CONSERVATION OF PALEONTOLOGICAL HERITAGE IN SERBIA: FROM PHILOSOPHY TO PRACTICE

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Serbia has a rich paleontological heritage that includes both, fossiliferous sites and fossilized remains and traces of once living plants and animals. Their study allows paleontologists and geologists to understand and interpret the evolution of life on Earth, ancient environments and past climates, to establish the age of rocks and to correlate rock units in different part of the world. Fossiliferous sites and fossils are not only an integral part of geodiversity and geoheritage but also important component of our national natural and cultural patrimony. Criteria for evaluation of potential paleontological heritage are suggested along with required conservation strategy in order to ensure that these phenomena, inherited from the past will still be with us in the future.

Key words: Paleontological heritage, conservation strategy, Serbia.

INTRODUCTION

Geodiversity, the variety of entire abiotic world, encompasses the geological, geomorphological and pedological features and phenomena together with the natural processes which form and modify them.

Geoheritage is the valuable part of geodiversity and refers to the conservation values of rocks, landforms and soils that are significant to humans (Dixon 1996, in Gray 2004). Geoconservation involves a set of actions focus on conserving, presenting and promoting geodiversity and geoheritage for their intrinsic, ecological, cultural, economic, scientific and educational values.

Geodiversity of Serbia consists of different parts of the earth's crust, formed within a time span of about 600 million years. During the long geological history, strong geodynamic movements have influenced the formation and development of various geological environments, from oceans and seas to islands and continents. Each paleoenvironment was once inhabited by the representatives of specific plant and animal species whose fossilized remains are a unique paleontological archive on diversity and abundance of life in the geological past.

The first geological data were provided by foreign scientists, mostly geologists and geographers who traveled across Serbia during the 19th century. Systematic geological research began in the first half of the 20th century and included exploration of mineral resources and detailed geological mapping. Intensive geological activities took place all over the country between 1950 and 1990; at that time, 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 motivated many researchers to give their own contributions to development in this domain.

Prior to 1995, 80 geological objects were protected based on sporadically given individual proposals, including 78 geosites and 2 moveable geological objects (Maran 2012). Nine geosites, declared as single natural monuments, relate to the fossiliferous localities (Fig. 1).

Fig. 1: - One of the first protected paleontological sites, abandoned quarry “Mašin majdan”, Belgrade (photo: A. Maran Stevanović).

The project “Inventory of the geoheritage sites of Serbia”, initiated by the Serbian National Council for Geoheritage Conservation in 1996, was aimed to collect proposals for geosites that mark important events in the geological history of Serbian territory. The work on the inventory was undertaken between 1996 and 2003 and in 2004 preliminary list has been created. It includes 552 geosites proposed for conservation; they are classified into eleven categories according to criteria suggested by the European Association for the Conservation of the Geological Heritage (Maran 2012a). The category “Geological and stratigraphic heritage sites” entails 130 geosites recommended for conservation; selected fossiliferous sites include 46 localities with well preserved micro or macro fossils of Paleozoic (3), Triassic (1), Jurassic (12), Cretaceous (13) and Neogene (17).

In Serbia as well as other southeastern European countries, establishment of comprehensive National geoconservation strategy is still missing despite many warnings from specialists. Prior to define the strategy, however, many researches should take place, including preliminary selection of important geodiversity sites, valuing geodiversity, assessing potential threats, and identifying general actions to prevent or enhance significant geoheritage features (Maran 2012a).

IMPORTANCE OF PALEONTOLOGICAL HERITAGE

The Serbian Law on cultural properties (71/1994) recognizes two large categories of the national cultural and natural legacy, the non-moveable (*in situ*) and the moveable (*ex situ*). Following that general categorization, non-moveable paleontological heritage corresponds to the fossiliferous sites whereas particular fossil specimens, housed in museums and other collections, belong to the moveable paleontological heritage.

Procedures for assessing paleontological heritage depend on the valuing criteria. Some basic principles to evaluate the significance of potential geoheritage in Serbia were discussed and analyzed from various points of view (Maran 2010), including how unique and how representative it is as well as how instructive for the evolution of inanimate and animate nature, their natural process and form, and their importance for the development of geology and natural sciences.

