

GEOCONSERVATION IN SERBIA: BACKGROUND, CURRENT STATE, AND PERSPECTIVE

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Abstract. The basic geodiversity-related terminology is presented together with an overview of the past, present and future initiatives on geoconservation in Serbia. Geoconservation involves a set of actions with focus on protecting, conserving, presenting and promoting the geodiversity and geoheritage values through the application of acquired knowledge and practices in the field of scientific and professional research, education, legislation, spatial and urban planning and tourism. The territory of Serbia is a rich patrimony of various geodiversity and geoheritage objects, which represent an integral part of the five major geotectonic units: 1) the Carpathian-Balkanides of eastern Serbia, 2) the Serbian-Macedonian Massif, 3) the Vardar Zone, 4) the Dinarides of western Serbia and 5) the Pannonian Basin. Prior to 1995, 75 objects were protected, while additional 19 more geoheritage sites are in the process of protection. Evaluating the current state of art in geoconservation, several further steps are proposed to intensify work on geoheritage protection in Serbia: a) continue the inventory of immovable and moveable geoheritage; b) increase public awareness of the importance of geoheritage; c) ensure the support of planners, and strategic stakeholders for geoconservation; d) allocate the funds and provide the support for geoconservation-related projects; e) enhance capacity-building in geoconservation, including new geological specialists: geoconservationists; f) develop a scientific base to evaluate the potential of other areas to become members of the UNESCO Global Geoparks Network.

Keywords: geoconservation, Serbia, background, current state, outlook.

Résumé. La terminologie basique liée à la géodiversité est présentée avec un aperçu des initiatives passées, présentes, ainsi que futures en matière de géoconservation en Serbie. La géoconservation implique un ensemble d'actions dirigées vers la protection, la conservation, la présentation et la promotion de la géodiversité et de ses valeurs à travers l'application des connaissances et des bonnes pratiques acquises dans le domaine de la recherche scientifique et professionnelle, de l'éducation, de la législation, du tourisme ainsi que de la planification urbaine et gestion de l'espace. Le territoire de la Serbie est un patrimoine riche en géodiversité variée – de diverses formations de géodiversité et de géohéritage qui font partie intégrante des cinq principales unités géotectoniques: 1) les Carpates-Balkanides de la Serbie orientale, 2) le Massif Serbo-Macédozien, 3) la Zone du Vardar, 4) les Dinarides de l'ouest de la Serbie, 5) le Bassin pannonien. Avant l'année 1995, il y avait 75 formations qui étaient protégées, tandis que 19 autres sites de géohéritage étaient en cours de protection. Pour évaluer l'état actuel des connaissances en matière de géoconservation, plusieurs mesures supplémentaires sont proposées pour intensifier les travaux sur la protection du patrimoine géologique en Serbie: a) poursuivre l'inventaire du patrimoine géologique mobilier et immobilier, b) sensibiliser le public à l'importance du géohéritage, c) assurer le soutien des planificateurs et des parties prenantes en management stratégique pour la géoconservation, d) allouer des fonds et apporter un soutien aux projets liés à la géoconservation, e) renforcer des capacités en matière de géoconservation, notamment en intégrant de nouveaux spécialistes en géologie: les géoconservationnistes, f) développer une base scientifique pour évaluer le potentiel d'autres zones à devenir membres du réseau mondiale des géoparcs de l'UNESCO.

Mots-clés: géoconservation, Serbie, contexte, état actuel, perspectives.

INTRODUCTION

In modern approaches, Nature represents a complex system that functions through ecosystems in which physical and chemical factors (“abiotic” or “inanimate”) interact with the living (“biotic”) ones. In the holistic understanding and conservation of nature, the two essential components represent geodiversity and biodiversity (Fig. 1).

