Geopark „Belogradchik Rocks"

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Introduction

Belogradchik is an emblematic site for the Global Geoparks. Among the unique rock complex of the Belogradchik Rocks, in 1998 a new UNESCO Geoparks initiative was officially announced. The place of this meeting was not chosen by chance. At that time, Bulgaria actively participated in the events of the European Association for the Protection of Geological Heritage ProGEO, and the Belogradchik Rocks are one of the most impressive natural phenomena in Europe.

The Belogradchik Rocks are the undisputed leader among the natural landmarks of Bulgaria. They are a unique combination of picturesque relief, natural landscape, history and culture. That is why they are often compared to the most prominent natural phenomena in the world. The first independent assessment of the rocks was made by the French publicist Jérôme Adolphe Blanqui (1843) noted: *"The narrow mountain gorges of Olioul in Provence, the Pancorbo Pass in Spain, the Alps, the Pyrenees, the wildest mountains of Tyrol and Switzerland have nothing to compare with this."* In 1873, they were immortalized by the Hungarian ethnographer and painter Felix Kanitz, and a little later, the Viennese professor Franz Tula (1877) identified the first Bulgarian fossil deposits in the Carboniferous rocks of the Zelenigrad coal mine and the Triassic limestones along the old road to Vidin. In 1996, the president of the European Association for the Protection of the Geological Heritage ProGEO, William Wimbledon, compared the Belogradchik rocks to the the Dinosaurs Valley in the USA and the Nygardsbrynn Glacier in Norway (Wimbledon, 1996). Because of their unique landscape and natural beauty, they have found a place in a number of artistic and literary works. Many Bulgarian, German, Russian and Hollywood film productions have been filmed here.

From a geological point of view, the Belogradchik Rocks are fluvial deposits formed in the Early Triassic, even before the appearance of dinosaurs (more than 250 million years ago). In Europe, these facies is known as "Buntsandstein" or German Triassic. The formation of rock monuments by erosion began about 35 million years ago during the Eocene epoch and continues to this day. As a result of this long geological evolution, an 18-km strip of red-colored rocks with unique rock monuments resembling people, animals, castles and fairy-tale characters was formed. Some of them were named by the local population as early as the 19th century, and today they continue to impress with their unadulterated natural beauty.

In 2009, the Belogradchik Rocks were nominated for the New Seven Natural Wonders of the World and mobilized an unprecedentedly high vote – nearly 7 million votes. In 2012, the rocks won the national campaign of the newspaper Standart for "Wonders of Bulgaria" in competition with historical sites from the UNESCO List such as Tsarevets and the Rila Monastery with over 1 million visitors per year. The vote clearly showed the preferences of Bulgarians for the Belogradchik Rocks over all cultural and historical landmarks of the country. On October 3, 2012, at a solemn concert at the National Palace of Culture, the mayor of Belogradchik, Mr. Boris Nikolov, received the prize for the Belogradchik Rocks as a National Symbol of the Material Heritage of Bulgaria.

The first application of the Belogradchik Rocks Geopark to the European Geoparks Network

In 2010, the first attempt was made to apply for the Belogradchik Rocks Geopark to the European Geoparks Network. At that time, the requirements were quite low, but the application on behalf of the Belogradchik Municipality included only the natural landmark Belogradchik Rocks, whose territory of 600 ha is extremely insufficient and cannot fulfill one of the main functions of a true geopark - to promote the socio-economic development of the region.

The main recommendations of the European Network are to expand the area to include the Magura Cave, create an independent management structure with its own staff, develop educational programs, form collections for the geological heritage in the natural history museum and more widely involve the local community in the work of the geopark.

In the following years, a new concept for the Belogradchik Rocks Geopark was developed, including the territory of 4 municipalities with a total area of 1373 km2: Belogradchik, Dimovo, Chuprene and Ruzhintsi. The geodiversity was described under a project of the Scientific Research Fund of the Ministry of Education and Science by professors and students of the University of Mining and Geology “St. Ivan Rilski”.

Official application of the “Belogradchik Rocks” Geopark in the UNESCO Global Geoparks Network in 2014

Belogradchik Municipality has many years of experience (more than a century) in the management and maintenance of natural and cultural heritage and established traditions in the creation of tourist infrastructure (eco-trails, geo-trails, bicycle paths) and developed museum work (historical and natural history museum), which is a good prerequisite for rapid adaptation to UNESCO requirements and integration into the Global Geoparks Network. Until recently, the municipality had cooperation agreements in the field of education and protection of natural landscapes with the Moscow State University "M. V. Lomonosov" and the University of Mining and Geology "St. Ivan Rilski", thanks to which student field practices and excursions were held in the region every year. This allowed the work on the geopark to be placed at the university level.

In 2011-2014, professors and students of the University of Mining and Geology "St. Ivan Rilski" under the project of the Scientific Research Fund of the Ministry of Education and Science developed the scientific database of the ”Belogradchik Rocks” Geopark by compiling scientific dossiers in Bulgarian and English for 72 geotopes of aesthetic, scientific, ecological, cultural-historical and spiritual value (Синьовски, 2013a,b). A multilayer (topographic, geological and landscape) map was created in ArcGIS for an area of 1373 km², including the municipalities of Belogradchik, Dimovo, Chuprene and Ruzhintsi. In the development of the non-geological features of the geopark, landscape experts from the Moscow State University "M. V. Lomonosov" and archaeologists from the National Archaeological Institute with Museum at the Bulgarian Academy of Sciences, working on the territory of the geopark with French archaeologists from the University of Bordeaux, were involved.

At the same time, the main parameters of the geopark were published in the prestigious journal “Geoheritage” of the European Association for the Preservation of Geological Heritage ProGEO (Tronkov, Sinnyovsky (2012). After intensive field research, the Buntsandstein deposits of the Petrohan Terrigenous Group, exposed in the 18-kilometer strip between the border area “Sbegovete” and Falkov Most, were divided into three lithostratigraphic units: Belogradchik. Slovovnik and Kaluger Formations (Tronkov, Sinnyovsky, 2014). With full respect to the rapid lateral changes of the fluvial deposits, the total stratigraphic volume of the formation includes six well-traceable packets in the Belogradchik region with a total thickness of about 250 m. The stratitype section of the Belogradchik Formation between the Romantic Valley and the Antique stronghold “Kaleto” (Fig. 1) includes four of them and provides visitors with the opportunity to get acquainted with the emblematic Buntsandstein red rocks, among which the rock monuments are developed. They have recorded the annual flooding cycles characteristic of the fluvial deposits and the typical "desert tan" of the conglomerate particles, testifying to the hot, arid climate during the Early Triassic (Tronkov, 1998).

