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SCĂRIŞOARA ICE CAVE GEOMORPHOSITE – EVALUATION AND TOURIST CAPITALIZATION

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ABSTRACT. – Scărişoara Ice Cave Geomorphosite – Evaluation and Tourist Capitalization. The present study assesses the attractiveness potential of karst forms which exist in Bihor Mountains, focusing on Scărişoara Ice Cave. This cave is considered by researchers as one of the most important tourist attractions in Romania, due to the accumulation of qualitative and quantitative factors, which contribute to its inclusion in the category of geomorphosites. In the scientific literature, the notion of "geomorphosite" refers to a landform or a geomorphological process which possesses multiple scientific, cultural, economic, scenic, historical and aesthetic values. All these values are the result of the researcher's subjective perception, acquired over time. The better known these values are, the more tourists are interested in the landform. This research was accomplished by applying specific research methods, which were acknowledged both at national and international level. The findings of the research highlight the special scenic value of the landform analyzed, as well as its high tourist attractiveness.

Keywords: *geomorphosite, Scărişoara Ice Cave, tourist potential, capitalization, Pralong Method*.

1. INTRODUCTION

Scărişoara Ice Cave was not discovered at a certain date, but the first papers which mentioned it date back to the 19th century. These works had a descriptive character, encompassing a wide range of subjects.

The first scientific investigations about Scărişoara Ice Cave were performed in the 19th century, when the cave was the subject of specialized studies conducted by the scientist Emil G. Racoviţă. Referring to his research, he stated: *"I think that I*

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have demonstrated the great scientific interest which the Scărişoara Ice Cave shows. Apart from the deciphering passionate enigmas of the history of the glacier, many issues that concern all branches of natural sciences could be studied [...]". Over time, many investigations have been made by scientists from the Institute of Speleology, such as Mihai Şerban, Iosif Viehmann, Gheorghe Racoviţă, as well external collaborators like Răzvan Givulescu, Emil Pop, Ion Ciobanu, Liviu Blaga and many others.

The actuality of the present study is based on the high tourist capitalization of the landforms considered to be major attractions. A relevant example is represented by gemorphosites. To consider a landform as a geomorphosite, certain conditions have to be met. First, it is important that the form taken into account has special geomorphological characteristics. Secondly, it is important to have hydrographic and/or biogeographic features. Another defining aspect is the human perception of the form in question, as well as the assigned functions.

In this study, emphasis is placed on the interrelation between morphology and tourism from the point of view of the scenic capitalization of the geomorphosite, through its structural and functional analysis. This relationship is also illustrated by Muntele and Iaţu (2006): "*Terrain is the essential support in tourism arrangements, being also a basic element in creating the specific setting for each tourist attraction"*.

Scărişoara Ice Cave is located in the central part of Bihor Range, at an altitude of 1165 meters, being part of Scărişoara karst complex. The geological formations are represented by Mesozoic limestones which belong to the Bihor Autochthonous. According to some studies, it is considered that the specific rocks of the cave are ladder-age limestones. The surroundings of this tourist destination are defined by a series of isolated ranges and peaks which are separated by deposits or small karst basins such as Ocoale (Gh. Racoviţă, M. Şerban, I. Viehmann, B. Onac, 2003).

Scărişoara Ice Cave has the aspect of an aven with the diameter of about 48 meters and the depth of 50 meters. The entrance is in its western wall, through a 24 m high portal. It continues with the Great Hall, which shelters an ice block with a volume of about 75,000 m^3 and about 3,000 years of age. This room continues with the Small Reserve in the northern part and the Great Reserve in the southern part, which is considered the largest cave sector. The cave is composed of several sectors: Maxim Pop Gallery, Cathedral Hall, Coman Corridor. All these sectors lead to a total cave development of 700 m and a total area of approximately 5,500 m^2.

