



GEOLOGICAL HERITAGE AND MUSEUMS

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Abstract. Natural history museums gathering valuable collections play an important role in the protection of geological heritage. This role is inherently associated with the fundamental mission of museums concerning the protection of natural and cultural heritage. For the purpose of methodology, two categories of the inanimate nature monuments are distinguished: (1) immovable geological heritage (immobile monuments of inanimate nature) that cannot be removed from the surrounding environment and should be protected *in situ*, and (2) movable geological heritage (mobile monuments of inanimate nature) protected *ex situ*, within a museum. The paper presents the scientific and didactic criteria of the valuation of the main types of museum collections constituting the movable part of the geological heritage. New tendency in active preservation of geosites are indicated. These trends consist of the use of *in situ* museum techniques of conservation, exposition and of the construction of special museum pavilions and protective halls.

Key words: geological collections, natural history museums, immovable and movable monuments of inanimate nature, natural and cultural heritage, geoconservation, active protection, environmental education.

Abstrakt. Muzea przyrodnicze gromadzące cenne kolekcje spełniają ważną rolę w ochronie dziedzictwa geologicznego. Wiąże się ona integralnie z podstawową misją muzeów w zakresie zachowania dziedzictwa przyrodniczego i kulturalnego. Dla celów metodologicznych wyróżniono dwie kategorie zabytków przyrody nieożywionej: (1) nieruchome dziedzictwo geologiczne (nieruchome zabytki przyrody nieożywionej), nierozdzielnie związane z otaczającym środowiskiem i chronione *in situ* oraz (2) ruchome dziedzictwo geologiczne (ruchome zabytki przyrody nieożywionej), chronione *ex situ* w przestrzeni muzealnej. Przedstawiono naukowe i dydaktyczne kryteria waloryzacji głównych typów kolekcji muzealnych, stanowiących ruchomą część dziedzictwa geologicznego. Wskazano na nowe tendencje czynnej ochrony geostanowisk, polegające na zastosowaniu muzealnych technik konserwacji i ekspozycji *in situ* oraz budowie specjalnych pawilonów muzealnych.

Słowa kluczowe: kolekcje geologiczne, muzea przyrodnicze, nieruchome i ruchome zabytki przyrody nieożywionej, dziedzictwo przyrodnicze i kulturalne, geochrona, ochrona czynna, edukacja przyrodnicza.

INTRODUCTION

Museums — *ex definitione* — safeguard material evidence of the man-made and natural world. In other way, museums are custodians of movable cultural and natural heritage. Contemporary museums still function on the basis of the classical ICOM (International Council of Museums) definition which describes their identity in the following way: “*Museums are non-profit making, permanent institutions in the service of society and its development, open to the public, which acquire, research, communicate and exhibit material evidence of people and their environment, for purposes of study, education and*

enjoyment”. Public awareness of these fundamental goals concerns mainly the cultural heritage. The role of museums in the protection of the natural heritage is much less known.

This situation is, to a large extent, the consequence of an often invoked stereotype stating that the values of the cultural and natural heritage are not equal. It was the World Heritage Convention adopted by UNESCO (Convention Concerning the Protection of World Cultural and Natural Heritage, 1972) that began the process of changing this notion. Significant acceleration of international initiatives and launching of many

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multi-directional research programmes in the area of environment protection obviously affected the shaping of a holistic vision of the heritage. Already in 1997, 114 natural properties and 20 mixed natural/cultural properties, including areas and sites having primary geological significance, were added to

the World Heritage List except for the most valuable objects of the cultural heritage (UNESCO, 1999). Of course, new challenges affected the determination of the role and tasks of contemporary museum institutions, especially natural history museums, in the area of natural-heritage protection.

MUSEUM MISSION AND NATURAL HERITAGE

It should be recalled that contemporary museums of natural history have gathered an impressive number of collections during their over 250-year existence, especially during the period of accelerated development that began in the 19th century, a great age of scientific exploration. The number of biological specimens only (excluding palaeontological material) held in natural history museums world-wide has been estimated at over 2 billion specimens (Cranbrook, 1997). These collections steadily increased in size and importance. While geological collections *sensu largo* (i.e. minerals, rocks, fossils, etc.) are much more modest in terms of quantities, they constitute an important part of museum resources. For example, geological collections housed in the UK university museums comprise 5–6 million specimens. The Natural History Museum (London) only, apart from huge palaeontological collections exceeding c. 8 million specimens, holds a collection of over 0.5 million minerals (~330,000), rocks (~250,000), ores (~20,000), world class meteorites (~3,200) and important ocean-floor sediment collection (~30,000 samples).