For their part, the four municipalities did everything possible to improve the tourist infrastructure of their territories.The municipal road network was almost completely renovated (Fig. 2a,b). In Belogradchik, under the Operational Program “Regional Development”, a new visitor center was built (Fig. 2c,d), where a geological exposition representing the exceptional geodiversity of the Geopark was arranged. In Oreshets village on the territory of Dimovo municipality, the “Venetsa” cave was adapted for tourism under the European Interreg IPP program (CBC Bulgaria-Serbia) (Fig. 2g), and in the village of Dolni Lom, on the territory of Chuprene municipality, a new visitor center was built (Fig. 2h). The project also received support at the national level from the Ministry of Environment and Waters with a letter dated 22.08.2012. The Association for the Development of the Northwest (ADNW) with headquarters in the town of Belogradchik was registered as the managing body of Geopark. Its main goal was to develop the potential and resources for achieving

sustainable development of the Northwest Region and to carry out all necessary legal and factual actions for the establishment of a Geopark on the territory of the member municipalities and for its nomination for the European Geoparks Network, respectively for the UNESCO Global Geoparks Network.

During our participation in the 12th conference of the European Geoparks Network in Italy-2013, important contacts were established with experts from France, Spain, Italy, Greece and Romania. Commenting on the achievements of Bulgarian geoconservation since the beginning of the century, the President of the European Network, Nicholas Zouros, asked: "Why are you so late!? It is not you, but Europe and the world that lose from the absence of Bulgarian Geoparks in UNESCO!"

After intensive work on compiling the geological map and documenting dozens of geotopes on the territory of the four municipalities, on November 26, 2014, the official application of the Belogradchik Rocks Geopark was submitted to the UNESCO Global Geoparks Network. It included an application file, a geological part addressed to the International Union of Geological Sciences and standard application forms with data on geodiversity, ecology, landscapes, cultural and historical heritage, the management structure of the geopark, economy, geotourism and the tourist infrastructure of the territory.

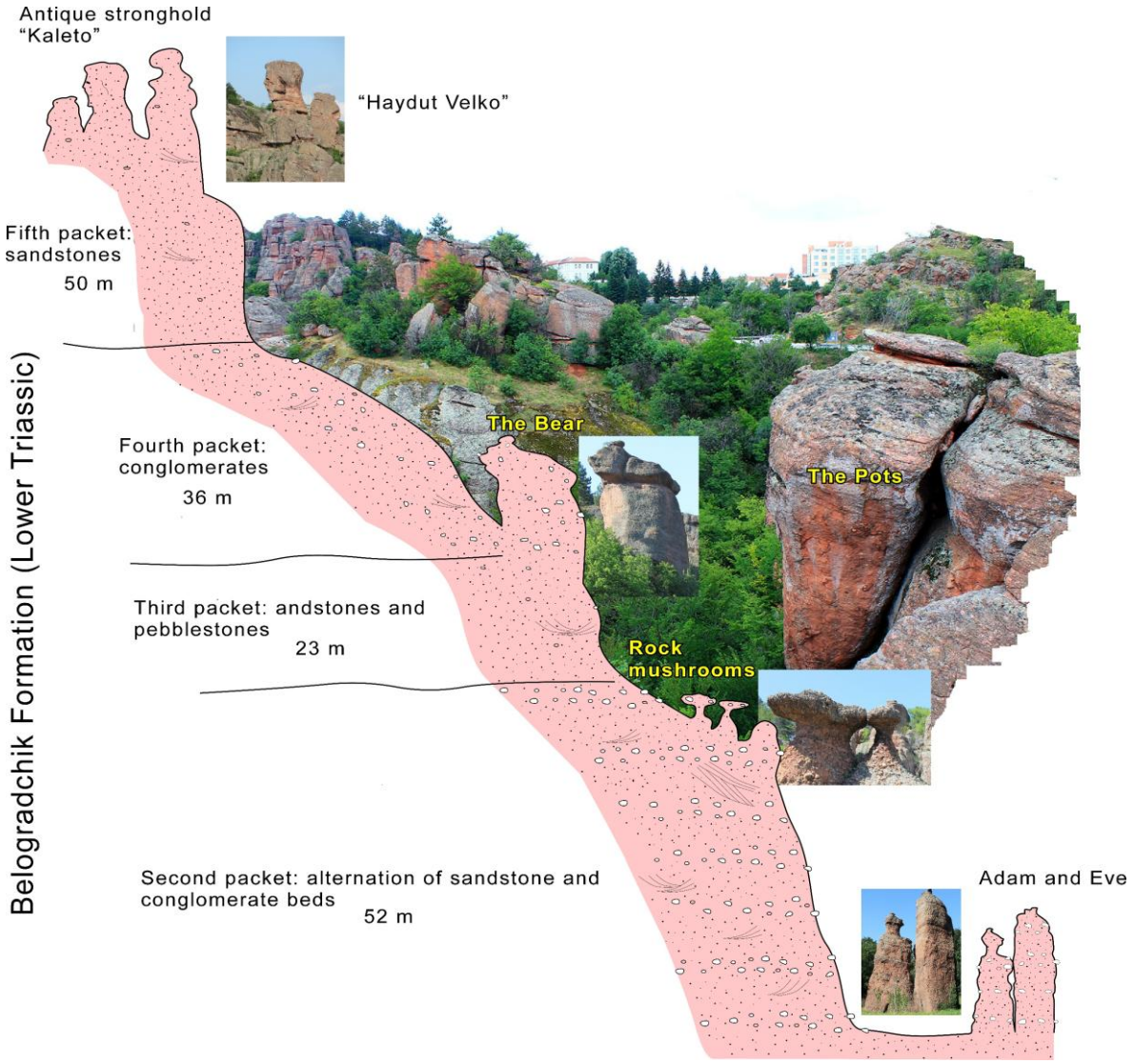


Figure 1: *Part of the stratotype of the Belogradchik Formation between the Romantic Valley south of Belogradchik town and the Stronghold at the top pf the Belogradchik rocks where it is exposed most fully and includes 4 packets of the entire stratigraphic volume of 6 packets (without the lowest and uppermost packets).*