Scientifically, educationally, culturally or economically important paleontological features deserve to be protected and preserved. But, before selecting a single site or specimen, it is necessary to identify which one best represents particular phenomena (e.g. significant events and episodes of earth history, first or last appearances of faunal and floral assemblage, macro and micro fossils concentration, special combination of fossils,

distribution of taxa, specific taphonomic characteristics, etc.). An objective assessment of the significance and value of paleontological features and phenomena is the starting point for their conservation and optimal utilization (Fig. 2).

The combined values that arise from paleontological phenomena can be classified into five general categories:

- Intrinsic value
- Ecological value
- Economic value
- Cultural value and
- Scientific and educational value

1. The concept of intrinsic value means that all Earth phenomena and possesses may have value beyond the social, economic or cultural values held by humans (Sharples 2002).

2. The fossil record preserves exceptional examples of interaction between ancient organisms and paleoenvironments and also contains an abundance of evidence useful to derive phylogenetic relationships and evolutionary trends (Fedonkin *et al.* 2007). By studying fossils, paleontologists, biologists and ecologists can learn not only about the organisms of the distant past, but also how they grew, what they ate, how they interacted, and many aspects of their behavior.

3. Although fossils reveal important and interesting information about the past, they provide much more. Sediments that yield fossils are essential as they supply humans with necessities for everyday life, including mineral fuels (petroleum and coal) and construction material (building stones). Fossiliferous sites and fossils can have significant economic value, particularly if they are rare, well preserved and well known (e.g. sites-bearing dinosaurs, ammonites, trilobites or rudists, fossil “jewellery”, fossiliferous ornamental stones, etc.). Geotourism, triggered by the aesthetic appeal or scientific value of paleontological sites, can generate income for the local economy (e.g. geoparks).

4. Fossils have been the subject of human interest from prehistoric times. Numerous myths about fossils, their magical or medicinal powers and decorative uses can be found in the folklore of many countries around the world (Maran 2013). Sites that yield fossils and the fossil specimens have cultural value due to their significant role in the development and a broader recognition of geosciences.

5. Fossiliferous sites and fossils have particular scientific and educational significance because they are rich in evidence of the evolution of life

on Earth, ancient environments and past climates as well as extinction events. Learning about the past using paleontological phenomena can provide a key for humans to understand, explain and plan future environmental changes. Fossiliferous localities can provide *in situ* polygons for training of the new generation of paleontologists, geologists, amateurs and children while fossils, as instructive educational tools, can be used for specific thematic and general environmental programs.

The significance of paleontological heritage should be also classified at international, national, regional and local level, by documentation, assessment and comparison. The three categories of non-moveable geoheritage of Serbia were proposed (Maran 2012, 2012a): a) Internationally Important Geosites (IIG), b) Nationally Important Geosites (NIG) and c) Regionally and/or Locally Important Geosites (RLIG). In order to synchronize classifications, the three categories of geological collections, equivalent to geosites have been also suggested (Maran 2012, 2012a): a) Internationally Important Collection (IIC), b) Nationally Important Collection (NIC) and c) Regionally/ or Locally Important Collection (RLIC). In addition to scientifically important collections, there are also educational collections, which serve as teaching resources housed at universities, colleges and schools as well as private collections made for personal interest.

Fig. 2. - Phases in recognizing potential paleontological heritage.

RISK MANAGEMENT

In order to choose appropriate conservation methods, it is necessary to assess current level of threat (various types of damage or disturbance) and current level of preservation. Threat to a paleontological feature depends on its size and the processes influencing it. Level of threat (LT) and level of preservation (LP) may be expressed numerically for each feature with numbers 0-5 (Tab. 1), and the final value will be reached through the following algorithm:

$$LT + LP = VU \text{ (maximum number of points is 10)}$$

Table 1. - Parameters and numerical values of parameters used to estimate level of threat and level of preservation for each paleontological feature.

Vulnerability (VU)	Score
Level of threat (LT)	0 – not threatened 1 – potentially threatened 2 – partially threatened 3 – threatened 4 – partially damaged 5 – highly damaged
Level of preservation (LP)	0 – very high 1 – high 2 – medium 3 – low 4 – very low 5 – not preserved

PALEONTOLOGICAL HERITAGE *IN SITU*

Threats to the integrity of fossiliferous sites are numerous and can be grouped as natural or anthropogenic. The first category mainly relates to natural degradation caused by erosion and weathering processes, landslides and vegetation growth.