It is thus fully justified to say that these vast museum collections of specimens (biotic and abiotic) are repositories of

knowledge on bio/geodiversity, and permanent record of our natural heritage of international or national significance. The increasing awareness of the significance of the most valuable natural science collections as irreplaceable world resource intended for long-term use, was expressed in the definition adopted by an international forum: “Natural science collections are defined as organised collections founded on biological specimens (living or dead) and geological specimens together with associated information and expertise. These natural science collections are held in museums and other institutions which are responsible for facilitating access to and the use of such resources, and for their care and development for the benefit of society” (International Accord on the Value of Natural Science Collections, Manchester, 1995).

It should be simultaneously emphasised that beside the indisputable scientific value, natural science collections have cultural, social-history and educational values — thus playing the key role in stimulating public awareness of nature and environmental protection. Taking care of the collections that have been put in their charge, museums concentrate their activities

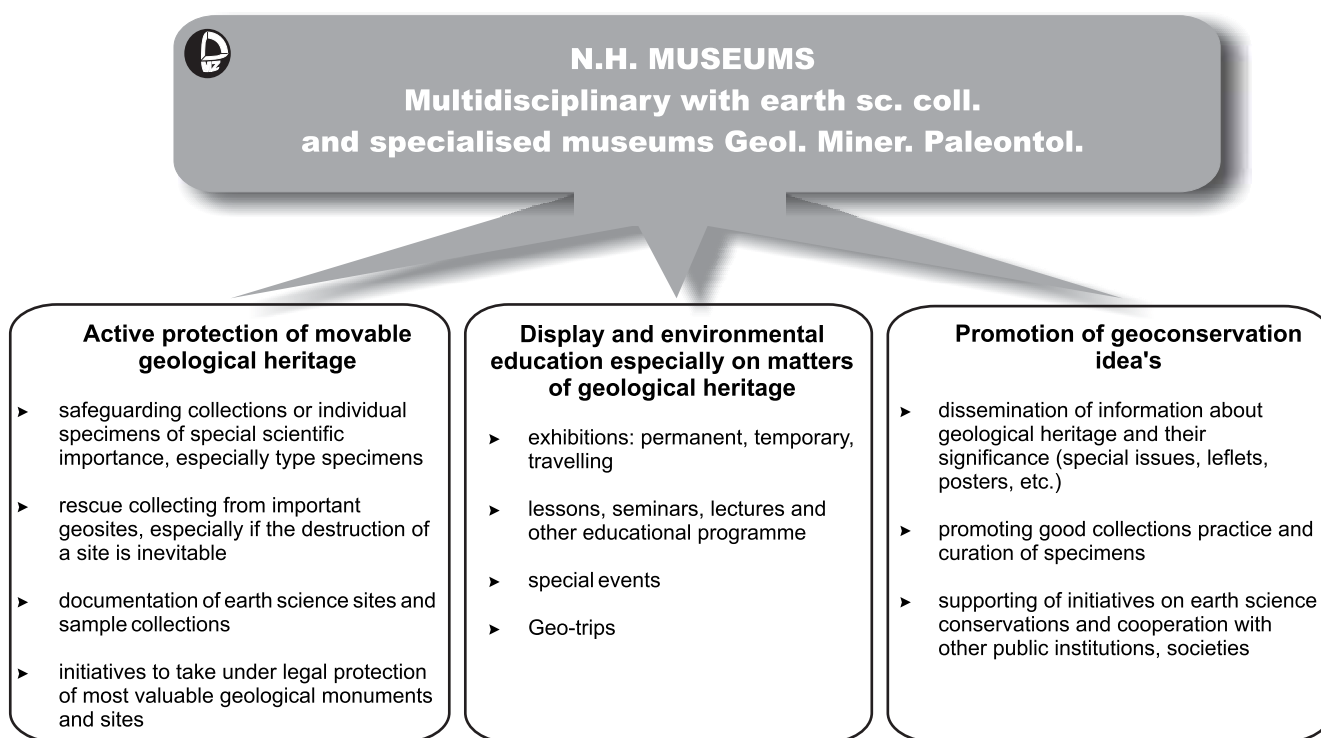


Fig. 1. Different kinds of possible measures on protection of movable geological heritage taken by natural history museums

on four basic tasks: collection, conservation, research and presentation. These tasks determine their role in the protection of the natural heritage, as well as their place in the contemporary national and international legislation, practical implementation and policies of nature conservation.

