GeoJournal of Tourism and Geosites Year **VII**, no. **2**, vol. **14, November 2014**, p.**178-184**
ISSN **2065-0817**, E-ISSN **2065-1198** Article no. **14108-163**

THE GEOSITES FROM DANUBE DEFILE IN ROMANIA. THE VULNERABILITY TO TOURISTIC ACTIVITIES

Florina GRECU*
University of Bucharest, Faculty of Geography, Geomorphology, Pedology and Geomatics Department
Blv. Nicolae Balcescu 1, Sector 1, Bucharest 010041, Romania. E-mail: florinagrecu@yahoo.com

Daniel IOSIF
University of Bucharest, Faculty of Geography, International Study Center on Danube River
Blv. Nicolae Balcescu 1, Sector 1, Bucharest 010041, Romania. E-mail: iosif.daniel@ymail.com

Abstract: This paper aims to a better understand of the geosites of Danube Defile in Romania, from the point of view of vulnerability to touristic activities. The Iron Gates Natural Park is an important area for geoconservation in Romania, as its geological heritage is among the richest in the South Carpathians. The series of structural units, typical for the South Carpathians, crossed by the Danube, shows unique features from paleontological, structural and morphological points of view, making the Park one of the most interesting areas in Geosciences, for research and education. Our introductory study of vulnerability of geological and geomorphological elements from Danube Defile is made from the *geosites* point of view. Geosites (term which include also the geomorphologic sites) are relief forms with a scientific, aesthetical, ecological, economical, and cultural value, in respect of human perception, that complete the total heritage of a given territory, including the biodiversity and human creation. In the last decades we assist to an increasing interest according to vulnerability studies. The specialty literature emphasizes the importance of measuring vulnerability to find new criteria and indicators to measure directly the vulnerability and the natural hazards. The geosites from Danube Defile are important geological and geomorphological elements of natural environment which start to become touristic attractions. In those conditions, it is necessary to initiate same studies regarding the vulnerability of those geosites in the local context of touristic development.

Keywords: Danube Defile, Romania, geosites, vulnerability, touristic activities

* * * * * *

INTRODUCTION

On our study area several studies concerning the geology and the geomorphology were made (Posea et al., 1963; Posea, 1964; Popa, 2003, 2011; Grecu et al., 2011; Carablaisa & Şelău, 2010) but any study concerning the vulnerability to natural risks of geological and geomorphological elements. Our approach aim for the geosites and geomorphosites from the Danube Defile (Iron Gates) in Romania in a particular perspective which is integrated in the large field of vulnerability and natural risks. In the

* Corresponding author

last decades we assist to an increasing interest according to vulnerability studies. The specialty literature emphasizes the importance of measuring vulnerability to find new criteria and indicators to measure directly the vulnerability and the natural hazards. Despite those contemporary researches, at this time there is no wide standard application unanimously accepted. Quantitative representation using attributes such as small vulnerability, medium vulnerability or great vulnerability always include quantitative analyses and only sometimes indirect assessments based on material damage and / or human loses (Grecu, 2009).