- Weathering processes and erosion that currently act on rock layers induce degradation of their natural form and structure and can lead to the loss of fossil contents.
- Landslides comprise a wide range of ground movements, such as rock falls, deep failure of slopes and shallow debris flows. They are

generally triggered by human activities, including deforestation, afforestation, construction and vibration from machinery and traffic.

- Vegetation growth may conceal partly or completely the natural form and structure of fossil-bearing exposures by development of scrubs and lichens (Fig. 3).

Fig. 3. - Growing scrubs completely concealed the fossiliferous exposure of Božurica hill, Mokra Gora area, western Serbia (photo A. Maran Stevanović).

The second group of threats, although almost unintended, resulted from human activities. They include expansion of urban areas, commercial quarrying, improper waste storage, inappropriate collecting and excessive tourist pressure.

- Expansion of urban areas mainly relates to unplanned construction and building works that have potential to damage or ruin sensitive fossiliferous exposures and fossils.
- Commercial quarrying of a rock is an obvious threat, which is particularly apparent when excavation involves heavy machinery or when the extent of the fossil-bearing rock layer is very limited. For instance, many valuable fossils have been damaged due to commercial quarrying (e.g. Upper Cretaceous fossilized rudists and coral colonies, the quarry Seča Reka, western Serbia, Fig. 4).
- Disposal of solid waste materials, including domestic waste and construction material, buries scientifically important fossiliferous

exposures and even inhibits access to them (e.g. fossiliferous site Faca Vajali, Boljevac area, eastern Serbia, Fig. 5).

- Inappropriate collecting represents a potential threat to the fossiliferous sites, particularly if it is conducted irresponsibly (e.g. amateur collecting, over-collecting, collecting without proper recording and curation, theft of fossils by tourists, etc.).
- Excessive visitor pressure to sites could damage, ruin or take away their fossil contents. Tourist activities, particularly if they perform improperly, may lead to the spreading of waste and other contaminating materials at fossiliferous sites.

Fig. 4. - Seča Reka quarry - Upper Cretaceous reddish massive bioclastic limestones with rudists and corals; 1. *Vaccinites* cf. *magillavryi*, 2. *Vaccinites* sp., 3. *Vaccinites* cf. *giganteus*, *Hippurites resectus*, 4. *Heliastrea lilli*, all specimens reduced 2.5 (photo: D. Milovanović & A. Maran Stevanović).

Fig. 5. - “Suitable” place for domestic waste-disposal, lowermost part of the Faca Vajali-Izvor section (photo: A. Maran Stevanović).

Fig. 6. - Potential risk to tourists, fossiliferous profile Pesača, Djerdap gorge, eastern Serbia (photo: Z. Stevanović).

In addition to the site-risk, there are also hazards to researchers and tourists by insecure rock exposures, falling rocks and site-closeness to the traffic-roads and railways. For example, many fossiliferous sites across Serbia present concrete danger to visitors as they are directly exposed along the frequent roads (e.g. fossiliferous site Pesača, Djerdap gorge, eastern Serbia, Fig. 6). All those, interested in individual research or visit, have to be informed on such risks by adequate warning signs.

Peternel & Herlec (2007) distinguished the three categories according to the site exposition to risk:

- a Very vulnerable/high risk paleontological site: site where scientifically important fossils have been discovered and threats are very high (e.g. landslides, bush vegetation, easy access for collectors, etc.).
- b Vulnerable/middle risk paleontological site: site where the fossil-bearing resource is either substantial or of unknown extent, and the fossils are generally well-preserved, having considerable scientific value, aesthetic appeal or commercial value with middle level of threats.
- c Robust/low risk paleontological site: site where fossils have not been discovered yet or where the fossils are poorly preserved or unspectacular.

Different conservation methods can be used to protect outstanding geodiversity features (Santucci 1998, Drandaki *et al.* 1999, Page 1999, Gray 2005, 2005a). Some of them, including secrecy, physical protection, proper collecting, monitoring, legislation, licensing and site-explanation are recommended for paleontological site conservation (Maran 2012).