The role of museums in active protection of the biotic elements of natural environment is limited to indirect, auxiliary actions. Biological collections housed in natural history museums provide a priceless and often irreplaceable scientific resource to environmental science, especially for taxonomy and systematics which are the foundation of all biology, and underpin all efforts to preserve biodiversity. The same collections, because they contain the primary scientific evidence of existence and identification of different species, provide also the

most reliable documentation of ecological change and species extinction. The collections provide also broad support for public education and through exhibits serve a key role in stimulating public awareness of nature conservation.

Geological collections in museums play an especially important role in active protection of our natural heritage. This is mostly because museums are capable of preserving the authenticity of inanimate nature specimens, as opposed to other biotic specimens of the recent living world which are only dead objects extracted from their natural environment. Fulfilling the condition of authenticity preservation treated as the fundamental principle of heritage conservation, allows the museums to play an important role in active protection of movable geological heritage (Fig. 1).

IMMOVABLE AND MOVABLE GEOLOGICAL HERITAGE

In situ protection, which preserves the authenticity and integrity of geological heritage, should be generally treated as the priority aim of every conservation activity. This is in accordance with the Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1999). It emphasised that every activity directed at geological heritage should assume as a fundamental principle the limitation to the absolute minimum of any intervention affecting the authenticity and integrity of geosites and monuments of inanimate nature. This strategic approach to geoconservation is also the methodological basis of contemporary international initiatives, e.g. the GEOSITES project co-ordinated by IUGS and ProGEO Association (Wimbledon *et al.*, 2000) or the proposed UNESCO GEOPARK Programme (Patzak, Edger, 1998).

It must be remembered that the nature of geological heritage may differ from large areas associated with natural space and wilderness to small objects, like rock walls, tors or erratic boulders. Many valuable geological sites are often localised in environments strongly altered by humans (e.g. quarries, road cuttings, mines). Therefore, the real and effective protection of geological heritage requires different approaches and protective instruments. Integral geoconservation in the framework of natural space is not always the most adequate strategy in view of the specific needs of geological heritage preservation. While geological heritage is often a part of a protected natural landscape, its protection is far from being guaranteed. Many valuable geological sites are permanently threatened even if they are legally protected. Special regulations for the specific, most fragile elements of geological heritage, like mineralogical or palaeontological sites, should be a satisfactory alternative.

It should be helpful to distinguish between two categories, i.e. “immovable geological heritage” and “movable geological heritage”. These categories may be defined as follows:

- **Immovable Geological Heritage (IGH)** — important Earth heritage areas and sites which geological features are regarded as fundamental components of a landscape or as outstanding natural geophenomena, permanently associated with natural space, due to their intrinsic value in terms of science or aesthetics. IGH can only be protected and managed in

the context of the landscapes in which they reside, in other words *in situ*. Essential part of geological heritage sites is protected in this manner (Dingwall, 2000). Most of them are related to: geo(morpho)logical features, erosion and deposition processes, landforms; continental or oceanic-scale geological features, relationships of tectonic plates; igneous, metamorphic and sedimentary petrology, textures, events and provinces, structural features (tectonic) or astroproblems (cosmogeology). In accordance with site based approach to geoconservation, preference will be given to *in situ* preservation also for others categories, such as stratigraphical, palaeoenvironmental, palaeontological, mineralogical — if conditions for the professional and effective protection in original environment may be achieved.

