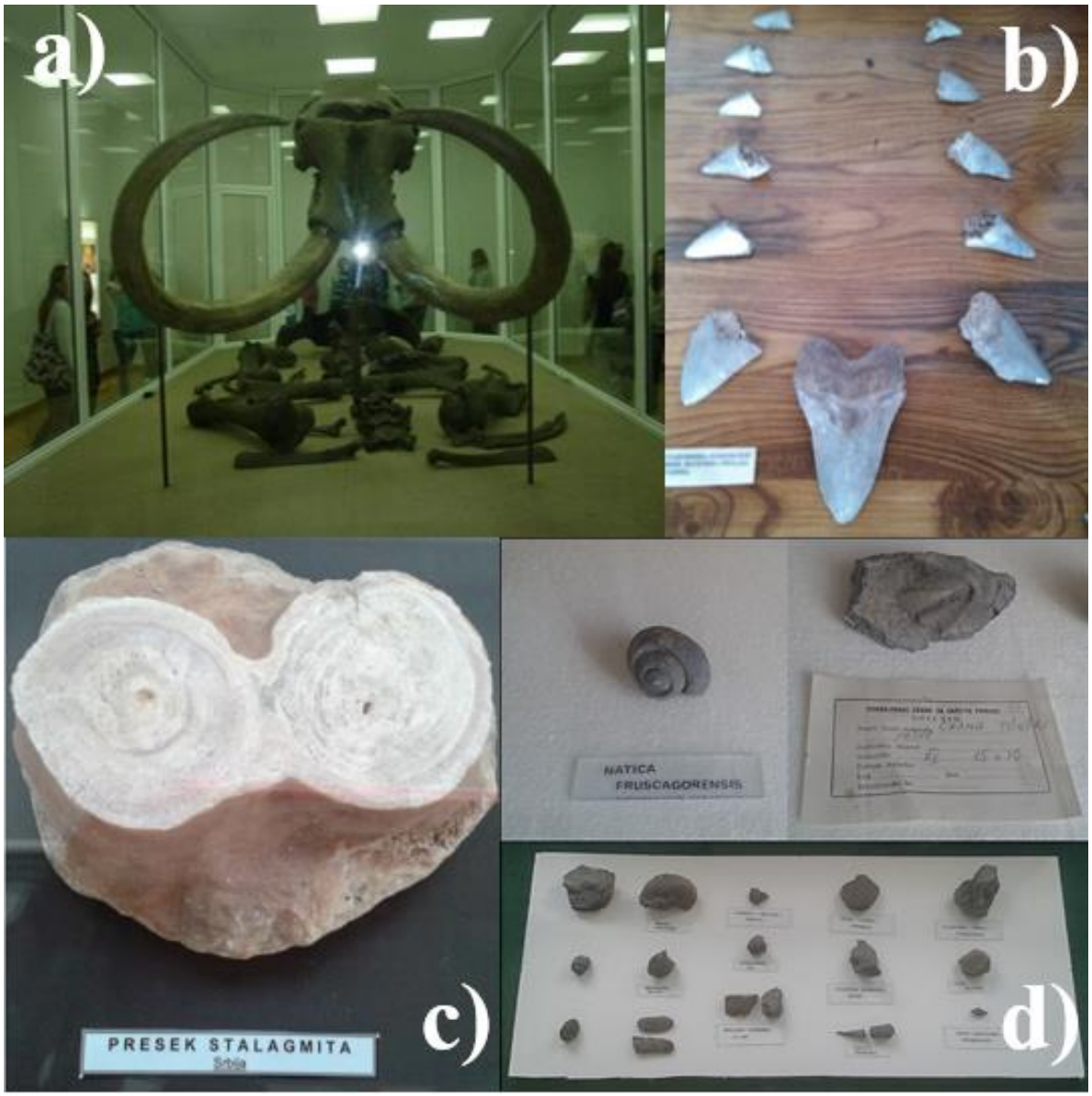

Fig. 2 a – Fossil remains of a mammoth in the National Museum of Kikinda, **b** – Teeth of Pannonian shark in the City Museum of Bačka Palanka, **c** – Stalagmite exposed in the Provincial Institute for Nature Conservation in Novi Sad, **d** – Fossils exposed in the Local Museum in Čerević (photo by: Jovana Boškov)

Mineralogical-petrographical and paleontological collections of the Provincial Institute for Nature Conservation are within the Natural History Department, consisting of over 25 000 specimens. The mineralogical-petrographical collection of the Provincial Institute represents the most complete collection of its kind in Vojvodina. Mineralogical part of the collection consists of samples of ores and minerals, found in famous mines of former Yugoslavia. Formation of this collection began simultaneously with the establishment of the Natural History Department at the Museum of Vojvodina, in 1947 (http://pzzp.rs/sr/prirodnjacka-zbirka-i-izlozba/prirodnjacke-zbirke/geolosko-paleontoloska-zbirka.html). The petrographical part of the collection mainly contains specimens of rocks, originating from Fruška Gora and Vršac mountains, as well as from other parts of Serbia. Especially interesting are examples of sedimentary rocks - parts of stalactites and stalagmites. Exhibits of paleontological collection have been divided into six separate units (fauna of Tethys and Paratethys from the area of Fruška Gora; fossils of Mesozoic invertebrates from the area of Eastern Serbia; flora of Fruška Gora mountain; Deninger's bear; cave bear; remains of woolly mammoths, woolly rhinos and primitive proboscidean). The most precious exhibit is the skull of the woolly mammoth (*Mammuthus primigenius*), from Upper Pleistocene, found in the Tisza River near Novi Bečej, 1947. The skull is very massive, and on that base, considered as an unique sample not only in Serbia, but also in Europe.

RESULTS AND DISCUSSION

The main aim of this paper was to investigate the tourist attractiveness of mineralogical-petrographical and paleontological collections in museums of Vojvodina, as well as to identify problems related to their larger tourist activating. This was done through a survey which included 100 respondents, from all parts of Serbia. Answers to the specific questions, related to tourist attractiveness and extent of visits of mineralogical-petrographical and paleontological collections in museums of Vojvodina are explained in more detail below.