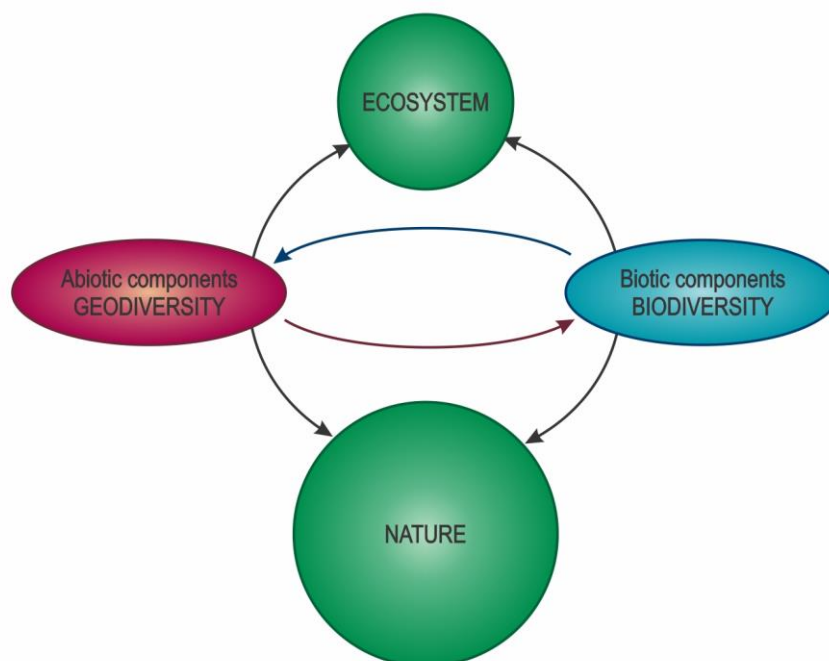


Fig. 1. Essential components of Nature (draw: A. Maran Stevanović & P. Ilić).

The term “biological diversity” was used firstly by scientist and conservationist Raymond Dasmann in 1968 and introduced to the scientific community in the 1980s by Thomas Lovejoy (Wilson, 1992). It explains the relative diversity among organisms, from genes to species, present in different ecosystems. According to the Convention on Biological Diversity (1992), biodiversity implies the variety of life on Earth in all its forms, including the variability among living organisms, genetic differences among them, communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning. The benefits of conserving biological diversity are manifold: biological resources provide all food and many medical and industrial products for humans and support their well-being through the provision of ecological services that are essential for the maintenance of soil fertility and clean, fresh water and air (UNEP-WCMC and IUCN, 2016).

The term geodiversity first appeared in a Tasmanian Forest Commission document, intending to describe the diversity of features and systems on Earth (Sharples, 1993). The Tasmanian geoscientists realized that there are many parallels between biological diversity and diversity in the abiotic world which, taken together, help promote a more holistic approach to nature conservation. Given that geodiversity relates to the overall variety of forms, phenomena and processes in the context of inanimate nature, geoheritage objects signify ‘geodiversity pearls’ – the representative phenomena of abiotic world, singled out as special natural valuables or natural resources of significance for science, education, culture and tourism (Maran Stevanović, 2015). Geoheritage can also be recognized as “those components of natural geodiversity of significant value to humans” (Dixon 1996, in Gray 2004) or “as the inheritance of rocks, soils and landforms (active and relict) and the evidence they contain that enables the history of the Earth to be unraveled” (Wilson, 1994).

The importance and value of potential geoheritage have to be estimated on the basis of all available, relevant information – the attributes of each particular phenomenon, including how representative it is, how valuable it is in terms of science, education, geoconservation and tourism, how vulnerable it is to potential threats, as well as by their comparison with the similar objects at the international, national, regional and local level (Maran, 2010).

Geoheritage objects can be grouped as immovable and moveable. Immoveable (*in situ*) geoheritage objects are areas or localities with clearly pronounced geological, geomorphological and pedological characteristics, including geological and soil profiles, ore and fossiliferous sites, surface and underground forms of relief, structural and tectonic elements, relict and active hydrogeological phenomena and processes, types of soil and their relict and active processes of formation. Moveable (*ex situ*) geoheritage objects are representative specimens of minerals, rocks and ores, fossilized remains of plants and animals, as well as the traces of their life activities, kept within the geological and natural history collections in museums and other scientific, educational and cultural institutions.

Geoconservation, a relatively young scientific discipline, combines various methods, techniques and measures of preventive, corrective and curative protection of geoheritage, through the application of acquired knowledge and good practices in the field of scientific and technical research, education, legislation, spatial and urban planning and tourism. It plays a considerable role in helping to deliver sustainable development through conserving and promoting scientifically, educationally and culturally important geoheritage features, sites and specimens of an individual region, a country's economic wealth or cultural identity.