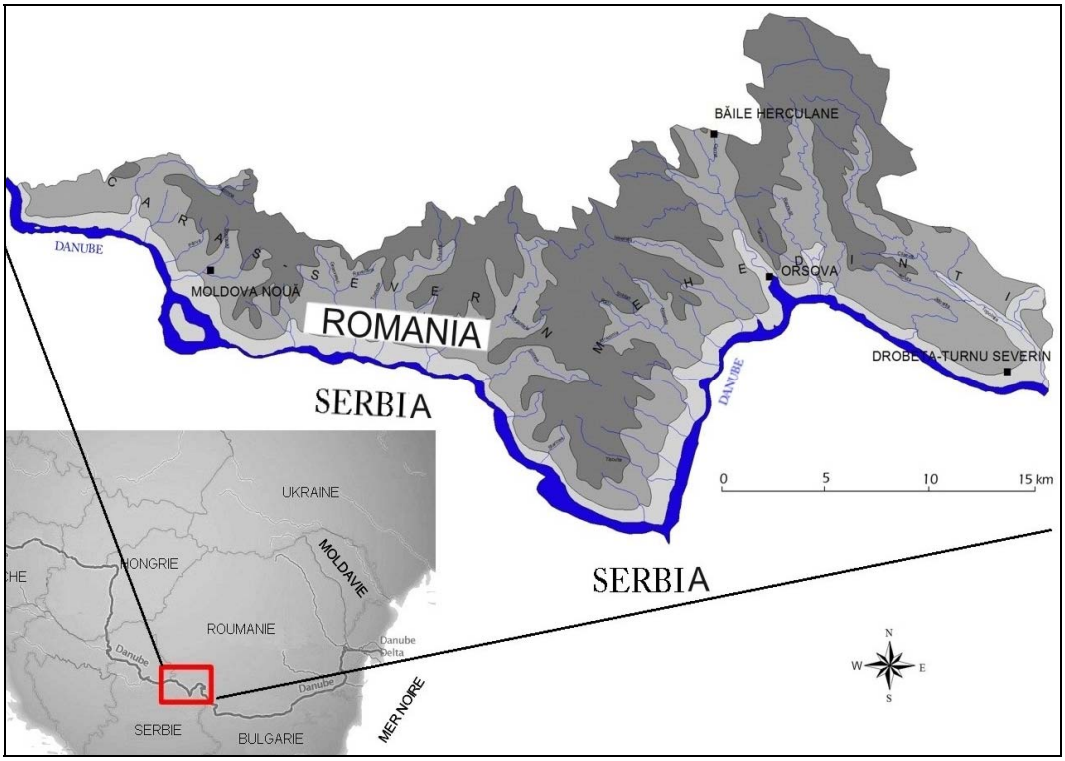

Figure 1. Localization of the Danube Defile in the south-western part of Romania,border with Serbia

STUDY AREA

The Danube Defile on the Romanian side is a valuable natural unit of a character unique along the entire 2,875 km length of the Danube. A lithological and morphological variety in the relief, a climate with sub-Mediterranean influences, a complex biotic cover, as well as a multitude of historical, cultural and religious remains, lend the landscape an aspect of originality. Historical relics attest to thousands of years of human habitation on this territory. To the West, the boundary of the park coincides with that of Baziaş village, while to the South; the limit follows the Danube watercourse downstream to the dam at Gura Vaii (Figure 1). To the north, the boundary follows the southern flanks of the Locva Mountains, partly includes the Almăj Mountains and almost the entire area of the Mehedinţi Mountains (Pătroescu & Vintilă, 1997). The Danube Defile in Romania is best known by the name of Iron Gates.

The Iron Gates are situated in the aria between Baziaş locality and Drobeta Turnu-Severin city (Caraş-Severin and Mehedinţi County) for a distance of about 140 km. The name applies to the region where the Danube River cuts through the

Carpathian Mountains forming a spectacular defile. Geologically and geomorphologically, the Iron Gates is a very complex region. The Danube valley defines here a multitude of microreliefs and reveals most of geodiversity (Iosif, 2012). The geologists call this region „a museum in open air", the diversity of geology being the main characteristic of this region, characteristic which confers to the Iron Gates a great scientific potential (Figure 2).