a


b

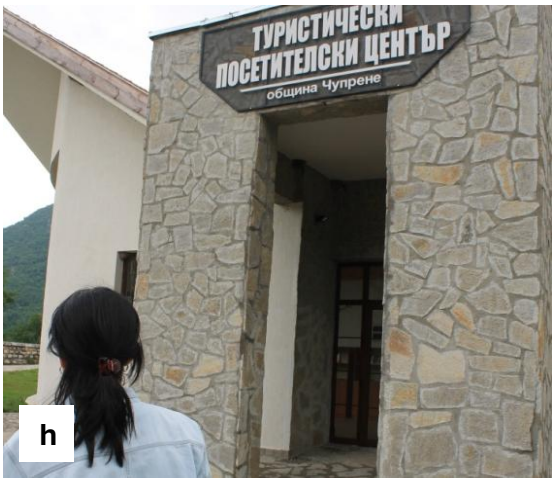

c


d


e


f


g



h

Figure 2. *In the border areas of the municipalities, the entire road network was renovated;* ***c,d,*** *The new Visitor Center in the town of Belogradchik built under the Operational Program "Regional Development";* ***e,f,*** *The geological exposition in the Visitor Center;* ***g,*** *"Venetsa" Cave;* ***h,*** *The Visitor Center in the village of Dolni Lom.*

Following the positive opinion of the International Union of Geological Sciences on the geodiversity of the territory, the UNESCO Secretariat (Department of Environmental and Earth Sciences) appointed an official mission to the Geopark in the summer of 2015. In connection with this mission, the Coordinating Council of the European Geoparks Network recommended the participation of a representative of the geopark in the 13th conference in Finland and the intensive course organized annually in the Petrified Forest Global Geopark on Lesbos Island under the auspices of the Global Geoparks Network.

Unfortunately, due to the denied financial support from the Ministry of Environment and Waters, the mentioned events were not visited, no information panels with geological information adapted for the general public were installed, and the mission itself was financed with personal funds by the director of the geopark, who covered the internal transport costs and plane tickets of the UNESCO experts, and the municipality of Belogradchik covered the accommodation expenses of the mission.

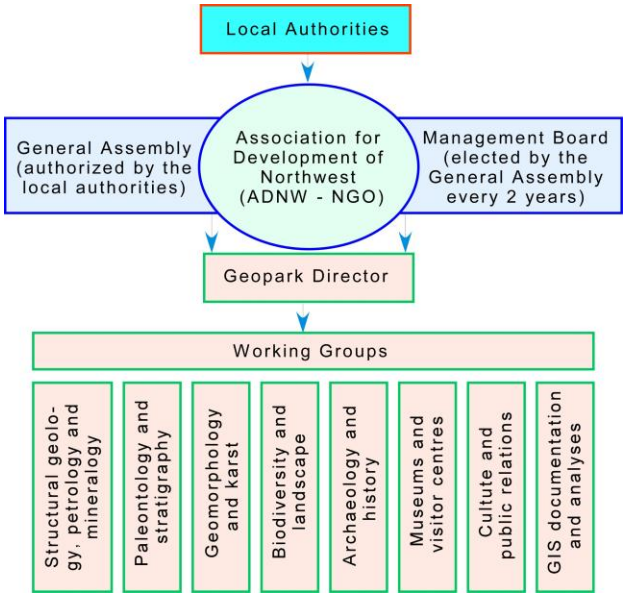


Figure 3. *Organizational chart of the governing body of Belogradchik Rocks Geopark - Association for the Development of the Northwest (ASWD)*

The mission, which took place between June 30 and July 2, 2015, highly appreciated the scientific development and the improved municipal infrastructure, but due to the lack of sources of funding, information panels with geological information, and staff on a permanent employment contract to work permanently on the development of the park infrastructure, the bureau of the Global Geoparks Network assessed that the geopark did not yet have the necessary maturity to be recognized as a UNESCO Global Geopark. This time, 14 recommendations were made, which do not require much funding, except for the maintenance of permanent staff and the development of a geopark development plan.

Thus, the paradox was reached that during the first application in 2010, after only two recommendations, the geopark was almost accepted, and after the large-scale expansion of the area, the significant improvement of the tourist infrastructure (a new visitor center with a geological museum) and the scientific development of 72 geotopes in Bulgarian and English, the application was categorically rejected with 14 recommendations. Perhaps the assessment of scenic landscapes of global value, supplemented by a remarkable diversity of rocks from the entire stratigraphic chart, which is undoubtedly the Belogradchik region, should not be reduced to formal parameters that have nothing to do with the geological heritage.

In fact, at that time there was an option to accept a geopark, provided that the mission's recommendations were implemented by the end of the second year. This would have consolidated the four municipalities to strengthen the joint project in the name of the achieved results. Instead, the unsuccessful second application led to great disappointment among the local community. The general opinion can be summarized as follows: "We don't need UNESCO, we are happy with our natural heritage anyway." After the negative result of the mission, two of the municipalities, Chuprene and Ruzhintsi, abandoned the project. Obviously, the municipalities from the poorest region of Bulgaria and Europe do not have the opportunity to bear such costs and this wonderful project once again remained outside the Global Network. Thus, despite

many years of efforts, Bulgaria still does not have a Global Geopark and from a leading country in the field of geoconservation, on whose territory the UNESCO Global Geoparks initiative was announced in Belogradchik in 1998, it has become an outsider with two unsuccessful applications. At the same time, in other European countries, which at that time had no idea about geoparks, there are already several UNESCO geoparks.