Extent of visits of mineralogical-petrographical and paleontological collections in museums of Vojvodina.

To questions related to the extent of visits, respondents answered with *yes* or *no* (Table 2). Out of 100 respondents who took part in the survey, 51% visited some of the mineralogical-petrographical collections in museums of Vojvodina. A large percentage of respondents (49%) never visited any of the mineralogical-petrographical collections, which appears to be a result of the fact that many of these collections have not been exhibited for a long time. For example, in museums in Subotica and Vršac the collections have not been exhibited for more than 25 years, while in the Museum of Srem, the mineralogical-petrographical collection has never been exhibited. These examples highlight the lack of activity and engagement of museums in the field of protection and conservation of the geological history of our country. Most museums in Vojvodina give primacy to historical, artistic, and especially ethnographic collections.

Unlike mineralogical-petrographical, paleontological collections are characterized by a higher extent of visits.This is understandable considering that in Vojvodina there are ten paleontological collections, and only six mineralogical-petrographical collections.

Which mineralogical-petrographical collection have you visited?

In this question the respondents were able to choose between mineralogical-petrographical collections in following museums: National Museum of Kikinda,

Table 2. Extent of visits of mineralogical-petrographical and paleontological collections in museums of Vojvodina

Questions	Answers (%)	
	YES	NO
Have you ever visited any of mineralogical-petrographical collections in museums of Vojvodina?	51	49
Have you ever visited any of paleontological collections in museums of Vojvodina?	63	37

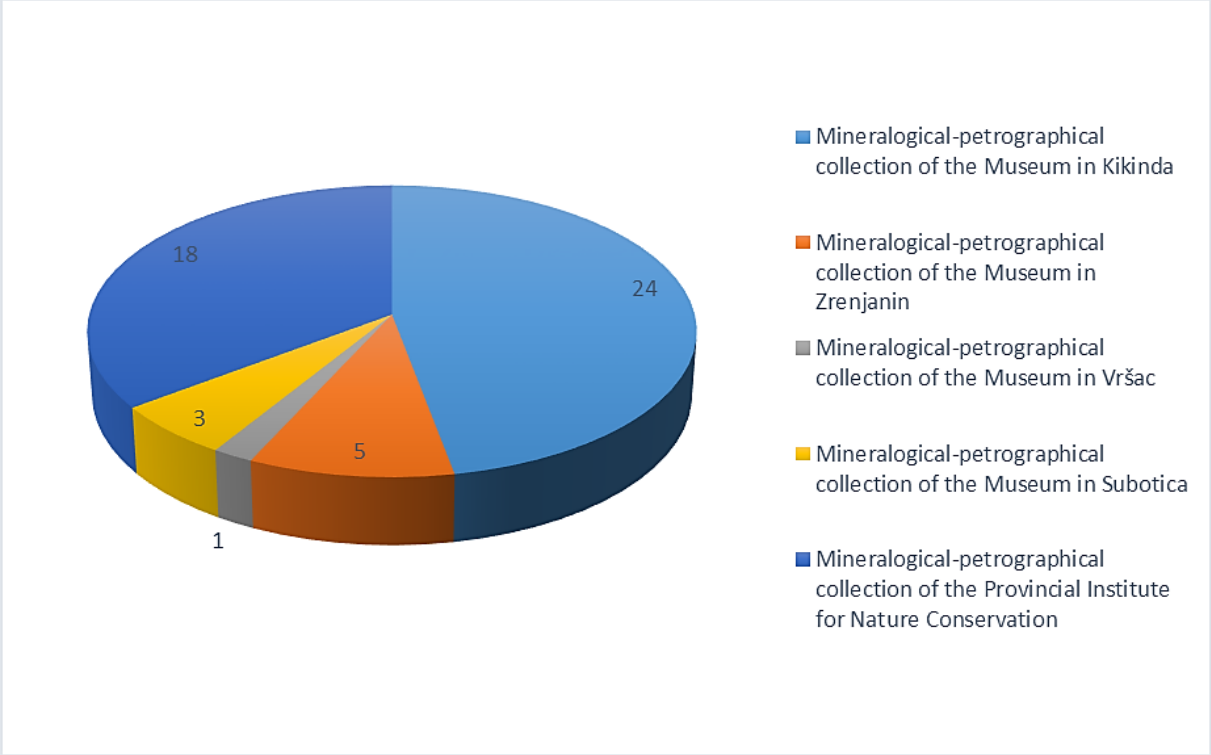

Fig. 3 Number of respondents who have visited mineralogical-petrographical collections

National Museum of Zrenjanin, City Museum of Vršac, City Museum of Subotica and Provincial Institute for Nature Conservation in Novi Sad. Mineralogical-petrographical collection of Museum of Srem is not listed, because it was never exhibited.

As shown in Figure 2, the most visited is the mineralogical-petrographical collection of the National Museum of Kikinda (24). However, considering that the survey included 100 respondents, it is clear that this collection is also visited in small extent. On the other hand, a surprising result is that only 18 respondents visited the mineralogical-petrographical collection of the Provincial Institute for Nature Conservation in Novi Sad. As already mentioned this collection is the most complete collection of its kind in Vojvodina, and it is also significant that is located in Novi Sad, the capital of the Autonomous Province of Vojvodina. For these reasons, it was expected that the number of visitors is bigger. Only five respondents visited the mineralogical-petrographical collection of the Museum in Zrenjanin, and only three visited the mineralogical-petrographical collection of the Museum in Subotica. The collection of the Museum in Vršac is the least visited - only one respondent visited it. Such a structure of answers is in accordance with the aforementioned condition of these collections in museums of Vojvodina. As mentioned, in some museums these

collections have not been exhibited for a long time. On the other side, respondents are between 21 and 35 years old, so the number of visitors is extremely small.

Which paleontological collection have you visited?

In this question the respondents were able to choose between the paleontological collections in museums in: Zrenjanin, Kikinda, Bela Crkva, Vršac, Sremska Mitrovica, Čerević, Bačka Palanka, Senta, Subotica and Novi Sad.

