Geomorphosites in the Ialomiţa Subcarpathians

Vasile LOGHIN, George MURĂTOREANU, Eduard PĂUNESCU

Abstract. The authors of this scientific papers have pursued a double goal: a scientific one, namely to identify, classify, characterize and map the geomorphosites in the Subcarpathians of Ialomița; and a practical one, specifically to evaluate the tourist potential of each geomorphosite in turn, in order to integrate them into the tourist circuit. In order to select, characterize and evaluate the geomorphosites in the above-mentioned Subcarpathian area, we have used the methodology that has been recently agreed upon concerning the study of this category of applied geomorphology themes. So, in the Subcarpathians of Ialomița, we have identified and assessed a number of eight geomorphosites. Two of them (Cheile Dâmboviței and Malu de Răsună) could become part of a tourist circuit during a proximal stage, while the sandstones from the area of Bela – Miculeşti (north of Pucioasa) and the cuestes from the zone in which Cricovul Dulce springs (Râpa Şoimilor) meet the conditions required to be declared *natural monuments*.

Keywords: geomorphosites, identification, evaluation, classification, hierarchy, Ialomița Subcarpathians

1. Introduction

Geomorphosites are a type of relief or geomorphological process which, in time, acquired esthetical, scientific, cultural, historical or economic value, due to human perception (Panizza, 2001; Piacente, 1993, cited in Pralong, 2005).

As part of the current geomorphological heritage, „geomorphosites are important in studying the history of the Earth, the evolution of the climate, the evolution of life on the planet, and they are also important from an ecological, economic and cultural point of view" (Grandgirard, 1997, cited in Reynard et.al., 2007, p. 148).

In the scientific literature, a series of terms were used to name the components of the geomorphological heritage: geomorphological values; geomorphological goods; geomorphological sites; geomorphological geotypes; sites of geomorphological interest; geomorphosites.

In his paper „L'évaluation des géotopes" (*The Assessment of Geotypes*), Grandgirard (1999) considers that the evaluation of the geomorphosites is performed according to three important criteria: rarity, representativeness and integrity. There are also certain optional criteria which can be added according to the context, such as the ecological value, the educational value and the paleogeographic importance.

In Romania, geomorphosites were not very much studied until now. The most important contributions to the study and knowledge of geomorphosites after 2000 belong to Ilieş and Josan (2009), Comănescu et al. (2009), the latter authors referring to the geomorphosites in the Bucegi and Ceahlău mountains.

Another approach to the Romanian geomorphic heritage belongs to Szepesi (2007), who analyses the geomorphologic geotypes in the Iezer Mountains, naming them *geomorphologic objectives*. The evaluation of these was performed on the basis of two types of criteria: factors (integrity, specificity, exemplary quality – representativeness, rarity, paleogeographical value, sites of special interest) and indicators (dimension, geometrical configuration of the types of relief, composition, age, geodiversity, number of relief types, their aggregation and distribution, the context, the environment, the morphogenetic activity, their functionality etc.).

By approaching this subject, the authors have pursued a double goal: a scientific one, namely to identify, classify, create a hierarchy and map the geomorphosites in the Ialomița Subcarpathians (with a projection towards a possible selection of natural monuments) and a practical one, specifically to evaluate the touristic potential of each geomorphosite, in order to integrate them as beneficially as possible in the economic circuit.

The selection, the characterization and the evaluation of the geomorphosites in this Subcarpathian sector has respected a methodology that has come to light increasingly clearly in the applied geomorphological studies, not only abroad but also in our country. The results obtained can constitute a support for the specialized agencies

from Dâmbovița and Prahova County, concerned with the touristic development through the promotion of new interesting touristic destinations for the young generation and the general public.

In the Ialomița Subcarpathians, we have identified and evaluated a number of eight geomorphosites. Two of them could become part of a tourist circuit in a future stage (Cheile Dâmboviței and Malu de Răsună), while the sandstones from the area of Miculeşti – Bela and Râpa Şoimilor could be declared *natural monuments*.

2. Methods

In order to identify and evaluate the geomorphosites in the Ialomița Subcarpathians from a qualitative and a quantitative point of view, we have considered a series of features and criteria, namely those agreed upon by the specific studies in this domain.