- CONCEPT OF SECRECY should be used at fossiliferous sites where discovery is not advertised until research work is completed and even then the site location may not be made public for many reasons.
- PHYSICAL PROTECTION involves clearance of eroded fragments and overgrown bushes. In sites requiring periodic clearance of fallen rocks, an effective measure to prevent potential hazard of eroded fragments is the construction of small defensive barriers which could be placed at appropriate distance from the site-bottom. It is expected that the placement of garbage boxes would prevent, or at least significantly reduce inappropriate disposal of waste materials.
- PROPER COLLECTING is commonly practiced particularly for vulnerable fossils which are carefully removed from sites and stored in museums.
- SITE-MONITORING relates to periodic reassessment of the site-form in order to identify any issues which have to be maintained or restored

to a favorable conservation condition. Taking into consideration that most geosites are still not incorporated into any local management plan or program (except protected areas), the following topics require periodic review:

- 1) site-access,
 - 2) level of degradation/preservation, and
 - 3) level of site use (e.g. the inclusion of the site within guided or self-guided tours).
- LICENSING can be applied at some sites, intending to control access by visitors or researchers. Many protected fossiliferous sites worldwide restrict collecting and research by issuing licenses.
 - LEGISLATION is used to give formal protection to specific areas, including geoheritage sites. Legal measures for site-protection commonly define the nature of the geological resource to be protected, fix penalties for committing damaging acts and assign responsibility to the appropriate organizations.
 - SITE-PREPARATION FOR VISITORS is required to facilitate the site-accessibility and to inform visitors on valuable geological features (Fig. 7). It mainly relates to the establishment of interpretation boards and the creation of suitable visitor pathways. Information panels have to include the following information:
 - the name of the geosite
 - geographical coordinates
 - short description of the geosite (geological formation and age of formation)
 - tectonic/sedimentary structures
 - fossil contents with photo illustrations
 - index and number of the geosite in the national inventory
 - status and category of the geosite
 - responsible guardian institution
 - proper visitor behavior

A procedure for safety and appropriate behavior at geological and paleontological sites is proposed within the Code of good practice (Maran 2012). To encourage “good visitor behavior” and a responsible approach to collecting, this Code includes some common suggestions (Fig. 8).

Fig 7. - Protected fossiliferous profile at Gluvi Potok, Prebreza, south Serbia (photo: Z. Marković & A. Maran Stevanović).

NATURAL HISTORY MUSEUM IN BELGRADE

**CCMGS - Centre for Conservation
of Movable Geoheritage of Serbia**

Code of good practice

Adopting a responsible approach to collecting is important for protecting our fossil heritage. The guided principles listed below should be followed by all those intending to collect fossils.

- Keep collecting to a minimum and avoid removing fossils in situ.
- Collect only a few specimens, preferably from fallen or loose rocks.
- Record precisely the locality where fossils are found.
- Ask for expert advice on specimen identification and care.
- Provide an appropriate depository for fossils.

Each collector or visitor is required to request in advance permission to collect fossils from the site

Do not leave the site in an unsightly or dangerous condition for those who come after.

Never go alone and do not take risks on insecure cliffs or rock faces.

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Fig. 8. - Code of good practice, Center for Conservation of Movable Geoheritage of Serbia (prepared by A. Maran, 2011).

PALEONTOLOGICAL HERITAGE *EX SITU*

Collecting fossils is an activity practiced by many people for different reasons, ranging from scientific research and education to commercial sale. In certain circumstances, however, inexpert collecting from paleontologically significant areas may cause the loss of unique fossils together with the scientifically important information. The main management aim for any significant specimens is to provide an adequate storage place for such material, preferably in museums, to ensure their proper curation and documentation as well as their accessibility and long-term security.

The moveable geoheritage includes specimens of rocks, minerals and fossils that represent individual phenomena grouped by their systematic position, age range or the site where they were recorded (Maran 2005). Geological collections can be formed gradually by collecting the material during field research, but may also be acquired by exchange or sale, or as legacies.