The largest number of respondents (69) visited the paleontological collection of the Provincial Institute for Nature Conservation. This is justified by the fact that the Institute organizes a large number of different events, which include a visit to the collection. Novi Sad is the University center of Vojvodina, so every year a big number of students and pupils come to visit this collection. However, in the structure of answers a discrepancy is evident. This discrepancy is reflected in the following: mineralogical-petrographical and paleontological collections of the Provincial Institute are exhibited in the same room, next to each other and constituing a unique collection, so it is surprising that the mineralogical-petrographical collection was ranked in second, and the paleontological collection in the first place. Reasons for such mismatch could be a lack of information and respondent's inability to make the difference between these collections. The second most visited is the collection of the National Museum in Kikinda (54). This Museum gained great popularity thanks to the fossil remains of

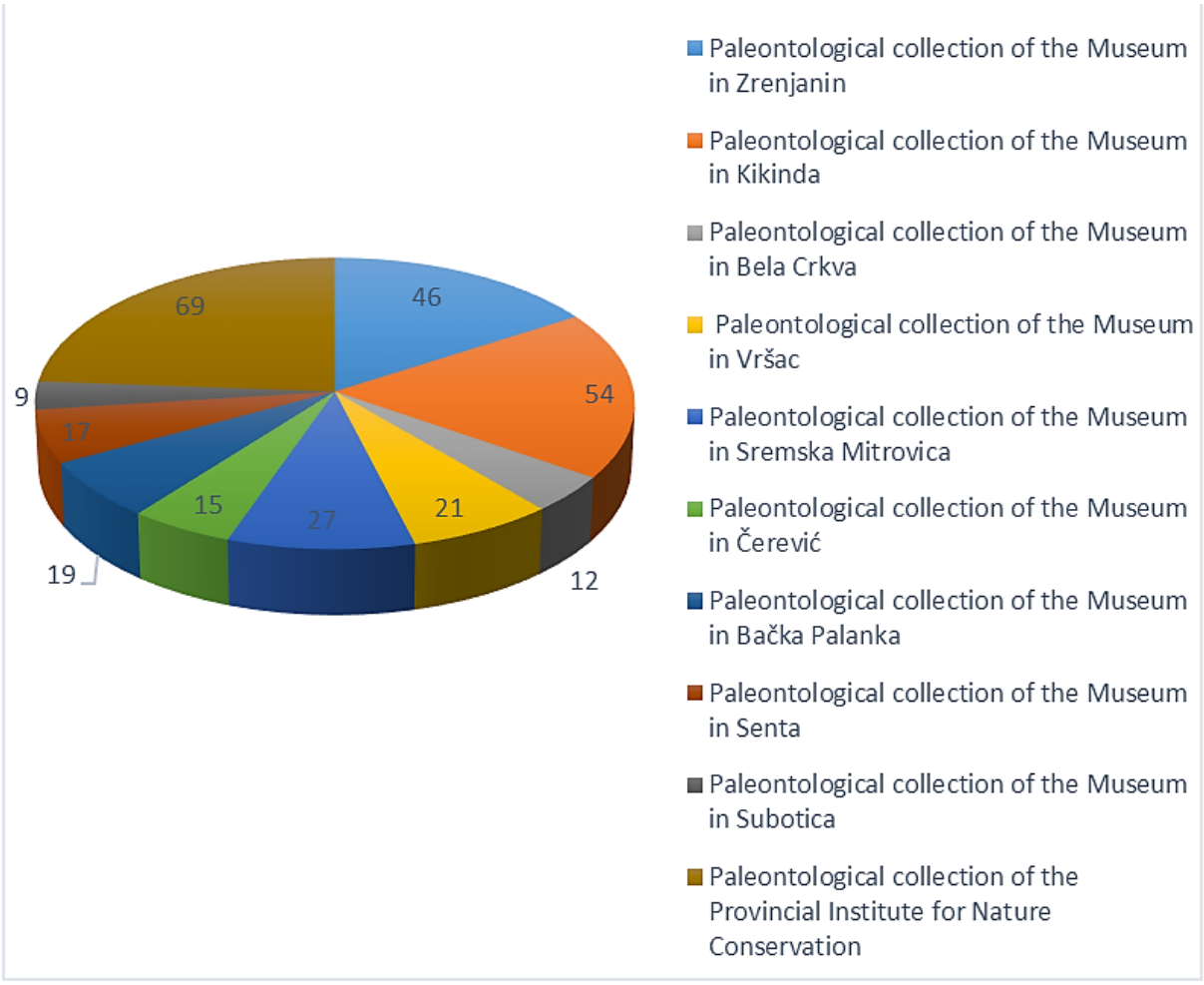

Fig. 4 Number of respondents who have visited paleontological collections

become a the mammoth Kika, which has kind of a brand not only of the Museum, but also of Kikinda in general. The lowest number of visitors of paleontological collections was observed in the Museums of Bela Crkva (12), and Subotica (only 9). This is understandable considering that in the Museum of Bela Crkva the paleontological collection has not been exhibited since 2012, and also in the Museum of Subotica it has not been exhibited for some time.

What are the biggest problems related to mineralogical-petrographical and paleontological collections in museums of Vojvodina?

In this question three statements relating to problems of presentation of aforementioned collections and their inclusion in the tourist offer were listed. Respodents could evaluate their agreement with each of these statements ranging from 1 to 5, with 5 indicating complete agreement with the statement.