Pralong (2005) and Reynard (2006) from the University of Lausanne, in their evaluation of the geomorphological sites, use four sets of criteria and features, quantified by scores from 0 to 1: the *scenic criterion* (number of observation points, average distance to the observation points, area covered, height, chromatic contrast with the neighborhoods), the *scientific criterion* (paleogeographic interest, representativeness, rarity, integrity, ecological importance), the *cultural criterion* (cultural traditions, iconographic representations, historical and archeological importance, religious importance, cultural and artistic events), and the *economic criterion* (accessibility, natural risks, annual number of visitors from the region in which the site is situated, attractiveness, official level of protection).

Ielenicz (2010) synthesized, in a few synoptic tables, the features, the criteria and the scores used for assessing the geomorphosites, the criteria for the selection of the geomorphosites and the features and criteria highlighting the tourist value of a geomorphosite. The above-mentioned author has valorized the data of the foreign and Romanian specialized literature in connection to this theme as well as his own viewpoints on this topic. So, in order to choose the geomorphosites in a geographic unit, the following features were retained: physiognomy, frequency, relation to other types of geosites, accessibility, endowments, types of tourist activities, importance for the regional development.

The identification work, through observations in the field and through the analysis of large-scale topographic maps, has allowed us to classify and map, describe and evaluate a number of eight geomorphosites in the Ialomița Subcarpathians.

3. Results

3.1. Identification, classification and mapping of the geomorphosites in the Ialomița Subcarpathians

In the Ialomița Subcarpathians, there are certain forms of relief that can be included in the category of geomorphosites. These are forms that, trough their specificity and representativeness, rarity or even uniqueness, or their spectacular aspect, appear as sites of a special scientific interest for the specialists, as sites that have gradually become - to the population and the collective perception - true landmarks on topographic maps, in localities' monographs, in specialized scientific papers, and in tourist guides. All these features signal a certain touristic potential for the respective geomorphological sites.

The landforms that we are referring to are conditioned by the petrographic and structural peculiarities, brought to light by specific modeling agents (fluvial erosion, torrential erosion) or by certain gravitational processes (landfalls, landslides etc.). Such is the case of the petrographic and structural scarps, of the precipices resulted following erosion or landslide processes (often strongly affected by ravines), of the prominent erosion witnesses (hills, mounds, cliffs/rocky ridges), of the sandstones visible in the relief (Loghin, 2000).

Their scientific importance is given by the fact that, being representative for the morphology of this geographic unit, they can constitute landmarks for morphogenetical and morphodynamic theories.

The practical value derives from those dimension- and shape-related features that make them impressive, spectacular or scenic, turning them into tourist destinations. They are places increasingly frequented, often by pupils (during hiking and trips), by students (during their field-trips, for instance by the bachelor and master students of the Geography Department of the Valahia University of Târgovişte), and also by the general public (during different leisure activities).

Through their intrinsic features, through their reflex in the landscape, some geomorphosites from the Ialomița Subcarpathians are or can be proposed as natural monuments or as protected areas. For example, the Dâmbovița Gorges (Cheile Dâmboviței) from Cetățeni are included among the sites NATURA 2000, while the sandstones from the area of Miculeşti – Bela (in the north of Pucioasa Town) and the Râpa Şoimilor gully (in the area of Cricovul Dulce springs) meet the necessary requirements to be declared "natural monuments".

The diversity of the selected geomorphosites has obliged us to use the classification operation first and then to proceed to their typological mapping. In their classification, we have applied the genetic criterion for the relief forms. The following have been identified:

- *Gorges*: Cheile Dâmboviței at Cetățeni;

- *Structural and petrographic escarpments* in form of cuesta scarps cut in brittle sandstones with a monocline or quasi-horizontal stratification: Râpa Șoimilor, in the source area of the Cricovul Dulce, along Costișata Valley; Malu de Răsună, in the upper Bizdidel catchment, upstream of Bezdead locality; Râpa Obrocea, Cuesta in the in the source area of the Râu Alb River;

- *Fluvial erosion scarps*, with the appearance of terrace structures at the surface, bringing to light the succession of gravels, loesses and fossil quaternary soils: the escarpment carved by the Prahova River in the front of Câmpina terrace, downstream of the confluence with the Doftana River, north of the Cocorăștii Caplii locality;