- **Movable Geological Heritage (MGH)** — the most vulnerable and fragile parts of earth science heritage facing different kinds of threats (natural degradation or human action) and, as a consequence, forced to be transferred from their natural site for fear of inevitable destruction. These are mostly minerals, fossils from classical localities and outstanding geological/palaeontological/mineralogical sites, which as a part of the movable natural heritage can (or must) be protected *ex situ*. Their inclusion into a museum collection creates often the only chance for the preservation of these invaluable inanimate nature monuments. Rescue collecting at the sites, causing imminent destruction and subsequent safeguarding of the retrieved specimens, is essential for earth science conservation. In many cases, when a geological heritage object is located in areas strongly altered by humans, and conflicts arise between existing or proposed land uses — real protection may be achieved through special regulations and conservation techniques. Even abandoning the *in situ* principle has to be considered, if necessary (e.g. huge erratic boulders in urban agglomeration removed from the original site and saved as geological or cultural/historical monuments). The category of movable geological heritage includes also important historical collections, instruments and archival materials, recognised as the most valuable for the development of earth sciences.

PERCEPTION AND USE OF MOVABLE GEOLOGICAL HERITAGE IN MUSEUMS

Significant role of multi-disciplinary natural history and specialised geological museums in active protection of movable geological heritage is indisputable. This is documented by a huge amount of collections gathered from the most valuable geosites and held in museums and museum based organisations. For example, the majority of samples collected from fossil sites of global importance are safeguarded in n. h. museums. It is worth mentioning superb examples, such as famous “fossilienlagerstätten” Ediacara, Riversleigh (Australia), Burgess Shale (Canada), Mazon Creek, Bear Gulch (USA), Rhynie (UK, Scotland), Liaoning (China) or “old” classic localities in Germany, such as Bundenbach, Holzmaden, Solnhofen, Messel. Of course, many more examples could be cited. Similarly, all the outstanding mineralogical sites are represented in museum collections because it is the only practical way of protecting these valuable and fragile specimens. It is important to stress that these rich resources of movable geological heritage are international in scope and require the improvement of international standards and regulations concerning the protection of the global heritage. Potential threats are being posed, for example, by the increasing commercialisation of mineral and fossil collecting. Therefore, caring for the objects that have been put in their charge and making them available to the public are two crucial tasks that museums have to perform, regardless of their size or stature.

The concept of establishing a close connection between museum functions and the protection of movable objects of inanimate nature has a long tradition in Polish museology. The Museum of the Earth, Warsaw, at the very beginning encompassed both “mobile monuments of inanimate nature” (that is unique museum specimens) and “immobile monuments of inanimate nature”, remaining in natural environment

(Małkowski, 1960). Monument-studies and development of the active protection of movable geological heritage, enriched with new forms corresponding to present-day needs, have been continued (Jakubowski, 1997).

The rising emphasis on geoconservation is giving new significance and urgency to the role of museums. Undoubtedly successful protection of inanimate nature depends also on activity of natural history museums. Particularly important from a museum viewpoint is the safeguarding of various kinds of movable geological heritage. There can be distinguish the following main categories of movable geological heritage, which may be described as “Museum Geological Heritage Collection” (MGHC):

A. Scientifically important collections or individual specimens, especially of the material “type” (palaeontological, mineralogical), as well as figured, cited and referred material. These collections provide a priceless and often irreplaceable resource relevant to earth science and are regarded as having the greatest scientific value of any material evidence. Therefore, their preservation is of absolute necessity (Fig. 2).

B. Collections of specimens from the most valuable and representative geosites legally protected or assigned for conservation on a national/international level. These are usually the most fragile specimens (minerals, fossils) requiring special protection within the museum. These collections are an integral part of the scientific resource of important geosites. These specimens often come from the most valuable sites facing inevitable degradation or total destruction due to natural or anthropogenic reasons (Fig. 3, 4).

C. Collections or individual specimens from classical localities now run out and no longer collectable. This unique ma-



Fig. 2. “Type” specimens in museum collection are regarded as having the greatest scientific value of any material evidence. Holotype specimen *Lathridius jantarius* Borowiec, 1985 of the family Lathridiidae (Coleoptera) from outstanding collection of amber organic inclusions housed at Museum of the Earth PAS in Warsaw