Leading problems of tourism in Vojvodina in general, and also in case of these collections, are bad marketing and promotion. At the statement that marketing of mineralogical-petrographical and paleontological collections is adequate, more than half of the respondents (54) gave the lowest grade (1), 29 of the respondents gave 2, 7 respondents gave 3 and 8 respondents gave 4. Only 2 out of 100 respondents are completely agreeing with this statement. Except for marketing, there is also a problem of poor inclusion of these collections in the tourist offer of Vojvodina. However, this problem should be observed from a wider perspective. Museums in Vojvodina are rarely present in the tourist offer. Their activities are insignificant and quite badly organized, starting from the organization of collections, supporting programs, marketing, registration of number of visitors which is often lacking etc. In a large number of museums no one takes care of museum objects and collections, there is no inventory of exhibits, nor basic museum documentation. Considering all abovementioned, it is evident that the tourist activation of museums in general should be done first, and then the mineralogical-petrographical and paleontological collections could be

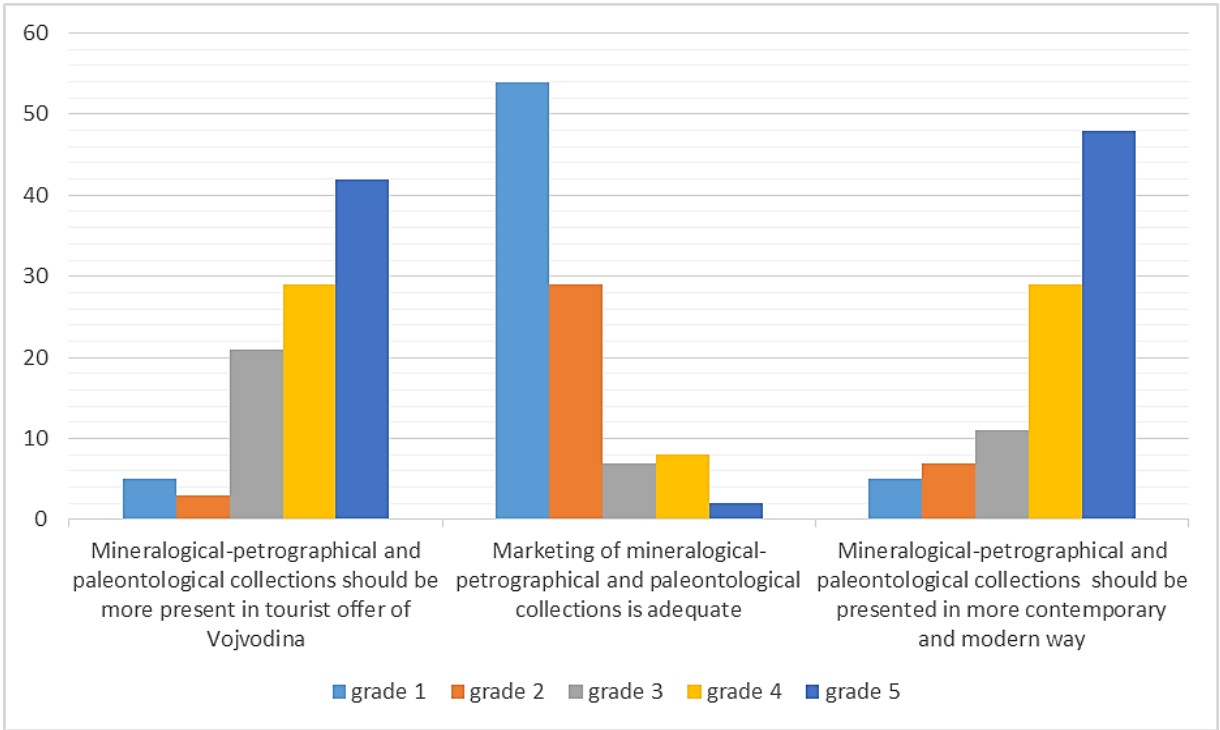

Fig. 5 Problems related to presentation of mineralogical-petrographical and paleontological collections in museums of Vojvodina

more included in the tourist offer of Vojvodina. This observation is corroborated by the insight into the number of visitors in museums of Vojvodina, that in larger, better-known and better-organized museums does not exceed 35 000 per year (Boškov, 2015). A large number of respondents (42) fully agree with the statement that collections should be more present in the tourist offer of Vojvodina. Regarding the same statement, 29 of the respondents gave the grade 4, 21 respondents gave a 3, and only 3 respondents gave a 2. Only 5 respondents completely disagree with this statement. The statement that mineralogical-petrographical and paleontological collections should be presented in a more contemporary and modern way was evaluated as following: grade 1 (5), grade 2 (7), grade 3 (11), grade 4 (29), while the highest grade (5) was given by 48 of the respondents. The necessity for modernizing the collections is clearly reflected in the attitudes of respondents. This is supported by the fact that only one of the mentioned museums uses modern approaches in the presentation of the mineralogical-petrographical and paleontological collections.

In your opinion, to what extent are mineralogical-petrographical and paleontological collections in museums of Vojvodina attractive for tourist visits?

The respondents could answer this question in the same way as the previous ones by giving grades from 1 to 5, where 1 reflects the lowest, and 5 the highest value.

As it can be seen in Figure 5 the biggest number of respondents (45) evaluated the tourist attractiveness of mineralogical-petrographical and paleontological collections in museums of Vojvodina with the highest grade (5), 33 of the respondents gave a 4 and 6 respondents gave a 3. Only 5 respondents evaluated this statement with a 2, while the lowest grade (1) was given by 11 respondents. The research points to favorable attitudes of respondents in relation to the tourism importance of mineralogical-petrographical and paleonto-