- *Salt massifs*: the salt massif from Ocnița, modeled by dissolution (clints), erosion and rockfalls;

- *Petrographic outliers*: the cliff Colțul Bratei, situated in the upper side of the left slope of Ialomița Valley, within the perimeter of Buciumeni commune, the peak Cetățuia, on the interfluve Bărbulețu – Valea Largă, the escarpment Piatra Corbului, on the interfluve Râul Alb – Ialomicioara;

- *Sandstones* which have come to light in the relief (interfluve, slope and riverbed sandstones): on the interfluve Ialomița – Bizdidel (in the area of Bela village, which is part of Pucioasa town), on the right slope of Bizdidel valley and in the riverbed of Bizdidel river, upstream from Miculeşti (Pucioasa) (Loghin et al, 2005).

A particular category of geomorphological points having a touristic value is that of the highest points in a relief unit, which are important not by themselves, but by the fact that their dominant position and their uniqueness provides them the quality of revealing observation points, with a large panorama over the relief and the geographic setting as a whole. They are points from which the geographers and the geologists carry out general scientific observations, they are belvedere points for tourists and for all those who love to see new, spectacular, charming and relaxing sights. These points are generally situated along the line of the highest peaks, representing the watersheds or the upper area of the hills.

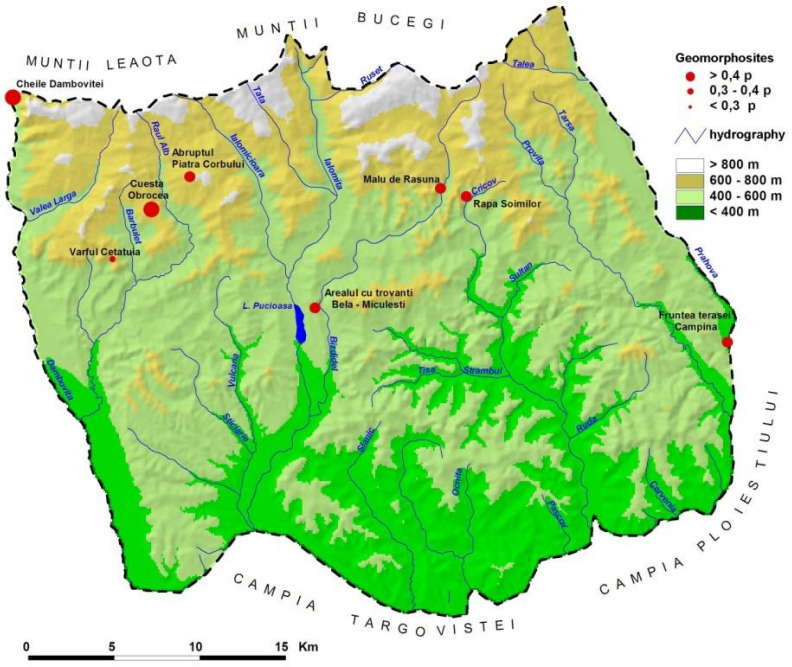

Fig. 1. **The geomorphosites in the Ialomița Subcarpathians according to their global value**

3.2. Evaluation and hierarchy of the geomorphosites in the Ialomița Subcarpathians

The evaluations carried out for the geomorphosites of the Ialomița Subcarpathians have relied on the criteria and scores proposed by Pralong (2005). We are referring to the scenic, scientific, cultural and economic criteria and their scores range from 0 to 1. We would like to mention that these evaluations have provided almost identical scores to those

carried out on the basis of the criteria and scores proposed by Ielenicz (2010).