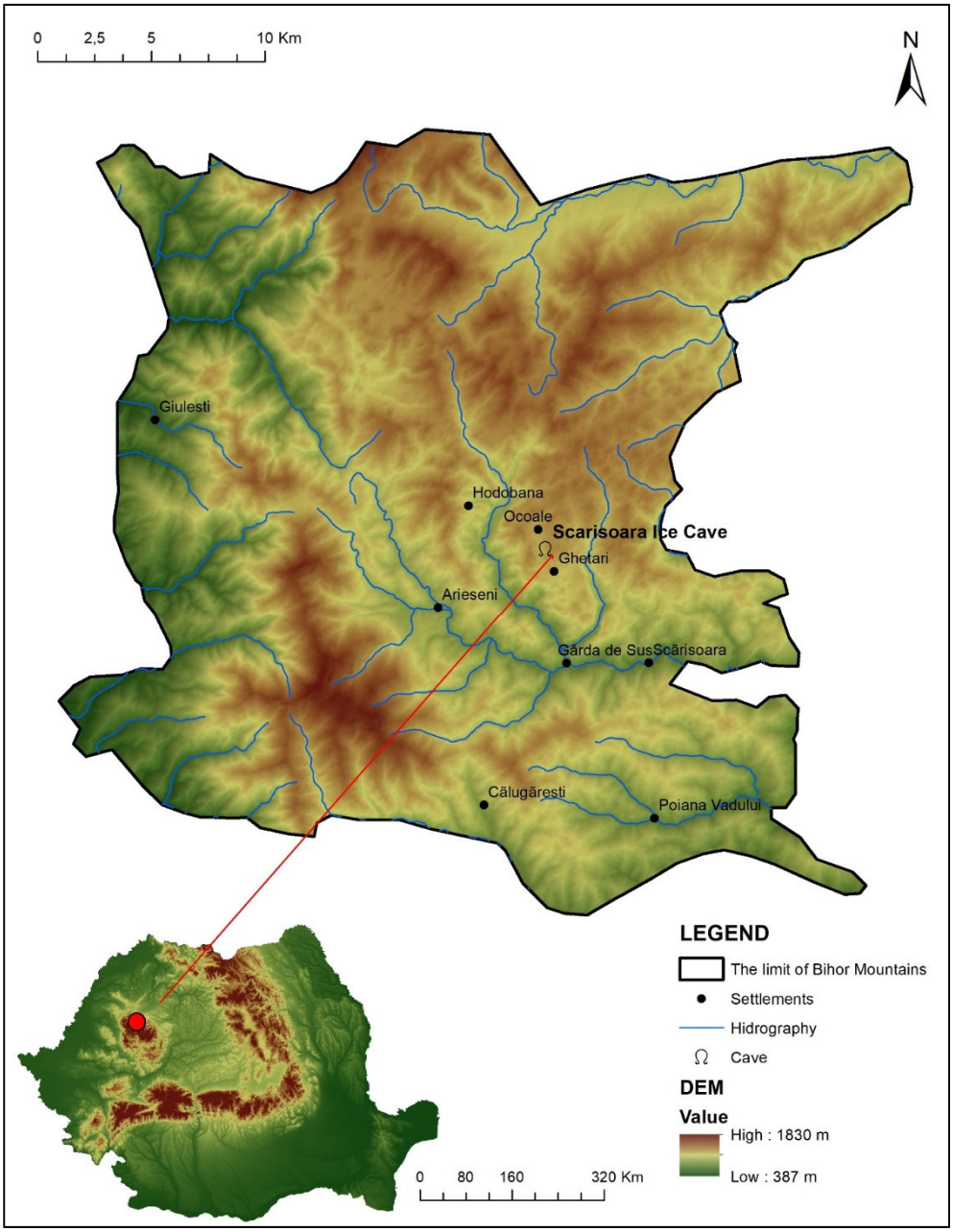

Fig. 1. Location of Scărişoara Ice Cave

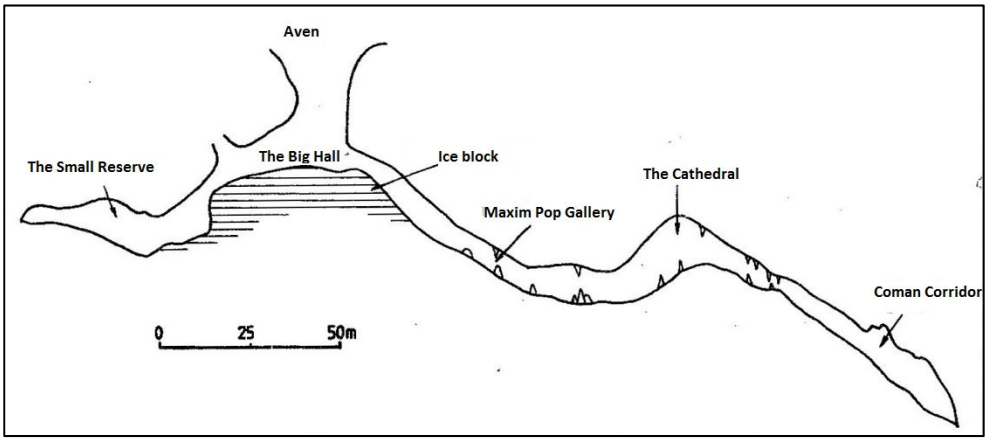

Fig. 2. Scărişoara Ice Cave (*section realized after Şerban M., and colab., 1948*)