Besides their scientific, educational and cultural significance, geoheritage objects also have great economic potential. With good management, presentation and promotion of geodiversity and geoheritage, with the support of decision-makers, active participation of all the relevant stakeholders and the provision of financial resources, multiple benefits can be achieved not only for specific regions and the local population but also for the entire national economy (Maran Stevanović *et al.*, 2016). The best examples are the geoparks from the UNESCO Global and European Networks – territories with clearly defined boundaries within which the representative geoheritage objects are protected, presented and promoted together with all other natural and cultural-historical values. In the initial European Geoparks Network, founded in 2000, four territories of similar natural and socio-economic characteristics have been selected: La Reserve geologique de Haute-Provence (France), Lesvos Petrified Forest (Greece), Maestrazgo Cultural Park (Spain) and Volcanic Eifel Nature Park (Germany). The European Geoparks Network currently comprises 70 regions in 23 countries (source: www.europeangeoparks.org) whereas the UNESCO Global Geoparks Network, established in 2004, encompasses 127 areas worldwide, including the European, Asia Pacific and African Geoparks (source: www.globalgeopark.org). All networks are non-governmental organizations under the auspices of UNESCO, which, through international partnership, develop and implement best practice models in the field of protection and conservation of natural and cultural heritage, geoheritage sites in particular. Main activities in a geopark are oriented to exploring, protecting and promoting not only internationally important geoheritage but also other valuable natural and cultural resources in the area through tourism development, aiming to stimulate and engage the local communities, enhance their socio-economic status, advance geoconservation and, create a balance between the economic growth and environmental protection (Mc Keever & Zouros, 2005).

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The territory of Serbia is the rich patrimony of various geodiversity and geoheritage objects that represent an integral part of the five major geotectonic units:

- 1) the Carpathian-Balkanides of eastern Serbia (the northern Alpine branch);
- 2) the Serbian-Macedonian Massif (the crystalline core between the Carpathian-Balkanides and the Dinarides);
- 3) the Vardar Zone (a remnant of the ancient Vardar Ocean);
- 4) the Dinarides of western Serbia (a part of the southern Alpine branch);
- 5) the Pannonian Basin (the back arc extensional basin situated between the Dinarides and the Carpathian-Balkanides).

The first data on geology of Serbia were provided by foreign scientists, mostly geologists and geographers who traveled across the country during the nineteenth century. The earliest systematic geological researches were initiated at the beginning of the last century by the founder of natural sciences in Serbia, botanist J. Pančić and anthropologist J. Žujović as well as their successors J. Cvijić, S. Urošević, S. Radovanović, P. Pavlović, V. Petković, J. Mihajlović and D. Antula.

The idea for conservation of geological sites in Serbia was born at the same time the first systematic geological investigations were undertaken. The initiative by P. Pavlović in 1924 to protect the Zlot caves in eastern Serbia was the first official proposal for conservation of particular natural monuments. A preliminary list of movable geoheritage originated in 1925; the first holotype collection, including 115 fossil specimens, was completed by P. Pavlović in 1927.

Two institutions in Serbia are responsible for the protection of geodiversity and geoheritage – the Natural History Museum in Belgrade and the Institute for Nature Conservation of the Republic of Serbia. The Natural History Museum was founded in 1895 as the first specialized institution devoted to the study of national natural patrimony. Today, the museum's collections hold approximately 3,000,000 specimens – a significant and valuable fund of the Serbia's natural and cultural heritage. Since 1948 and the foundation of the Institute for the Nature Conservation, the management of nature protection has been divided into *in situ* conservation (the Institute) and *ex situ* conservation (the Museum). Experts from both institutions work on research of nature and natural resources and the advancement, education, presentation and promotion of natural values, including geodiversity and geoheritage as their segments.

In the period 1950–1990, intensive geological activities took place all over the country and many scientifically important geological sites, outcrops and sections were discovered and explained. These investigations provided not only the basis for all further geoconservation activities but also inspired many researchers to give their own contributions to development in this field.

Although the initial activities relating to the preservation of individual natural sites of geological and geomorphological character in Serbia started back in the first half of the 20th century, the planned geodiversity and geoheritage protection began no earlier than the mid 1990s. The defining of the terms “geodiversity” and “geological heritage” in the international scientific and professional community (1993) and the membership of Serbia in the European Association for the Conservation of the Geological Heritage (ProGEO) (1995), were the milestones for changing the approach to the geoconservation.