The eight geomorphosites selected following our field research were characterized based on standard sheets. These standard sheets helped us select scores for each sequence and they represented the criterion based on which we were able to calculate the sites' global value. The analytical and the synthetic values, as well as the structural diagrams have allowed us to put down the following ideas:

- the scores summed up for each criterion by every of the eight geomorphosites from the Ialomița Subcarpathians are quite close to each other: 0.7 – 0.35 for the criterion *scenic value*, 0.750 – 0.375 for *scientific value*, 0.2 – 0 for *cultural value* and 0.65 – 0.35 for *economic value*. The maximum differences are of about 0.3. They give these sites a comparable importance and a similar eligibility degree (Tables 1, 2, 3, 4);

- the highest scores have been obtained, in order, by the criteria: *scientific value* (4.571), *economic value* (4.25) and *scenic value* (4.15) (Fig. 2). The cultural criterion gathered the lowest score for each of the destinations under analysis (0.25) (Fig. 3);

- the highest *scenic value* was obtained for Cheile Dâmboviței (0.70), the maximum *scientific value* also for Cheile Dâmboviței (0.750), while the highest *economic value* corresponds to Malu de Răsună (0.65); the second place is occupied by: Cuesta Obrocea and Râpa Șoimilor (0.60) in terms of *scenic value*, the sandstones from the area of Bela – Miculești (0.666) in terms of *scientific value*; Cuesta Obrocea in terms of *economic value* (0.60) (Tables 1, 2, 3 and 4);

- after summing up the scores obtained according to the evaluation criteria, it was possible to calculate the global value and the hierarchy of the geomorphosites from the Ialomița Subcarpathians (Table 5, Figs. 1 and 3). On the first three places are situated: Cheile Dâmboviței with a general score of 0.5125, Cuesta Obrocea (0.50625), Malu de Răsună (0.42275). So, the maximum global score is held by Cheile Dâmboviței (0.5125), while the minimum global score pertains to the Cetățuia peak (0.30625), with a significant difference.

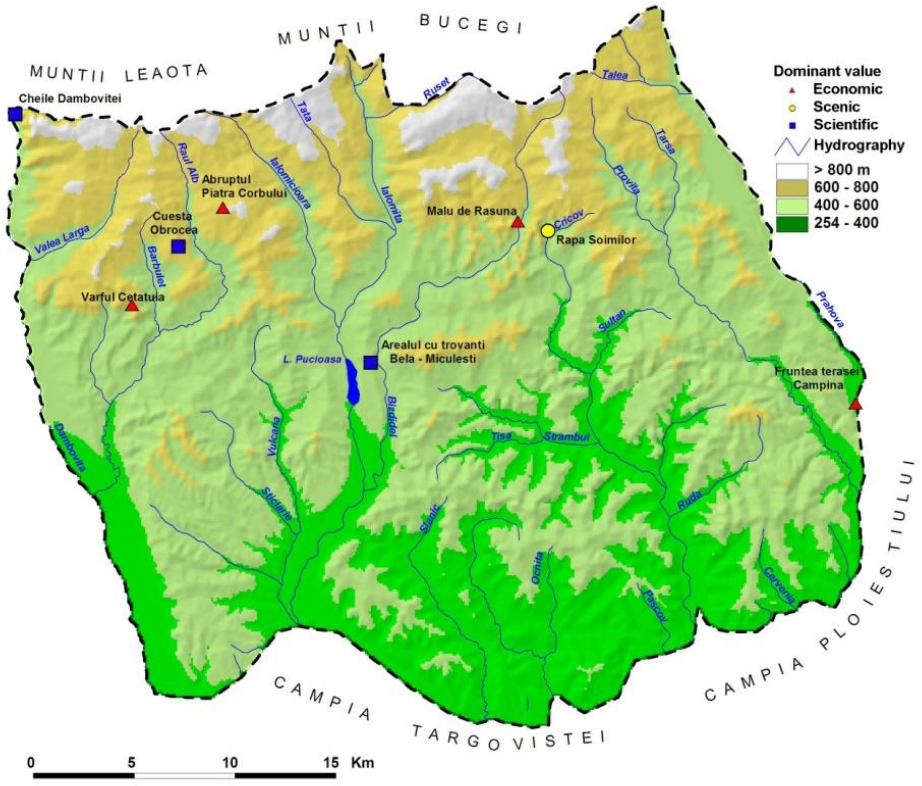

Fig. 2. **The geomorphosites in the Ialomița Subcarpathians according to the dominant value in their score**