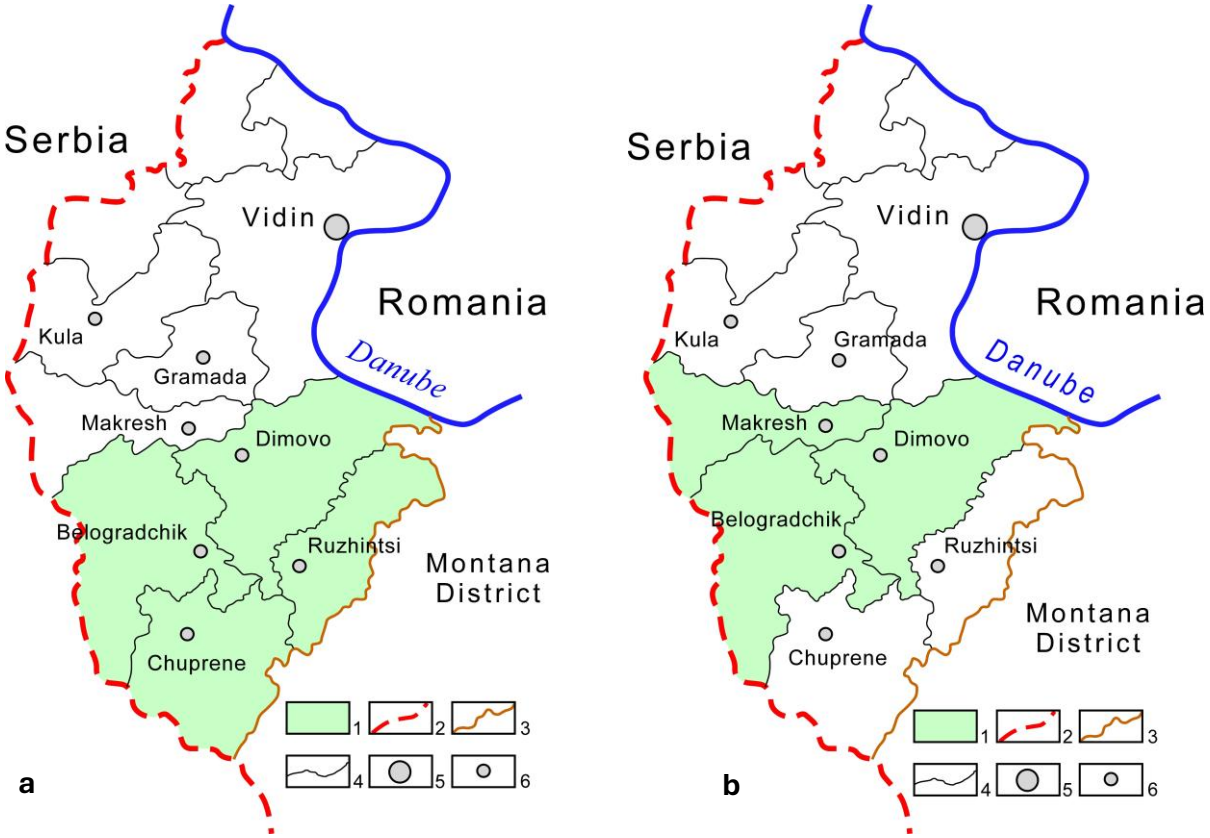


Figure 4. *Applying area of Geopark "Belogradchik Rocks" for UNESCO Global Geopark:* ***a,*** *Unsuccessful application area - 2015 (1373 km^2),* ***b,*** *New application project - 2017 (1049 km^2); 1 – Geopark area; 2 – State border; 3 – District border; 4 – Municipality border; 5 – District center; 6 – Municipal center.*

Despite the unsuccessful application, the Belogradchik Rocks Geopark took a step forward by falling into the "Aspiring Geoparks" category (registered on the UNESCO website) with information on the UNESCO website and the transformation of the name into UNESCO Global Geopark, according to a letter from the National Commission for UNESCO to the Secretary-General of UNESCO dated 10.09.2016. In September 2015, the Chairperson of the National Commission for UNESCO, Ms. Katya Todorova, confirmed in a letter to the Secretary-General of UNESCO, Ms. Irina Bokova, our agreement to rename the "Belogradchik Rocks Global Geopark" into "UNESCO Belogradchik Rocks Geopark", according to the new International Geosciences and Geoparks Programme of UNESCO. The geopark is now in the UNESCO database and it depends only on us whether it will become an active member of the Global Network.

Given the disappointing situation regarding the denied funding of the UNESCO mission and the preparatory activities for it, the initiators of Geopark were ready to give up further efforts to apply to UNESCO. However, two of the municipalities that participated in the unsuccessful project - Belogradchik and Dimovo - continued their efforts to establish a geopark and, with the help of the Makresh municipality, registered a governing body of the Geopark - the Association for Development of the North-West, structured with the sole purpose of performing the functions of the governing body of Geopark (Fig. 3). Within the framework of the contractual relations of the Belogradchik municipality with the universities, 8 working groups of experts with different profiles were formed, which will perform their functions on a voluntary basis. The format of 4 municipalities with an area of 1373 km^2 (Fig. 4a) was replaced by a format of three

municipalities (Fig. 4b), which joined their efforts to fulfill the UNESCO recommendations and apply again with an area of 1049 km^2.

A good prerequisite for a successful new application is the high potential of the three municipalities for participation in projects under European cross-border cooperation programs, including lead partners, as well as the Local Initiative Group registered by them in January 2017.

Figure 5. *International Scientific Conference "Geoparks and Contemporary Society":* ***a,*** *General photo of the participants at Mislen Kamak;* ***b,*** *At the "Skalite" Hotel;* ***c,*** *At the Natural History Museum;* ***d,*** *Tasting of wines aged in the Magura cave at a temperature of 12°C.*

The start of the new format of the Belogradchik Rocks Geopark was given with the inclusion of the Belogradchik municipality in the development of a project for the creation of UNESCO Global Geoparks in sensitive territories (protected areas, including Natura 2000 and territories of cultural significance) with partners from Greece and Albania within the framework of the European INTERREG BALKAN-MEDITERRANEAN program. At the initiative of the director of the geopark, contact was established with the President of the UNESCO Global Geoparks Network, Nicholas Zouros, the coordinator of the Petrified Forest Geopark in Lesbos, Ilias Valiakos, the Institute of the Environment in Athens, Nadia Chartidou, and the Deputy Director of the Albanian Geological Survey, Prof. Ariane Bekirai, and in May 2016, a joint project was developed under the European Balkan-Mediterranean Program between the Municipality of Belogradchik - Petrified Forest Natural History Museum in Lesbos, the Institute of the Environment in Athens, and the Polytechnic University of Tirana, to create three new geoparks on the territory of Bulgaria (Belogradchik Rocks), Greece (Pikermi), and Albania (Vlora). Unfortunately, the project was not approved at the level of second call of the program.