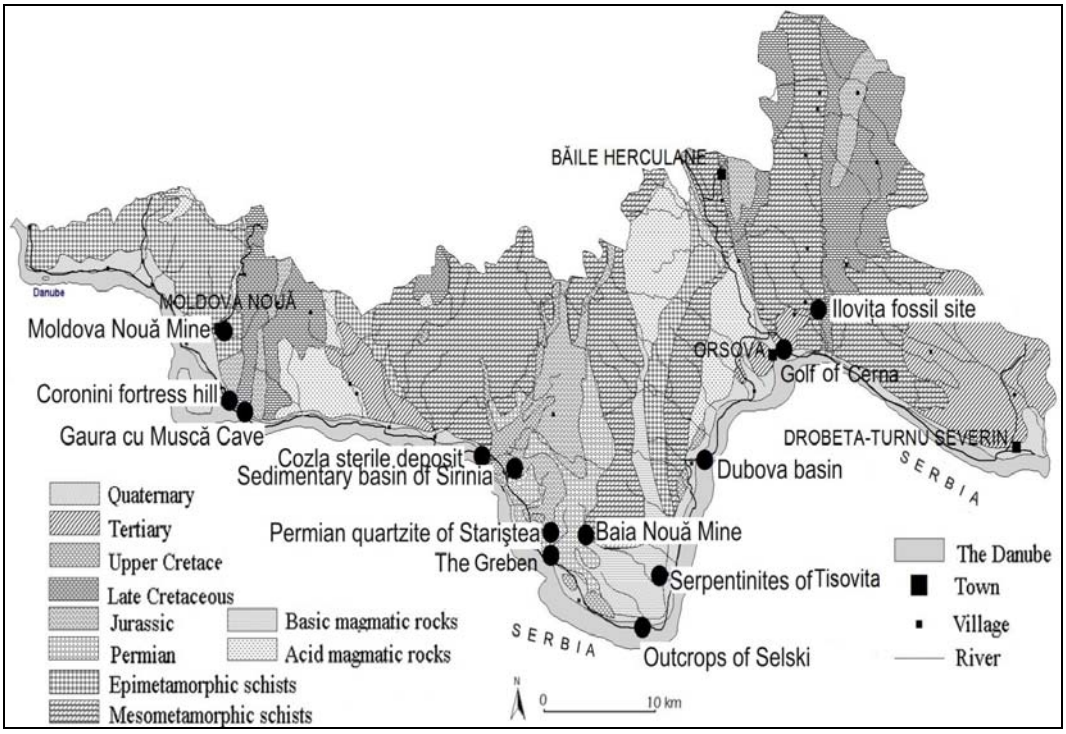

Figure 2. The geosites from Danube Defile those are accessible from the main road

METHODOLOGY

Geosites (term which include also the geomorphologic sites) are relief forms with a scientific, aesthetical, ecological, economical, and cultural value, in respect of human perception, that complete the total heritage of a given territory, including the biodiversity and human creation (Panizza, 2001; Panizza & Piacente, 1993; Pralong, 2006; Reynard, 2008; Reynard & Coratza, 2005; Reynard et al., 2007; Reynard & Coratza, 2007; Ilieş & Josan, 2009; Grecu & Iosif, 2014).

Our analysis takes in consideration the human accessibility to those geosites. In this case and considering that in our region function just one single road (from Baziaş to Turnu-Severin) we have split our inventoried geosites in two groups: one group of geosites which are near the road (and accessible for great public) and the second group of geosites which are far away from the main route, isolated (and inaccessible for great public). Taking this criteria to our analyze, we must mention that this study region is poorly equipped concerning the accessibility. There is just one main road, along the Danube, a national road that presents, in places, very bad sectors.

RESULTS & DISCUSSIONS

By field experience of the authors and by a work consisted in many discussions with another specialists in the geology, geomorphology and physical

geography of the analyzed region, we could identify 40 geosites in the Danube Defile. We must mention that we inventoried just the geosites which can be one way or another, touched by the tourist activities.

From the possible typology presented above and consisted in ten types of geosites we find in Danube Defile seven types of geosites vulnerable to touristic activities. The Table 1 presents all the 40 geosites and the typology consisted in seven classes, corresponding to seven morphogenetic processes.