Paleontological collections in Serbia constitute a large part of all natural history collections and, together with fossiliferous sites, offer valuable information for the interpretation of major events in the development of the earth and life. The most important paleontological collections are housed in different institutions conducting geological investigations, including the Natural History Museum in Belgrade, the Faculty of Mining and Geology, Belgrade University, the Serbian Geological Survey, NIS-Nafta-Gas as well as some local museums and organizations. They contain specimens from the territory of Serbia, former Yugoslav republics and other parts of the world. For instance, the NHM in Belgrade houses early collections from the 19th century that are linked with the founders of geology, paleontology and natural sciences in Serbia. They have been established as the result of lengthy geological investigations and museological works. However, the majority of collected specimens signify geological and museological rarities because they derived mostly from sites which have been destroyed or are no longer accessible and represent an important resource which cannot be replaced (Maran 1998) (Fig. 9).

The collections accomplished full scientific value and importance only with the proper archiving of data. The documentation on the paleontological collections represents their complementary part and comprises the field books, collection books (books of incoming material), labels, books of outgoing material as well as the inventory books and inventory cards (Maran 2000). The contents of the register include: 1) inventory number, 2) scientific name of fossil, 3) place of origin with geographical coordinates, 4) stratigraphic level, 5) date when it was collected, 6) name of person who collected it (or the name of donor), name of the person who identified the

material and name of journal or publication in which the data about fossils were published. Each identified specimen has a label which holds essential information, including the date and location of its collection and the name of its collector. In addition, each specimen has a unique registration number which is used to keep track of the specimen and its associated information.

Fig. 9: Lumachelle of the Jurassic ammonites, Greben/Djerdap gorge - 1-2, *Procerites procerus* 3, *Phylloceras* sp., Mesozoic Invertebrate Collection, NHM, Belgrade (photo: A. Maran Stevanović).

LEGISLATION AND INSTITUTIONAL FRAMEWORK

Geological, paleontological and mineralogical-petrological features were mentioned for the first time as nature rarities within the Law on protection of cultural monuments and natural rarities of the Federal Republic of Yugoslavia (81/1946).

The Law on Cultural Properties of the Republic of Serbia (71/1994), recognized the geological objects (sites and specimens) as cultural assets of general interest which deserve special protection because they are “... *unique (rare) documents of the history of nature ... that have particular significance for the social, historical and cultural development of the people or for development of their natural environment*”.

The terms “geodiversity” and “geoheritage” were recognized for the first time within the laws on environmental (135/2004) and nature

protection (36/2009, 88/2010). Although their dominant parts mostly concern the biodiversity-related issues, they also bring some improvements in the field of geoconservation (Maran 2012, 2012a). For instance, the Law on environmental protection recognizes geodiversity as a variety of geological sites and objects, including various rock formations, structures, landforms and processes as well as rock, mineral and fossil specimens that make a special contribution to the understanding of geology and the geological history of the earth. Geoheritage is regarded as the representative and valuable part of geodiversity, which refers to structural and tectonic features, sedimentological and paleontological sites, hydrogeological and speleological features, active and abandoned quarries, as well as many other manifestations formed by natural processes. Nevertheless, this act on nature protection states that nature, with its biological, landscape and geological diversity, and its ecological processes must be preserved for the future.

Prior to 1948 and the foundation of the Institute for nature conservation of Serbia, the conservation of nature was exclusively under the direction of the Natural History Museum in Belgrade (Maran 1998). Since that time, management of nature protection and responsibility for its implementation have been divided between the Institute for nature protection (*in situ* protection) and the Natural History Museum (*ex situ* protection). Experts from both institutions work on the advancement, protection and promotion of natural values, including geoheritage as one of their segments.

By 2013, the environmental and natural resources protection in Serbia were under the authority of the three ministries, depending on the object type and character of protection. Since 2013, the governmental body responsible for nature conservation in Serbia is the Ministry of Agriculture and Environmental Protection whereas the field of national cultural legacy protection, which also includes the natural-heritage objects, is under the competence of the Ministry of Culture and Information.

