sciendo

Acta Geoturistica volume 9 (2018), number 2, **1-13**
doi: 10.1515/agta-2018-0005

Comparison of geotourism assessment models: and experiment in Bakony–Balaton UNSECO Global Geopark, Hungary

MÁRTON PÁL and GÁSPÁR ALBERT
ELTE Eötvös Loránd University, Department of Cartography and Geoinformatics, Pázmány Péter prom. 1/A., 1117, Budapest, Hungary
(E-mail: marchello@map.elte.hu, albert@ludens.elte.hu)

ABSTRACT
Geological and scenic values of locations are the non-living curiosities that can be preserved and popularized a lot easier using the institutional background of geotourism, such as geoparks. UNESCO Global Geoparks Network is responsible for protecting and fostering natural, scenic and cultural values and especially geosites that are the exciting visible physical elements. Our goal was to quantify the geotourism potential around Csopak, a scenic village in the Balaton Uplands giving home for the headquarter of the Bakony-Balaton UNESCO Global Geopark. After designating 216 potential geosites using topographic and geological maps, we applied two assessment models: the Geosite Assessment Model (GAM) and the Modified Geosite Assessment Model (M-GAM). GAM has been applied with good results in Hungary on different areas, but M-GAM has not been used before. As M-GAM involves tourists into the process counting with their opinion, it may give a more realistic view of the geosites. The two methods produced different but comparable final values of geotourism potential counted from the Main Value and Additional Value scores. We discovered that the proportion of the difference of these values carries major information. The ratio of ΔAV/ΔMV used as linear functions and depicted on diagrams can derive which values are more important for the visitors. From this result we can draw conclusions about the future development trends: scientific or infrastructural values should be more effectively fostered. Using our results, geosites can be handled and developed as visitors expect it.

Key words: geotourism, geosite, assessment, geopark, Balaton Uplands

INTRODUCTION

To start geoconservation the first step is to recognise and evaluate sites that carry major geological information amongst the aspects of tourism. Generally, there are two ways of geosite assessment. The qualitative approach mainly uses the expertise of the assessors and procedures that focus on the quality of the examined site. It dates back to the 1960s (Watson & Slaymaker, 1966). The quantitative methodology is related to the ranking of geosites. It started to emerge in the 1990s (Grandgirard, 1997; Rivas et al., 1997) and has developed in order to do more appropriate and objective evaluations (Lai & Graefe, 2000; Melián-González & Garcia-Falcón, 2003). They use different numerical methods to rate a particular site. Since during qualitative assessment we do not have the exact process documented and there is a large factor of subjectivity depending on the assessors' expertise. It is mainly used to designate potential geosites. Proper gesoite assessments can be done by the combined use of these two methodologies (Pereira, P. & Pereira, D., 2010). We need experts from different fields of earth science to determine whether a site has enough scientific values, while quantitative assessment is essential to determine the importance of these scientific, aesthetic and infrastructural values.

Quantitative geosite assessing has been used in Hungary only a few times. For instance, in the famous volcanic region of Tokaj, Szepesi et al. (2016) made an assessment to revive Hungarian volcano tourism. It turned out during the assessing that the most appropriate model for the area was the Geosite Assessment Model (GAM) developed in Serbia by Miroslav D. Vujičić et al. (2011). Csorvási (2017) carried out geosite assessment in Fejér County in two study areas. 6 geosites with different attributes were chosen and assessed using 10 distinct assessment models. The most realistic result was given by the aforementioned GAM.

The GAM is a well-defined method, which can be used anywhere. However, it does not reflect the diversity of the aspects, which makes a certain geosite important for the visitors. To incorporate the opinions of the visitors in the assessment a modified version of the GAM emerged and it was called M-GAM (Tomić & Božić, 2014).

This study is aimed to make a dual geosite assessment at an area, where currently active geoturism is present: the Bakony-Balaton UNESCO Global Geopark. Although this was the first geopark of Hungary, there wasn't any quantitative assessment in the area. Our study aims to solve this issue on the Eastern area of the Geopark, where parallel with the study a new geological hiking map was compiled (Albert et al., 2018).

The results of the study highlight the advantages and disadvantages of the assessment methods. Is also demonstrates the implementation of the scientific assessment method into a practical communication between the geopark and the visitors via the geological hiking map.

METHODS: GAM AND M-GAM

The Geosite Assessment Model is a great milestone in the development process of quantitative methods. It is consisted of two main parts: Main Values (MV) and Additional Values (AV). There are subgroups within the MV and AV groups: scientific/educational values (VSE), scenic/aesthetic values (VSA), protection (VPr) and functional (VFn), touristic (VTr). These subgroups are also divided into smaller parameters called indicators: 12 of them is in the MV group and 15 is in the AV group. Each geosite is assessed by evaluating these indicators: they can get 0, 0.25, 0.5, 0.75 and 1 values. Then with the application of three simple equations we can produce the sum of a geosite's score:

$$MV = VSE + VSA + VPr,$$
$$AV = VFn + VTr,$$
$$GAM = AV + MV.$$

The evaluation system can be seen in Table 1. and Table 2.

In 2014, Tomić & Božić basically used the methodology of GAM to assess 3 Serbian geosites. However, they added a small change to the model: the Modified Geosite Assessment Model supplements the experts' aspects with the opinion of visitors and tourists. In this way they involve the audience into the evaluation process increasing objectivity. It has been necessary as geotourists are mainly not geologists or earth scientists: they may be also open for cultural, historical, scenic and entertaining sights, possibilities. Usually an average visitor searches for a particular place for the sum of the mentioned attributes. The researchers interviewed 96 visitors about their personal importance of each indicator of the GAM. Then the values were summed and every single indicator got its Importance (Im) factor. If we multiply the GAM score with his, we produce the M-GAM score of a geosite:

$$MGAM = Im(GAM) = Im(MV + AV).$$

In the article describing M-GAM Tomić & Božić introduces the scatterplot matrices of both models. Considering the matrix field of every geosite, we can easily determine the geotourism development of each geosite

(Figure 1). Amongst using these diagrams for visualizing the differences between the two models, it is also an opportunity to analyse the differences between the GAM–M-GAM MV and AV values of a geosite. This method provides an opportunity to designate if scientific or infrastructural values need development.

Table 1. GAM and M-GAM MV indicators with their Im factor

Indicators:	Im	0	0.25	0.5	0.75	1
Scientific/Educational values - VSE:						
Rarity, nearby occurrence (SIMV1)	**0.95**	Common	Regional	National	International	The only occurrence
Representativeness of a formation (SIMV2)	**0.7**	None	Low	Moderate	High	Utmost
Knowledge on geoscientific issues (SIMV3)	**0.66**	None	Local publications	Regional publications	National publications	International publications
Level of interpretation (SIMV4)	**0.84**	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 but easy to explain to common visitor
Scenic/Aesthetic values - VSA:						
Viewpoints to the geosite (SIMV5)	**0.83**	None	1	2 to 3	4 to 6	More than 6
Surface, area of the geosite (SIMV6)	**0.58**	Small	x	Medium	x	Large
Surrounding landscape and nature (SIMV7)	**0.91**	x	Low	Medium	High	Utmost
Environmental fitting of sites (SIMV8)	**0.87**	Unfitting	x	Neutral	x	Fitting
Protection values - VPr:						
Current condition (SIMV9)	**0.92**	Totally damaged (as a result of human activities)	Highly damaged (as a result of natural processes)	Medium damaged (with essential geomorph. features preserved)	Slightly damaged	No damage
Protection level (SIMV10)	**0.78**	None	Local	Regional	National	International
Vulnerability (SIMV11)	**0.87**	Irreversible (with possibility of total loss)	High (could be easily damaged)	Medium (could be damaged by natural proc. or human activities)	Low (could be damaged only by human activities)	None
Suitable number of visitors (SIMV12)	**0.58**	0	0 to 10	10 to 20	20 to 50	More than 50

Table 2. GAM and M-GAM AV indicators with their Im factor

Indicators:	Im	0	0.25	0.5	0.75	1
Functional values - VFn:						
Accessibility (SIAV1)	**0.75**	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 or public transport)
Additional natural values (SIAV2)	**0.66**	None	1	2 to 3	4 to 6	More than 6
Additional anthropogenic values (SIAV3)	**0.67**	None	1	2 to 3	4 to 6	More than 6
Vicinity of emissive centres (SIAV4*)	**0.71**	More than 100 km	100 to 50 km	50 to 25 km	25 to 5 km	Less than 5 km
Vicinity of important road network (SIAV5)**	**0.74**	None	Local	Regional	National	International
Additional functional values (SIAV6*)**	**0.69**	None	Low (1)	Medium (2-3)	High (4-6)	Utmost (6<)
Touristic values - VTr:						
Promotion (SIAV7)	**0.71**	None	Local	Regional	National	International
Organized visits (SIAV8)	**0.56**	None	Less than 12 per year	12 to 24 per year	24 to 48 per year	More than 48 per year
Vicinity of visitors' centre (SIAV9)	**0.74**	More than 50 km	50 to 20 km	20 to 5 km	5 to 1 km	Less than 1 km
Interpretative panels (SIAV10)	**0.87**	None	Low quality	Medium quality	High quality	Utmost quality
Number of visitors (SIAV11)	**0.58**	None	Low (less than 5000)	Medium (5001 to 10000)	High (10001 to 100000)	Utmost (more than 100000)
Tourism infrastructure (SIAV12*)**	**0.7**	None	Low (1)	Medium (2-3)	High (4-6)	Utmost (6<)
Tour guide service (SIAV13)	**0.74**	None	Low	Medium	High	Utmost
Hostelry service (SIAV14)	**0.73**	More than 50 km	25 to 50 km	10 to 25 km	5 to 10 km	Less than 5 km
Restaurant service (SIAV15)	**0.76**	More than 25 km	10 to 25 km	10 to 5 km	1 to 5 km	Less than 1 km

(*) We have counted with the distance of Budapest. Another option could have been Veszprém or Székesfehérvár, but every geosite gets the same value in all 3 cases.
(**) We have worked with the distance of Route 8.
(***) We have set up a circle area with a radius of 2 km.

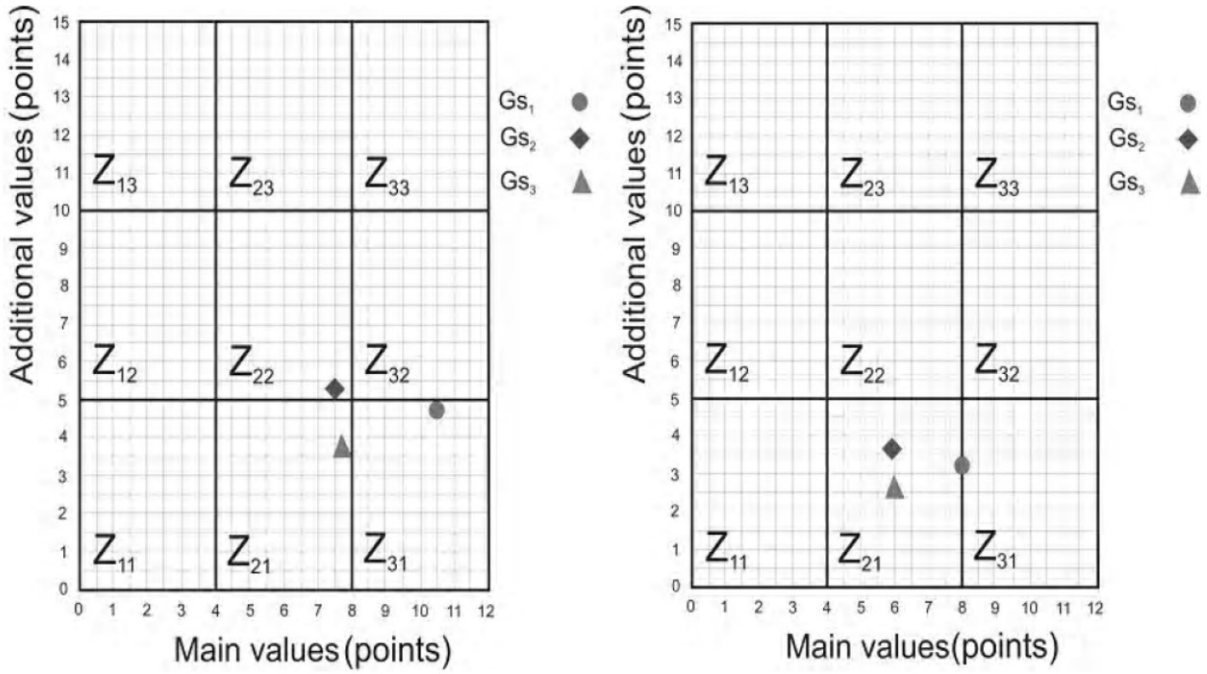

Fig. 1 Scatterplot matrices in Tomić & Božić (2004). GAM values can be seen on the left and M-GAM values on the right.

By analysing the scatterplot matrices one can determine the relative scientific and infrastructural values of the sites and the decision-makers could easily plan which sites can be utilized for geotourism. For example, geosites that can be found in fields Z_{23} and Z_{33} own enough scientific values and have active tourist use. Here, future planning demands the wise consideration of tourism's effect on the nature, communities and the possibilities of sustainable development. In the case of field Z_{23} the increasing of tourism infrastructure would be recommended to satisfy the visitors. Fields Z_{31} and Z_{32} contain geosites with high scientific but low additional values. These sites can be the candidates for future infrastructural projects: information panels, nature trails would attract geotourists.

Study area

The surrounding of Lake Balaton is one of the most visited tourist destinations in Central Europe. Every kind of visitor can find something to do here: the beaches on the shore, famous wine cellars and cultural heritage mean high tourism potential. But the great variety of natural values make this area even more distinctive. The northern coast of the lake is a part of the Transdanubian Mountains and is also well-known for its unique geological formations. The climate of the Balaton Uplands has Mediterranean features on the lower areas, but on higher altitudes is mainly temperately cool and wet. Due to its mountains and hills it does not have great rivers. But there are lots of small streams in the deep valleys called "séd". The valleys of the "séd" streams have cool microclimate during hot summer days (Dövényi, 2012; Futó, 2013). There are two institutions responsible for the natural values of the area: Balaton Uplands National Park and Bakony–Balaton UNESCO Global Geopark (Figure 2).

Our work studies the eastern part of the Balaton Uplands. The geological history of rocks here dates back to ancient times to times when life was only present in oceans. The great variety of rocks is caused by the intensive work of the nature: volcanoes, deep and shallow seas, deserts and lagoons has transformed the area. Plates were folded into mountains by the force of fierce earthquakes and tectonic movements (Albert et al., 2018). The oldest formations

here are from the Silurian Period, so they are more than 410-420 million years old. Between the sediments of Lovas Slate we can find the layers of a basic volcanic rock: Alsóörs Metarhyolite. The outcrops of these formations are rare and highly protected. The most specific rock of the area was formed during the Permian. It is called red Balatonfelvidék Sandstone due to its colour. This formation is commonly used especially in the surroundings of Balatonalmádi-Vörösberény as a building stone (Budai & Konrád, 2011). Besides these famous features Neogene sediments have less importance than marls and limestones from the Mesozoic. Such rocks as in the Alps can be found here from this era (Budai et al., 1999).

Fig. 2 The extent of the Bakony–Balaton Geopark (red border) and the examined area (green border)

GEOSITE ASSESSMENT

Convinced by the promising outcomes of the GAM applications in Hungary, we have decided to use this method. Moreover, having a geodatabase of geosites assessed with the same methodology as the previous works may facilitate a countrywide initiative in the future to create a National Geosite Cadastre.