2. METHODOLOGY

The methodology used in this research is based on the analysis of the site, by consulting specialized scientific papers. The main methods used to evaluate a geomorphosite have been identified, namely: Panizza Method, the method proposed by Coratza and Giusti, Pralong Method, Pereira's Method, Reynard's Method, the method proposed by Serrano and Truebla Gonzalez. Of all these, we have chosen to use the Pralong Method, as it is focused on the tourist capitalization of geomorphosites, which is attempted to be highlighted in this research.

The main characteristic of this method is the fact that the tourist value of the geomorphosites is calculated as the mean of the following values: scenic (Vsce), scientific (Vsci), cultural (Vcult) and economic (Veco). An important feature of this method is the fact that these values have equal weight when the tourist value is calculated.

The scenic value and the economic one are calculated as the mean of many factors. According to Panizza, the scenic value depends on the spectacularity and peculiarities of the geomorphosite. Thus, the factors considered are: the number of viewpoints, average distance to viewpoints, the area of the site, the elevation and the chromatic contrast. Different scales are used between the values assessed, between 0 and 1.

The economic value is based on the features that make possible the capitalization of the geomorphosite, such as: accessibility, natural risks, annual number of visitors, official level of protection, attraction. On the other hand, the scientific value is based on palaeogeographical interest, representativeness, area, rarity, integrity, ecological interest and is expressed by:

$$Vsci = (Sci1 + Sci2 + 0.5 * Sci3 + 0.5 * Sci4 + Sci5 + Sci6) / 5$$

In this formula, the values of Sci3 and Sci4 factors were halved, as they are closely related to the site area (Sce3).

The cultural value depends on the artistic events or traditions associated with the site: the presence of some customs, the representation of the site in art, historical and archeological relevance, religious relevance, art and cultural events. The formula of this value is:

$$Vcult = (Cult1 + 2 * Cult2 + Cult3 + Cult4 + Cult5) / 6$$

It can be observed that the Cult2 factor has an unequal weight, as it depends on the number of literary mentions.

Table 1. Criteria and scores used to assess the tourist value of a geomorphosite

SCENIC VSCE	Number of viewpoints (Vsce1)	1	6 or more
		0.75	4 or 5
		0.5	2 or 3
		0.25	1
		0	No viewpoints
	Average distance to viewpoints (m) (Vsce2)	1	More than 500
		0.75	Between 200 and 499
		0.5	Between 50 and 199
		0.25	Between 25 and 49
		0	No viewpoints
	Surface, related to other similar sites from the same area (Vsce3)	1	Very large
		0.75	Large
		0.5	Moderate
		0.25	Small
		0	Very small
	Elevation (Vsce4)	1	Very high
		0.75	High
		0.5	Moderate
		0.25	Low
		0	Very low
	Chromatic contrast (Vsce5)	1	Strong contrast
		0.75	Moderate contrast
		0.5	Very different colours
		0.25	Different colours
		0	Identical colours
SCIENTIFIC	Palaeogeographical interest (Vsci1)	1	Very high
		0.75	High
		0.5	Moderate
		0.25	Low
		0	No interest
	Representativeness (Vsci2)	1	Very high
		0.75	High
		0.5	Moderate
		0.25	Low
		0	No representativeness

VSCI	Area % (Vsci3)	1	More than 90,1
		0.75	Between 50,1 and 90
		0.5	Between 25,1 and 50
		0.25	Between 10,1 and 25
		0	Between 0,1 and 10
	Rarity (Vsci4)	1	Unique
		0.75	Between 1 and 2
		0.5	Between 3 and 4
		0.25	Between 5 and 7
		0	More than 7
	Integrity (Vsci5)	1	Intact
		0.75	Weakly deteriorated
		0.5	Deteriorated
		0.25	Very deteriorated
		0	Destroyed
	Ecological interest (Vsci6)	1	Very high
		0.75	High
		0.5	Moderate
		0.25	Low
		0	No interest
SOCIAL-ECONOMIC VECO	Accessibility (Veco1)	1	By a road of national importance
		0.75	By a road of regional importance
		0.5	By a road of local importance
		0.25	Less than 1 km of track
		0	More than 1 km of track
	Natural risks (Veco2)	1	No risk
		0.75	Controlled risk
		0.5	Partially controlled risk
		0.25	Not controlled risk
		0	Uncontrollable risk
	Annual number of visitors (Veco3)	1	More than 1 000 000
		0.75	Between 500 000 and 1 000 000
		0.5	Between 100 001 and 499 999
		0.25	Between 10 000 and 100 000
		0	Less than 10 000
	Official level of protection (Veco4)	1	No protection
		0.75	Limiting for 25% of the area
		0.5	Limiting for 50% of the area
		0.25	Limiting for 75% of the area
		0	Complete
	Attraction (Veco5)	1	International
		0.75	National
		0.5	Regional
		0.25	Local
		0	No attraction