The National Council for the Geoheritage Conservation was constituted in 1995, and the first scientific conference on geoheritage of Serbia was held later the same year. Based on the ProGEO suggestion, the Council initiated the project “Inventory of the Geological Heritage of Serbia” in 1996, which aimed to collect proposals for geosites that mark important events in the geological history of Serbian territory. The inventory process itself was carried out over the period 1996–2003, and the preliminary register of potential immovable geoheritage objects, a total of 552 sites, was presented at the Second scientific conference on geological heritage in Belgrade in 2004 (Maran, 2012a).

Besides geosites, there is also very significant part of geoheritage, which cannot be neglected. It refers to the moveable (*ex situ*) geological objects and includes all specimens housed in museums and in private collections. The most important geological collections, containing specimens from the territory of Serbia, former Yugoslav republics and other parts of the world, have been established as the result of lengthy geological investigations and museological works. They are kept in the Natural History Museum in Belgrade, the Faculty of Mining and Geology, the Serbian Geological Survey and NIS-Naftagas. The Natural History Museum in Belgrade houses early collections from the 19th century that are linked with the founders of natural sciences in Serbia. These specimens signify both the geological and museological rarities simply because they derived mostly from geosites which have been destroyed or are no longer accessible and represent an important resource which cannot be replaced. The recording of the moveable geoheritage fund began simultaneously with the identification of immovable, but has not been completed yet for objective reasons.

According to data obtained from the Institute for Nature Protection (2017), there are 438 protected natural areas in Serbia, including national parks (5), nature parks (17), areas with exceptional characteristics (16), general and special nature reserves (72), natural monuments (325), and protected habitats (3). Individual geological, geomorphological and hydrological-hydrogeological sites of interest for the Republic of Serbia have been declared natural resources as natural monuments and areas with exceptional characteristics (Fig. 2). Out of the total number, 75 objects are protected (73 immovable and 2 moveable), while additional 19 more geoheritage sites are in the process of being granted the same status.

The first nature conservation act was declared in 1945. Geological, paleontological, mineralogical-petrological sites and objects were mentioned for the first time within the Law on protection of cultural monuments and natural rarities from 1946. Advanced laws and regulations concerning nature conservation and management of natural resources were promulgated between 1961 and 1995 (e.g. the Act on Nature Protection, the Law on Environment Protection, the Law on Nature Protection, the Law on National Parks, the Law on Cultural Properties, and the Law on Geological Research). The term “geodiversity” was introduced for the first time into the Law on Nature Protection (“Official Gazette” no. 135/2004) in order to describe the diversity of geological forms and phenomena in the nature and their origins. The innovative laws on Nature Protection (“Official Gazette” no. 36/2009, 88/2010) defined additionally the terms “geodiversity” and “geoheritage”, and the proposed amendments and supplements to this Law (“Official Gazette” no. 14/2016) also included the definitions of the terms “geoconservation”, “geoheritage objects”, “immovable and moveable geoheritage” and “geopark”. By improving the existing legislation and introducing the term “geopark”, the statutory framework has been created for the realization of the idea of establishing geoparks in Serbia.

In the last ten years, several geoconservation-related projects have been undertaken, aiming to identify the areas of geological interest and to inform the public on their existence (Maran, 2012b). Some of these projects include: “Geological sites and natural phenomena as an integral part of the geodiversity of the Belgrade city area”, “Geoheritage of the National Park Fruška Gora”, Geodiversity and geoheritage of the northwestern Serbia – geological history of the Krupanj-Valjevo region”, “Geoheritage of the Nature Park Šargan-Mokra Gora”, “Geoheritage of eastern Serbia” and “Geoheritage of the Djerdap National Park”.

The Commission for the Geoheritage Conservation of the Serbian Geological Society was established in 2013, aiming to provide better ambience for, and to intensify work on geoconservation. Through the engagement of the members of the Commission, the Society contributes to the affirmation of geology and geosciences and provides scientific and professional assistance and support to the geoconservation.

In cooperation with representatives of the relevant ministries, conservation institutions, faculties and managers of protected areas, members of the Commission participate in the planning, organization and implementation of activities, the results of which should serve as the basis for the creation of geoconservation strategy in Serbia.