Table 1. All the 40 inventoried geosites from Danube Defile and their typology

Nº	NAME OF GEOSITE	TYPE
1	Statue of King Decebalus	Anthropic
2	Baia Nouă mine	Anthropic
3	Moldova Nouă mine	Anthropic
4	Cozla's sterile deposit	Anthropic
5	Quarry of Iuți	Anthropic
6	Big Cazans	Geomorphologic
7	Small Cazans	Geomorphologic
8	Karstic plateau of Ciucaru Mare	Geomorphologic
9	Curchia waterfall	Geomorphologic
10	Mraconia collapse	Geomorphologic
11	Liubotina landslide	Geomorphologic
12	Coronini fortress hill	Geomorphologic
13	Babacaia rock	Geomorphologic
14	Golf of Cerna	Hydrologic
15	Basin of Dubova	Hydrologic
16	Saraorski valley	Paleontological
17	Iloviţa fossil site	Paleontological
18	Curchia fossil limestone	Paleontological
19	Trescovăţ volcanic dome	Petrographical
20	Urgonian limestone-bars of Dubova	Petrographical
21	Outcrops of Selski	Petrographical
22	Permian quartzite of Staricştea	Petrographical
23	Permian tuffs of Povalina	Petrographical
24	Serpentinites of Tişoviţa	Petrographical
25	The Greben	Petrographical
26	Outcrops of Jeliseva	Petrographical
27	Sedimentary basin of Sirinia (Cozla)	Sedimentary
28	Conglomerates of ancient Zancleen delta	Sedimentary
29	Moldova Veche island	Sedimentary
30	Sedimentary basin of Sirinia (Munteana)	Sedimentary
31	Ponicova cave	Speleological
32	Gaura cu Muscă cave	Speleological
33	Veterani cave	Speleological
34	Climente cave	Speleological
35	Gaura Haiducească cave	Speleological
36	PadinaMatei cave	Speleological
37	Zamoniţa cave	Speleological
38	ValeaCeuca cave	Speleological
39	Cioaca Borii cuesta	Structural
40	Zelişte-Veligan natural amphitheatre	Structural

Conform to the methodology presented above, first step was to split our inventoried geosites in two groups: one group of geosites which are near the road (and accessible for great public) and the second group of geosites which are far away from the

main route, isolated (and inaccessible for great public). The Figure 2 shows the geosites that are accessible for tourists from the main road that follows the Danube valley from East to West (from Drobeta Turnu Severin to Moldova Noua and Bazias).

To mention that three of them (Ilovita fossil point, Baia Noua and Moldova Noua mines) are not on the main road but they are very well accessible from secondary roads. We have identified 13 geosites which are particularly sensible to touristic activities. Those geosites cover seven types, which demonstrates that the issue of vulnerability in Danube Defile is a very significant aspect and touch important geological and geomorphological sites.

Contrary to those geosites, we have found also 11 elements that are not on the main road, but inside of the territory, far away from the touristic areas. Generally, the touristic activities are spread only along the Danube River, in the villages founding here. In the north of Danube waters, the mountains areas and the poorly accessibility made to exist few villages, bad roads and, consequently, no touristic activities in present.

However, the areas situated north of Danube River are very riche in geological and geomorphological sites. Only the five types of those geosites emphasis the poorly accessibility of those areas and therefore a smaller attention from the researchers. This methodology and result are perfectly correlated with the theory that argues that the vulnerability and damage of a geological region is directly linked by his accessibility and especially by his touristic exploitation. The more a region is accessible, the higher it is exposed to human pressure.