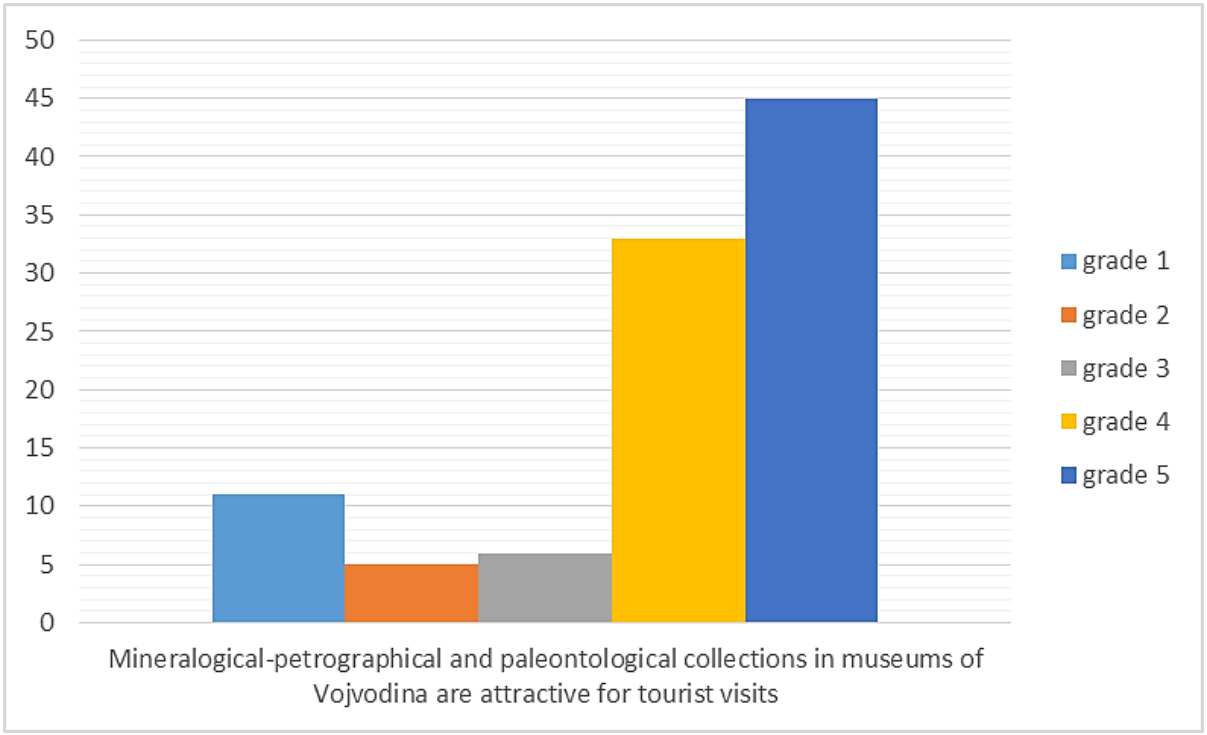

Fig. 6 Tourist attractiveness of mineralogical-petrographical and paleontological collections in museums of Vojvodina

logical collections in museums of Vojvodina. Answers of respondents come down to the opinion that these collections have a certain tourist value, however due to the fact that museums in Vojvodina have no significant role in the tourist activity, these values can not be highlighted enough. Nevertheless, there is the necessity of applying more modern approaches and concepts in the work of museums (such as adequate positioning and branding, application of experiences of more successful museums, multimedia presentation, participation in various projects and linking with other museums and related institutions, strategic planning and controlled implementation of cultural policies, with the active participation of public, private and civil sector), as well as increased promotion and marketing.

CONCLUSION

On the territory of the Autonomous Province of Vojvodina, there are five museums that possess mineralogical-petrographical, and nine museums that possess paleontological collections. Also, the Provincial Institute for Nature Conservation, within its natural history collection, owns these collections. The condition of these collections can be characterized as extremely poor, due to the fact that in many museums there is no documentation, inventory, adequate presentation, as well as appropriate employees. On the other hand, in some of the mentioned museums collections are not exhibited. Based on the conducted survey it was found that the population has a positive attitude towards the tourist value of mineralogical-petrographical and paleontological collections in museums of Vojvodina. Major obstacles in their activation are poor organization, lack of interest of museums to present these collections, as well as poor promotion and marketing. However, it is certain that with careful planning and investing, mineralogical-petrographical and paleontological collections could be included in the tourist offer of Vojvodina.

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The importance of water in tourism in the sector of accommodation services

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ABSTRACT
Water is a key resource for any entrepreneur, whether it is for food, clothing, mining, or any other industry. It is also an indispensable source in the field of business focused on providing accommodation services. This article deals with the importance of water, its necessity and actual water consumption in accommodation facilities. The study is focused on three districts: Rožňava, Rimavská Sobota and Revúca, which together belong to the region of Gemer.

Key words: water, tourism, accommodation, consideration

INTRODUCTION

Each person needs water for his daytime operations. He needs it for drinking, personal hygiene, cooking, and for the countless other activities. Apart from the needs of human, incredible amounts of water are required for industrial activities. As an example, the production of a single sheet of paper consumes 10 liters of water. If we take into account the production of plastic material weighing 500 grams, water consumption is now 91 liters of water. It is evident that the development of industry increases labor productivity, creates employment opportunities and thus reduces unemployment, but also increases the demands on water resources. According to estimates, the amount of water used in industry will increase by 400 % by the year 2050. In the case of the food industry, we can conclude that for one calorie of food it should be consumed only one liter of water. The opposite is true because in practice it is consumed over 100 liters of water for one calorie of food. Taking into account the fact, that by 2050 it is expected increase in demand for food by 60 %, in developing countries by 100 % hence we can expect that the consumption of water in agriculture will grow (Kahan, 2015).

All these data say about the ever-increasing consumption of drinking water, and we took into account only the two basic industrial sectors to point out this state. Various forms of traditional and non-traditional tourism, whether it is tourism or geotourism, imply specific needs (Kršák et al., 2015). However, all the needs of tourism initially begin with the need for water. So if we talk about a business area of accommodation services, we can assess that this area is not up to such a massive consumer of water because its consumption worldwide is only one percent, but it is necessary to think ahead and realize the importance of water in hotels now.