In the period 2012–2014, the Ministry of Natural Resources, Mining and Spatial Planning of the Republic of Serbia initiated three different projects. The first project refers to the long-term program of geological research for the period 2013–2023, which also included the geoconservation. The second one relates to the preparation of national geoconservation strategy whereas the third project is focused on the establishment of potential national geopark and its nomination to the UNESCO Global Geopark Network.

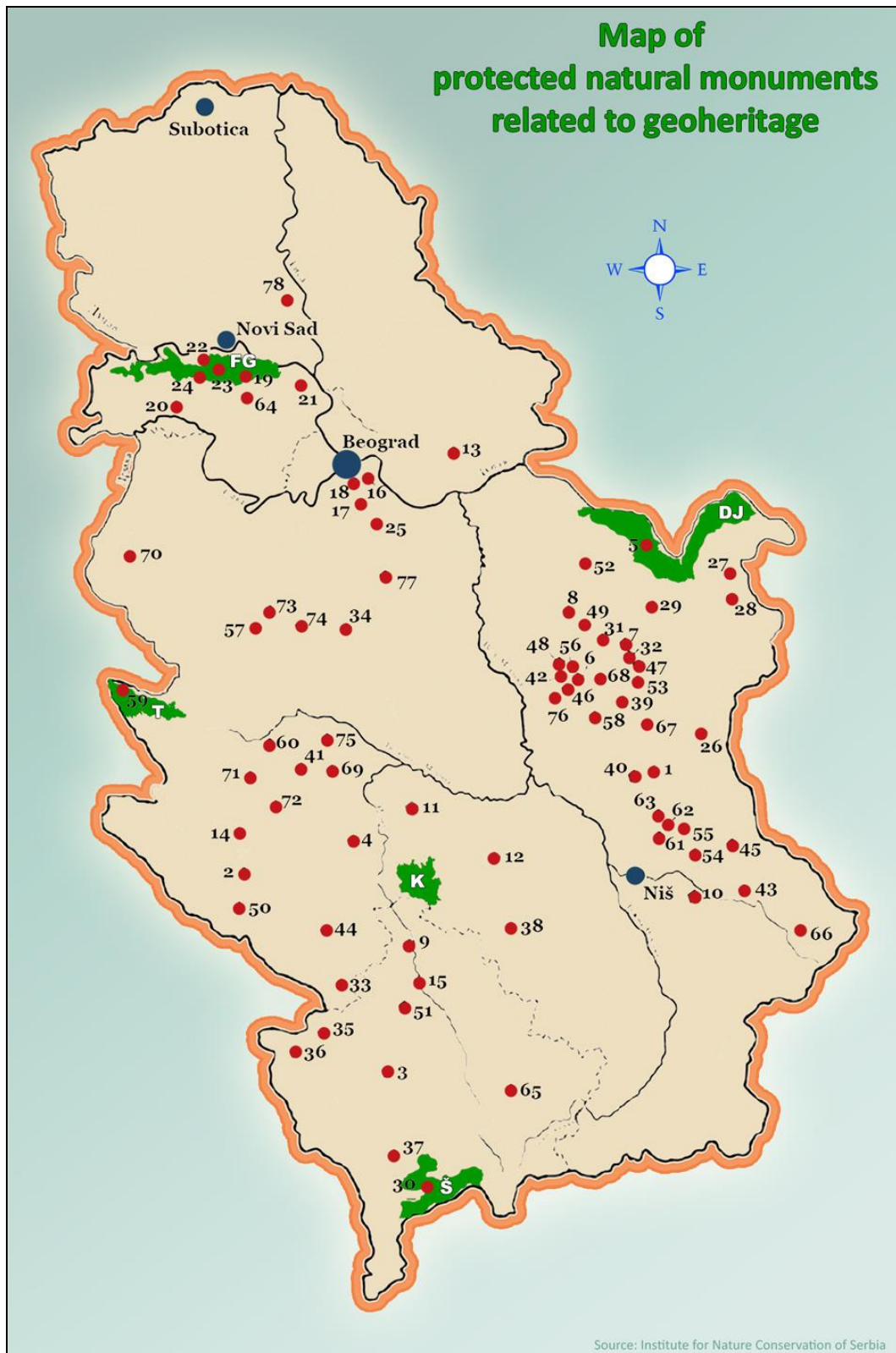


Fig. 2. Map of protected geoheritage sites of Serbia (from Maran, 2012a, modified).