Figure 6. *The Belogradchik Fortress with the Roman stronghold "Kaleto":* ***a,*** *General view of the fortress;* ***b,*** *The interior of the Roman stronghold "Kaleto";* ***c,*** *Watercolor of the Belogradchik Fortress by Felix Kanitz (1873); d, Watercolor of the interior of "Kaleto" by Felix Kanitz (1873); e, Watercolor of the Belogradchik Rocks by Felix Kanitz (1873).*

The transition of Belogradchik Rocks Geopark to the category of "Aspiring UNESCO Geopark" is a great opportunity for Bulgaria to acquire its first UNESCO Global Geopark. Based on the results achieved so far, for the successful finalization of the multi-year efforts to create the Belogradchik Rocks Global Geopark, certain actions need to be taken at the local and national levels. The specific actions to implement UNESCO's recommendations can be implemented with the joint efforts of local authorities, the experts who developed the geopark, and the consultant appointed by UNESCO through:

• Strengthening the concept for developing the geopark on the territory of the three municipalities of the Northwest Development Association – Belogradchik, Dimovo and Makresh;

• Development of geotopes with aesthetic, scientific, educational and cultural value in the new geopark format.

• Development of a geopark management plan;

• Creation of a common regional strategy for developing geotourism and other alternative forms of sustainable tourism – ecotourism, rural tourism, cultural tourism.

One of UNESCO's recommendations is to find a way to appoint Geopark staff - at least two or three experts who, with the help of the experts developing the geopark, will draw up the geopark management plan, prepare projects under regional development programs and take on the organizational activities for arranging the new visitor center at the Belogradchik Fortress, developing geotrails, cycle paths, walking routes, etc. A successful solution to this problem was found in taking over the management of Geopark from the Municipal Museum of Natural History, which has appointed 8 employees on permanent employment contracts. The remaining activities will be carried out as before on a voluntary basis by the members of Geopark's governing body.

Despite the series of failures, in 2018 the Association for Development of the Northwest organized an international scientific conference "Geoparks and Modern Society" on the occasion of 20 years since the announcement of the UNESCO GEOPARK initiative in Belogradchik (Sinnyovsky, Nikolova, 2018). It was recognized by the President of the Global Geoparks Network, Prof. Nicholas Zouros, and the leadership of ProGEO, but due to the many initiatives of ProGEO in the summer of 2018, it was postponed to October. However, the conference brought together participants from 4 continents, who exchanged experiences in the conservation of geological heritage in a park environment (Fig. 5) and got acquainted on the ground with the geological heritage of the region, summarized in a field guide (Sinnyovsky et al., 2018). A direct result of the conference is the letter from the Minister of Environment and Waters to the Belogradchik Rocks Geopark, giving the green light for a new candidacy of the geopark in the Global Network. To this end, the Governing Body of the Geopark must build the necessary park infrastructure and mobilize the local community to welcome the next UNESCO mission.

Key geotopes

The Belogradchik Fortress (Fig. 6a) with the Roman fortress "Kaleto" (Fig. 6b) is a geotope of aesthetic, historical and cultural value, which has been the subject of works of art since the 19th century (Fig. 6c-e). The fortress and especially the Roman "Kale" were built on the highest, naturally inaccessible part of the Belogradchik Rocks. In the 20th century, "Kaleto" became emblematic of the Belogradchik Rocks and now it is the most visited place in Geopark, attracting tens of thousands of visitors annually. Recently, the Belogradchik Rocks became the host of the summer festival "Opera of the Peaks – Belogradchik Rocks" of the Sofia Opera and Ballet, and the cannons of Kanitz's painting (Fig. 6c) are replaced by stage sets (Fig. 7a,b).

Now the rocks are magnificent backstage for "Tosca", "Turandot", "Swan Lake", "Mamma Mia", performed outdoors in the Belogradchik Fortress. This wonderful idea attracts many visitors from Bulgaria and abroad contributing to the global promotion of the natural and cultural value of the Belogradchik Rocks.

The Romantic Valley (so named by Jérôm-Adolphe Blanqui, 1843) was first illustrated in the J. Szombaty's 1875 lithograph, published by Franz Tula (1877) (Fig. 7c). Its surroundings include the most popular geotopes of aesthetic and historical value, some of which were named by the local population as early as the 19th century (Figs. 8a-h). Although the rock fairy tale provides the human imagination with unlimited possibilities for interpretations, some of the emblematic figures such as the "Madonna" (Fig. 8a), the "Lion" (Fig. 8b left), the "Schoolgirl" (Fig. 8b right), the "Bear" (Fig. 8c), "Adam and Eve" (Fig. 8d), "The Horse Man" (Fig. 8e), etc., have gained national popularity and are uniquely identified in the field. In addition to their aesthetic qualities,

the rocks also possess specific textures and structures characteristic of their river origin such as annual flooding cycles, the orientation of the pieces indicating the direction of the river currents, a desert tan characteristic of the arid climate during the Early Triassic, when the river gravels and sands were formed, etc.

Figure 7. a, *Announcement of the Sofia Opera and Ballet Summer Festival "Opera of the Peaks – Belogradchik Rocks 2019";* ***b,*** *Every summer, the Belogradchik Rocks, which are part of the World Natural Heritage, provide a stage for the World Cultural Heritage;* ***c,*** *Lithograph of the Romantic valley by J. Szombathy,1875 (in Toula, 1877).*

The rock assemblage "Kaleto" has only one named figure - the hero of the struggles for national liberation in the 19th century, Haidut Velko (Fig. 9a). South of "Kaleto" are "The Monks" (Fig. 9b), and even further south is the rock composition "Alice in Wonderland" (Fig. 9c), as well as a single rock resembling a leopard (Fig. 9d).