CURRENT STATE OF GEODIVERSITY CONSERVATION

Although the system of nature and natural resources conservation was improved in the last decade, the disproportion is evident between the quality and quantity of biodiversity and geodiversity related programs and projects. Due to the limited financial and technical support for geological and professional researches in the field of geodiversity and geoheritage conservation, many potentially significant geoheritage phenomena are neither sufficiently explored nor adequately protected.

In 2012, the Ministry of Natural Resources, Mining and Spatial Planning initiated the formation of a long-term program of geological researches for the period 2013-2023 and appointed the members of working groups for its preparation. As a member of the working group for geocology, geodiversity and geoheritage, the author of this paper has participated in preparation of a long-term program for geodiversity conservation and proposed precisely defined goals, tasks, works and activities required to be implemented, along with dynamics and relevant subjects. The SWOT analysis was applied to evaluate the conditions for achieving long-term objectives of geodiversity and geoheritage protection, preservation, enhancement and sustainable development (Tab. 2).

Table 2. - The SWOT analysis.

ADVANTAGES-STRENGTHS	DISADVANTAGES-WEAKNESS
<ul style="list-style-type: none"> • Great potential of georesources • Good professional base • Great stories and opportunities to engage public • Potential for development of tourism and local economies • Clear state commitment to improve geodiversity conservation 	<ul style="list-style-type: none"> • Rapid geoheritage deterioration • Lack of financial support • Lack of skilled personnel • Lack of geoconservation strategy • Lack of National Council for geodiversity/geoheritage conservation • Lack of geoheritage underpinnings in environmental laws and regulations • Lack of coordinating/partnering across organizations • Frequent changes in management control • Undefined priorities • Insufficient geosciences education in primary and secondary schools • Insufficient promotion and presentation of geology, geodiversity and geoheritage • Low geological knowledge of all inventory • Low level of general geological knowledge • Low level of general environmental awareness • Insufficient media campaign

POSSIBILITIES-OPPORTUNITIES	RISKS-THREATS
<ul style="list-style-type: none"> • Involving in international projects and programs, financed by IPA funds • Harmonizing laws and standards with EU legislations • Adopting methodology, criteria, good experiences and practices from successful countries • Increasing national recognition of geodiversity and geoheritage • Strengthening cooperation between individuals and institutions at national and international level • Integrating bio and geo diversity protection • Involving local communities and local authorities in nature/geodiversity protection • Rising environmental awareness at all levels • Strengthening cooperation with tourism agencies/integrating geoheritage sites in tourist offers • Founding geoparks • Developing rural areas through sustainable (geo)tourism 	<ul style="list-style-type: none"> • Slow economic prosperity, unemployment, migration of qualified personnel • Limited budget, limited time • Mixing institutional competencies • Insufficient cooperation among competent ministries, conservation related institutions, and local authorities - difficult dialogue • Conflict of interests between activities and groups involved in geoconservation • Conflicts between laws and regulations • Insufficient scientific education/awareness by the policy makers • Insufficient public and academic awareness concerning geoconservation • Absence of academic training programs in geodiversity and geoheritage conservation • Ignorance and apathy • Insufficient interest of scientists and experts to affirm and present geodiversity and geoheritage

STATE OF PALEONTOLOGICAL HERITAGE CONSERVATION

The current situation concerning fossiliferous sites protection can be summarized as follow (Maran 2012, Maran 2012a):

- Numerous nationally or even internationally important paleontological sites are not protected by any specific regulation and their protection zones are not delineated.
- There are few areas in Serbia that have updated inventories of paleontological resources, including precise information on their location, state of preservation, value and vulnerability thus hindered their appropriate conservation.

- Not all paleontological sites of potential importance located within declared protected natural areas are well studied and scientifically assessed on a comparative base. Their vulnerability to damage is not known, thus there are not properly protected and their potential as a resource is not properly used.
- There is a lack of common understanding among the different specialists involved in nature protection (e.g. biologists, ecologists, geologists, or geographers) to develop joint, coherent measures and actions, thus prevents the efficiency of geoconservation and in general, of nature conservancy.