In line with the assessing work the design of the first Hungarian large-scale geological hiking map has started that depicts the examined area (Albert et al., 2018). For both works prior hiking and geological maps were suitable as data sources. The preliminary assessing was carried out with the help of a database that served as a basis of our map. In addition, we have used our field drafts. Data gathering and qualitative geosite designation were followed by consultation with experts of the area and the application of the two quantitative models.

Datamining and filtering

The extent of the area was inherited from the hiking map of Felsőörs and its surroundings (Schwarcz, 2013) as it was the

technical base for the geological hiking map. This map was also a source for the datamining by selecting different map symbols that may have denote geosites (cliffs, breaks, gullies) with coordinates. We also used georeferenced military (Gauss-Krueger) and civilian (Uniform National Mapping System – EOTR, MÉM OFTH 1977) topographic maps with the scale of 10k and 25k. Their map key contains much larger amount of information. So that we searched for all the elements with the possibility of geosite features in the key books. Then these point-feature elements were inserted into the preliminary GIS database.

For processing geological data sources, we looked for the corresponding sheets of the engineering geological maps of the area (1:20 000, 1986) in the library of the Mining and Geological Survey of Hungary (MBFSZ). It contains clastic and intact outcrops, boreholes, quarries, mines and explorational pits. We set up 3 map size groups according to importance (<50 m; 50–100 m, 100 m<) and only geosites with these sizes were recorded. The 50k-scale Geological map of the Balaton Highland (Budai et al., 1999) does not contain outcrops: this was used to check the correct geological formation of the formerly designated sites.

We put the elements of the key section list of MBFSZ into our database as they carry fundamental geological features although their infrastructure is often poor (MBFSZ, 2018). We also looked through the available Google photos in the area as hikers who used Google services and made photos of their walk often uploaded these to Google/Picasa. After designating, we had nearly 450 potential geosites in our database.

This huge amount of sites from this small area includes many unimportant, inaccessible and non-existent geosites. To reduce the number of sites that has to be checked on the field a preliminary filtering was applied. We chose the OpenStreetMap database to filter our points by the current extent of settlements and industrial areas. Google photos and key sections were good to correct this phase, because some outcrops have been preserved despite construction works. In Hungary, mining areas with valid permission are cannot be visited by civilians so we deleted them from the database. During fieldwork we also made a filtering according to the geological importance, distance and size. After this phase, only 75 geosites remained to be quantitatively assessed.

Quantitative assessment

The onsite documentation of the remaining geosites had large importance in the subsequent work phases. We used GPS and mobile applications on the field to record tracklogs and mark evaluable geosites. We wrote a detailed report on each site with geological index and characteristics. Photos of every visited place were taken. The remaining work sessions were carried out in office. Using GAM/M-GAM requires multiple methods to get results: indicators can be evaluated by executing spatial queries in the geodatabase (GIS methods), analysing and classifying the sites using photos and notes and consulting with experts.

GIS methods are suitable to evaluate those indicators which depend on measuring distances and quantities from other geographic features. These spatial queries were carried out with QGIS open software. “Rarity, nearby occurrence”, “viewpoints to the geosite”, “accessibility”, “additional natural values”, “additional anthropogenic values”, “vicinity of visitors’ centre”, “hostelry service” and “restaurant service” were scored by setting up buffer zones around geosites and counting the corresponding elements within the circle with a certain radius. In the description of the GAM some of the spatial-dependent indicators are vaguely defined. Indicators such as the “vicinity of emissive centres”, “vicinity of important road network”, “additional functional values”, “tourism infrastructure” do not have determined

parameters to define the exact values for evaluation. The values in Table 1 and 2 of these indicators are determined for the study area.

For most of the indicators, our field notes, photos and the corresponding scientific publications were good materials to perform the assessment. The available tour guides and information panels of the National Park and the Geopark also helped us to reach higher objectivity by providing exact data in some cases. Also, we consulted with experts in the case of some indicators such as the "knowledge on geoscientific issues", "promotion", "number of visitors" and "tour guide service".

RESULTS OF THE ASSESSMENT

The next step was the calculation of the GAM/M-GAM results based on the assessed indicator values of each geosite. For this we exported the database into an Excel table, where the calculation and visualization of the data was more appropriate than in QGIS. The results are visualized on Figure 3a-b.

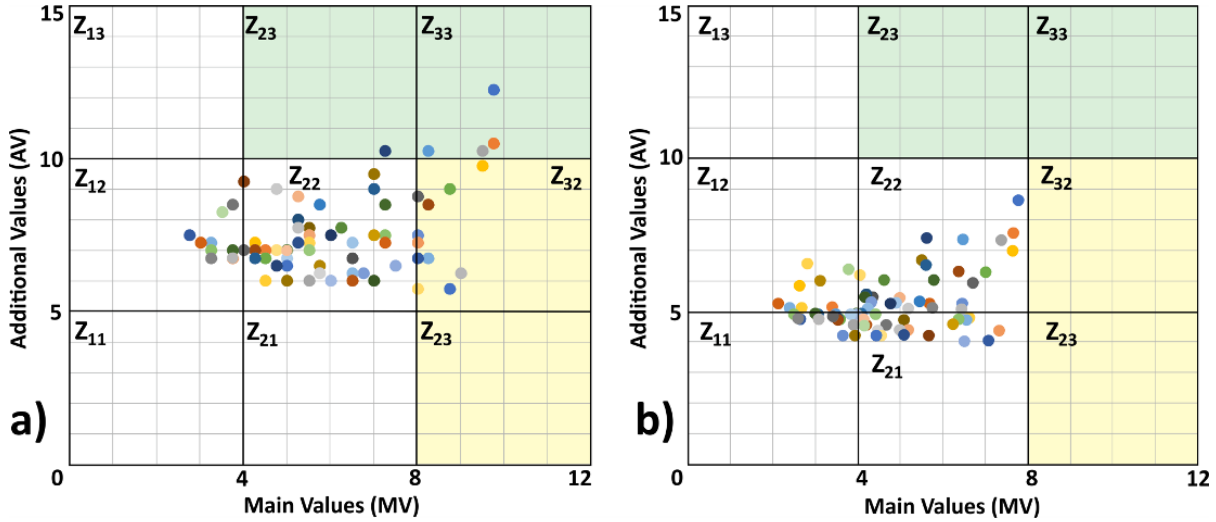

Fig. 3 Scatterplot diagrams of the results. a: GAM values in a 15 by 12 matrix determined by the possible GAM maximum scores; b: M-GAM values in a matrix determined by GAM maximum scores modified by the Im factor. Green matrix fields mean already popular geosites with good scientific and infrastructural balance while yellow fields mean geosites with high scientific values but poor infrastructural potential.

The Main Values can be found on the horizontal axis, while Additional Values are on the vertical axis. If we divide both axes into three equal parts, the whole diagram can be seen as a 3x3 matrix. These fields carry major information that relate to the nature and development of geotourism.

Tomić & Božić (2014) did not use a diagram defined by the maximum values of M-GAM, they inserted their Im factor modified results into the GAM diagram. The analysis of the result using only the GAM matrix may produce false conclusions because amongst the assessed geosites there were frequently visited (i.e., Lóczy Cave: 160k visitors/y) sites as well which fell into the Z_{22} matrix cell after applying the Im factor (Figure 4b). So it seemed that the GAM matrix is not expressive for the presentation of M-GAM values. To better differentiate the geosites, we decided to use an M-GAM matrix adjusted to the maximum values.

In Figure 4a-b, most of the geosites are out of fields that have the best values. It is important to select geosites with large scores, because they are the most developed ones, or worth near-future development. We applied Jenks' natural breaks (1967) method for clustering. The clustering resulted 24 geosites with higher potential than the others; these are the ones

Table 3. The clustered geosites with their score

ID	Name:	Score:
62	Lóczy Cave	16.43
31	Felsőörs, Forrás-hegy nature trail	15.26
19	Lake Kócsi nature trail	14.74
59	Koloska Cliffs	14.65
22	Alsóörs, Vöröskő nature trail	13.85
63	Lóczy Clave, limestone cliffs	13.30
67	Csopak, Pele Circuit	13.05
55	Nádaskút, werfen key section	12.71
21	Miske Cliff	12.67
23	Alsóörs Metarhyolite key section	12.22
58	Main Dolomite in Koloska Valley	12.14
42	Triassic (T3s and T3f) key section	11.84
26	Cliffs next to Miske Cliff	11.74
47	Kopasz Hill, quarry	11.74
6	Kő Hill, Ember Cliff	11.55
60	Koloska Linden	11.43
16	Nagy-kő orra	11.31
50	Cliffs next to Csákány Hill Cave	11.15
68	Sárkány (Dragon) Hole	11.14
29	Király-kút Valley, limestone cliffs	10.97
66	Tamás Hill, sediments with dolomite	10.89
71	Csákány Hill Cave	10.83
73	Balatonalmádi, Triassic key section	10.81
3	Balatonalmádi, P/T key section	10.66

that are worth more detailed examination. In Table 3 the elements of the set with high scores or high chance of future development can be seen.

COMPARISON OF THE VALUES

The M-GAM differs from GAM because of the Im factor that represents the visitors' opinion about each GAM indicator's importance. Because of the estimating process, the Im is always smaller than or equal one:

$$Im \leq 1.$$

That's why the M-GAM scores are mainly smaller than GAM scores. If we draw a GAM diagram and put GAM and M-GAM values inside of it, the difference can be well seen (Figure 4). In the next step, we plotted linear functions between points from the different models. The variable was the Main Value, the function value was the Additional Value in each case. By counting the steepness of a function, we can determine whether the AVs or MVs were modified by Im more significantly. In our case every function has a steepness larger than 1 (Figure 4), so AVs ("infrastructure") were much more corrected by visitors than MVs ("science") without any exception. We created 3 groups according to the value of steepness by equidistantly trisecting the difference of the maximum and minimum steepness:

$$Green: 1{,}006 \leq s(g) \leq 1{,}39167;$$
$$Yellow: 1{,}39167 \leq s(y) \leq 1{,}77733;$$
$$Red: 1{,}77733 \leq s(r) \leq 2{,}163.$$

The modificatory effect can also be expressed by the comparison of the Δx (=ΔMV) and Δy (=ΔAV) values of each geosite (Figure 5). This kind of representation even more highlights that in the full score of a geosite AV values are more modified by the Im factor (ΔAV is always larger than the ΔMV). From left to right the functions of ΔMV and ΔAV differences spectacularly shrink. This also means that the full value of a geosite decreases, so the importance slightly depends on the Additional Values. There is also a difference between the deviation of ΔMV and ΔAV values meaning that average people can more easily differentiate infrastructural indicators than scientific ones.

ΔAV-ΔMV value also worth mentioning (Figure 6). This index-number indicates how important are the infrastructural Additional Values to a tourist and how strongly AVs have decision influencing effect when searching for destinations. This number is greater than 0 in the case of every 24 examined geosite.

Taking into consideration the results of this comparison, we can state that an average geotourist is eager to visit a geosite with better infrastructure even if it has less scientific-educational values.

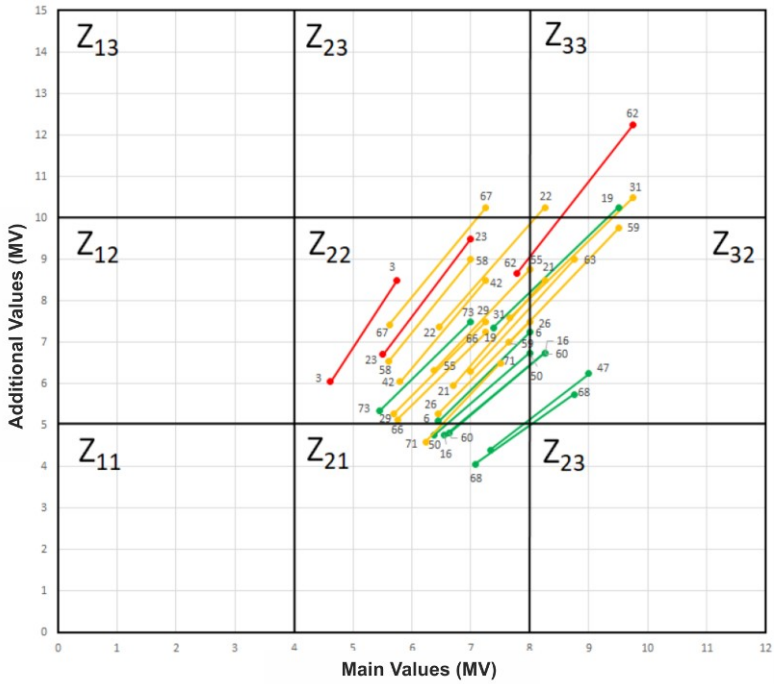

Figure 4. The 3 steepness groups of the linear functions depicted in a GAM matrix

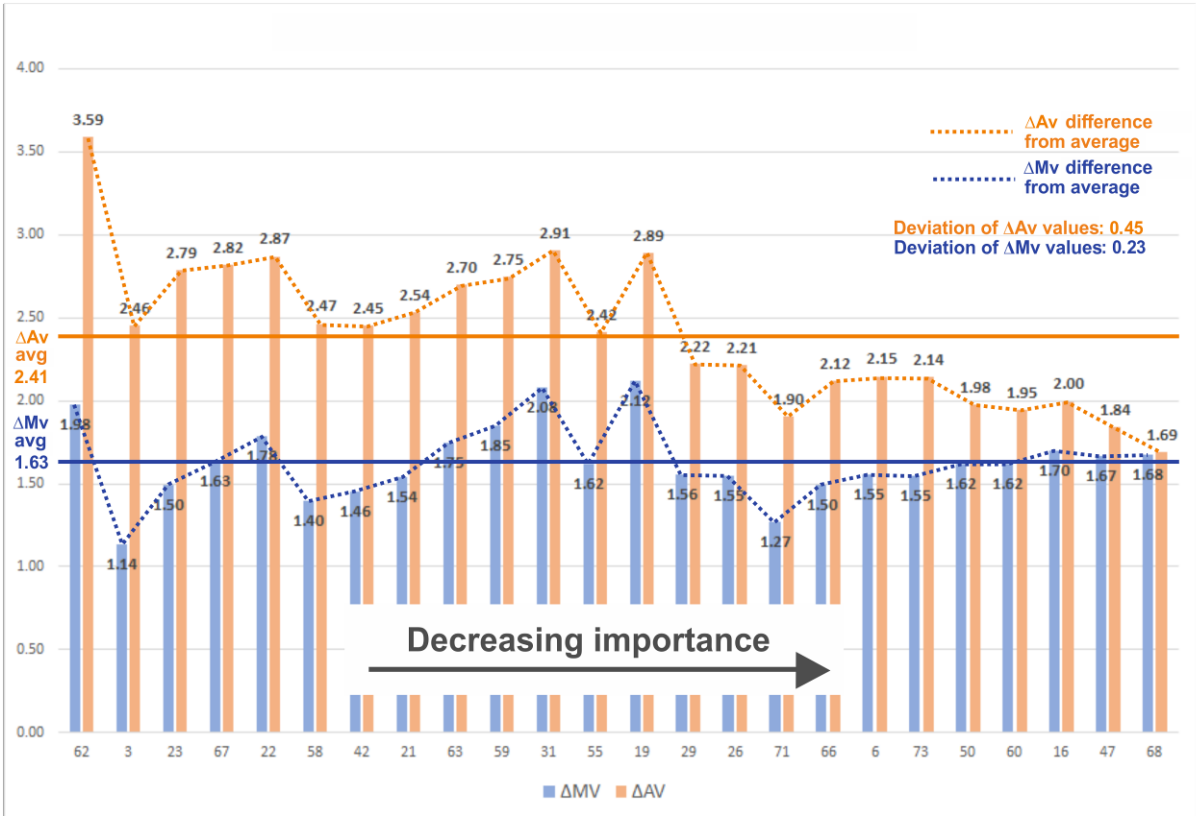

Figure 5. The diagram of ΔMV and ΔAV

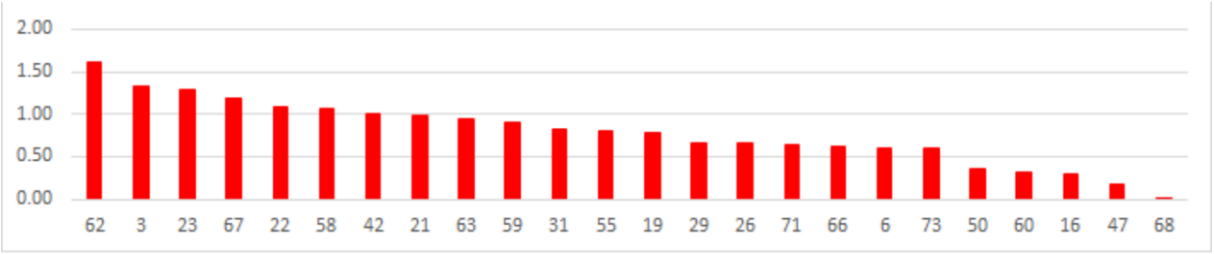

Fig. 6 ΔAV-ΔMV values of the 24 geosite

The major task for the caring institutions' (Balaton Uplands National Park Directorate and Bakony–Balaton UNESCO Global Geopark in this case) is to develop sites with high Main Values in order to present the geological uniqueness of it to the visitors. Naturally it is impossible to upgrade every geosite to the same infrastructural level, but this is not something to achieve! Planning the infrastructural investments with taking consideration of the results of an assessment is what a caring institution should do!