"Markashnitsa" area northeast of the village of Izvos is a rare combination of majestic geological phenomena, a charming natural landscape and adequate anthropogenic activity (Fig. 9e). East of Markashnitsa is the famous Sabubin Stone (Fig. 9f), and between them is the Lepenitsa cave, which is a rock niche with a length of about 50 m. Ancient ceramics and tools of labor were found in the cultural layers of the cave floor (Fig. 9g). Northeast of the village of Izvos is situated a Latin fort and a rock assemblage called "Jabba from Star Wars" (Tronkov, Sinnyovsky, 2012) (Fig. 9h).

"Magura" Cave is a natural landmark of national importance. It is a large karst formation in the Upper Jurassic-Lower Cretaceous limestones of the Cherepish Formation, forming the Rabishka Mogila hill.

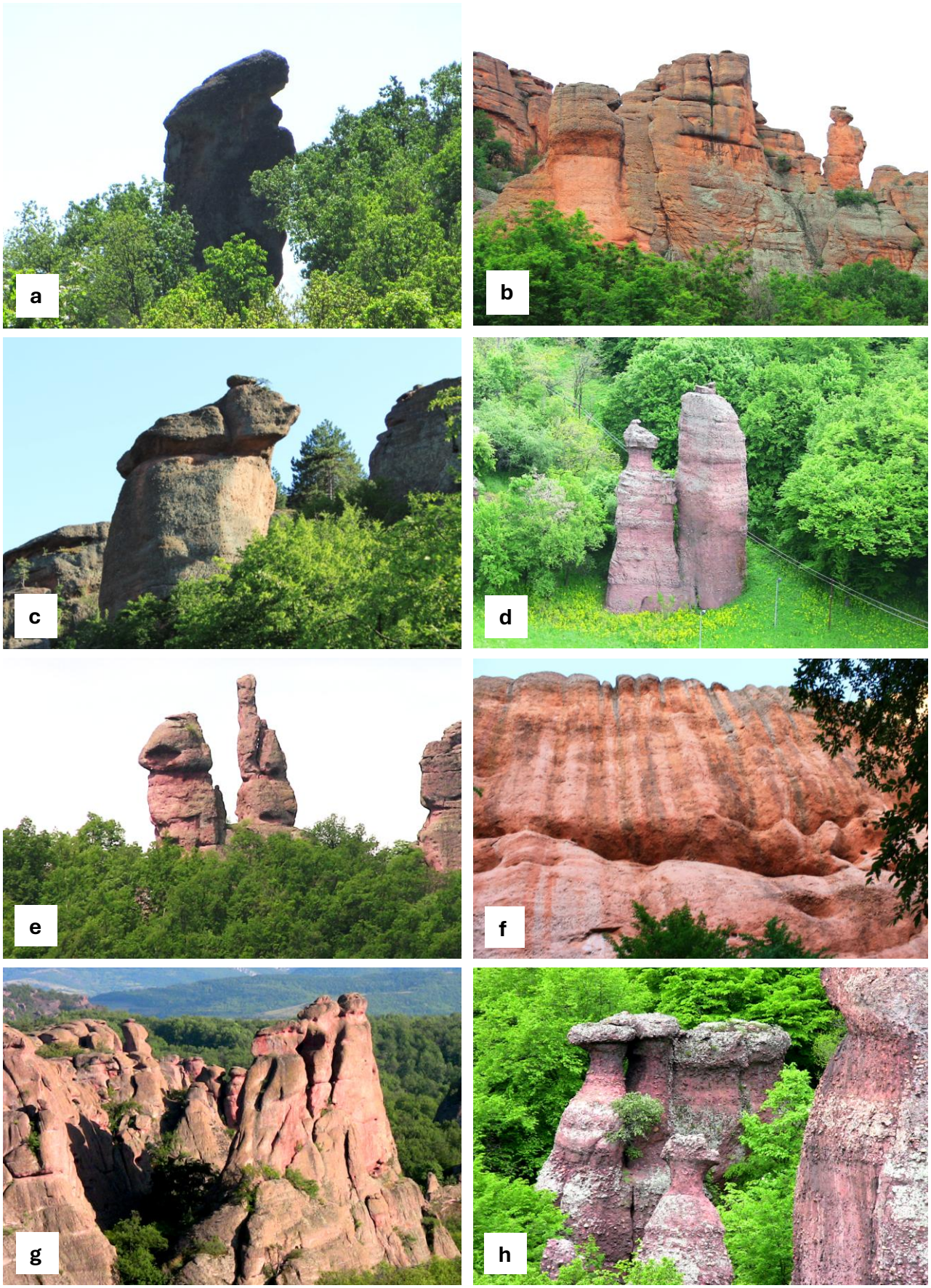


Figure 8. *Rock monuments in the Romantic period:* ***a,*** *"Madonna";* ***b,*** *The "Lion" (left) and the "Schoolgirl" (right);* ***c,*** *The "Bear";* ***d,*** *"Adam and Eve";* ***e,*** *The "Horseman";* ***f,*** *The "Great Wall";* ***g,*** *The "Dinosaurs";* ***h,*** *Rock Mushrooms.*

Figure 9. *Rock monuments between the Citadel and Markashnitsa area at Izvos village:* ***a,*** *"Haidut Velko";* ***b,*** *"The Monks";* ***c,*** *"Alice in Wonderland";* ***d,*** *"The Leopard";* ***e,*** *Markashnitsa area;* ***f,*** *Sabubin Stone;* ***b,*** *Lepenitsa Cave;* ***b,*** *Rock assemblage "Jabba from Star Wars".*

It is assumed that the intensive karstification of the area began in the Miocene about 15 million years ago, when the formation of the cave began (Angelov et al., 2006). First, the lateral cave caverns were formed, from where the waters penetrated and formed the cave. Then, narrow karst passages were formed, expanded over millions of years to the actual cave halls with their modern dimensions and cave formations, which give the cave its unique modern appearance. It is characterized by a variety of speleothems: stalactites, stalagmites, stalactones, sinter pockets, cave pearls and “cave milk”.