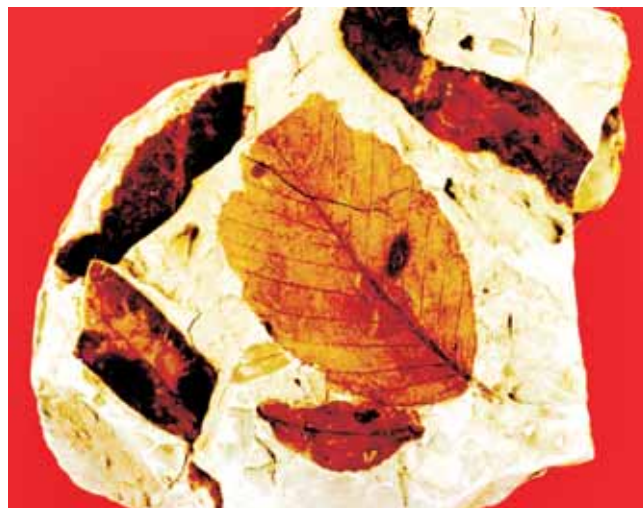


Fig. 3. Well-preserved imprints of elm and willow leaves from classical Neogene (Miocene) fossil flora site Sośnica, Lower Silesia, Poland; Museum of the Earth PAS, Warsaw



Fig. 4. Perfectly preserved, one of the biggest ammonite in Polish museum collections (*Anapachidiscus wittekindi*) from classical middle Vistula section; the Upper Cretaceous succession

This rare specimen links scientific, educational and aesthetic values; display collection of the Museum of the Earth PAS, Warsaw

terial safeguarded in museum may often be the only evidence for the Earth history, geological events and geodiversity of these areas. Geological specimens often become important historical documents, as particular, natural environments are changed or lost. This is especially important nowadays, as we modify the Earth with increasing vigour (Fig. 5).

D. Unique or rare specimens, e.g. extraordinary, well-preserved fossils, perfect, well-formed minerals or attractive association of mineral species. In addition to their scientific value that specimen or collection may have many other values at the same time: educational, aesthetic and, sometimes, great importance as historical and cultural heritage. The utilisation of natural history collections values is often limited to exposing their information functions. Yet, many objects in natural history collections, especially geological ones, may have a great intrinsic beauty (e.g. minerals), therefore require a favourable position on the museum display. Other specimens, e.g. unique fossils, apart from purely scientific values, have an emotional expression connected with scientific idea, discovery or their historical significance as representing the natural and cultural heritage (Fig. 4, 6).



Fig. 5. Well-preserved Jurassic ammonite fauna collected from scientific important locality protected as Łuków Nature Reserve
Now exhausted temporary exhibition in the Museum of the Earth, Warsaw



Fig. 6. Unique, large crystal of smoky-quartz from outstanding granitoid mineral-ferrous site

Strzegom, Lower Silesia, Poland; display collection in the Museum of the Earth, Warsaw



Fig. 7. Archival photo of famous “Belgica” ship from Antarctic Expedition (1897–1899)

Earth science historical documents collection of the Museum of the Earth, Warsaw

E. Historical collections related to the names of eminent scientist, famous collectors, history of geological exploration and significant discoveries. These collections represent the cultural and scientific heritage of natural science and history of science as such. Museums are still motivated by a quest to decipher the natural world recorded in the existence of the objects. As historical documents, specimens invariably retain a role in contemporary science. “Old fashioned collections” and associated archival materials (e.g. manuscripts, photos, books, instruments) may also be an important resource for social history inquiries (Fig. 7).

These main categories were formed based on the roles and functions of geological material evidence in museum practice, and on principles of geoconservation. It should be noted that either entire collections or their parts or even individual specimens may be assigned to the respective category. This informa-

tion is essential for the management of geological collections. There is no doubt that one of the most important criteria in valuing a museum’s geological collection is its significance for the protection of natural and cultural heritage. The opportunity, if we take it, will also have implications for a museum’s collecting policy, including the acquisition and disposal of geological collections as a result of research and educational activity.

Museum collections or individual specimens belonging to the category of movable geological heritage are subject to appropriate conservation techniques that guarantee long lasting protection and proper conditions for making them available for research and education purposes. Entire accordance with the basic principles of earth science conservation and museum functions (i.e. safeguarding the specimens and making them available to the public) is observed there. In practice, however, conflicts often arise between the specific requirements of conservation and the need to make the collections available to the public. This problem may be illustrated by the Berlin specimen of *Archeopteryx lithographica* exposed at the exhibition in the Museum für Naturkunde, Humboldt Universität, which in fact is an accurate copy of the original specimen protected in a special room and available for research purposes, only.