CONCLUSIONS

Our study is unique, because a comparison of GAM and M-GAM has never been done before in such details. We found that if M-GAM results are put in the GAM matrix, the local importance of the geosites are too much diminished, and thus, the method did not seem to reflect the reality. However, when a M-GAM matrix was used, the M-GAM method correctly reflected the current state of the geosites.

Using the M-GAM method parallel with the GAM could be the base of detailed examination too. It is because the Im factor modifies the various sites differently. After the use of Im factor, a general skew along the AV axis was detected. This means that AVs have more effect on tourists than MVs and the opinions of average visitors are differentiated better by infrastructural values (ΔAV has greater deviation). The magnitude of the skew can reflect the sensibility of certain geosites to infrastructural parameters. With analysing these results we can give advices and show further opportunities to the corresponding authorities for developing certain geosites.

The M-GAM has the deficit that it was evaluated on a certain area. We suppose that the Im value is unique for all geosites, and the values published by Tomić & Božić (2014) are not universal. Thus, we plan to designate some geoistes in the current study area where we ask tourists to fill a questionnaire similar to the one in Serbia for each geosite. By the results we will be able to tell a better prognosis for future plans for each geosite.

A rare but spectacular way to present geologically important information is the aforementioned geological hiking map. The 24 examined geosites are marked with a special pictogram, and the 9 most visited are described in details on the back of the map. This kind of map is a good opportunity to bring the geological and anthropogenic heritage nearer to the people as it presents topographic, touristic and geological information too (Figure 7). The popularization of geological treasures serves different purposes: the development of geosites attract more and more tourists who impinge the area's economic situation and give over heritage to younger generations.

Acknowledgement

We thank for the help of Dr. Tamás Budai, geologist of the Mining and Geological Survey of Hungary and Barnabás Korbély, the Head of the Geopark Group who provided data to evaluate some of the GAM indicators.

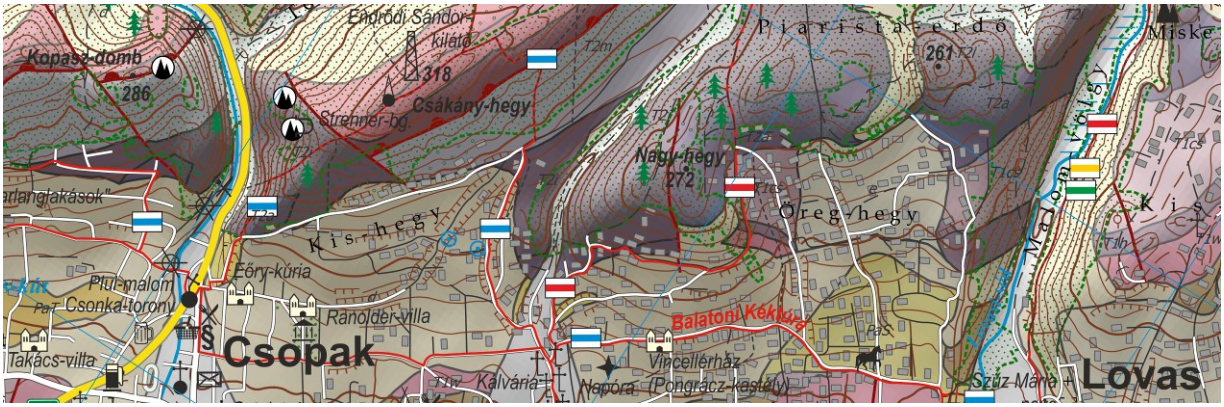

Fig. 7 An excerpt of the geological hiking map (Albert et al., 2018)

REFERENCES

Albert, G. (2004). Geoscientific results in "tangible" format: the geotourist map. – only in Hungarian: Földtudományok eredménye „kézzelfoghatóan": a földtani túratérkép. Geodézia és kartográfia, 51(7), 27-30.

Albert, G., Pál, M., & Schwarcz, Gy. (2018). Geological hiking map of the surroundings of Csopak. 1:30 000, Schwarcz Térkép.

Bakony–Balaton Geopark. (2018). What is a geopark? – only in Hungarian: Mi a geopark? Source: http://geopark.hu/home/mi-a-geopark [accessed: 2018. 08. 30.]

Haas, J. (ed.). (2012). Geology of Hungary. Springer Science & Business Media.

Budai, T., Császár, G., Csillag, G., Dudko, A., Koloszár, L., & Majoros, Gy. (1999). Geology of the Balaton Highland. Budapest, Hungarian Geological Survey. 169-257.

Budai, T., Csillag, G., Dudko, A., & Koloszár, L. (1999). Geological map of the Balaton Highland. Budapest, Hungarian Geological Survey.

Csorvási, N. (2017). Evaluation of geotouristic potential on a study area of Fejér County. – only in Hungarian: Geoturisztikai potenciálfelmérés Fejér megyei mintaterületen. XXXIII. National Conference of Scientific Students' Associations, Debrecen, Hungary.

Dowling, R. (2011). Geotourism's Global Growth. In Geoheritage, 3(1) pp. 1-13.

Dövényi, Z. (ed). (2012). Geography of the Carpathian Basin. – only in Hungarian: A Kárpát-medence földrajza. Budapest, Publishing house of Academy.

Futó, J. (2013). Tour proposals – Natural experiences next to Lake Balaton and in Bakony Mountains. – only in Hungarian: Túrajavaslatok - A természet élménye a Balaton mellékén és a Bakonyban. Balaton Uplands National Park Directorate, Csopak, Hungary.

Grandgirard, V. (1997). Géomorphologie, protection de la nature et gestion du paysage. Thèse de doctorat en géographie, université de Fribourg, p. 210.

Grant, C. (2010). Towards a typology of visitors to geosites. In Second Global Geotourism Conference, Making Unique Landforms Understandable. Mulu, Sarawak, Malaysia.

Hose, T. A. (1995). Selling the Story of Britain's Stone. In Environmental Interpretation, 10(2) pp. 16-17.

Hungarian Geological Society (2018). Geosite Day – only in Hungarian: Geotóp Nap. Source: http://geotopnap.hu/ [accessed: 2018. 08. 30.]

Lai, L., & Graefe, A. (2000). Identifying Market Potential and Destination Choice Factors of Taiwanese Overseas Travelers. Journal of Hospitality & Leisure Marketing, 6(4), pp. 45-65.

Hungarian People's Army Mapping Agency (1964): Map key of 1:25 000, 1:50 000 and 1:100 000 scaled topographic maps. Budapest, Hungary.

Melián-González, A., & Garcia-Falcón, J. (2003). Competitive Potential of Tourism in Destinations. Annals of Tourism Research, 30(3), pp. 720-740.

Mining and Geological Survey of Hungary (2018): Map of Hungarian key sections. Source: https://map.mbfsz.gov.hu/fdt_alapszelvenyek/ [accessed: 2018. 08. 30]

Newsome, D., & Dowling, R. (2010). Geotourism: The Tourism of Geology and Landscape.

Pereira, P. & Pereira, D. (2010). Methodological guidelines for geomorphosite assessment. Géomorphologie: relief processus environnement, pp. 215-222.

Rivas, V., Rix, K., Frances, E., Cendrero, A., Brunsden, D. (1997). Geomorphological indicators for environmental impact assessment: consumable and non-consumable geomorphological resources. Geomorphology 18, pp. 169-182.

Szepesi, J., Harangi, S., Ésik, Z., Novák, T., Lukács, R., & Soós, I. (2016). Volcanic Geoheritage and Geotourism Perspectives in Hungary: a Case of an UNESCO World Heritage

Site, Tokaj Wine Region Historic Cultural Landscape, Hungary. Geoheritage.

Tomić, N., & Božić, S. (2014). A modified geosite assessment model (M-GAM) and its application on the Lazar Canyon area (Serbia). International journal of environmental research, 8(4), 1041-1052.

Vujičić, M., Vasiljević, D., Marković, S., Hose, T., Lukić, T., Hadžić, O., & Janićević, S. (2011). Preliminary geosite assessment model (gam) and its application on Fruška gora mountain, potential geotourism destination of Serbia. Acta Geographica Slovenica, 51(2), 361-377.

Watson, E., Slaymaker, O. (1966). Mid-Wales, a survey of geomorphological sites. Department of Geography, University College of Wales, Aberystwyth, p. 92.

Acta Geoturistica volume 9 (2018), number 2, **14-23**
doi: 10.1515/agta-2018-0006

Increasing the attractiveness of the Zádielska dolina ("Zadiel Gorge") in the area of modern climbing as a tourism development support tool

JANA SELEPOVÁ
Department of Geo and Mining Tourism, Faculty of Minig, Ecology, Process Control and Geotechnologies, Technical University of Kosice, Letna 9, 042 00 Kosice, Slovakia
(E-mail: jana.selepova@tuke.sk)

Abstract
The Zádielska dolina ("Zadiel Gorge") belongs to the most beautiful and from a natural science perspective to the most interesting landscape formations of the Slovak Karst. The area represents the National Nature Reserve in the National Park and is part the European Network of Protected Areas NATURA 2000. The site is characterized by climbing activity. This article provides suggestions of attractiveness in the field of climbing that respect the development of tourism in accordance with nature and landscape conservation. The basis for the proposals were theoretical knowledge, thorough analysis of the area and own experience with the issue. Recommendations from other climbing places and identification of problems between climbing and nature, have been key for us in making appropriate proposals. The increasing interest in adventure tourism, including climbing, means a global trend in tourism and therefore it is necessary to pay close attention to this issue.

Keywords: Zádielska dolina ("Zadiel Gorge"), climbing, development, protected area

INTRODUCTION

People are looking for opportunities how to overcome obstacle between themselves and nature. The infinite diversity, size and amount of climbing terrain, some of which are also accessible for tourists, others only for the most skillful individuals, predetermine the breadth of climbing activities. Climbing has long been a full-fledged sport with its own competition rules.

Zádielska dolina ("Zadiel Gorge") is a magnificent place with a climbing potential that has been in use since the beginning of the last century. Moreover, the site is comparable in terms of natural conditions, especially geomorphological, with the other most popular climbing localities. However, the possibility of climbing activity is not sufficient. There exist other factors that affect the attractiveness of the site. Therefore, our goal is to create a proposal that will increase the attractiveness of the Zádielska dolina ("Zadiel Gorge"), that can motivate
the visitor to choose this climbing place and which will have a decisive importance to the local economy.

STUDY AREA

Different landscapes of the Slovenský kras ("Slovak Karst") are valleys and gorges. Zádielska dolina ("Zadiel Gorge") with an area of 214,73 ha is situated over the village Zádiel. It is a gateway to the southeastern part of the geomorphological unit Slovenský kras ("Slovak Karst") (Mihálik & Ponec, 2006). In the east it borders on the Zádielska planina ("Zadiel plateau"), which has the smallest area in the Slovenský kras ("Slovak Karst"). To the

West of the valley is morphologically sharply bounded the Horný vrch (“Plateau of Upper Hill“) (Kliment & Lacika, 2009). The plains are built with limestones and dolomites (Mello et al., 1997; Mello, 1997). To the north borders Zádielska dolina (“Zadiel Gorge“) on the geomorphological unit Volovské vrchy (”Volovec Mountains”). The southern border consists of the Turnianska kotlina (”Turnianska basin”) and the Košická planina (”Kosice basin”)
(Bánesz, 1994).

The narrow Gorge, with a minimum width of 10 m was eroded by the cascading river Blatnica (”Blatnica”). It rises in the Volovské vchy (”Volovec Mountains”) at an altitude of about 950 m (Čech, 2015). The perpendicular and overhanging walls tower over both sides of the 3 km long valley (Fig.1). From the bottom to the top edge of the plateau is the height difference 250-300 m (Mihálik & Ponec, 1981).

The west side comprise of Červená skala (”Red rock”) with Ostrý chrbát (”Sharp Ridge”), behind them are Trojuholníková Stena (”Triangle Wall”) with Kolova Veža (”Kolova Tower”) and Šunový chrbát (”Sunovy Ridge”), upper are Čertova stena (”Devil´s wall”), Lavínová Veža (”Lavin´s Tower”) and Kozí Chrbát (”Goat´s Ridge”). At the end of the valley is situated Mesačná stena (”Monthly wall”). The eastern side begins with Orlia Veža (”Eagle´s Tower”), Prídavkova veža (”Pridavkova Tower”). Next, there is Zubatá veža (”Toothed Tower”), Predná and Zadná veža (”Front and Back Tower”), and Oltár (”Altar Rock”), Trojkráľový hrebeň (”Tripleking Ridge”) and Májová stena (”May´s Wall”) (Baláž & Pukanský 2013). In the middle of the valley is a remarkable rock formation called Cukrová Homoľa (”Sugar Tower”). This isolated rock-shaped tower reaches a height of about 105 m (Bizubová, 2008).

There are also caves in the rocks of Zádielska dolina (“Zadiel Gorge“). Among the most famous caves belong: Tajná jaskyňa (”Mysterious Cave”), Erna (”Erna Cave”), Zrnov Previs (”Zrnov Overhang Cave”), Kráľovská and Kostrová jaskyňa (”Royal and Skeletal Cave”) (Ďurček, 1989).

Fig. 1 Huge walls of Zádielska dolina (“Zadiel Gorge“) (source: own photo)

We rank the Zádielska dolina (“Zadiel Gorge“) among a slightly warm, damp-to-highland area. There is a significant climatic inversion (Jakál, 2002). The local climate of the bottom is markedly different from the upper edges of the gorge. The lower part is cooled down and humidified by a stream flowing through the valley (Ďurček, 1989). Higher altitudes like the sunny edges of the plains, have been occupied by thermophilous and dry-loving species (The Administration of National Park Slovak Karst).

CONSERVATION AREA

In the territory of the Zádielská dolina (“Zadiel Gorge“) is in force Legislative document on nature and landscape conservation of the Slovak Republic - the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on Nature and Landscape Protection as of 1 January 2003.