The cave has 10 rooms of different sizes, the largest of which, the Concert Hall, is colossal - 200 m long, 50 m wide and 20 m high (Fig. 10a). This hall provides a stage for performances within the framework of the Sofia Opera and Ballet Summer Festival "Opera of the Peaks - Belogradchik Rocks", and Wagner's music merges with Paleolithic art. The bat guano mural paintings (Fig. 10b) depicting dancing women, hunters, disguised men, various animals, suns, stars, instruments, plants, etc., dating from the Late Paleolithic to the Early Bronze Age, belong to the World Cultural Heritage.

In addition to its geological and archaeological significance, this place is of great importance for the local and national wine industry. This is the only place in Bulgaria where “Magura” natural sparkling wine is produced, which is aged in the cave at a constant temperature of 12°C (Fig. 4d).

The rock monuments near the village of Borovitsa include the largest single rock in the Belogradchik Rocks - “Borovitsa Stone” or “Borov Kamak” (Fig. 10c), which corresponds to the term “butte”. This is the name given to the high single rock monoliths with vertical slopes in the Monument Valley in Utah and Arizona. With its impressive height of 113.3 m and the surrounding groups of nameless rocks (Figs. 10d,e), the area really looks like a diminished model of the “Gloves” in Monument Valley, Arizona. This place has incredible natural beauty. In the past, there was a monastery here, inherited by the so-called “Red Church” built in 1854 with stones from the Belogradchik Formation (Fig. 10f).

Kozarnika Cave (Fig. 11a,b) is a geotope of scientific and cultural value. It was formed in the Upper Jurassic limestones of the West Balkan Carbonate Group, deposited more than 150 million years ago on the bottom of the warm Tethys Sea. The geological value of the cave lies in the presence of the widespread Alpine facies “ammonitico rosso”, composed of red nodular and clastic limestones with ammonite moulds. Another geological phenomenon is the section with well-preserved climatic cycles recorded in the limestones around the cave. In the rhythmic alternation of the limestone layers, 20,000, 100,000 and 400,000-year Milankovitch cycles are recognized (Fig. 11c). The cultural value of the cave lies in its importance for European and world archaeology. The latest excavations in the cave’s antechamber shed new light on human activity during the Paleolithic, testifying to the earliest migration of people from Africa to Europe.

The Cretaceous/Tertiary boundary near the village of Kladorub is a geotope associated with a global event: a thin iridium layer formed during the great cosmic catastrophe at the end of the Mesozoic Era. Then the Earth was hit by a cosmic body known as the “Chicxulub meteorite” or “the meteorite that killed the dinosaurs”. Near the village of Kladorub, the iridium layer was discovered in 2002 under the project of the Ministry of Environment and Water to compile a Register and Cadastre of Geological Phenomena in Bulgaria (Sinnyovsky, 2003). This event occurred 65 million years ago at the end of the Cretaceous period of the Mesozoic Era, when a giant meteorite with a diameter of about 10 km passed through the atmosphere and, heated to melting, hit the Earth’s surface near the Yucatan Peninsula, causing the greatest catastrophe in the history of the planet.

The meteorite disappears in seconds into the Earth's crust, and immediately after the impact, a cloud of hot dust, ash and steam erupts back from the crater, rising to the stratosphere. Then, molten rock (tektites) begins to rain from the sky, causing global fires. A giant shock wave spreads across the entire Earth's surface, and a megatsunami forms in the North American region, which penetrates hundreds of kilometers into the continent.