The use of objects, belonging to movable geological heritage, in public museum exhibitions is a separate issue closely associated with the general trends in contemporary museology of natural history, and particularly with the introduction of new display techniques (Jakubowski, 2001). It should be stressed that, apart from purely cognitive functions, displaying the original objects of movable geological heritage at public exhibitions (permanent, temporary or travelling) is extremely important for environmental education and promotion of earth science conservation. Displayed collections of minerals, rocks, and fossils are the “real things” for visitors. In other words, they are “natural” nature objects.

Possibilities of stimulating the imagination through direct contact with real nature is an essential factor for the popularisation of both natural sciences and fundamental problems of nature conservation (Jakubowski, 1983, 1997).

NEW TENDENCIES — FROM PROTECTION OF GEOLOGICAL HERITAGE IN MUSEUMS TO MUSEUM ON SITE

Certain objects of movable geological heritage may be efficiently protected outside museum rooms. Specially arranged open-air exhibitions are often located next to museum buildings or in other protected areas. The objects displayed in this way are usually resistant to external factors (e.g. massive rock fragments, erratic boulders, fossilised tree-trunks, etc.) (Fig. 8).

Experience gained in this area by museums may also be applied to the *in situ* protection of geological heritage. Recently, many different protection and display techniques have been introduced in several geosites, between others construction of special shelters, fences and protective halls and pavilions or construction of a whole museum-on-site. Museum Hauff in Holzmaden, Germany, or the famous Glacier Garden in Lucerne, Switzerland, are the classical examples of the combina-

tion of the *in situ* protection with museum functions. If we want to stay on in Europe, interesting solutions such as glass-site museum of siren fossils and “museum units” (Martini, 2000) have been employed in Haute-Provence Geological Reserve, France. The protection programme of a famous dinosaur-footprint site in La Rioja, Spain (Perez-Lorente, 2000) is also worth mentioning, as well as the interesting museum educational concept developed in the form of the extension of the protective hall over the natural monument “The Muenchehagen Dinosaur Track”, NW Germany (A. Gervais, K. Gervais, 1999). Very interesting efforts of turning geological sites into museums (exomuseums of geology) are co-ordinated in Portugal by the National Museum of Natural History, Lisbon University (Galopim de Carvalho *et al.*, 1999).

Display techniques used in museum are also employed to develop methods of disseminating the fundamental information on scientific and educational aspects of protected regions and sites of geological heritage. These are e.g. special out-door interpretative panels, banners, pergolas, plaques and educational trails. A project carried for many years out in Great Britain, as well as those carried out in other European countries, such as Germany, France and Spain, are specially interesting (Hose, 2000).

The so-called visitor centres are very important for the active protection of geological heritage. The centres offer an extensive educational programme beginning with museum display and ending with guided geological trails. These trails are situated within protected areas or sites, or nearby them. This concept is being successfully implemented in the U.S.A. and Canada, e.g. in the Dinosaur National Museum Visitor Centre (Colorado) or the Devil's Canyon Science and Learning Centre, Fruita, Colorado. A versatile, exemplary programme of *in situ* protection combined with research and educational functions is implemented in the famous Tyrrell Museum of Palaeontology and Field Station (Drumheller, Alberta, Canada), opened in 1985. Similar European examples may be found in the National Stone Centre and the Charmouth Heritage Coast Centre opened in Great Britain, Puy Du Dome Visitor Centre, France, and Garrotx Volcanical Park in Spain. Such initiatives will become still more



Fig. 8. Big erratic boulders belong to the largest group of inanimate nature's monuments in Poland

Very often, especially in urban areas, the erratic boulders should be saved *ex situ* as a geological or cultural monuments; this "collection" is preserved on the special protected area at National Library, Warsaw

important in the future not only because of the efficiency of the active protection of the geological heritage that they offer but also because of the accelerated development of geotourism.

CONCLUSIONS

Multidisciplinary natural science museums and specialised geological museums are important and complementary links strengthening the implementation of the geological-heritage protection programmes at regional, national and international levels.

Museums play an important role in the area of active protection of movable geological heritage and promotion of earth science conservation.

Experience gained by museums are useful in the introduction of different methods of *in situ* protection of valuable geological regions and objects. The programmes of the construction of museum-on-site, visitor centre, etc., implemented currently indicate that this concept of efficient protection of the most valuable sites of geological heritage is the optimum one.

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