MANAGEMENT OF WATER RESOURCES IN THE SECTOR OF ACCOMMODATION SERVICES

Accommodation facilities have significant business and moral responsibility in the use of water. The purchase price of water is one of the main factors since bills for the water in these facilities are up to 10 % of their total costs. The greater part of the facilities pays for the water even twice,

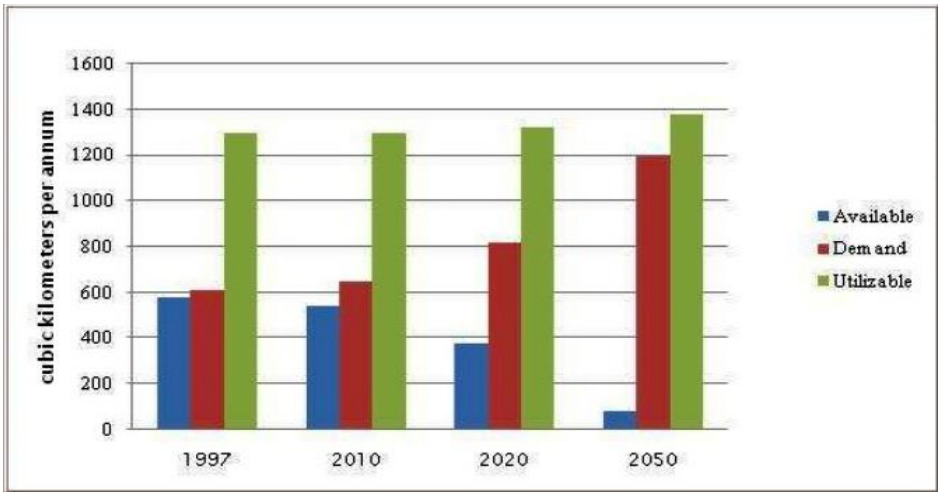

Fig. 1 Available water, demand and utilizable water reserves in the world (source: Zafar, 2015)

for the water they consume and also for the waste water. According to the UK's Environment Agency, hotels depending on their rational use of water can reduce its consumption by up to 50% of water consumed per guest per night (Tuppen, 2013). In accommodation facilities, it is higher consumption of water particularly by tourists than water consumption of the domestic population. The average European tourist spends per day in averaged 300 liters of water compared to an ordinary citizen of the European Union, which spends 100 to 200 liters of water per day (EEA, 2009; Eurostat, 2011; Gossiling et. al., 2011).

There are several reasons for the higher consumption of water particularly by tourists in accommodation facilities, namely the following: maintenance of areas, irrigation, daily cleaning, daily washing, intensive activities of the kitchen, intensive use of bathroom by guests, and also maintenance of swimming pools (Eurostat, 2009). Water consumption in accommodation facilities usually comprises 10 % of all water consumed in the city where the facility itself is located. Various types of facilities, however, consume different amounts of water, for example, guests staying at the hotel spends on average 312 litres of water per day, in the apartment (Holiday House) it is 273 litres, in Cmpise it is 148 litres, and in Group Accommodation it is 115 litres of water (Styles, D.; Schönberger, H .; Martos, JLG, 2014). In general, water in the various accommodation facilities is also used by other components or subjects, which is essential for the overall operation of the facility (Tab. 1). At the same time, it is important to mention that various activities associated with the consumption of water vary according to the actual type of accommodation (Styles, D.; Schönberger, H.; Martos, J.L.G., 2013).

Tourism is largely concentrated in the destinations, although the share of tourism in the global water consumption is less than one percent, it significantly contributes to water shortages especially in the active sites of tourism. Water consumed in accommodation facilities (ITP, 2008) is divided into (Fig. 2):

- rooms for guests – 34 % of water consumed,
- kitchen - food preparation, dish washing machines – 22 % of water consumed,
- toilets in the hotel (except guest rooms) – 20 % of water consumed,
- laundry service – 17 % of water consumed,
- boiler – 4 % of water consumed,
- swimming pool heating – 2 % of water consumed,
- HVAC (**H**eating, **V**entilation, and **A**ir **C**onditioning) – 1 % of water consumed (ITP, 2008).

Tab. 1 Areas of water consumption in tourism enterprises (according to Styles et al., 2013)

Service/Activity	**Main environmental pressures**
Administration	Office management Reception of clients
Technical services	Producing of hot water and space heating/cooling Swimming pools Green areas
Restaurant/bar	Breakfast, dinner, lunch Beverages and snacks
Kitchen	Food conservation Food preparation Dish washing
Room use	Use by guests Housekeeping
Laundry	Washing and ironing of guests' clothes Washing and ironing of
Activities	Outdoor activities Indoor activities
Additional services	Spa and wellness Hairdresser, etc.
Building and construction	Repair of existing areas or services Construction of new areas or services

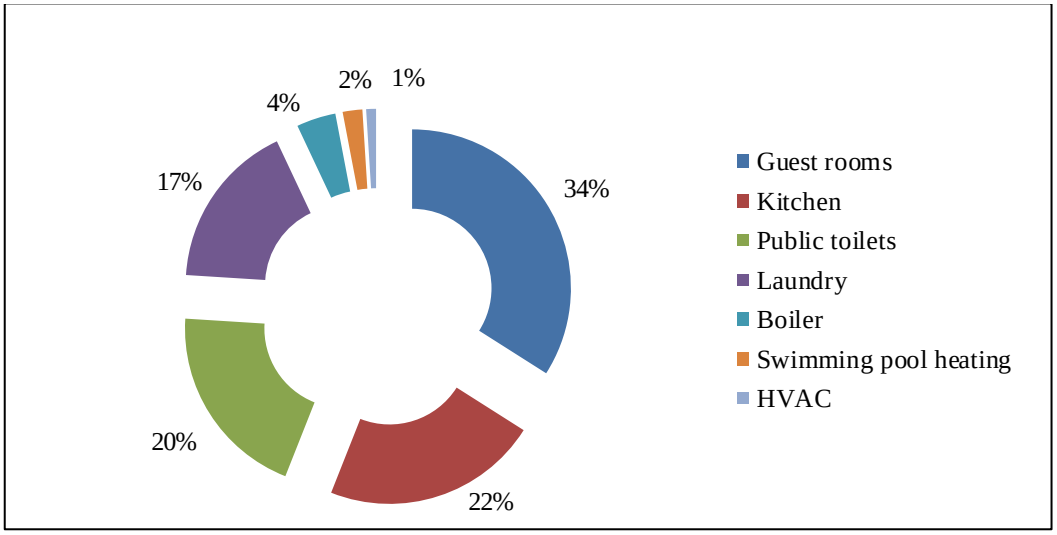

Fig. 2 Different components of the water consumed in accommodation facilities (source: ITP, 2008)