There are overlapping protected areas with varying degrees of protection. National Park provides the gorge the highest level of protection. Zádielska dolina (“Zadiel Gorge“) pertains to the National Park of Slovak Karst, which represent our largest karst area. We classify it in the plain type of karst, which is characterized by high-lying plateaus. These platforms are bordered by steep slopes to the bottoms of

the adjoining valleys, gorges, basins, like the case of the Zádielska dolina ("Zadiel Gorge") (Rozložník, 1998).

Zádielska dolina ("Zadiel Gorge") is one of ten national nature reserves of the aforesaid national park. It includes the most precious parts of nature in terms of nature conservation at national level and moreover in terms of European importance. It was declared in 1954 as a national nature reserve. The subject of protection is a unique relief and the natural geobiocenosis of the Slovenský kras ("Slovak Karst ") with the representation of rare endemic, relict species of flora and fauna. The justification for the protection is scientific-research, educational, cultural-educational (Bánesz, 1994).

Another pillar of conservation for our territory is Natura 2000. Their introduction means a new layer of protected areas of European significance (Šubová et al., 2010). NATURA 2000 results from the need to protect the common natural heritage, which is important for the whole of Europe, to take care of its protection and to support those activities, which are in the interests of nature protection (Vološčuk, 2005). NATURA 2000 system consists of 2 types of territory: Protected Bird Areas and Territories of European Importance. Our subject area is part of the Protected Bird Area Slovenský kras ("Slovak Karst") and the Territory of European Importance Horný vrch ("Upper Hill") (Tomaškinová, 2013).

MOUNTAINEERING AND ITS PRESENT IN THE ZÁDIELSKA DOLINA ("ZADIEL GORGE")

Mountaineering expresses activity that lead to the top of the mountain. It takes place in various mountaineering terrains (Frank, 2007). Depending on the terrain, we distinguish different categories of mountaineering: sport climbing on the rocks, winter climbing, climbing on indoor walls, bouldering, mountain climbing, ice climbing and more.

For the needs of our work we define the sport climbing because the Zádielska dolina ("Zadiel Gorge") is characteristic of this climbing type. Sport climbing is one of the fastest growing branch of mountaineering. The basic principle consist in the effort to cope with the climbing movement (Long, 2010).

In order to be able to concentrate as much as possible on the movement, the anchors are permanently fixed in the rock walls (Procházka, 1990).

Like other sport disciplines climbing has its own rules for performance ratings. Performance in mountaineering is not only a problem solving by physical strenght, but also a reconciliation of physical strenght with will and courage, while the overall level of human psyche is important (Frank, 2007). The basic tool for assessing difficulty is the classification scale. The UIAA grading scale links to our territory. The mentioned scale begins with the difficulty I and upwards is open.

In Slovakia we find several climbing sites that are known for this branch of mountaineering. Besides the Zádielska dolina ("Zadiel Gorge") there are the following areas: Súľovské skaly ("Sulov Rocks"), Višňové ("Visnove"), Kalamárka ("Kalamarka"), Porúbka ("Porubka"), Turne ("Turne"), Prečín ("Precin") and others. World significant sport climbing area are for instance southern France, where are known the areas of Verdon and Buoux, Spain and its areas Siurana, Oliana, Italy and its climbing area Arco, Paklenica in Croatia, the Island of Greece Kalymnos, Osp and Mišja peč in Slovenia and others.

Sports climbing in the discussed valley began in the year 1902. At that time was the first climb on Cukrová Homoľa ("Sugar Tower") (Baláž & Pukanský, 2013). Annually, new climbing routes have been added to sites not yet mentioned. Nowadays there is the possibility to climb

in 18 sectors. We can choose from 337 climbing routes.

The suitable time for climbing is from April to November. The sector Oltár ("Oltar") is characterized by the highest number of routes, specifically 50 climbing routes. There are 30 climb on the popular Cukrová Homoľa ("Sugar Tower"). The lighter routes than the difficulty VII is 86. Most of them are in the sector Oltar ("Oltar") and the sector Trojkráľový Hrebeň ("Tripleking Ridge"). The routes of difficulty VII and VIII is 126. The highest number we can find also in the sector Oltár ("Oltar") and in the sector Zadný komín ("Back Tower). The hard routes than the difficulty VIII is characteristic of 125 routes, mainly in the sectors Projekty ("Projects") and Sokolie ("Falcon´s").

With regard to nature conservation, mountaineering is permitted from 1 July to 31 January at the most visited sectors of the National Nature Reserve of Zádielska dolina ("Zadiel Gorge). Other sectors are open either earlier or later than 1 July. Mountaineering will be allowed in another period, if the site of nesting migratory change.

Fig. 2 Climb Cukrová homoľa ("Sugar Tower") (source: own photo)

Motivations that drive climbers to choose climbing locality

The climbers are looking for sites that are attractive to this sport. The main motivation for a visit climbing locality is the possibility of climbing together with the geomorphological conditions of the area. The sites with geomorphological importance and with a certain form of tourist attractiveness represent many advantages. They reduce visitor pressure on traditional roads. They also extend the seasonality of tourism (Panizza 2007; Mazúrek & Škodová, 2011). But the fact that it is possible to climb in the area is not enough. There are other factors that affect the choice of the climbing site. One university in Germany devoted to this issue. In the following table we show their summary (Tab. 1).

Knowing the motives can help us to create a destination that becomes more attractive (Woratschek, 2007).

Possible risk between climbing and conservation area

When using these climbing sites, we shouldn´t forget about the possible risks associated with the dynamic nature of the environment. Within the climbing activity we distinguish a possible damage caused by climbing or indirectly caused damage resulting from climbing activities before and after climbing (Hanemann, 2000). Mailänder (1999) identified several problem areas, which may be damaged as a result of climbing. **1.** Access to the climbing route **2.** The place where climbing activity begins **3.** Climbing wall (rock) **4.** The place where the climbing activity ends **5.** Way down from the point where the climbing activity ends.

It is important to assess the possible negative impact on the rock biotope. It is also relevant to consider the vulnerability of fauna and flora in the climbing area and their ability to regenerate (Bichlmeier, 1991).

According Hanemann (2000) possible negative impacts caused by climbing activity include: **1.** Mechanical impact – climbing, climbers to the rocks, soil erosion, manual intervention **2.**

Tab. 1 Dimensions of motivation

Dimensions of motivation	**Motives**
Looking for a new climbing area	New climbing experience Nex climbing routes and rock structure
Infrastructure of tourism (for climbing site)	Cheap accomodation Safety of climbing routes Access to climbing routes Easily accessible location (road information) Availability of information
Condition of climbing	Optimal climate Choice of climbing routes and closure of sectors
Calm and rekreation	Calm and recreation
Unsociable	Avoiding places which are usually crowded with tourists
Leisure activity a sports activities other than climbing	Other sports activities than climbing Leisure activity
„Climbing scene“	Place where can people with same intent meet Special event Accomodation for climbers and family atmosphere
New country	New place New culture Regional cuisine

Material impact - garbage and faeces **3.** Visual / acoustic impact - visual change in biotope structure, noise and disturbance.

Cases of negative impacts of climbing activity on fauna and flora include: **1.** Loss of individual plants **2.** Diminished area of the plant population **3.** Displacement of vulnerable species **4.** Reassignment of animals that are sensitive to noise (owl, owl) **5.** Prevention of stunning, **6.** Loss of species (Hanemann, 2000).

Negative impacts can be mitigate by zoning the area. It can be a solution for nature conservation and fulfil the climber's requirements. For instance a three-dimensional zonation concept is applied in the Frankenjura climbing site in Germany. The area is divided into a zone where climbing is not allowed, to a zone where climbing is permitted on existing routes and to a zone where climbing is permitted without any restriction.

Another option for nature conservation which is also introduced in our locality is the closure. This means closure for a certain period of time, in a certain part of the site (Hanemann, 2000).

Every form of regulation in the climbing area requires adequate awareness of climbers. This should be mediated by all means of communication: climbing guide, journal with climbing topics, public media, information boards and others.

COMPARING THE ZÁDIELSKA DOLINA (“ZADIEL GORGE“) WITH THE VISITED FOREIGN CLIMBING SITE

For comparison, but especially for inspiration how climbing site can look, we choose the Grand Paklenica Canyon. Due to the fact that it is comparable with the Zádiel Gorge from the point of view of nature conservation and the rarity of this area. Owing to its unique natural features was declared National park of Velka Paklenica in 1949. The main reason for declaring was the protection of the largest and best preserved forest complex in Dalmatia, which was exposed to the risk of over-exploitation (Čujič, 2017). Although it is a national park, guardian express an understanding for the realization of climbers.

To highlight the climbing potential of Zádielska dolina (“Zadiel Gorge“) in comparison with the most visited climbing site in Croatia, we evaluate some of the features that characterize the climbing area. We work with information: the beginning

Tab. 2 Zádielska dolina ("Zadiel Gorge") with comparison to Grand Paklenica Canyon. Their features that characterize the climbing area.

Climbing site	The beginning of the climb history	Number of climbing routes	The well-liked rock	The rock type	The access to the rocks
Zádielska dolina ("Zadiel Gorge")	1902	360	Cukrová Homoľa ("Sugar Tower")	limestone	good
Grand Paklenica Canyon	30 years of the 20th century	400	Anica Kuk	limestone	very good

of the climbing history, the number of climbing routes, the well-liked rock, the rock type and the access to the rocks (Tab. 2).

ANALYSIS

Acces to the area

Currently, the transport infrastructure is provided mainly by individual car due to the irregularity of the transport lines and their absence during the weekend. Besides, railway was redirected to the final terminal in Moldava nad Bodvou which is 13.5 km distant from the Dvorníky-Zádiel railway station.

The main road connecting Košice - Moldav - Rožnava - Zvolen belong to the 1st class no. 50. This route represent a supraregional national importance and it is also included in the international European network E 571. At the beginning of Zádielska dolina ("Zadiel Gorge") there is a parking lot for visitors, with the capacity about 50 cars.

Tourist attractions in the destination

There are several hiking trails in the area, which are uniqueness in every season. The village Zádiel is the most suitable starting point for the gorge. There is a popular educational walkway of Zádielska dolina ("Zadiel Gorge"). Walking routes are mostly less demanding, accessible year-round and no time-comsuming. In the end of Gorge is significant crossroad of hiking trails, which is oriented to many natural features of the Slovak Karst. Zádielska dolina ("Zadiel Gorge") is also a part of cycling circuit, which is suitable for mountain bikers.

Alternative routes of cultural, natural or other character can mitigate the pressure of visitors to the area. The possibility of further activities positively influences selection our locality. List of tourist attraction near the area of Zádiel Gorge: Turniansky hradný vrch ("Turniansky castle hill"), Hájske vodopády a Hájska dolina ("Waterfall of Haj and Haj valley"), Hrhovské rybníky ("Hrhov ponds"), Moldavské múzeum ("Moldava Museum"), Premonštrátsky kláštor v Jasove ("Premonstratension monastery in Jasov"), Jasovská jaskyňa ("Jasov Cave"), Krásnohorská jaskyňa ("Krasnohorska Cave"), Mauzóleum Andrassyovcov v Krásnohorskom Podhradí ("Andrassy Mausoleum in Krasnohorske Podhradie").

There is a tourist information centre in the National Park of Slovak Karst in the district town of Rožňava at Square of Miners. Only an information monitor is installed in Zádielska dolina ("Zadiel Gorge"). It provides useful information about the gorge, walkway over gorge and about the accessible nearby caves.

Lodging and gastronomic facilities in the destination

Within the National Park Slovak Karst is the use of accommodation services low and represents an average of only 18% per year. The average number of overnight stay is about two days. These low values are in consequences of the absence of suplemetary services, deficient quality of service in

accommodation facilities (Štupákova, 2013).

Nowadays, in the village of Zádiel, is only one accommodation facility. In order to increase the accommodation options, we analyzed them within the radius of 15 km. We obtained 11 additional accommodation facilities, whose capacity is 151 beds higher. The accommodations are in particular of a lower category. Category "hotel" is absent here. In adition to that, there is a shortage of typical accommodation for active people, like camps and tourist hostel.

We also identified gastronomic facilities in the places where the accommodations are located. Together we have choice of 10 gastronomic facilities.

PROPOSAL

The unlimited use of the country in which climbing takes place can lead to environmental damage. But legitimate closures as well as infrastructure measures can regulate visitors. At the same time, the improvement of the infrastructure in the sense of a marked path and a book guide which will complement the orientation of the area, can be one of the factors that will decide on the preference of the climbing site. In our proposals for improving the infrastructure we procced from the research about the MonteLeone Rocca Doria climbing area and the problematic areas between climbing and nature according Mailänder. The basis for the proposal is also an analysis of motivation for site selection, carried out by the German University in the Frankenjura climbing area. We focused mainly on those we consider to be deficient in the area. Furthermore, on the basis of our own experience we add justified points that will improve the infrastructure of the Zádielska dolina ("Zadiel Gorge"). Another inspiration for making this place more attractive in the field of climbing is the Grand Paklenica Canyon climbing site in Croatia.

Marked path

Strengtheting of paths to the rocks and their marking can result in diminish of soil erosion. Especially, further variations of the trails can be avoided and acces to rocks can be easier and more evident. One of the conditions following from the Act on Nature and Landscape Protection Act commands to use only existing paths. There are no signs in the territory that would give a direction to climbers to use only an existing walkway along the road to the sectors. Rock sectors of Zádiel are not accessible directly from the tourist path and are not visible due to the rich tree crowns. Another important thing is that the sectors are not interconnected, but they have a separate path for everyone. Therefore, simple minimalist guidelines will be designed, which will be located just at the point where it is necessary to turn off the tourist path leading across the gorge to the sector.

Tourism signs will contain the name of the sector and the note: with the permission of climbing members of SHS James and foreign organized climbers. The next trail description will not be in the terrain. So that it does not offer visitors who have come to the valley for another purpose, such as climbing, for forbidden exploration of the route. Trail description will be given in the location guide, which is a necessary tool for every climber. For this purpose, we need a more detailed approach to the sectors and therefore a new climbing guidebook will be our next point of proposal.

Climbing guide book

Each climbing site has a book guide. The climbing guidebook of Zádielska dolina ("Zadiel Gorge") was issued in 2016 at a cost of 400 pieces. In the near future will be proposed a new sophisticated climbing guidebook. The reasons for this change is the designation of new roads, but especially the more accurate processing of navigation to sectors which is inadequate. We also

propose to add a guide to information on constraints in individual sectors that would increase the knowledge about the regulation of climbing activity in the gorge.

Information panel

In the field is placed on a wooden carrier under the name of the national nature reserve laminated paper about climbing activity in the Zádielska dolina ("Zadiel Gorge"). Unfortunately, providing information is already 8 years old and two times changed by the District Office in Košice and the Department of Environmental Care. As well, it is situated in a place which in our opinion and experience has a very low ability to capture visitors and climbers attention.

In connection with this reality, it will be suggested that all necessary information to ensure nature protection through the information panel and corresponding signs be placed in the parking lot, or in starting points. This includes in particular information on constraints in the sectors. In addition, points about the appropriate behavior of the climber will be proposed as part of the panel. Besides, the panel will be complemented by a drawing of climbing sectors in the valley, compulsory climbing equipment, and information about camps or other types of accommodation that can prevent wild bed down and help make the local region economically beneficial.

Awareness of ice climbing

Winter months are an opportunity for climbers to ice climbing. Ice is located in the gorge, behind a climbing cottage. Ice is not a natural character, but it is built on the basis of a built system that draws water from the Blatnický stream. The ice is about 15 m high. It offers 4 to 7 climbing routes. The number of routes depends on how wide ice can be built, what is affected by temperature stability below zero.