Table 1. **Scenic value of the geomorhosites**

No.	Name of the geomorphosite	Scenic value					
		Sc_1	Sc_2	Sc_3	Sc_4	Sc_5	Total
1.	The gorge Cheile Dâmboviței	0.25	1	1	1	0.25	**0.70**
2.	The hill Cuesta Obrocea	0.75	0.75	0.25	0.25	1	**0.60**
3.	The peak Vârful Cetățuia	0.5	0.5	0.25	0.5	0	**0.35**
4.	The escarpment Piatra Corbului	0.5	0.5	0.5	0.25	0.5	**0.45**
5.	Malu de Răsună (The Sounding Slope)	0.5	0.75	0.25	0.5	0.5	**0.50**
6.	T he ravine Râpa Șoimilor	0.5	0.75	0.5	0.75	0.5	**0.60**
7.	The sandstones in the area of Miculești – Bela	0.5	0.25	0.75	0.25	0.5	**0.45**
8.	The front of Câmpina terrace, downstream from the Prahova – Doftana confluence	0.25	0.25	0.5	0.5	1	**0.50**

Table 2. **Scientific value of the geomorhosites**

No.	Name of the geomorphosite	Scientific value						
		$Șt_1$	$Șt_2$	$Șt_3$	$Șt_4$	$Șt_5$	$Șt_6$	Total
1.	The gorge Cheile Dâmboviței	1	1	1	1	0.5	0	**0.750**
2.	The hill Cuesta Obrocea	0.25	0.75	0.25	1	1	0.5	**0.625**
3.	The peak Vârful Cetățuia	0.25	0.25	0.25	0.25	1	0.25	**0.375**
4.	The escarpment Piatra Corbului	0.25	0.5	0.5	0.5	1	0.5	**0.541**
5.	Malu de Răsună (The Sounding Slope)	0	1	0.5	0.5	1	0.25	**0.541**
6.	T he ravine Râpa Șoimilor	0	1	0.5	0.5	1	0.5	**0.583**
7.	The sandstones in the area of Miculești – Bela	0	1	1	1	0.75	0.25	**0.666**
8.	The front of Câmpina terrace, downstream from the Prahova – Doftana confluence	0.75	0.75	0.5	0.5	0.5	0	**0.500**

Table 3. **Cultural value of the geomorhosites**

No.	Name of the geomorphosite	Cultural value					
		C_1	C_2	C_3	C_4	C_5	Total
1.	The gorge Cheile Dâmboviței	0	0.25	0	0	0	**0.05**
2.	The hill Cuesta Obrocea	0	0	0	0	1	**0.20**
3.	The peak Vârful Cetățuia	0	0	0	0	0	**0.00**
4.	The escarpment Piatra Corbului	0	0	0	0	0	**0.00**
5.	Malu de Răsună (The Sounding Slope)	0	0	0	0	0	**0.00**
6.	T he ravine Râpa Șoimilor	0	0	0	0	0	**0.00**
7.	The sandstones in the area of Miculești – Bela	0	0	0	0	0	**0.00**
8.	The front of Câmpina terrace, downstream from the Prahova – Doftana confluence	0	0	0	0	0	**0.00**

Table 4. **Economic value of the geomorhosites**

No.	Name of the geomorphosite	Economic value					
		E_1	E_2	E_3	E_4	E_5	Total
1.	The gorge Cheile Dâmboviței	0.5	1	0	0.75	0.5	**0.55**
2.	The hill Cuesta Obrocea	0.75	0.75	0	1	0.5	**0.60**
3.	The peak Vârful Cetățuia	0.5	0.75	0	1	0.25	**0.50**
4.	The escarpment Piatra Corbului	0.25	1	0	1	0.25	**0.50**
5.	Malu de Răsună (The Sounding Slope)	0.75	1	0	1	0.5	**0.65**
6.	T he ravine Râpa Șoimilor	0.25	0.25	0	1	0.25	**0.35**
7.	The sandstones in the area of Miculești – Bela	0.75	0.25	0	1	0.5	**0.50**
8.	The front of Câmpina terrace, downstream from the Prahova – Doftana confluence	1	0.5	0	1	0.5	**0.60**