Members of the Working Group for the establishment of National Geoparks in Serbia, formed in early 2014 under the umbrella of the Ministry of Agriculture and Environmental Protection, analyzed the natural, cultural, scientific, educational and tourism potentials of certain areas in Serbia. Based on the evaluation of several prospective regions, it was decided to choose the Djerdap area for a candidacy to the UNESCO Global Geoparks Network due to its geographic position, valuable natural and cultural resources, a long tourist tradition and an aspiration of local residents to be involved in planned promotional activities (Fig. 3). Being long-lasting process, the implementation of activities on establishing potential geopark took place in stages. The initial phase, conducted in the period 2014–2015 by the Working Team for the establishment of Djerdap Geopark (founded officially in late 2014), was involved the identification of geopark area and its boundaries, foundation of appropriate management structure and expert teams, cooperation with representatives of the local authorities, local communities and local private sector. During 2016, members of the Working Team accomplished detailed research to appraise situation in the field, identify risk factors and the level of vulnerability of geological and cultural-historical sites, in order to timely undertake necessary measures and actions to improve the preservation of these objects (Maran Stevanović, 2017).

The nomination process of Djerdap Geopark also took place in stages. In line with clearly defined Operational Guidelines for the UNESCO GGN, as a mandatory first step, members of the Working Team submitted the letter of intent through the official channel – the National Commission for relation with UNESCO. The preparation of comprehensive application dossier started at the beginning of 2016, and included the fulfill of five main sections: A) Identification of the area, B) Geological heritage, C) Geoconservation, D) Economic activity & business plans and E) Interest and arguments for becoming a UNESCO Global Geopark. Application file also entailed the following required annexes: 1) self-evaluation document, 2) repeated section of the geological heritage, 3) an endorsement of relevant local and regional authorities and a letter of support from the National Commission for UNESCO, 4) a large scale map of the proposed UNESCO Global Geopark showing clearly defined boundary of the proposed geopark with all marked towns and villages, sites of valuable natural and cultural heritage and tourism facilities and 5) geological and geographic summary with a detailed map and standard UN geographical maps with the geopark location. The final point in nomination procedure was submission of the formal request for membership. With minor revisions, the dossier was accepted in early 2017, and, in the middle of the year, experts from UNESCO GGN were appointed for evaluation in the field. The field evaluation mission was carried out at the beginning of August 2017, with positive appraisal. However, the evaluation process for the Djerdap area has not been completed yet due to decision of the UNESCO Global Geoparks Council to defer this candidature for a maximum of two years to allow for improvements to be made to the quality of the application.

Although the progress in the field of protection of nature and natural resources in Serbia has been made, there is still an obvious disproportion between the number and quality of research programs and projects in the field of biodiversity protection in relation to those connected to geodiversity. Insufficient representation of geology and geological scientific disciplines in the existing formal education programs has a negative impact on the level of general geological knowledge and the awareness of the wider community of the significance and need to preserve the integrity of nature and understand the causal relations between the two main natural components: bio and geo diversity. Although a fundamental science, geology is not included in the curricula of primary and secondary schools as a separate subject. This approach to education has resulted in a lack of knowledge of both the teachers and the students on the structure and composition of the Earth and the processes and events from the geological past that made up the framework for the creation and evolution of life on Earth.



Fig. 3. Geoheritage sites in the area of Djerdap Geopark in foundation: a) Golo Brdo viewpoint, b) Golubinke gneiss, c) Boljetin River Gorge, d) Gradašnica Cave, e) part of Pesača section, f) abandoned limestone quarry, g) river terrace in Kladušnica (photo: A. Maran Stevanović).

Lack of qualified staff in the line ministries – as those who should represent the interests of geoconservation – and the insufficient general knowledge of the topics of geodiversity and geoheritage have caused a lack of interest and support of decision-makers and potential strategic partners, limited financial resources for the study and protection of geodiversity, and a lack of motivation of scientists and experts concerning project participation. These are also the main reasons why most potentially significant geoheritage sites are not adequately researched, studied or conserved.