The proposal is focused on improvement awareness of this attraction through e-marketing tools (Fig. 3).

Ice climbing can help extend seasonality in the climbing community. For tourists, it can be motivation and it may not be the main reason for a visit to the site, but at least an attraction that will increase their tourism rating in the Zadielska dolina ("Zadiel Gorge") in the winter months.

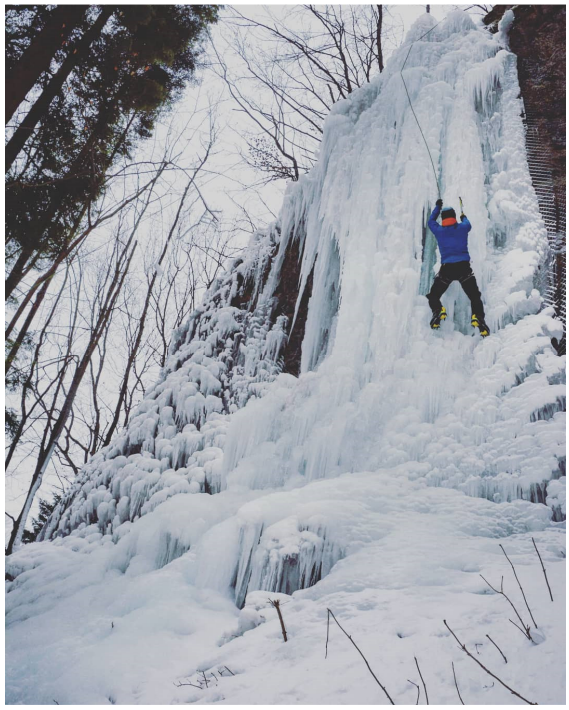

Fig. 3 Proposal of presentation material – Ice climbing in Zádielska dolina ("Zadiel Gorge") (source: own photo)

CONCLUSIONS

In the past, words like mountaineers, mountaineering were very closely related to nature, place of stay and movement in it, its thorough protection, defense and improved. Even today we must not forget the message of those who were there long time ago, who set the goals, which we are trying to accomplish. Zádiel Gorge has a beautiful climbing history. But the fact that it provides the possibility of climbing is not enough at present. The choice of a climbing site also affects other factors that make it more attractive.

Therefore, the main goal was to make the Zádiel Gorge more attractive through climbing by creating suggestions that would have deciding importance in choosing this climbing site. Work was also intended to

create an attractive location that will be a turning point in the local economy and will be a supportive tool for the development of tourism.

Zádiel Gorge can attract thousands of tourists every year and that through the possibility of climbing activity, the development of tourism there will be achieved.

REFERENCES

Baláž, M. and Pukanský, J. (2013) RP in Zadiel. Kosice: Vienala, 47 p. (in Slovak)

Bánesz, L. (1994) Protected Landscape Area - Biosphere Reserve Slovak Karst. Martin: Osveta, 476 p. ISBN 80-217-0211-7.

Bichlmeier, F. (1991) Climbing - Conservation a Conflict? Reports of the Bavarian State Office for Environmental Protection, Munich, p. 10-24. (in German)

Bizubová, M. (2008) Natural beauty of Slovakia: Stones. Bratislava: Dajama, 120 p. ISBN 978-80-89226-48-1. (in Slovak)

Čech, V. (2015) Geographical aspects of nature and landscape protection. Prešov: University in Presov, 221 p. ISBN 978-80-555-1289-1. (in Slovak)

Čujič, B. (2017) Paklenica climbing guide. Zagreb: Astroida, 303 p. ISBN978-953-6912-21-6.

Ďurček, J. and Zahatňanský V. (1989) Tourist Guide of Czechoslovakia Slovak Karst. Bratislava: Sport,. 222 p. ISBN 80-7096-020-5. (in Czech)

Frank, T. and Kublák T. (2007) Mountaineering aplhabet. Praha: Epocha, 662 p. ISBN 978-80-87027-35-6. (in Slovak)

Hanemann, B. (2000) Cooperation in the European Mountains The sustainable management of climbing areas in Europe. IUCN Gland: Schwitzerland and Cambridge,158 p. ISBN 2-8317-0541-X.

Jakál, J. (2002) Karst landscape, its properties and resistance to anthropic impact. In: Geografický časopis. vol. 54, no. 4 , p. 381-392.

Lacika, J. and Kliment, O. (2009) National Parks. Bratislava: Dajama, 127 p. ISBN 978-80-89226-27-6.

Long, S. (2010) Climbing Guide: A complete guide to safe and exciting rock climbing. Brno: Computer Press, 192 p. ISBN 9788025129623.

Mailänder, N. (1999) Strategies for nature-friendly climbing. In: DAV (ed.): Conception for climbing in the extra-Alpine rock areas in Germany. Introduction Part. Munich, p. 127-136. (in German)

Mello, J. et al.(1997) Geological map of Slovak Karst 1:50 000. Ministry of the Environment of the Slovak Republic, Bratislava.

Mello, J. (1997) Explanatory notes to the geological map of Slovak Karst 1:50 000. Bratislava: Dionyz Stur Publisher, 255 p.

Mokras-Grabowska, J. (2016) Sport tourism terminological discussion. In: Tourism. vol. 26, no 1. ISSN 0867-5856.

Panizza, V., Mennella M. and Sassari. (2007) Assessing geomorphosites used for rock climbing. The example of Monteleone Rocca Doria. In: Geographica Helvetica. vol. 67, no. 3. p. 181-191.

Ponec, J. and Mihálik, Š. (1981) Nature Reserves in Slovakia. Martin: Osveta, 281p. (in Slovak)

Procházka, V. (1990) Mountaineering. Praha: Olympia. 241 p. ISBN 80-7033-037-6.

Rozložník, M. (1998) The Biosphere Reserve Slovak Karst form the Viewpoint of its Twenty Years Existence. In: Životné Prostredie. vol. 32, no. 1, p. 15-18.

Škodová, M. and Mazúrek J. (2011) Protected areas of Slovakia, Banska Bystrica: Matej Bel University, 117 p. ISBN: 978-80-557-0138-7. (in Slovak)

Štupákova, V. (2013) Feasibility study of an intermodal cross-border route. Kosice. 54 p. (in Slovak)

Šubová, D. (2010) NATURA 2000 metodical manual. 1. pub. Liptovsky Mikulas. Slovak museum of nature protection and speleology. 118 p. ISBN 9788088924722. (in Slovak)

Tomaškinová, J. (2013) Integrated Managment of National Park Slovak Karst. 1. ed.. Banska Bystrica: Matej Bel University. 147 p. ISBN 978-80-557-0589-7. (in Slovak

Vološčuk, I. (2005) Protection of nature and landscape. Zvolen: Technical University in Zvolen, 245 p. ISBN 80-228-1511-X. (in Slovak)

National Park Paklenica [online]. available at: <https://www.np-paklenica.hr/en/> [accessed 17. 02. 2018].

The Administration of National Park Slovak Karst: Upper Hill. Banska Bystrica: ŠOP SR. 11 p. ISBN 978-80-89310-24-1.

Woratschek, H., Hannich F. and Ritchie B. (2007). Motivations of Sports Tourists - An Empirical Analysis in Several European Rock Climbing Regions. In: Wirtschaftswissenschaftliche Diskussionspapiere. vol. 7, no. 2 ISSN 1611-3837.

World organisation tourism : Global report on adventure tourism [online]. available at: <https://skift.com/wp-content/uploads/2014/11/unwto-global-report-on-adventure-tourism.pdf> [accessed 20.02.2018].

Legislative document on nature and landscape

conservation of the Slovak Republic - the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on Nature and Landscape Protection.

Acta Geoturistica volume 9 (2018), number 2, **24-27**
doi: 10.1515/agta-2018-0007

Notes on the impact of cycling infrastructure on tourist destination management

ADRIANA ŠEBEŠOVÁ and BRANISLAV KRŠÁK
Department of Geo and Mining Tourism, Faculty of Mining, Ecology, Process Control and Geotechnologies, Technical University of Kosice, Letná 9, 042 00 Kosice, Slovakia
(E-mail: adriana.sebesova@gmail.com branislav.krsak@tuke.sk)

ABSTRACT
There has been a large support given to building of cycling routes in Slovakia for last few years at all levels and many aspects. Not just legislative, strategic and technical point of view but also financial support is necessary to take in account. According to this big effort is necessary to be more focused on a question of evaluation of impacts on local communities. This article deals with analysis of cycling infrastructure impact on destination performance.

Keywords: cycle tourism, tourist destination, impact

INTRODUCTION

Cycling is a topic that has been said lately a lot and has been even more expected. Often it does not say as a form but as a phenomenon that brings the opportunity to move cycling to the level of economic activity with respect to the environment. The popularity of cycling as a recreational activity continues to grow. Along with an interest in sustainable tourism, health and the environment the cycling is suitable for the unique type of holiday activities, which has all the prerequisites to fulfil the conditions for the sustainable development of tourist destinations.

CYCLING TOURISM AND ITS IMPACTS IN COMMON TERM

According to the World Tourism Organization in 2017, tourism represented 10% of the world's gross product, 30% was on the export of services and 1 of 10 people were employed in tourism. The global measure also showed that up to 57% had travelled by plane (in the year 2016 it was 55%), and 37% had used for its transportation to holiday destination a car (in the year 2016 it was 39%). There were 672 million of foreign arrivals to Europe in the year 2017 and earnings from tourism reached 451 billion Euros.

The figures underline the fact that tourism is an area that has the ability to affect the lives of communities, whether in a positive or negative way. And therefore, it is important to monitor its effects and search for solutions that will lead to sustainable development.

One of the possible forms of sustainable tourism seems to be cycling tourism. Accurate statistical data on the performance of the cycle tourism in Europe are not available. The economic importance of selected routes in Europe was estimated for the European Parliament, through a "Cycle route Demand Forecast Model“, which was laid out by Lumsdon at al. (2009) and redefined by Weston at al. (2012). The average expenditure for the one-day bicycle trip has been estimated at 15, 39 Euros. Expenditure per trip of average length of holiday 7.7 days has been 439 Euros. The estimated number of cycling trips with overnight stays has been 20.36 million and a one-day cycling trip has been 2.274 billion. According to these figures the estimated direct revenue of cycling tourism

in Europe has been almost 44 billion Euros per year.

Cycle tourism can be developed in a variety of forms. As cycle tourists we can consider long-distance bikers, tourists, who come to discover the destination by bike but also those who are searching for a specific cycling infrastructure or take a part in various events. Cycle tourism is taking an active part in different types of destinations. The highest potential of its development has been recorded in a rural environment and also in an environment with an attractive geographical nature.

Several studies have been done on the impact of cycling on local communities and they have confirmed that each of the forms of cycling has the ability to influence social, environmental and economic relationships in the destination.

According to the results of the different studies, we can generalize the fundamental benefits of cycling tourism:

Social area
- cycling improves the mental and physical health of people,
- taking part in cycling activities can be reasonably cheap,
- cycling tourism is suitable for all age groups, like individual tourists, families, etc.,
- encourages people to have a healthier life style,
- connect communities - people and places.

Environmental area
- can be an environmentally friendly as alternative transport
- does not cause noise and visual pollution,
- encourages people to behave ecologically and transfer this behaviour into everyday life,
- brings to tourists the ability to "experience" the natural and cultural environment and transport possibility to remote part of destination,
- promotes the protection of natural resources and the cultural heritage,

Economic area
- direct benefits through tourism services - accommodation, food, transportation and other expenses in the destinations,
- can be developed in areas where another industries are receding,
- stimulates new business opportunities (rental, transport and guide services, shops)
- can bring a large investment,
- creates new job positions, and not only in services but also for the maintenance of the bicycle infrastructure.

Cycling tourism can also create negative impacts especially in the environmental field
- poor planning can cause negative interference into the structure of the landscape,
- if there is low quality technical performance of cycle paths, especially in the case of mountain bike tourism, this may cause soil erosion, fauna disturbance and also may damage vegetation.

CYCLING INFRASTRUCTURE

An essential tool for the development of cycling tourism is cycling infrastructure. This type of infrastructure requires besides the high initial cost also expenditure for regular maintenance. In the case of the concept of the international EuroVelo network (after completion this European cycling network will be long 70 000 km).The European Cycling Federation is predicted expenditure on construction and maintenance for the period 2012-2020 at a height of 1.5-2.5 billion .The expected annual economic benefit from this network is estimated at 5 billion a year once when is complete.

Well-planned, built and maintained infrastructure, which provides security and comfort to cyclists, has the ability to attract more bikers and increase the expected

benefits. When cycling infrastructure is designed, it is recommended to take into account in particular, the safety of the route, straightness, network interconnection, comfort and attractiveness of the route. These attributes are valid for all types of cycling infrastructure, whether they are cycling paths with a solid surface, unpaved or specific types of routes as single-track routes. An important factor is the existing services or the potential for initiating new tourism services along the route.

CYCLING TOURISM IN THE SLOVAK REPUBLIC

The history of cycling routes in Slovakia dates back to 1994, when various interest groups started to mark cycling routes by using existing infrastructure (road, local and service roads). There are currently registered 15,263 km of cycling routes in Slovakia according to the data of the Slovak Cycle Club, which administers the National Cycle Route Register. For cycle routes conditions are responsible their management organizations - administrators, which task is to ensure maintenance of their routes, including the renewal of the marking. The administrators of these cycling routes can be non-governmental associations or local governments. After the adoption of the law No. 91/2010 Coll. on the promotion of tourism, which enabled the creation and funding of tourism organisations (DMOs), they have begun to enter more actively into the process of implementation of the cycle routes and link them to services for bikers.

Due to the high legislative and financial difficulties of building cycling infrastructure, especially cycling paths with a hard surface, as we know from abroad, the greatest burden in their realization remains on local governments. According to previous implemented cycling project in Slovakia expenditure per 1 km of cycle trail with asphalt surface has reached 130 000 Euros and more. In the case of cycle recreational routes running on the different types of roads and marked by cycle signalization, the setup costs are significantly lower (300 € per 1 km).

Despite the high cost of building and maintenance, existing network in Slovakia is continuously improved. A comprehensive evaluation of the impact of this segment on the development of the tourist destinations in Slovakia has not been realized so far. The intensity of cyclists, cycle services and the erosion of the trails are partially monitored.

The benefit can be seen through an increasing number of cyclists and growing services in tourist areas. For example, we can mention the project "Bajkom k Tajchom – Štiavnica biking trails" in the Štiavnica Mountains, where cyclists can use 150 km of mountain biking trails, there is the rental of electric bicycles and more than 20 accommodation facilities with bicycle facilities are available to the cycle tourists.

Another good example, where the impact of mountain biking is partly monitored, is the National Park of Slovak Paradise. There is a Destination management organisation the Slovak Paradise & SPIŠ in this area; they make an offer for bikers as one of its priority theme. At present, there are permitted 18 cycle routes with a total length of 93.4 kilometres. According to data from the counter of cyclists located in Čingov, was during May till October 2018 recorded 8 940 cyclists, there is 14% growth up when we were comparing data from 2017. According the State Nature Protection organisation cycle trail erosion in the National Park have been identified for the first time in 2008 in the length of 0,5 km. In the year 2015, 3 km of cycle trails were damaged by erosion.

CONCLUSION

It follows that in Slovakia the measurement of the complex impacts of cycling infrastructure on tourist destinations does not yet receive sufficient attention.