Table 5. **Global value of the geomorhosites**

No.	Name of the geomorphosite	Scenic value	Scientific value	Cultural value	Economic value	Global value
1.	The gorge Cheile Dâmboviței	0.70	0.75	0.05	0.55	**0.51250**
2.	The hill Cuesta Obrocea	0.6	0.625	0.2	0.6	**0.50625**
3.	The peak Vârful Cetățuia	0.35	0.375	0	0.5	**0.30625**
4.	The escarpment Piatra Corbului	0.45	0.541	0	0.5	**0.37275**
5.	Malu de Răsună (The Sounding Slope)	0.5	0.541	0	0.65	**0.42275**
6.	T he ravine Râpa Şoimilor	0.6	0.583	0	0.35	**0.38325**
7.	The sandstones in the area of Miculeşti – Bela	0.45	0.666	0	0.5	**0.40400**
8.	The front of Câmpina terrace, downstream from the Prahova – Doftana confluence	0.5	0.5	0	0.6	**0.40000**

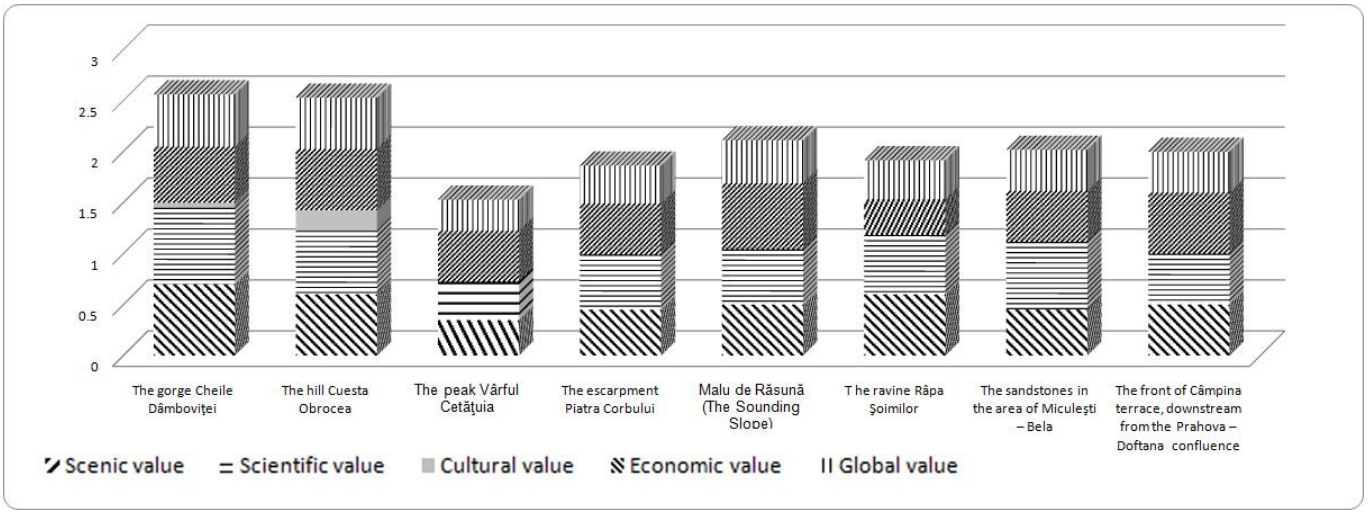

Fig. 3. **Diagram representing the value-related structure of the geomorphosites in the Ialomița Subcarpathians**

4. Conclusions

We consider that this evaluation and hierarchy reflects the objective reality, so that it could offer to decision makers a base to prioritize in integrating, managing and touristically exploiting these destinations. This is an action that we envision as one that should be undertaken along with the protection of the geomorphosites having a final goal the inclusion of some of them into the category of natural monuments or protected areas. In this sense, we consider that the geomorphological sites of Cheile Dâmboviței (Cetățeni) and Malu de Răsună (translated: *The Sounding Slope*) (Bezdead) meet the most adequate conditions for their integration, as soon as possible, in the touristic management and exploitation circuit. At the same time, we propose that the geomorphosites represented by the sandstones from the Miculeşti – Bela area (Pucioasa) and the Râpa Şoimilor gully (source area of the Cricovul Dulce river) should receive the status of *natural monuments*.

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Valahia University of Târgoviște,
***Faculty of Human Sciencies*,**
Lt. Stancu Ion, 35, 130105, Targoviste, Romania
muratoreanug@yahoo.com