CONCLUDING REMARKS

Lack of knowledge is the biggest obstacle to the preservation of geodiversity and geoheritage, thus education should be given priority over all other activities. One of the strategic goals of preventive geoconservation is to improve educational programs intended for different target groups. The thematic documentaries, popular lectures, scientific and popular publications, visits to natural history collections and exhibitions, participation in creative workshops and visits to nature parks and natural monuments are just some of the activities that can contribute to better knowledge of natural resources, understanding their significance and value, perception of real and potential risk factors and the possibilities for overcoming them. Using modern information and communication technologies (ICT) in interpretation of geodiversity and geoheritage phenomena (e.g. virtual reality, 3D graphic presentation and various applications), this part of natural heritage will become more attractive to a wide audience, particularly the younger generations.

The training of experts in the field of geoconservation is also one of the priority tasks in the upcoming period, necessary in order to achieve the mission of geoconservation: wise use, and conservation of immovable and moveable objects of geodiversity and geoheritage for the future generations. Active participation of scientists and experts in the popularization of geology and promotion of geodiversity and geoheritage is not only a prerequisite for the expansion of the general geological knowledge and the strengthening of environmental awareness, but also for more effective conservation of this part of the natural heritage.

Tourism presents a major challenge, but it is also an opportunity for local and regional development. As the needs and interests of tourists shifted in the last ten years toward acquisition of new skills and knowledge, popular educational programs in geology and other earth sciences can complement and simultaneously raise the level of the existing tourist offer. It is an undisputed fact that nature and natural resources are what attracts most tourists, and that is where all available human, technical and technological resources should be directed. Particular attention should be paid to long-term planning of educational programs to protect nature and the environment at the local level, in order to enhance the knowledge and raise awareness of the local population and representatives of the local governments about the natural resources and opportunities for economic development and prosperity that can come from sustainable use of natural resources.

REFERENCES

- Gray, M. 2004. *Geodiversity: Valuing and Conserving Abiotic Nature*. John Wiley & Sons, Ltd, Chichester/UK.
- Maran, A. 2010. *Valuing the geological heritage of Serbia*. Bulletin of the Natural History Museum **3**: 47–66.
- Maran, A. 2012a. *Geoconservation of the Cretaceous marine geosites from Serbia: Boljevac and Mokra Gora area*. PhD thesis, University of Bucharest, 221 pp.
- Maran, A. 2012b. *Geoconservation in Serbia-State of play and perspectives*. European Geologist **34**: 29–35.
- Maran Stevanović, A. 2015. *Methodological guidelines for geoheritage site assessment: a proposal from Serbia*. Geološki anali Balkanskoga poluostrva **76**: 105–113. DOI: 10.2298/GABP1576105M.

- Maran Stevanović, A. 2017. *Activities on the establishment of the Djerdap Geopark (Serbia) and candidature of the area to the UNESCO Global Geoparks Network*. Bulletin of the Natural History Museum **10**: 7–28. doi:10.5937/bnhmb1710007M.
- Maran Stevanović, A., Ganić, M., Rundić, Lj. & Milovanović, D. 2016. *Risk management in the area of conservation of Serbia's geoheritage*. Report of the Serbian Geological Society for the year 2016, 111–136.
- Mc Keever, P., Zouros, N. 2005. *Geoparks: Celebrating Earth heritage, sustaining local communities*. Episodes **28**(4): 274–278.
- Sharples, C. 1993. *A Methodology for the Identification of Significant Landforms and Geological Sites for Geoconservation Purposes*. Hobart, Tasmania: Forestry Commission.
- UNEP-WCMC and IUCN, 2016: *Protected Planet Report 2016*. UNEP-WCMC and IUCN: Cambridge UK and Gland, Switzerland.
- Wilson, C. 1994. *Earth Heritage Conservation*. Geological Society of London and the Open University.
- Wilson, E. O. 1992. *The diversity of life*. Harvard University Press, Cambridge.
- ***Law on Environmental Protection, Official Gazette of the Republic of Serbia, no. 135/2004.
- ***Law on Nature Protection, Official Gazette of the Republic of Serbia, no. 36/2009, 88/2010, 14/2016.
- ***European Geoparks Network, <http://www.europeangeoparks.org>, Accessed: December 2017.
- ***UNESCO Global Geoparks Network , <http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks>, Accessed: December 2017.