Despite the already proven positive and also negative effects, the impacts are, in the most cases addressed through the level of data collection and presentation. In order to achieve a more effective and responsible development of cycling tourism in Slovakia, greater attention of evaluation should be paid not only at the state and regional level, but also at tourism organizations whose task is to create and manage products in tourist sites.

REFERENCES

„Bajkom k tajchom“, available at http://www.bajkomktajchom.sk, (Accessed 4. October 2018)

Bodor A. and **Lancaster E.,** (2011) EuroVelo the European cycle route network, Development strategy 2012 – 2020, www.eurovelo.org (Accessed 3. October 2018)

Declaration of District Office Košice No. 2/2018 of 10 October 2018 on the Rules of Procedure of the Slovak Paradise National Park and its Protective Zone (2018), available at http://npslovenskyraj.sopsr.sk/wp-content/uploads/2018/01/np-old.pdf (Accessed 4. October 2018)

Eijgelaar, E., Peeters, P. and **Piket, P.** (2011). *European cycle tourism: tool for sustainable regional rural development?*. Paper presented at Paper presented at the Second AGRIMBA-AVA Congress, 24-06-2011; Wageningen, The Netherlands,

EuroVelo the European Cycle Route Network, available at www.eurovelo.com, www.eurovelo.org (Accessed 3. October 2018)

Gazzola P., Pavione E., Grechi D. and **Ossola P.** (2018), Cycle Tourism as a Driver for the Sustainable Development of Little-Known or Remote Territories: The Experience of the Apennine Regions of Northern Italy, *Sustainability* 2018; 10(6):1863. available at: https://doi.org/10.3390/su10061863 (Aceessed 2. October 2018)

Košice Self-governing Region (2018), Data from Counter of cyclists in National Park Slovak Paradise, Čingov, available at author

Lumsdon L., Weston R., McGrath P., Davies N., Peeters P., Eijgelaar E. and **Piket P.** (2009). The European cycle route network EuroVelo: challenges and opportunities for sustainable tourism. Brussels, Belgium: European Parliament, Directorate General for Internal Policies, Policy Department B: Structural and Cohesion Policies, Transport and Tourism, available at http://www.europarl.europa.eu/studies (Accessed 17 September 2018)

Lumsdon L., Weston R., McGrath P., Davies N, Peeters P., Eijgelaar E. and **Piket P.** (2012). The European Cycle Route Network: EuroVelo Study, Update of the 2009 Study, available at: http://www.europarl.europa.eu/studies, DOI:10.2861/32423 (Accessed 18 September 2018)

Považan R., (2017) Erózia pôdy vplyvom cestovného ruchu, available at: https://uzemia.enviroportal.sk/indicator/detail?id=665, (Accessed 2.October 2018)

Rotar J. (2012), How to develop cycle tourism?, available at: http://www.bicy.it/docs/35/How_to_develop_cycle_tourism_ang.pdf, (Accessed 2. October 2018)

Quinn M. and **Chernoff G.** (2010), Mountain Biking: A Review of the Ecological Affects, Mistakis Institute, available at https://www.lib.washington.edu/msd/norestriction/b67566091.pdf (Aceessed 2. October 2018)

UNWTO Tourism Highlights 2018 Edition (2018), available at: https://www.e-unwto.org/doi/pdf/10.18111/9789284419876, DOI: 10.18111/9789284419685 (Accessed 1. October 2018)

Acta Geoturistica volume 9 (2018), number 2, **28-34**
doi: 10.1515/agta-2018-0008

Canyons of Albania and geotourism development

MERITA DOLLMA
Department of Geography, Faculty of History and Philology
University of Tirana, Tirana, Albania
(Email: meritadollma@yahoo.com)

Abstract
Canyons are among the most interesting geosites created by the erosive activity of the rivers, processes of weathering and erosion or tectonic activity and are distinguished for the aesthetic beauty of the shapes, the labyrinths of the valleys, the steepness of the slopes, the greatness of vertical walls, waterfalls, caves, etc., bearing high scientific, educational and touristic values. Albania has a considerable number of canyons due to the presence of a rich river network flowing through the variety of geological formations and tectonic faults. Outstanding are the well-formed canyons in limestone rocks with almost vertical walls such as Gradec canyon in Çorovoda, Lëngarica canyon in Përmet, Grunas canyon in Theth, etc. The only canyons which are formed on magmatic rocks are the canyons of Devoll. For their values, the most interesting canyons are included in the list of nature monuments as geomonuments. The most magnificent and frequented canyons for tourism in Albania are the Osum canyons, Gradec canyon, Lëngarica canyon and Nivica canyon. These distant impressing landforms, once forgotten and unexplored, are now attracting the attention of many tourists either for admiring their natural scenery, hiking and rafting or for curative tourism. However, despite their values the canyons are not enough known due to lack of information or poor promotion. Filling this gap has served this study where the geotouristic potential of the canyons is evaluated according to four criteria of Knapik.at.al such as accessibility, state of preservation, scientific value and education value (Solarska and Jary, 2010). The database of the canyons is organized in an inventory card which contains general and specific data of each geosite. The final product of this project will be a website that will inform the public and promote the values of the canyons of Albania.

Keywords: canyons, Albania, evaluation, geotourism

INTRODUCTION

According to National Geographic Society (2015), geotourism is defined as a tourism that sustains or enhances the geographical character of a place, its environment, culture, aesthetics, heritage, and the well-being of its residents. This means that geotourism is a multifaceted sustainable tourism centered on the conservation of geoheritage, appreciating its geological creation through learning and enrichment of the economy (Swarnal et al., 2013). Canyons geosites, especially Osum canyons, in a way have initiated geotourism development in Albania, mainly for their scenic landscape and water sports. Geotourism is bringing tourists in less developed areas, generating new jobs and revenues for local population and contributing to the sustainable development of the region and decrease of the migration level. The local population living in the rural villages nearby, are re-evaluating the presence of these wonders of the nature, and are investing or shifting their activities to support geotourism development.

The promotion of the touristic values of these geomonuments and their declaration as protected sites increased the interest of tourists to visit them. Their scenery and water sports have attracted many tourists, whose number is continuously increasing, and travel agencies are including the main

canyons in their tours. Geotourism development in the areas of the canyons is resulting also into the creation of the touristic infrastructure, promotion of the natural and cultural heritage of the areas nearby, increase of the employment in the tourism industry, increase of the land price, development of the local bio products, etc. However, there is still a great need to highlight the canyons and include them in the touristic map of Albania. Most of the visitors come to explore the unknown misteries of the canyons, but they are not properly informed where to go and what values the geosites posess. Therefore, canyons of Albania with scientific, educative and touristic values, need to be valorised, preserved and promoted not only to encourage their frequentation but also to support their conservation.

VALORIZATION OF THE GEOTOURISM POTENTIAL OF THE CANYONS

Geomonuments are natural monuments with particular aesthetic, ecological and touristic values, which are protected by law being classified in the third category of nature monuments of IUCN. Thanks to the efforts of geologists, geographers, ProGEO Albania members, etc., 291 geosites of Albania, or 41% of the nature monuments, are listed in this category of protected areas. In this list, 22 canyons are included as geomonuments with geological, geomorphological and biological values (Fig. 1).

To determine the geotouristic potential of individual canyon, the methodology of Knapik at al. is applied where each of four criteria is assessed based on five features with values of points from 1-5 for the accessibility and state of preservation and from 2-10 for the scientific and education criteria (Tab. 1). The four criteria assessment of Knapik.at.al allows making a statement of every object's significance for their geotouristic and educational functions (Solarska & Zdzisław, 2010). This evaluation ranks the canyons based on their touristic potential and enriches the database of canyons, and it helps to create tour itineraries based on the touristic potential and visitor expectations.

The results of valorization proved the existence of a significant geotouristic potential of the canyons, where nine of the 22 evaluated canyons resulted with highest potential for geotourism (Tab. 2). These canyons with high values, even regional ones, such as Osum canyons, Gradec canyon and Lëngarica canyon, are significant for their aesthetic beauty and variety of landforms as testimonies of the geomorphologic processes, weathering and erosion, and tectonic activity.

They offer possibilities for diverse activities such as rafting, climbing, bird watching, curative tourism, and some of them are easily accessible or relatively good roads to reach them exist. All of them are well preserved sites with no visible signs of degradation, thanks to their location in far away or difficult terrain. They have multi educational values such as understanding the geology of the area, geomorphological evolution of the structures, weathering and erosive processes, biodiversity of special habitats, etc., and can be considered as open books to read the story of the earth.

They are reachable in most parts of them, for they are either situated direct on the road trail or the distances are not too far. Some of them are within national parks and if included in the tourism packages, they will add values of the tours that have the park as the main destination.

Although the number of the visitors to the canyons is increasing continuously, geotourism development in these areas requires the provision of the basic facilities to the visitors, which in most of them are missing except Osum canyon. Information boards, maps, leaflets, road trails, panorama viewpoints, etc., lack almost for all of them.

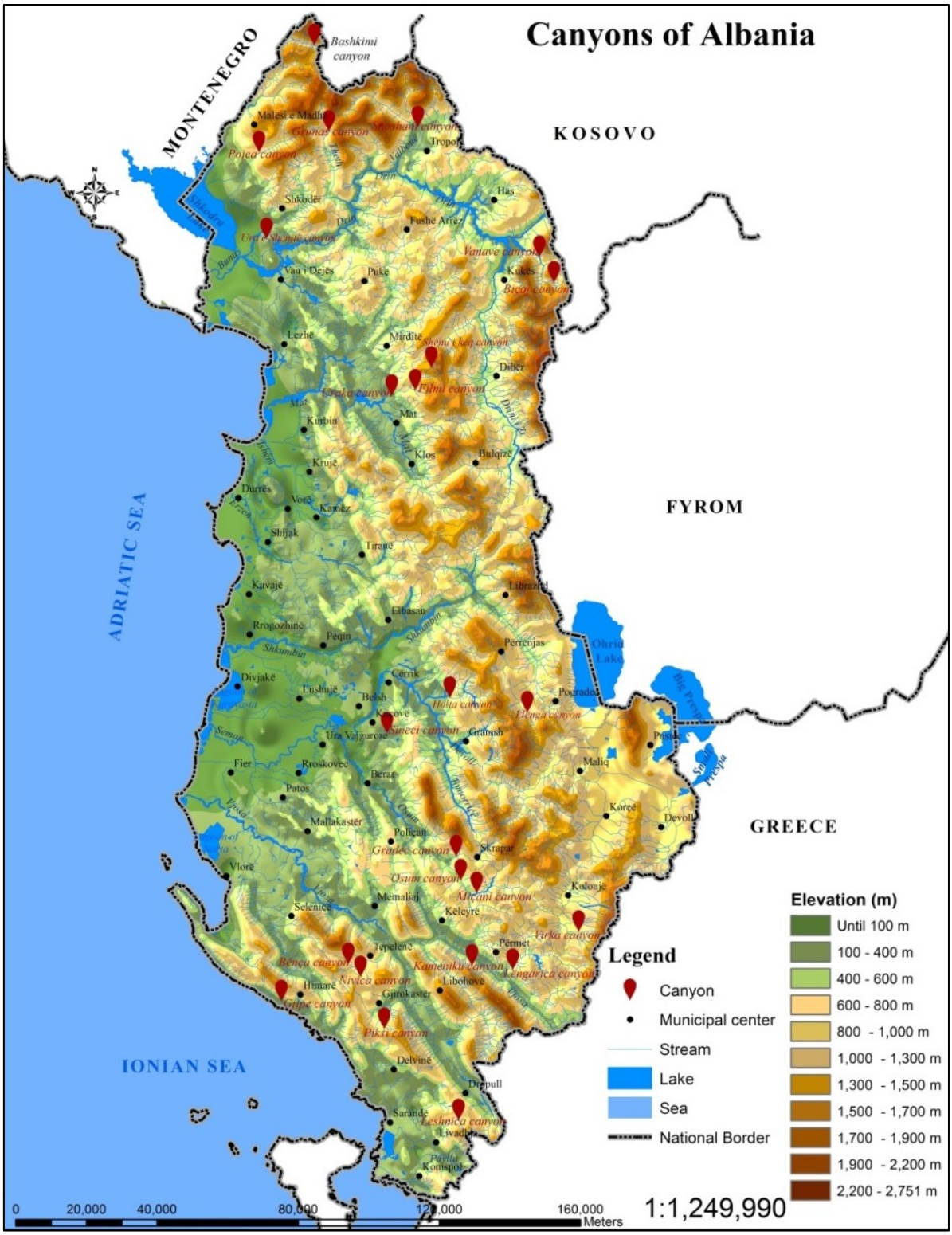

Fig. 1 Location of canyons in Albania

Lëngarica canyon (Përmet)

Lëngarica river originates close to Kamnik village of Kolonja, where Shalë and Barmash streams join, flowing through an area with different lithology and structure creating narrow and deep landscapes in limestones and wide valleys in terrigenes. After joining its right branch,Gostivisht, this river flows southwest cutting the anticline structure of Lëngarica. Here this river has shaped the canyon of Lëngarica (Fig. 2) with deep and vertical slopes of 80-100m, where the bottom width mostly is 1,5-2 m in a length of 3 km. The canyon and the waterfall of Lëngarica are situated close to Petra

Tab. 1 Criteria of assessment for inventoried geomonuments (according to Knapik, et al., 2009, modified by Solarska and Jary, 2010)

Criteria	**Traits**	**Points**
Accessibility	Site clearly visible, located directly on the touristic trail or nature's path	5
	Site clearly visible, located on the road or path	4
	Site barely visible, located more than 250 m away from the path or road	3
	Site difficult to access for tourist (ex. significantly overgrown or difficult to access)	2
	Site unavailable for tourists	1
State of preservation	Well preserved site with no visible signs of degradation	5
	Site in slight violation of its structure	4
	Partially destroyed	3
	Site heavily modified by human	2
	Site destroyed - loss character of geosites	1
Scientific worth	Very high: one site in the region, unique in a wider scale	10
	High: very important for regional studies	8
	Average: significant for regional research	6
	Low: common site with average values	4
	Very low: no particular distinctive features	2
Education	Very high: number of represented issues: 5 and more	10
	High: number of represented issues: 4	8
	Average: number of represented issues: 3	6
	Low: number of represented issues: 2	4
	Very low: number of represented issues: 1	2

Tab. 2 Valorization of canyons

Nr.	**Geosite**	**Criteria**				
		Accessibility	State of preservation	Scientific values	Education	Summarised value
1	Osum canyon	5	5	8	8	26
2	Gradec canyon	3	5	8	8	24
3	Lëngarica canyon	3	5	8	8	24
4	Bënca and Nivica	3	5	8	6	22
5	Grunasi canyon	4	5	4	6	19
6	Shoshani canyon	5	5	4	4	18
7	Sineci canyon	3	5	6	4	18
8	Holta canyon	3	5	6	4	18
9	Gjipe canyon	4	5	4	4	17

village, along the downstream of the Lëngarica river, at 400 m altitude.

The slopes of both sides of the canyon are very close to each other, even meeting in some spots and forming tunels. The canyon is hardly passable in whole its length due to several deep threshholds, escalates, underground tunels or holes. Several caves and cavities on the slopes of the canyon are connected through tunels or galleries, where the most attractive is the cave of Pëllumbi known as a prehistoric cave according to the archaelogical findings (Academy of Sciences of Albania, 1991). At the exit of the canyon many thermal waters of Bënja sprung in both sides of the valley whose temperature reach up to 30^0C. The canyon, thermal waters, the forest, caves as well as the monuments of culture such as Old Bridge of Katiu and church of Bënja, are being frequented all over the year by the tourists but especially during the spring and summer season for rafting in some parts. Lëngarica canyon for its complex of values, karstic forms, waterfall, caves, etc., has international and regional values.