RECOMMENDATIONS

In order to achieve internationally approved geoconservation objectives and to improve *in situ* paleontological heritage conservation, the following initiatives and activities are proposed:

- Increasing the geoeducation (establishing communication and coordination among groups with research, management, educational and tourist interests in paleontological sites);
- Improving the inventory and re-inventory of sites to know their actual situation;
- Creating the national databases;
- Assessing the site-importance (scientific, cultural and economic) and identifying the threats to valuable sites, particularly to those of national and international importance;
- Implementing relevant protection measures and actions upon valuable sites, based on recognized threats;
- Improving the existing legislation on nature protection to increase site conservation;
- Fostering the public awareness, community involvement and understanding of the value of geoheritage sites, both as wildlife habitats and as resources for education and geological study;
- Integrating the conservation of biodiversity and geodiversity;
- Identifying the interpretative/educational potential of sites (e.g. inclusion of sites in guided georoutes);
- Allocating the funds for geoconservation;
- Ensuring the support of planners, developers and strategic stakeholders for geoconservation;
- Enhancing capacity-building in geoconservation, including new geological specialists - geoconservationists;

- Developing a scientific base to evaluate the potential of certain areas to become geoparks.

In the field of *ex situ* paleontological heritage, the initiatives mainly include recognition of paleontology related terminology in existing regulations by:

- introducing the term “moveable geoheritage objects”,
- defining the terms fossil(s) and fossiliferous site,
- defining the term paleontological collection,
- defining the criteria for the collection-assessment,
- categorizing the paleontological collections,
- defining potential threats to paleontological objects,
- proposing proper measures to mitigate the threats and to enhance moveable paleontological heritage protection and
- establishing new law directions on geoheritage/paleontological heritage protection.

Although the movement of national cultural assets in Serbia is regulated and limited by the Law on cultural properties, it does not refer strictly to geological specimens. The Natural History Museum in Belgrade should play an active role in the prevention of the sale of illicit geological materials, especially fossils.

The public are not always aware of the existence of museum collections, particularly if the museum no longer houses a geological display such as the case of the Natural History Museum. Thematic exhibitions, popular lectures, seminars and creative workshops can ensure that collections be used to raise public interest in and understanding of geology, paleontology, geodiversity and geoheritage.

REFERENCES

- Drandaki, I., Diakantoni, A., Eder, W., Fermeli, G., Galanakis, D., Gonggrijp, G. P., Koutsouveli, A., Martini, G., Page, K. N., Patzak, M. (1999): GRECEL, Geological heritage: Research in Environmental, Education and Cooperation in European Level. In: Baretino, D., Vallejo, M., Gallego, E. (eds): Towards the balanced management and conservation of the Geological Heritage in the New Millenium: 324-329. – Sociedad Geologica de Espana, Madrid.
- Fedonkin, M. A., Gehling, J. G., Grey, K., Narbonne, G. M., Vickers-Rich, P. (2007): The Rise of Animals: Evolution and Diversification of the Kingdom Animalia. – Johns Hopkins University Press, Baltimore.
- Gray, M. (2004): Geodiversity: Valuing and Conserving Abiotic Nature. – John Wiley & Sons, Ltd, Chichester, UK.