MONITORING OF THE STATE OF CONSIDERATE USE OF WATER IN THREE SPECIFIC DISTRICTS IN EASTERN SLOVAKIA

For example, it is stated a study conducted in three districts of the region Gemer, namely in the districts of Rožňava, Rimavská Sobota, and Revúca. The study was performed based on the field research by asking questions related to saving water directly in accommodation facilities specifically aimed at providing accommodation services. An important role is played by the fact that in Slovakia there are no statistics that focus on the consumption of drinking water only in the accommodation facilities itself. Therefore, this article tries to point out the necessity of obtaining such data to determine the actual impact of individual accommodation facilities for the water consumption and thus the sustainability of tourism in the research area. Despite this fact, it is possible at least

partially point out the water consumption for one overnight visitor at the accommodation facility in all three districts as follows: ***Consumption of drinking water in total without households*** per year and data ***Number of overnight stays of tourists at accommodation facility*** per year (Tab. 2). For a specific example it was set the year 2012 (Enviroportál, 2013).

For possible demonstration, it is also necessary an element of Primary consumption of water of other subjects per one day in the Slovak Republic, which reflects the value of 177,8 liters of water / one inhabitant in 2012, which is representing a consumption of water without households (Enviroportál, 2013).

In the case of the district Rožňava, the amount of water consumed by one overnight visitor in accommodation facility presents a figure of 226 litres of water per day, in district Rimavská Sobota it is 385 litres of water for one overnight visitor per day in the AF and in the district Revúca it is 236 litres of water for one overnight visitor per day in the AF. All these figures are higher than the stated average of 177,8 liters.

However, at the same time, they are approaching the European average water consumption of tourists per day, as already mentioned above. However, it is the place to note that this calculation is only approximate and indicative, as there are no statistics that would monitor the amount of water consumed in the accommodation sector. In the case of a field research conducted by questionnaire survey, it was not possible to verify these data not even directly in individual accommodation facilities, they lacked their very willingness to provide information of this type, or did not have the statistics processed at all.

Consumption of drinking water in individual districts presents data that has been calculated as the difference: Consumption of drinking water in total for each district minus Consumption of drinking water in households for each district (Tab. 3).

Questions that were selected to detect the state of the water saving were set as the following:

- Installed their own solar panels for heating water in the summer months,
- Toilets with the option of economical flushing system (dual-flush),
- Use of taps with water saving system flow rate,
- Considerate change of towels, bed linen regarding the water saving,
- All waste water is processed by the device itself or by the sewage treatment facility.

Tab. 2 Water consumption for one overnight visitor in AF (according to Datacube, 2015)

Year 2012	**District**		
	Rožňava	**Rimavská Sobota**	**Revúca**
Consumption of drinking water in total without households (Megalitre)	481	690	272
Number of overnight stays in AF	39 804	97 039	23 469
Water consumption for one overnight visitor at AF	226 l/day/1 visitor	385 l/day/1 visitor	236 l/day/1 visitor

Tab. 3 Consumption of drinking water in total without households in the districts of Rožňava, Rimavská Sobota, Revúca (ŠÚSR, 2015)

	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
District Rožňava	619	597	576	610	551	466	687	651	918	481
District Rimavská Sobota	1371	1361	1240	3055	842	821	745	722	705	690
District Revúca	409	375	328	434	294	300	388	294	579	272

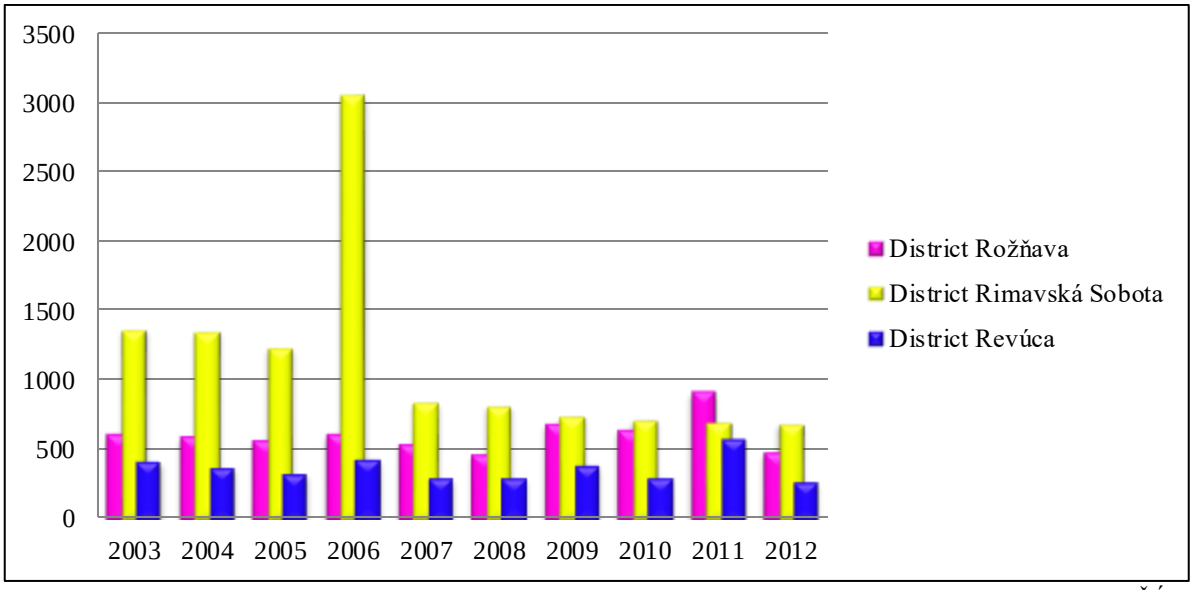

Fig. 3 Consumption of drinking water in the districts of RV, RS, RA, processed by author according to (ŠÚSR, 2015)

Tab. 4 Results of responses in individual districts

Questions	**Rožňava**		**Rimav. S.**		**Revúca**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Installed their own solar panels for heating water in the summer months	4	4	3	16	1	8
Toilets with the option of economical flushing system (dual-flush)	54	54	11	8	3	6
Use of taps with water saving system flow rate	7	7	4	15	0	9
Considerate change of towels, bed linen regarding the water saving	56	17	13	6	7	2
All waste water is processed by the device itself or by the sewage treatment facility	31	42	11	8	8	1

These questions were selected based on a comparison of individual data relating to the water saving in different accommodation facilities all over the world that meet stringent criteria and effectively contribute to the reduction of water consumption.