Fig. 2 Lëngarica canyon (Photo: Joni Margjeka)

Shoshani canyon (Valbonë)

Shoshani canyon (Fig. 3) is right down the bridge with the same name, starting close to Shoshan village and stretching westward for around 1,1 km long. Valbona river has eroded the limestone rocks of Mesozoic creating the canyon, whose slopes on both sides are almost vertical (70-90^0) (Neziraj te al., 2016) reaching 30-40 m deep and 2-5 wide, but even less than 1m in some parts. The narrow distance of the riverbed bottom and the blue color of the river, which sometimes is white due to melting snow, can be admired from the bridge. Anyone going to the National Park of Valbona can stop to see the canyon on the road trail, or can go for hiking in the valley leading to the valley of Dragobia and the valley of Valbona upstream river, surrounded always by the giant mountains and peaks of Jezerca, Maja e Hekurave, etc. Those who dare can enjoy rafting in some parts of the canyon following the windings of the flow, admiring the vegetation in both sides and listening to the sound of the flowing water of the river.

GEOINFORMATION OF THE CANYONS

Geoinformation of the canyons of Albania created with the help of ArcGIS10.5, is a digital database about each geosite, where general and specific data about geographical position, geology, geomorphology, biodiversity, state of preservation, management, etc., are provided (Fig. 4). Following the approach proposed by Giardino and Mortara (2004) to each geosite an inventory card containing pictures and descriptions divided in sections is created. The general data of the canyon is presented in the first section; pictures and text in the second, cultural values, curiosities and legends in the third section and state of preservation and risks in the last one. The inventory cards needs to be completed with further information about geology and geomorphologic evolution, stratigraphic sections, 3 D views, etc. The database completion is an ongoing process, for in many cases there is no updated data or the information is completely missing.

Fig. 3 Shoshani canyon (Photo: Joni Margjeka (left), Adil Neziraj (right))

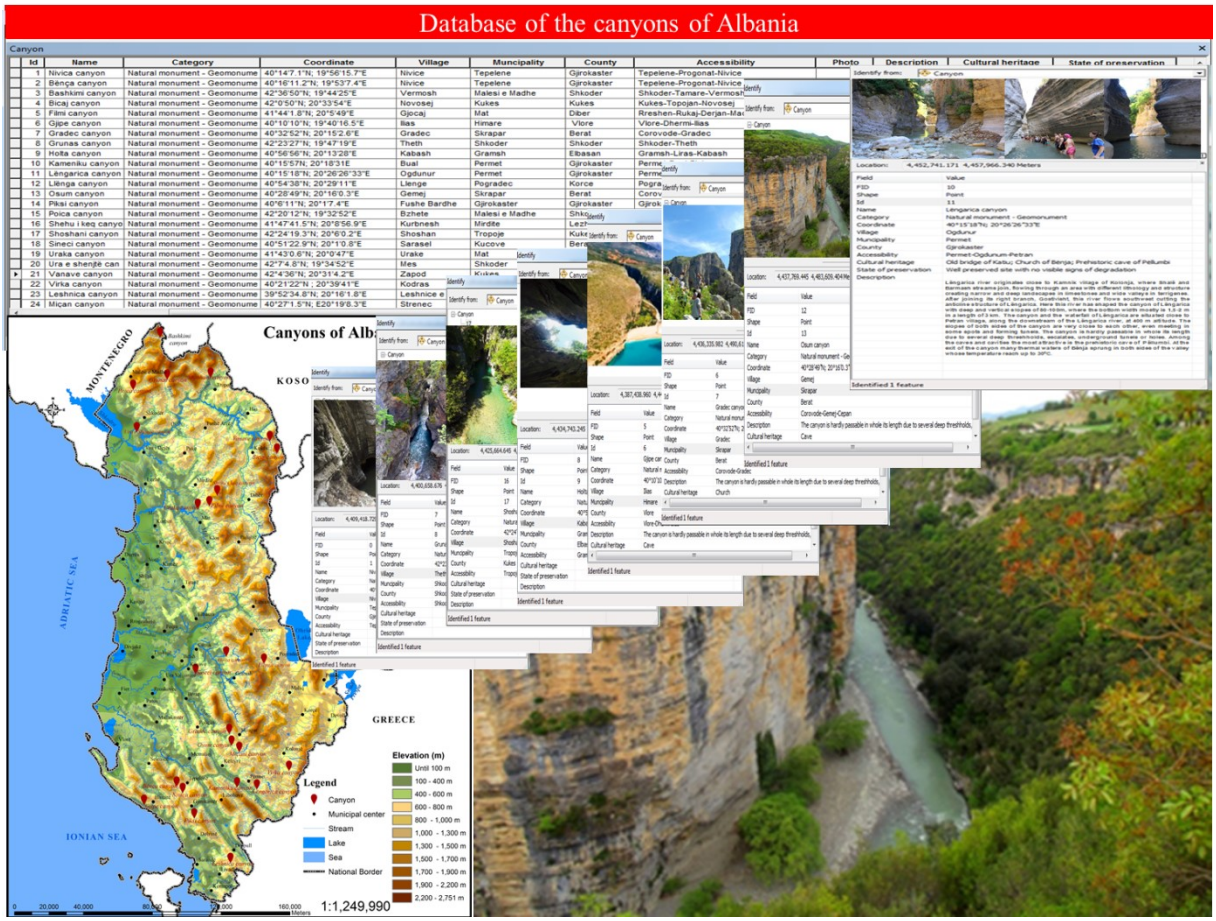

Fig. 4 The geoinformation database of the canyons in Albania

This gap needs to be filled through continuous monitoring of the geosites from the experts in the field of geology, geomorphology, biology, speleology, archaeology, etc. In order to make available the information to the public are combined GIS applications with internet technology, allowing the publication of cartographical

data integrated with other information, including images and descriptive cards (Ghiraldi at.al. 2009). Tourism would be better developed if the tourists would be informed and have access to digital information for the canyons. The geoinformation of the canyons of Albania will inform the tourists about these interesting landforms through the promotion of their touristic values. Therefore, the geoinformation for the whole canyons that are included in the list of the nature monuments is created. The geoinformation of the canyons can be updated as frequently as required based on new information and will be available to the public through the website www.canyonsofalbania.com.

CONCLUSIONS

Based on the valorization of the canyons, it can be concluded that nine of the nature monuments have high potential for geotourism development. The results of the canyon valorization realized by this study can be considered as initial step for the public awareness raise about the geosites importance. Geotours need to provide geological, geomorphological and biological knowledge to the visitors in order to raise their understanding of the area. Valorization of the canyons is the first step toward geoheritage cataloging. Much more is needed to be done for the information update, monitoring the state of the art of the canyons, completion of the database with more geological and geomorphological data, etc. The creation and publication of the website should be the next step where itineraries of geotours are proposed to the general public together with maps and other information.

Acknowledgement

This research was supported by Rachel Carson Center. I thank all the Carson fellows for their comments on the earlier version of this paper.

REFERENCES

Academy of Sciences (1991) Physical Geography of Albania, Kombinati Poligrafik-Shtypshkronja e Re, Tiranë, p. 326.

Dollma M. (2015) Geotourism and sustainable development in Skrapar. Acta Geoturistica, vol. 6 nr. 2, 11-17.

Dollma M. (2015) Geoinformation of hydromonuments of Albania in function to the tourism development, Journal "Geographical research", Kosovo.

Ghiraldi, L., Coratza,P., De Biaggi, E., Giardino, M., Marchetti, M. and **Perotti, L.** (2009) Development and usage of Geosites: new results from research and conservation activities in the Piemonte Region (Italy), Studia Universitatis Babeş-Bolyai, Geologia, vol. 54, nr. 2, p. 25.

Giardino, M. and **Mortara, G.** (2004) I geositi nel paesaggio della Provincia di Torino. Pubblicazione del Servizio Difesa del Suolo della Provincia di Torino, v. I, p. 116. (in Italian)

National Geographic (2015) About geotourism, available at:http://travel.nationalgeographic.com/travel/sustainable/about_geotourism.html

Neziraj A., Moisiu L. and **Avxhi A.** (2016) Gjeologjia, Gjeoresurset, Gjeorreziqet dhe Mjedisi në bashkitë e Shqipërisë (Nënprojekti Gjeomonumentet sipas Bashkive në shkallën 1:50000), Arkivi ShGjSh, Tiranë. (in Albanian)

Serjani A. and **Dollma M.** (2012) Geoecosystems in Albania. Geologia dell'Ambiente, Periodico trimestrale della SIGEA, Società Italiana di Geologia Ambientale Poste Italiane S.p.a. - Spedizione in Abbonamento Postale - No. 3, p.181-189.

Solarska A. and **Jary Z.** (2010) Geoheritage and Geotourism Potential of the Strzelin Hills. Geographica Pannonica, vol.14, nr. 4, 118-125.

Swarna, K., Biswas, S.K. and **Harinarayana, T.** (2013) Development of Geotourism in Kutch Region, Gujarat, India: An Innovative Approach. Journal of Environmental Protection, 4, 1361.

sciendo

Acta Geoturistica volume 9 (2018), number 2, **35-41**
doi: 10.1515/agta-2018-0009

Revitalised geotourism mining heritage potentials in the Posavje Folds

MATEJA GOLEŽ
Slovenian National Building and Civil Engineering Institute,
Dimičeva ul.12, 1000 Ljubljana, Slovenia
(Email: mateja.golez@zag.si)

Abstract
The territory of the Posavje Folds offers many geotourism potentials reflecting in particular in rich mining heritage. For a long time, local communities have considered them mainly in the context of local problems, but nowadays we may see individual examples of successful revitalization of cave chambers and mining structures. All that has given rise to fantastic stories about the mining wealth of the underground world and the mining heritage interpreted with modern approaches and new findings. In addition to managers and heritage owners, the revitalization process also includes scientists, artists, architects and educators who, each in their own way, contribute to a holistic perspective of the values of the past in light of contemporary understanding of this type of heritage. As a result, the territory has witnessed the revitalization of the medieval lead and silver mine Padež pri Laškem, the former Laško coal mine machine room, which was transformed into the Strojnica Gallery, and the polymineral mine Sitarjevec within the last five years. All mentioned examples are cases of abandoned mining activities with long-lasting mining tradition, which left an imprint in the area in terms of the diverse social structure of the population and in terms of town development, which also allows us to evaluate from a distance the contribution to the construction of the railway between Vienna and Trieste, which put these towns on the European map of centres of industrial significance in the mid-19th century. Trains that still connect the Austrian capital with the Adriatic coast may in future, in light of sustainable green tourism, attract curious guests to stop and linger a while, which is the ultimate goal of the attempts of local communities to revitalise mining heritage. Meanwhile, the goals set can only be realised with the help of new and attractive tourist products that reflect own creativity related with tradition ranging from design ideas, music events, art installations, popular science evenings; in short, with contents that are suited to visitors of all ages.

Keywords: mines, heritage, revitalization, geotourism

INTRODUCTION

Approaches to the awareness of the importance of mining heritage revitalisation are interdisciplinary and multi-layered. They include local communities, societies, non-governmental organisations, educational and research institutions, artists and cultural establishments. Mining heritage brings together the protection of natural and cultural heritage and interpretations deriving from intangible heritage related with mining life. Mineral resources have been the driving force of civilisation development changing the world both in terms of settlement as well as in terms of cultural landscaping. Upon present awareness of the importance to preserve mining heritage, a strong tendency emerged to revitalise abandoned mines and mining architecture for tourism purposes, which has posed new challenges mostly in view of a sustainable economy. In the last decade, such trends have also been closely pursued by Slovenia, which has been included in the Global Geoparks Network with Geopark Karavanke and Geopark Idrija, but has not yet fully used all of its potentials to revive and promote mining heritage, particularly in the Posavje Folds, which also belong to the

list of potential geoparks according to some research studies (Erhatič, 2013). For that reason, it is necessary to devote all attention to programmes that have contributed to the revitalisation of individual mining heritage structures of the place for the past few years using the development funds provided by local communities and national (Perkmandeljc) and international projects (VirtualMine). Considering the visits, there is a large interest in the inclusion of such tourist products in rural adventure tourism. That is vital for the improvement of the situation in industrial heritage and farm/rural tourism in Europe, where Slovenia is found at the bottom according to the analyses made within the scope of the European structural and cohesion policy (Internet 1).

RESULTS AND DISCUSSION

Revitalised mining heritage structures in the Posavje Folds

Geographically, the Posavje Folds are a hilly terrain spanning between the Ljubljana Basin in the west and Obsotelje in east Slovenia. The shape of the surface results from the rock structure and past tectonic movements when rock would fold, which is why it represents an area of anticlines and synclines capturing mineral resources ranging from lead, zinc, mercury, barite and silver to lignite. Mineralised rock with metal minerals dates back to the Permo-Carboniferous Period, while coal seams are found in the rock of the Oligocene epoch.

Two of many metal mineral deposits in the area have been revived, i.e. the Padež mine and Sitarjevec mine, while mining heritage related with the present coal extraction is available in Govce (Laško coal mine) (Fig. 1). The ore-bearing rock at the Padež and Sitarjevec mines is micaceous-quartz sandstone with inclusions of dark grey feldspar and siltstone, while mineralisation took place as a result of tectonic movements that caused the cracking of quartz sandstone and the penetration of hydro-thermal solutions enriched with ore minerals and flint in the cracks (Herlec et al., 2006). Coal seams in Laško are found in molasse deposits of the former Pannonian Sea (Mlakar, 1986).

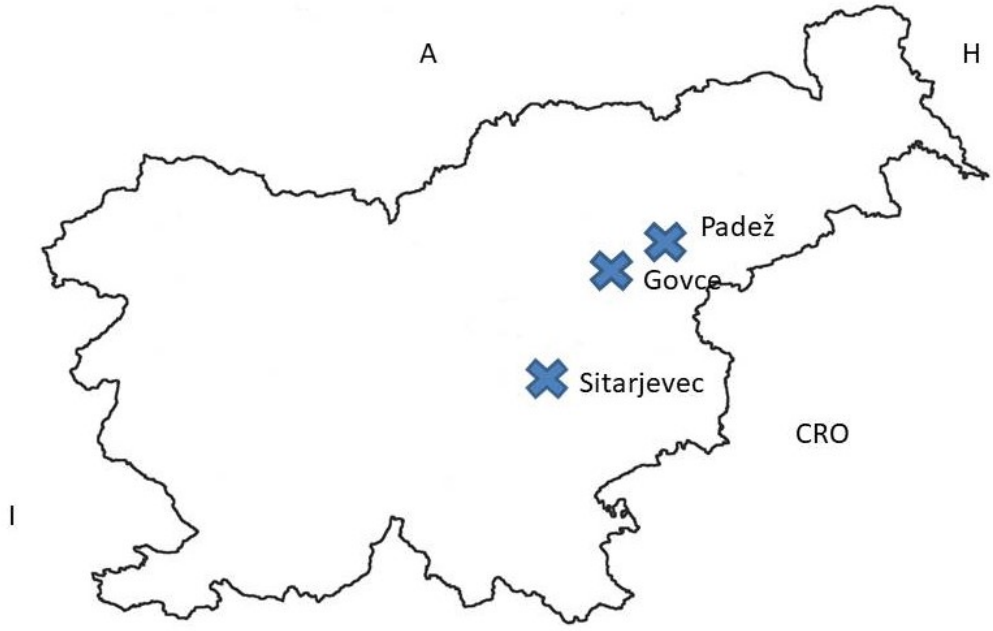

Fig. 1 Location of the revived mining heritage structures in the Posavje Folds in Slovenia

By reviving the mining structures of the place, access to rich mining heritage was provided to the general public, whereby the Republic of Slovenia follows the goals of the European Heritage Strategy for the 21st Century, as adopted by the Committee of Ministers of the Council of Europe at its 1278th session (Internet 2). Among other things, territorial and economic development (component D) highlights relations between cultural heritage and territorial development, the economy and local and regional management by taking into account the principles of sustainable tourism. In particular, strong focus is on the involvement of local communities, which is also expressed to the greatest extent possible in projects to revitalise mining heritage in the Posavje Folds.