- Gray, M. (2005): Geodiversity and geoconservation: What, Why and How? - **The George Wright Forum** 22(3): 4-12.
- Gray, M. (2005a): Planning for geoconservation. - **Earth Heritage** 23: 16-18
- Maran, A. (1998): The role of Natural History Museum in Serbia's geo-heritage conservation. In: 13th Congress of geologists of Yugoslavia 2: 335-343 – Herceg-Novi.
- Maran, A. (2000): Documentation and categorization of paleontological collections as geoheritage objects of Serbia. - **Protection of nature, Institute for nature conservation of Serbia** 52 (1): 117-122.
- Maran, A. (2005): Kriterijumi za selekciju i kategorizaciju geonasledja Srbije - paleontoloske zbirke i lokaliteti. In: Arhiva Prirodnjačkog muzeja: 1-15 – Beograd.
- Maran, A. (2010): Valuing the geological heritage of Serbia. - **Bulletin of the Natural History Museum in Belgrade** 3: 47-66.
- Maran, A. (2012): Geoconservation of the Cretaceous marine geosites from Serbia: Boljevac and Mokra Gora. – Archive of the Bucharest University. [unpublished doctoral thesis]
- Maran, A. (2012a): Geoconservation in Serbia - State of play and future perspectives. - **Journal of the European Federation of Geologists** 34 (Geoheritage): 29-35.
- Maran, A. (2013): Geom mythology: a way to raise public awareness on geodiversity and geoheritage. In: The 3rd International Conference “Harmony of nature and spirituality in stone”, Proceedings, 21-22 March 2013: 19-30. – Kragujevac, Serbia.
- Maran Stevanović A. (2014): Metodološke osnove za procenu objekata geonasleda. In: Zbornik radova, XVI Kongres geologa Srbije, Donji Milanovac 22-25 maj 2014: 842-845. – Donji Milanovac, Serbia.
- Page, K. N. (1999): Sites and their uses - Geoconservation in Devon, south west England, UK. In: Baretino, D., Vallejo, M., Gallego, E. (eds): Towards the balanced management and conservation of the Geological Heritage in the new Millenium: 28-31. – Sociedad Geologica de Espana, Madrid.
- Peternel, M., Herlec, U. (2007): Fossil site vulnerability and endangerment assessment proposal. In: The 12th Regional Conference on Geoconservation and ProGEO Working Group 1 Annual Meeting “Geological Heritage in the South-Eastern Europe”, Book of abstracts: 29. – Ljubljana, Slovenia.
- Santucci, L. V. (1998): Paleontological resource management: The Yellowstone paleontological survey. – Yellowstone Center for Resources, Wyoming.
- Sharples, C. (2002): Concepts and principles of geoconservation. – Published electronically on the Tasmanian Parks and Wildlife Service web site. [www.dpiwe.tas.gov.au]
- Law on protection of cultural monuments and natural rarities of the Federal Republic of Yugoslavia (81/1946).
- Law on Cultural Properties, Official Gazette of the Republic of Serbia, 71/1994.
- Law on Environmental Protection, Official Gazette of the Republic of Serbia, 135/2004.
- Law on Nature Protection, Official Gazette of the Republic of Serbia, 36/2009, 88/2010.

ЗАШТИТА ПАЛЕОНТОЛОШКОГ НАСЛЕЂА СРБИЈЕ: ОД ФИЛОЗОФИЈЕ ДО ПРАКСЕ

АЛЕКСАНДРА МАРАН СТЕВАНОВИЋ

Р Е з и м е

Фосилоносна налазишта и фосилизовани остаци биљака и животиња, интегрални део геодиверзитета и геонаслеђа, један су од најзначајнијих извора информација о кључним догађајима у геолошкој историји Земље.

Овом приликом разматрају се критеријуми за процену значаја и вредности потенцијалних објеката палеонтолошког наслеђа у Србији, идентификују природни и антропогени фактори који утичу на њихову деградацију, сугеришу мере и решења за ублажавање препознатих ризика и предлаже стратегија заштите палеонтолошких објеката.

На основу процене постојећег стања палеонтолошких објеката као и међународно усвојених стандарда, примера добре праксе и позитивних искустава, предвиђене су неопходне активности у домену заштите и очувања палеонтолошког наслеђа које обухватају:

- стандардизацију критеријума за процену палеонтолошких објеката
- ажурирање постојећег инвентара покретних и непокретних палеонтолошких објеката
- јачање свести шире друштвене заједнице о значају и вредности палеонтолошких објеката
- обезбеђење подршке планера и стратешких партнера
- унапређење постојећег законодавног система (увођење појединих геолошких/палеонтолошких термина у постојећу законску регулативу, успостављање нових законских прописа)
- јачање сарадње између националних и међународних геолошких организација и институција
- интеграцију заштите и очувања геодиверзитета и биодиверзитета
- унапређење образовања у области геозаштите, укључујући и нови профил стручњака „геозаштитар“
- формирање геолошких маршрута и укључивање палеонтолошких локалитета у туристичку понуду

- укључивање локалног становништва и представника локалне самоуправе у активности геозаштите
- унапређење заштите инструктивних палеонтолошких локалитета (обезбеђење финансијских средстава за геолошка и стручна истраживања у домену заштите, изградња неопходних инфраструктурних објеката, постављање информативних табли, израда популарних флајера, мапа, сувенира)
- процену потенцијала појединих подруча за номинацију у Европску мрежу геопаркова.