CULTURAL VCULT	The presence of cultural customs (Vcult1)	1	Indicatory of customs
		0.75	Strongly linked to customs
		0.5	Moderately linked to customs
		0.25	Weakly linked to customs
		0	No link
	Number of representations in art (Vcult2)	1	More than 50
		0.75	Between 21 and 50
		0.5	Between 6 and 20
		0.25	Between 1 and 5
		0	Never represented
	Historical and archeological relevance (Vcult3)	1	Very high
		0.75	High
		0.5	Medium
		0.25	Weak
		0	No vestige
	Religious relevance (Vcult4)	1	Very high
		0.75	High
		0.5	Medium
		0.25	Weak
		0	No relevance
	Art and cultural events (Vcult5)	1	Occasional events: traditions, feasts etc.
		0.75	Occasional religious events, marriages etc.
		0.5	Occasional events due to the implementation of a program
		0.25	Random events
		0	No events

In the assessment of tourist value, we also determined the exploitation value (Vexp), which is based on the sum of the degree of exploitation (Vdeg) with the modality of exploitation (Vmod) of the values obtained previously. The degree of exploitation depends on the number of infrastructure, used area, seasonal occupancy, daily occupancy.

$$Vexp = Vdeg + V\,mod$$

Table 2. Criteria and scores used to assess the exploitation value of a geomorphosite

DEGREE OF EXPLOITATION	Used surface (ha) (Vdeg1)	1	More than 15
		0.75	Between 10 and 14
		0.5	Between 6 and 9
		0.25	Between 2 and 5
		0	Less than 1
	Number of infrastructure (Vdeg2)	1	More than 10
		0.75	Between 6 and 10
		0.5	Between 2 and 5
		0.25	1
		0	No infrastructure
	Seasonal occupancy (days) (Vdeg3)	1	Between 271 and 360
		0.75	Between 181 and 270
		0.5	Between 91 and 180
		0.25	Between 1 and 90
		0	No occupancy
	Daily occupancy (hours) (Vdeg4)	1	More than 9
		0.75	Between 6 and 9
		0.5	Between 3 and 5
		0.25	Less than 3
		0	No occupancy
MODALITY OF EXPLOITATION	Use of the scenic value (Vmod1)	1	Mass-media promotion and products
		0.75	Mass-media promotion and one product
		0.5	One support and some products
		0.25	One support and one product
		0	No promotion
	Use of the scientific value (Vmod2)	1	Scientific promotion and products
		0.75	Scientific promotion and one product
		0.5	One support and several products
		0.25	One support and one product
		0	No support and products
	Use of the cultural value (Vmod3)	1	Several means of promotion and products
		0.75	Several means of promotion and one product
		0.5	One support and several products
		0.25	One support and one product
		0	No promotion
	Use of the economic value (tourists) (Vmod4)	1	More than 100 000
		0.75	Between 20 001 and 100 000
		0.5	Between 5 001 and 20 000
		0.25	Less than 5 000
		0	No tourists

The next stage of the research consisted in trips we made to enable the subjective assessment of the geomorphosite, according to the method mentioned. According to this, we went to the Scărişoara Ice Cave, which is located in the commune of Gârda de Sus, Alba County.

The last stage of the research was based on the direct observations we made in the previous stage. Thus, these allowed the validation of the initial hypothesis, following analysis and synthesis processes.

3. RESULTS AND DISCUSSIONS

Scărişoara Ice Cave is among the top tourist attractions of Romanian speleology. This is due to the accumulation of some structural and functional features of great importance, as well as to its geomorphosite quality. Thus, the first facilities made in the cave date back to the beginning of the 19th century, when some tourist-oriented literature mentioned the provision of wooden stairs at the entrance of the glacier. In 2001, the existing infrastructure was restored while lighting and electrification have been introduced in the cave. The most recent intervention was performed in 2012, when the lighting mode was replaced by a modern LED system.

Fig. 3. The infrastructure in the cave

In the following we will present the result of the evaluation based on the geomorphosite evaluation table.