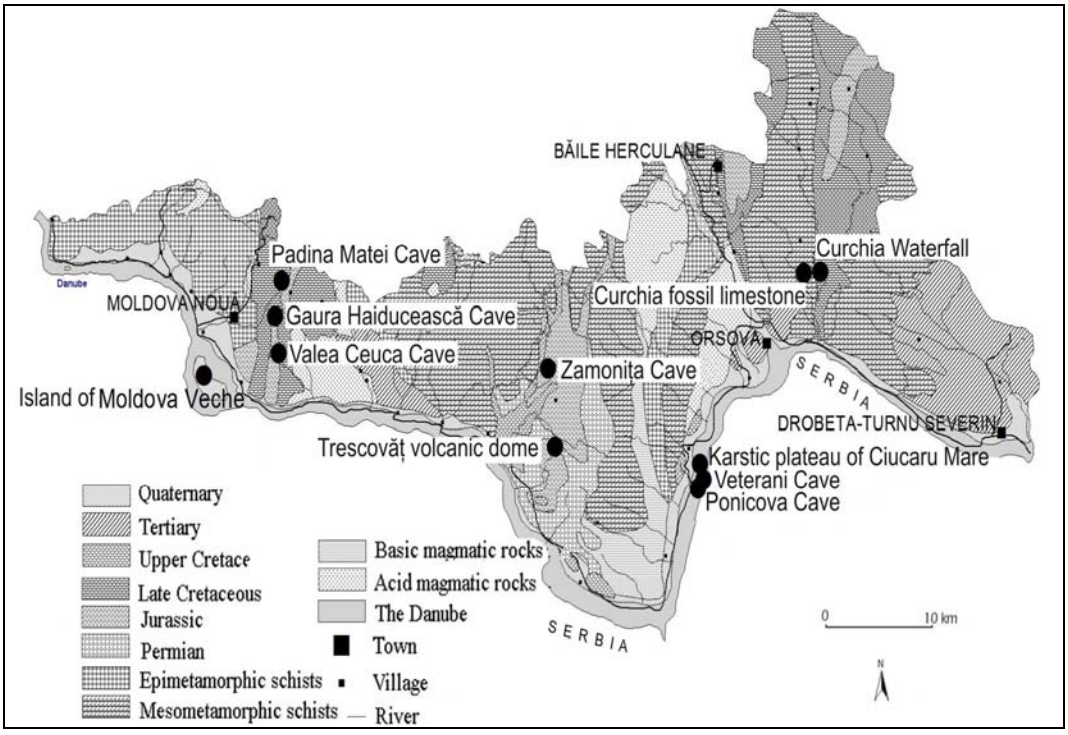

Figure 3. The geosites from Danube Defile that have no good accessibility (inland geosites)

In this second category of geosites we find important elements as the volcanic dome of Trescovat (a relevant geosites from our region, a Permian witness of Iron Gates geology) or several caves (good samples for almost intact cave environments). In addition to those speleological sites, we fund another three geosites (carstic plateau of Ciucaru

Mare and Curchia limestone and waterfall) which emphasis the presence of large limestone percentage in this area (Figure 3).

The limestone is a preferred rock for the Danube Defile geosites. We must also mention that some geosites integrated in this second category are not very far from the main road. It is the case of the carstic plateau of Ciucaru Mare and the caves of Veterani and Ponicova. Despite the fact that they are not so far from the main road, they present however some inaccessible features. For example, the carstic plateau is at 300 m altitude just above the main route. To arrive there, the tourist must mount a slope quite inclined, in approximately one hour. In these conditions, the geosite is practically inaccessible for the big public. The same thing with the Ponicova and Veterani caves.

The Veterani cave is near the road but the entrance is made only from the Danube, in a boat. For the Ponicova cave, the tourist must follow a dry carstic valley (very inaccessible because of its big limestone rocks) and then to descend several wooden stairs, also very instable. In this cases, the inaccessibility of geosites prevent the degradation of them under the touristic pressure.

However, all those sites present a basic vulnerability. For example, the geosites are visited by few tourists (comparable to the first category of geosites), but we have remarked that they to a lot of damage to geosites, especially by disrupting the outcrops or the geosites microformes (i.g. disruption of the stalactites and stalagmites of the caves). The Curchia limestone and the Ilovita fossil points were very affected by the tourists sampling and removing the paleontological in situ elements.

CONCLUSIONS

During the last two decenniums, in the countries which has contact with the Alps Mountains (Switzerland, Italy, France), desiring to express as eloquently as possible the connections between a large part of the relief forms and sometimes between the geologic/geomorphological processes and geotourism (especially in the sense of valorizing them for different tourist activities), in the specialized literature was introduced the term of „geosite".

The meaning was that of morphological element (indicated as process or form of relief) with a certain value for tourism. It can also be a reply to some terms (archeological site, historical site) used with a very high frequency in these states with an extremely rich history.

Despite the great number of geosites in the Danube valley of Iron Gates, few of them are utilizable in touristic and geotouristic activities. The main problem is the access possibilities, especially the lack of roads. From west to est, along all the Iron Gartes region there is only a road which lies almost long ways to Danube valley (DN 57). Along this road there is a series of geosites which presents same popularity between tourists and, consequently, are the only which are visited.

After field experience we observed that those geosites are degraded by the tourists in various levels. This article is a first attempt to draw the attention about the vulnerability of some very important geo(morpho)sites from the Danube Defile in Romania. Those geological and geomorphological sites represent the most important data in analyzing the geomorphology and the morphogenesis of Danube valley, aspects which are not totally clarified to the present.

Contrary to those sites which are near the main road, there is also o great number of geosites situated inland. This means that their accessibility is not an easy one. Consequently, this sites are not visited at all, except some specialists (geologists, geomorphologists etc.) which make their scientific documentation.