Revitalisation of the medieval lead and silver mine Padež

The process to revitalise the Padež mine started with the purchase of a small farm by the Slapšak family, which later turned out to have a narrow entrance to a mine tunnel in the forest. The desire to explore led the land owner to the first attempts to enter the underground world and, later on, to extensive cleaning of the collapsed mine tunnels, initially to search for a water resource in order to supply the farm with drinking water and later to an idea of offering the mine to the public within the scope of tourism development at the farm. During cleaning, mine galleries revealed interesting cave formations, cave pearls, sinks and aragonite urchins, which the farm owners wished to present to the general public. The project to revitalise the Padež mine was later also joined by Laško Municipality, which contributed to the arrangement of mining infrastructure, geological research and popularisation within the scope of the Perkmandeljc project, funded from the Rural Development Programme. Experts who participated in the research of the past development of the mine found that it was a medieval lead and silver mine that could not be detected in old maps of mineral resources due to its strategically important mineral resources (Maček, 2002). The Slapšak family, therefore, unveiled a mine that was long forgotten, with its intact mine galleries featuring magnificent cave formations of various colours and forms shaped by unstoppable forces of nature. The revitalised mine is managed by the Slapšak family and marketed for tourism purposes, and the abandoned mineshaft also holds adequate quantities of drinking water to supply the homestead (Fig. 2). Entry to the underground world is organised by agreement in small groups led by a member of the Slapšak family, so that visitors can experience a contact with heritage to the maximum possible extent, since the person who has discovered it, put it into order and maintained it is its best interpreter.

Strojnica Gallery in Govce

The land today known as Govce has evolved for millions of years in slow, yet persistent processes, like the tunnels produced by miners featuring impressive underground architecture that lies beneath Govce. By reviving mining heritage in Govce, particularly in the former machine room next to Liša shaft, a new chapter has opened in the development of a dialogue between the local community, experts, researchers and artists.

With due respect for the conservation of the rare ruins of former gems of farming architecture and heritage memories of past mining, new possibilities have opened to make a place of historic remembrance such as Govce also a development opportunity for the local community. The matter was the subject of a paper entitled “Govce” that was drawn up at the Faculty of Civil Engineering, Transportation Engineering and Architecture at the University of Maribor within the scope of participation in the VirtualMine project. The spatial planning study contains proposals to revitalise all potentials that are available on site (Fig. 3). It includes natural and cultural heritage, whereby the revitalised former mining machine room, transformed into the Strojnica Gallery (Machine Room Gallery),

Fig. 2 A – Slapšak homestead, B – Aragonite urchins, C – Cave pearls, D - Drinking water catchment in the shaft

Fig. 3 Revival of heritage potential in Govce: A – The ruins of Govce village, B – Laško coal mine, C – Strojnica Gallery featuring the Odstiranja and Sence exhibitions, D – Music event in front of the Strojnica Gallery

already hosts a rich cultural and artistic programme (Kobale et al., 2018). Hence, in cooperation with the Faculty of Natural Sciences and Engineering at the University of Ljubljana, Department of Textiles, pH15 group and the Slovenian National Building and Civil Engineering Institute, the room first hosted an exhibition entitled "ODSTIRANJA"(Unveilings), which was later accompanied by an exhibition of sculptures made by Milojka Drobne entitled "SENCE" (Shadows). Upon other occasions, the idyllic room held a music and dance event, a concert, a children's event, a full moon gathering and so on.

No doubt, Govce is an exceptional tourist potential that hides several 10-kilometre-long mine galleries featuring an interesting walk into the past intertwined with geologic natural assets and mining heritage related with lignite extraction from the 19th century to its closure in 1992 as well as with the memory of post-war events at Huda jama. All those potentials are the focus of development issues at the planned Ecomuseum of Mining, which is being developed by Laško Municipality together with partners (Fig. 5).

Revitalisation of the Sitarjevec mine

The Sitarjevec polymineral mine has been declared a natural asset of national importance due to its extraordinary mineral wealth. The mining tradition at the Sitarjevec mine dates back to the Celtic era, when the mine was allegedly used to extract the raw material for the production of the famous bronze Vače situla. The mine was used by the Romans and was first mentioned in the Middle Ages. The mine was abandoned and reopened several times, but was finally closed in 1966 due to a lack of investments in research and the ingress of water.

The Sitarjevec mine was a strategic mineral deposit of lead, zinc, copper, mercury, barite and iron ore (Preisinger, 2010). In 1886, the Litija smelter succeeded for the first time in obtaining silver from the ore extracted at Sitarjevec, which was used in the same year to manufacture the renowned Litija commemorative coins at the national mint in Vienna.

Today, the Sitarjevec mine is getting a new image, as it is being rearranged for tourism purposes by Litija Municipality. The first 100 metres of tunnels have already been revitalised and transformed into a museum product, while other mine voids harbouring mostly magnificent limonite cave formations are yet to be arranged. In cooperation with research and educational institutions, parallel research of the mine is being conducted that will contribute to a better interpretation of natural assets and mining heritage. A part of research is also included in the international VirtualMine project, which has yielded new tourist products attractive to the expert and general public in cooperation with the Slovenian National Building and Civil Engineering Institute, Department of Textiles at the University of Ljubljana Faculty of Natural Science and Engineering, Slovenian Museum of Natural History, Vocational College at the Srečko Kosovel School Centre in Sežana and Litija Municipality. The research has shown that the Sitarjevec mine is the site of the semi-precious stone hematite with jasper, which can be used for the manufacture of jewellery. Another interesting feature is the mine water, which is rich in iron and represents a potential natural dye for dyeing textiles. The experimental work conducted at the Department of Textiles at the Faculty of Natural Sciences and Engineering proved that the mine water mixed with an organic tincture made of pomegranate peelings may be a good dye for cotton fabric. The Sitarjevec mine is also extremely rich in the natural ochre pigment, which is deposited in abandoned mine tunnels. The latest research has shown that the pigment can be used particularly for artistic purposes in two versions, ochre and shades of red obtained from the thermal treatment of the ochre pigment (Fig. 4).

A group of students at the Department of Textiles of the Faculty of Natural Sciences and Engineering thought up of a way to enlighten the mine void and developed

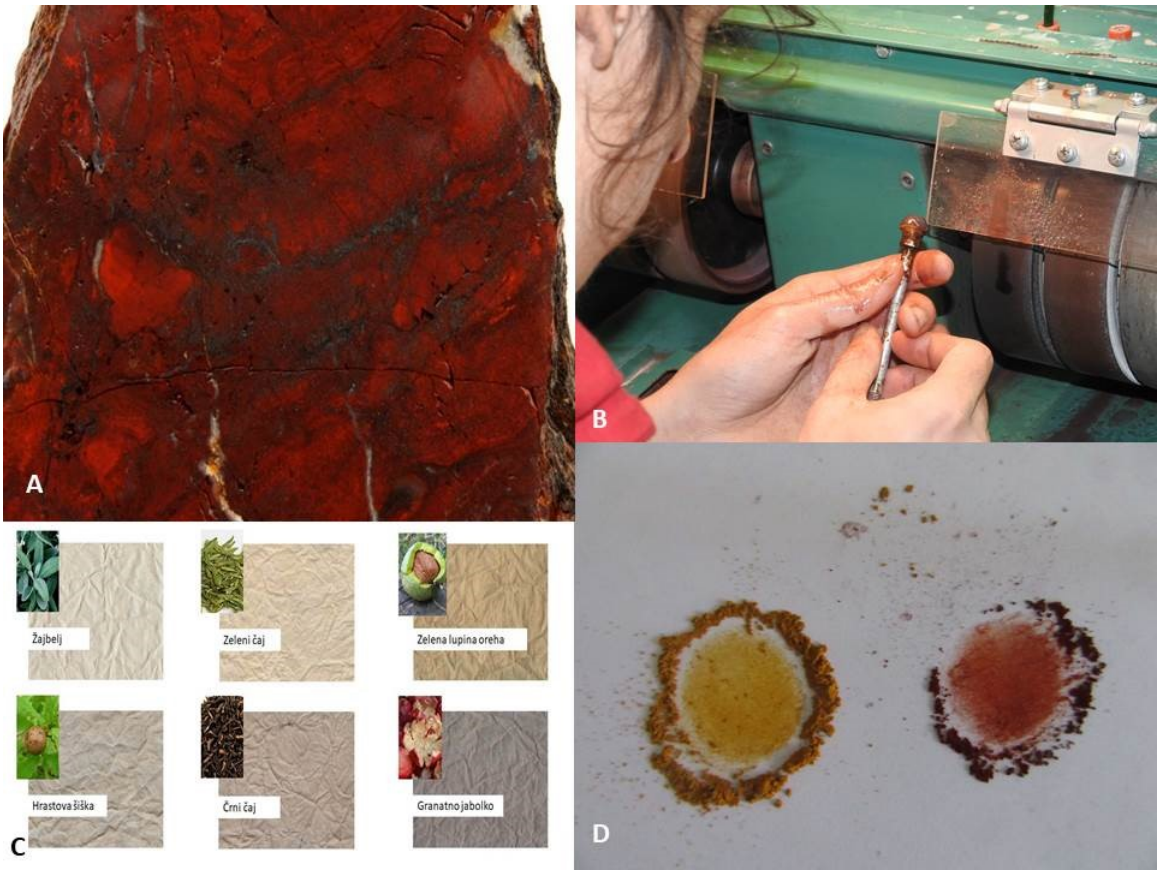

Fig. 4 Mineral potentials of the Sitarjevec mine: A – Hematite with jasper, B – Jewellery cutting, C – Textile dyeing with mine water and organic tinctures, D – Pigment

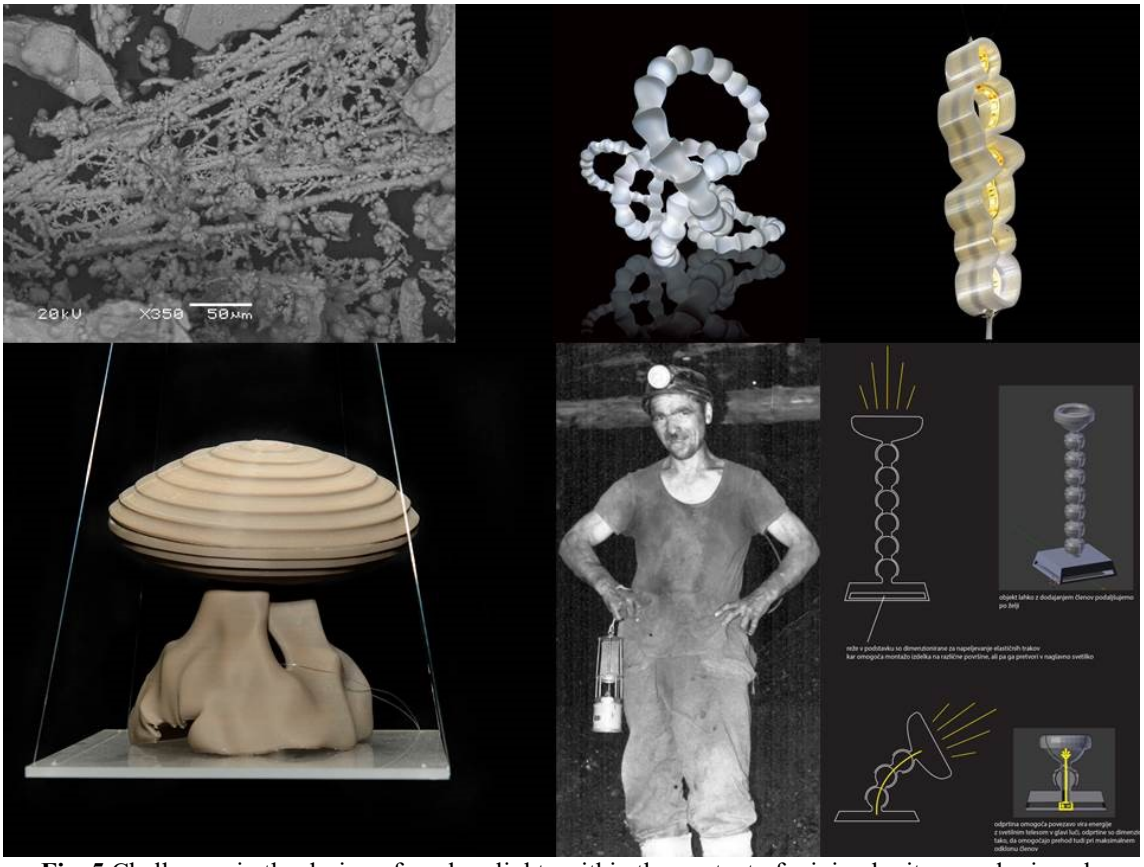

Fig. 5 Challenges in the design of modern lights within the context of mining heritage and minerals

a series of lights from mining heritage motifs that were printed 3D at the Slovenian National Building and Civil Engineering Institute. An ad-hoc exhibition of the lights has fascinated visitors and prompted them to consider mining heritage with contemporary thought (Figure 4).

CONCLUSION

Many past studies have revealed rich natural and cultural heritage in the Posavje Folds, which has contributed to tourism with individual cases of mining heritage revival. By integrating local settings, research and cultural organisations, and the economy, foundations have been laid to intensify efforts to exploit potentials and introduce new projects in regional development. The place that used to dictate the development of society due to its mineral resources dropped way behind the rest of Slovenia after the downfall of the mining industry. Regeneration processes focusing primarily on new economic programmes strengthened in the last few years, reducing unemployment, resolving environmental problems and, fortunately, reviving mining tradition for tourism purposes. Good practice examples to revitalise mining heritage have demonstrated that new tourist products attractive to modern tourists and providing a basis for further development may evolve only through an interdisciplinary process. The integration of tradition and modern interpretation approaches including the latest findings and advanced technology represents a possibility to open sustainable tourism to the world beyond the boundaries of the local environment.

REFERENCES

Erhartič, B., Zorn, M. and **Komac, B.** (2013) Geoturizem kot nova razvojna perspektiva Slovenije. Nove razvojne perspektive, 81-92, Ljubljana.

Herlec, U., Dolinšek, M., Geršak, A., Jemec, M., and **Kramar, S.** (2006) Minerali žilnih rudišč v Posavskih gubah in rudnika Sitarjevec pri Litiji. Scopolia. Ljubljana, p. 52-65.

Kobale et al. (2018) Govce. Prostorska študija. UMB, Fakulteta za gradbeništvo in arhitekturo, Maribor.

Maček, J. (2002) Rudnik svinca v Padežah pri Laškem – pred 450 leti. Laški zbornik 2002. Knjižnica Laško, 257-262, Laško.

Mlakar, I. (1986) Prispevek k poznavanju geološke zgradbe Posavskih gub in njihovega južnega obrobja. Geologija, 28/29,157-182 , Ljubljana

Preisinger, D. (2010) Opuščeni rudniki v Sloveniji, p.170, Trstenik.

Internet 1: (http://www.europarl.europa.eu/RegData/etudes/etudes/join/2013/495840/IPOL-TRAN_ET(2013)495840_EN.pdf.

Internet 2: https://www.coe.int/en/web/culture-and-heritage/strategy-21