Table 3. Tourist capitalization of Scărişoara Ice Cave

	Vsce					Vsci						Veco					Vcult	Vtour
	0	0	0.5	0.75	1	0.75	1	0.75	1	0.75	0.75	0.25	0	0.25	0.25	1	0	
TOTAL	**0.56**					**0.82**						**0.43**					**0**	**0.45**

Using the Pralong Method, we obtained a tourist value of 0.45 for Scărişoara Ice Cave. Following the analysis of the table above, one can notice that the highest score belongs to the scientific value, which is due to the accumulation of several attributes. Thus, the cave is of great palaeogeographic interest, due to the fact that the ice block contained may suggest climate changes in the period between the Pleistocene and present. Moreover, the cave contains a rare fauna biotope composed of a small number of troglophilous or troglodyte species, belonging to only three taxonomic groups: araneides *(Nesticus racovitzai* and *Troglohyphantes racovitzai)*, springtails (*Oncopodura crassicornis, Onychiu-rus spp*. and *Tomocerus minor*) and Leptodirinae Coleoptera *(Pholeuon prosperinae glaciale)* (Gh. Racoviță, M. Şerban, I. Viehmann, B. Onac, 2003). The very high representativeness is due to the fact that the cave contains an ice block of remarkable size, which is the biggest one at national level and the second one in the south-east of Europe. The area of scientific interest of this tourist attraction has a percentage of 50-90% and the melting of a small quantity of snow and ice makes it just a little damaged.

Fig. 4. The ice block in the cave

The scenic value holds the second score of the total value due to the morphometric attributes of the cave. It has a strong chromatic contrast, due to the game of colors the ice creates in contrast to the karst forming the walls of the cave and the light that enters through the ceiling of the Great Hall and puts the color of the ice in a perfect light, eclipsing the whole cave.

Fig. 5. Strong chromatic contrast of the cave

The economic value has a weaker score because the only factor that reaches the maximum score (1) is defined by the attractiveness of the site, which is internationally well-known. Regarding the accessibility, the tourists are not able to reach the objective by car, so that a distance of less than 1 km has to be walked. This site has a risk that cannot be controlled, represented by the presence of a thick layer of snow above the cave, which could produce the collapse of the ceiling, as well as the possibility of flooding in case of torrential rainfalls. In order to preserve the ice in the cave, the access of tourists is limited to certain sectors. The cultural value has the score 0, since the cave does not have relevance regarding this aspect.

Table 4. The exploitation value of Scărişoara Ice Cave

	Vdeg				**Vmod**				**Vexp**
	0.25	0.5	0.75	0.75	1	0	0	0.75	
TOTAL	**2.25**				**1.75**				**4**

The total score of the exploitation value of Scărişoara Ice Cave is 4. In assessing this value, we analyzed the degree of exploitation associated to the tourism capitalization, and the modality of exploitation of the values previously calculated. Thus, from the perspective of the tourism capitalization, the tourism infrastructure is composed by three elements: access stairways, walkways and lighting. The cave is opened for the public 8 hours a day, between 181 and 270 days a year. Regarding the promotion of the values taken into account for assessing the modality of exploitation, it is obvious that the scenic value is strongly promoted, while the scientific value has the lowest score, because there are no products to promote it.

As a result of the analysis, one remarks that there is a need to optimize the tourist activities related to the cave. Thus, in order to preserve the ice block and the site as a whole, it would be better to allow visitors in the period October-April. Besides, in the period May-September, access should be restricted, allowing visitors only in specific time intervals, preferably in the morning and afternoon. In this way, the anthropogenic impact would be minimized.

Despite the fact that the infrastructure is well developed, as recent improvements have been made regarding both the access roads to the cave and the site itself, there is a need for diversifying the promotion of the cave. Although there is a good scenic promotion for the moment, there should be also a promotion targeted on the specific scientific features of the cave.

4. CONCLUSION

In conclusion, Scărişoara Ice Cave is a representative geomorphosite in Bihor Mountains because of its special morphological and morphometric attributes. These aspects contribute at placing this site in the top of national tourist objectives.

The present study was based on the specific geomorphosite inventory methodology, in this case the Pralong Method. This implied the analysis of certain defining aspects, which were quantified by assigning values between 0 and 1.

By capitalizing the aesthetic, scientific, socio-economic and cultural values of the analyzed objective for tourism purposes, the region could be developed. However, we must consider the fact that the economic interests must not endanger the preservation of the site, which must be exploited from a sustainable perspective.

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