In the district of Rožňava, there were on the category of questions relating to water consumption answered 73 questionnaires / 73 accommodation facilities (Tab. 4). Among explicitly positively answered question in this case in the district Rožňava were included only two, namely: the question of ***Toilets with the option of economic flushing system (dual-flush)*** with the number of answer YES 54, and the second was the question of ***Considerate change of towels, bed linen in terms of the water saving*** with the number of positive response 56. The last three questions were of a negative nature of the response. The question ***Installed their own solar panels for heating water in the summer months*** reached the number of NO up to 69 times, achieving the highest number of negative responses in the category Water. Followed by the question of ***Use of taps with water saving system flow rate*** with the number of NO 66, and finally, the question of ***All waste water is processed by the device itself or by the sewage treatment facility*** with the number of negative responses 42.

In the district of Rimavská Sobota were on the category of questions relating to water consumption answered 19 questionnaires / 19 accommodation facilities (Tab. 4). Among the positively

answered questions in the district Revúca unlike in the district Rožňava, there were included up to three. The question with the highest number of positive response was a ***Considerate change of towels, bed linen regarding the water saving*** with the number of YES 13. Followed by the questions ***Toilets with the option of economical flushing system (dual-flush)*** and ***All waste water is processed by the device itself or by the sewage treatment facility*** that equally reached positive responses of number 11. While this question ***All waste water is processed by the device itself or by the sewage treatment facility*** reflected positively in the district Revúca, in district Rožňava it had a negative result. Significantly negative influence had the question ***Installed their own solar panels for heating water in the summer months***, which reached the number of negative responses of 16. The final question in that category was **Use of taps with water saving system flow rate**, which reached the number of negative answers only by one less, which is 15.

In the district of Revúca, there were on the category of questions relating to water consumption answered nine questionnaires / nine accommodation facilities (Tab. 4). Based on the results we can conclude significant differences in the responses because in the questioning there were evaluated only nine facilities, which is a considerable disparity on the other two district Rožňava and Rimavská Sobota. In the case of Rimavská Sobota it is only about a half, but compared to the district Rožňava it is just one-eighth. We can qualify two positively answered questions here. One was the question of ***All waste water is processed by the device itself or by the sewage treatment facility*** with the number of answer YES 8, which also represents the highest number of positive responses for the entire category. The second was the question of ***Considerate change of towels, bed linen regarding the water saving*** with the number of positive responses 7. It logically follows that there were three negatively answered questions in the category. Most answers of NO were reached on the question ***Use of taps with water saving system flow rate*** with the resulting number 9, where at the same time did not occur a single positive response. Another question was ***Installed their own solar panels for heating water in the summer months*** with the number of NO 8. The last of negative answers was the question ***Toilets with the option of economic flushing system (dual-flush)*** with the number of NO 6.

In a joint evaluation of the three districts, we can note that among the questions that were positive in all districts it was included only one, specifically the question ***Considerate change of towels, bed linen regarding the water saving***. For a completely negative result, we can consider the question of ***Installed their own solar panels for heating water in the summer months***, as it was reflected negatively in each of the districts. It should also be noted that regarding saving water in these districts there are still many questions that need to be targeted and consequently introduce a policy aiming at a reasonable management of water resources.

DISCUSSION ON POSSIBLE SOLUTIONS TO WATER SAVING IN ACCOMMODATION

Tourists who stay in accommodation facilities like to have their comfort, also about the fact that they are paying for the room. For the price, they expect hot heat water, suitably lit room with the possibility of ventilation through the window even during the winter months. Although the hotel managers are still interested in reducing energy consumption, water saving, the comfort of accommodated guests should not suffer because of that. Today's modern building management systems offer the possibility of reducing the cost of energy, economical use of water without compromising the comfort of

guests (Lütz, 2008).

To prepare as well as to achieve realistic goals for cost-effective management of water resources in the sector of accommodation service it will be necessary to invest not only time but also the financial resources to careful planning, training, and at the same time monitoring the objectives that were set. The first step in real water savings should begin with monitoring water consumption and setting specific goals. It is important to know the starting point, which is the detection of the current state of spending water in the facilities. Regular readings of water from various activities performed in accommodation facilities enable to find out where the largest water consumption is.

The next essential step is to know the costs for water and then find out where can be obtained water saving potential. Economical use of water has not only a positive effects on the financial costs of actual accommodation facility but also contributes to environmental protection.

Hence, if in different accommodation facilities will increase interest in considerate use of water, it is possible to follow several steps:

- Create realistic goals for saving water at individual departments in accommodation facilities,
- Leading management of the facility to save water, and the remaining staff,
- Ask employees about their own proposals to reduce the amount of water consumed,
- Include regular monitoring and reporting on the amount of water consumed by the worker, when in the case of saving the amount of water this information acts as the correct employee motivation.

An important role also plays detection of which sections of accommodation facility spend the largest amounts of water, whether it is a guest bathroom, laundry, kitchen, cleaning section, irrigation of land or if the facility has a swimming pool.

Finally, it is necessary to realize that water plays a crucial role not only for hotels but globally it is a major commodity, which is not available equally and to all.

CONCLUSION

Water is the world's indispensable source of human existence. The need for water itself affects all of us. Its deficiency increases from year to year. The water consumption in the area of accommodation services is not yet alarming, but despite the fact, it requires to focus on the saving now. Some hotels have in their marketing plan as a key priority to save water, but there are also those, which there are significantly more, that yet do not pay any or only minimal attention to this subject. Evaluation of the state of water treatment in accommodation facilities requires analysis of a large number of factors that are related. This article highlights the condition of water saving in three districts, in which there is so far no shortage of drinking water. Based on the results we can say that the saving is not exactly the most effective and it is necessary to deal with this issue further.

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