Our attention will focus in the futures studies on the vulnerability of all those geosites against the degradation made by the touristic activities. At this moment we work at a methodology to better quantify this touristic vulnerability (quantitative and

qualitative). Finally, we express our regret that this study was concentrated just on the Romanian side of Danube Valley. It was very interesting to analyze also the Serbian side and to have a complete image of the Danube gorges. Our futures studies will focus on this direction to.

REFERENCES

Carablaisa, S., Şelău, N., (2010), *Geomorphological processes in the Danube Defile. Case study: the Liubotina slide and the Mraconia collapse.* Revista de geomorfologie 12: 91-95.

Grecu, F., (2009), *Riscuri şi Hazarde Naturale,* Editura Universitară, Bucureşti.

Grecu, F., Carablaisă, S., Zaharia, L., Ioana-Toroimac, G., (2011), *Les précipitations – facteur de la dynamique des versants dans le défilé du Danube (Roumanie)*, Les climats régionaux: observations et modélisation 349-54.

Grecu, F., Iosif, D., (2014), *La notion du Géosite et son pertinence dans une étude sur la région des Gorges du Danube en Roumanie* (in press), Analele Universităţii Bucureşti: Seria Geografie LXIII.

Ilieş, D., C., Josan, N., (2009), *Geosites - geomorphosites and relief*, GeoJournal of Tourism and Geosites 3: 78-85.

Iosif, D., (2012), *Les Portes de Fer sous la loupe d'une recherche des geosites, Caractéristiques géo(morpho)logiques et enjeux,* Cinq Continents 2(6): 216-230.

Panizza, M., (2001), *Geomorphosites: concepts, methods and examples of geomorphological survey*, Chinese Science Bulletin 46: 4-5.

Panizza, M., Piacente, S., (1993), *Geomorphological assets evaluation*, Fur Geomorphologie N.F. Suppl.Bd. 87: 13-18.

Pătroescu, M., Vintilă, G., (1997), *Natural, cultural and historical potential for tourism of the Iron Gates National Park*, Geographica Pannonica 1: 35-38.

Popa, M., E., (2003), *Geological heritage values in the Iron Gates Natural Park, Romania*, Proceedings of the First International Conference on Environmental Research and Assessment, Editura Ars Docendi, Bucharest.

Popa, M., E., (2011), *Geologia parcului natural Porţile de Fier, Note de curs pentru rangerii parcului,* Note de curs, Bucuresti.

Posea, G., (1964), *Defileul Dunării. Natura*, Seria Geografie-Geologie 1: 45-50.

Posea, G., Grigore, M., Popescu, N., (1963), *Observaţii geomorfologice asupra defileului Dunării*, Analele Universităţii Bucureşti, Seria Ştiinţele Naturii XII.

Pralong, J-P., (2006), *Géotourisme et utilisation de sites naturels d'intérêt pour les sciences de la Terre : Les régions de Crans-Montana-Sierre (Valais, Alpes suisses) et Chamonix-Mont-Blanc (Haute-Savoie, Alpes françaises)*. Université de Lausanne, Lausanne.

Reynard, E., (2004), *Géotopes, géo(morpho)sites et paysages géomorphologiques*, in Reynard, E., Pralong, J-P., eds, Paysages géomorphologiques - Compte-rendu du séminaire de 3ème cycle. Institut de Géographie, Lausanne.

Reynard, E., (2008), *Scientific research and tourist promotion of geomorphological heritage*. Geogr. Fis. Dinam. Quat. 31: 225-30.

Reynard, E., Coratza, P., (2005), *Geomorphological sites: research, assessment and improvement. A working group of the International Association of Geomorphologists (IAG)*, Final Report 2001-2005, Lausanne.

Reynard, E., Coratza, P., (2007), *Geomorphosites and geodiversity: a new domain of research*, Geographica Helvetica 62: 138-39.

Reynard, E., Fontana, G., Kozlik, L., Scapozza, C., (2007), *A method for assessing „scientific„ and „additinal values„ of gemorphosites*, Geographica Helvetica 62: 148-58.

Submitted:	Revised:	Accepted and published online
10.06.2014	25.09.2014	29.09.2014