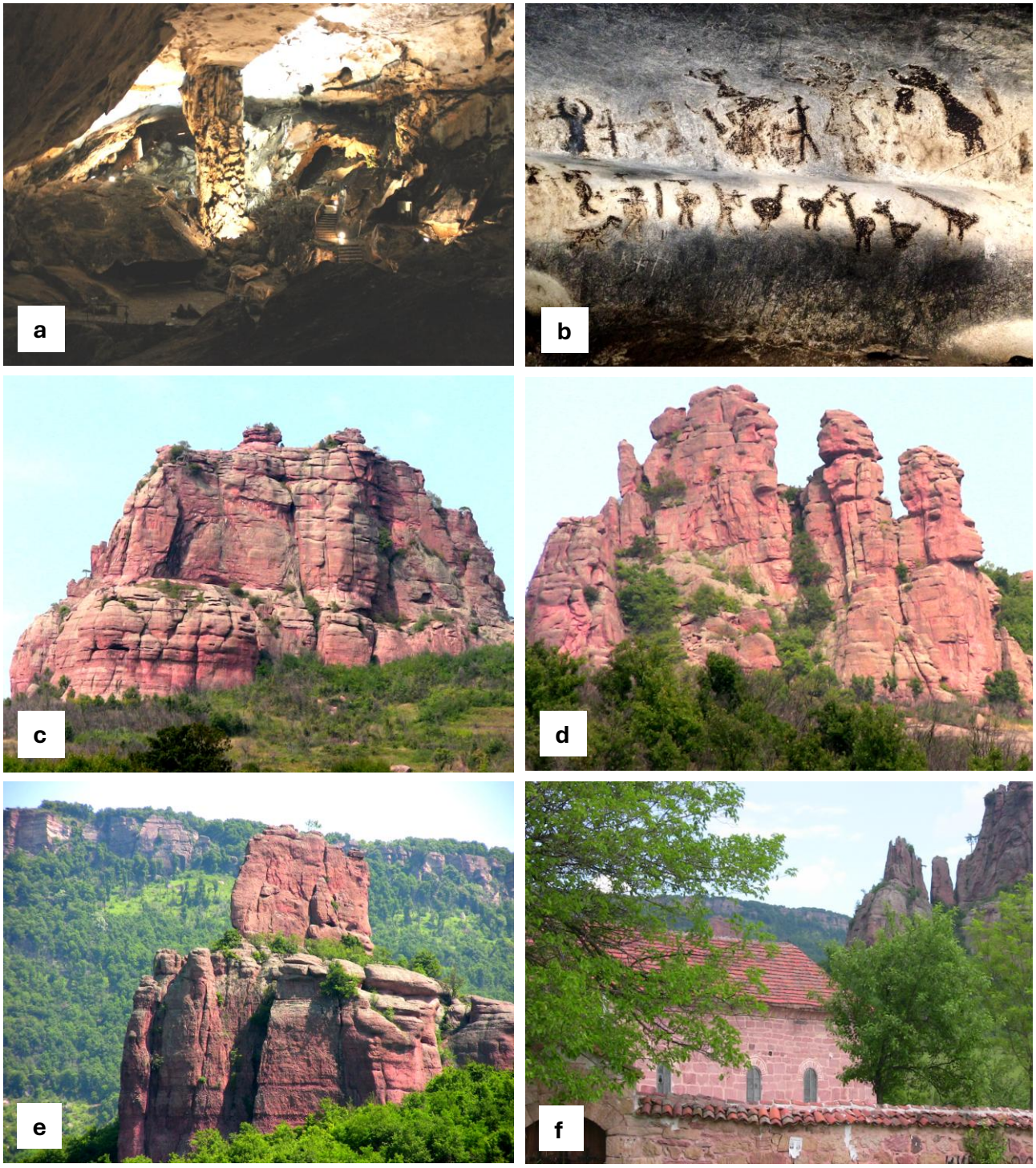


***Figure 10**. **a,** The huge "Concert Hall" in Magura Cave where some of the concerts of the summer music days "Opera of the Peaks" are held; **b,** The Paleolithic wall paintings, which are recognized as World cultural heritage; **c,** The "Borovitsa Stone" (113 m) is a typical "butte" with the status of an individual natural landmark; **b,c,** Nameless rocks around "Borovitsa Stone"; **d,** The medieval "Red Church" near the "Borovitsa Stone" which was built in the middle of the 19-th century.*

This led to a change in climate and the photosynthetic regime, which affected over 90% of unicellular planktonic flora and fauna, 60% of angiosperms and many groups of echinoids, corals, thermophilic mollusks and primitive mammals. The most vulnerable were unicellular golden algae called coccolithophores, which are at the beginning of the food chain. As a result of the global fall out, a thin, iridium-rich dark layer was formed on the ocean floor.

The content of iridium in the Earth's crust is negligible, since similar elements are concentrated in the Earth's core, but it is present in normal quantities in meteorites. Its presence in the boundary layer proves the cosmic origin of this catastrophe.

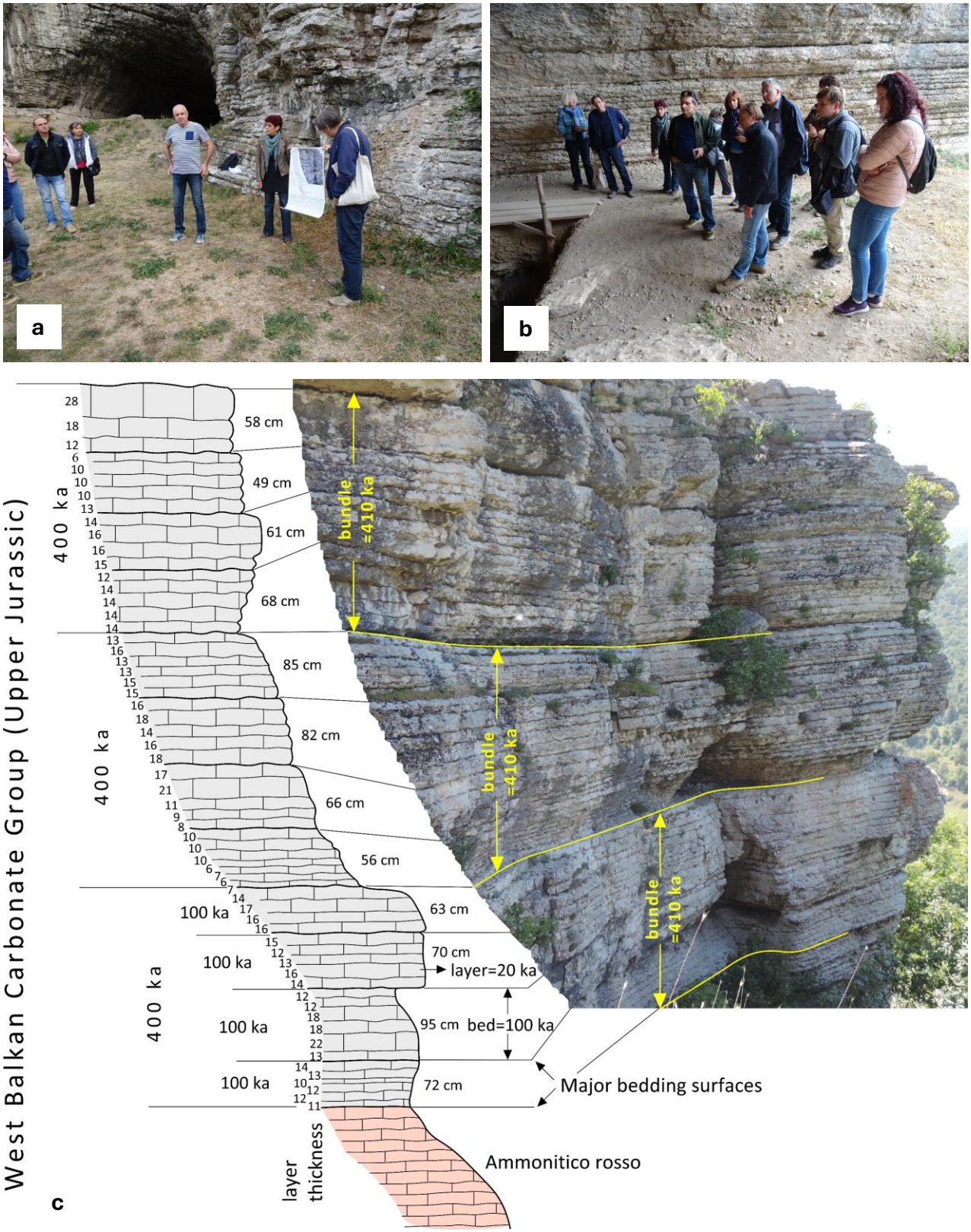


Figure 11. a,b, *"Kozarnika" Cave: field trip during the "Geoparks and Modern Society" Conference 2018;* ***c,*** *Milankovitch climatic cycles of 20 ka, 100 ka and 410 ka in the Upper Jurassic limestones of the West Balkan Carbonate Group (after Sinnyvsky, in Sinnyovsky, Krumov, 2018).*

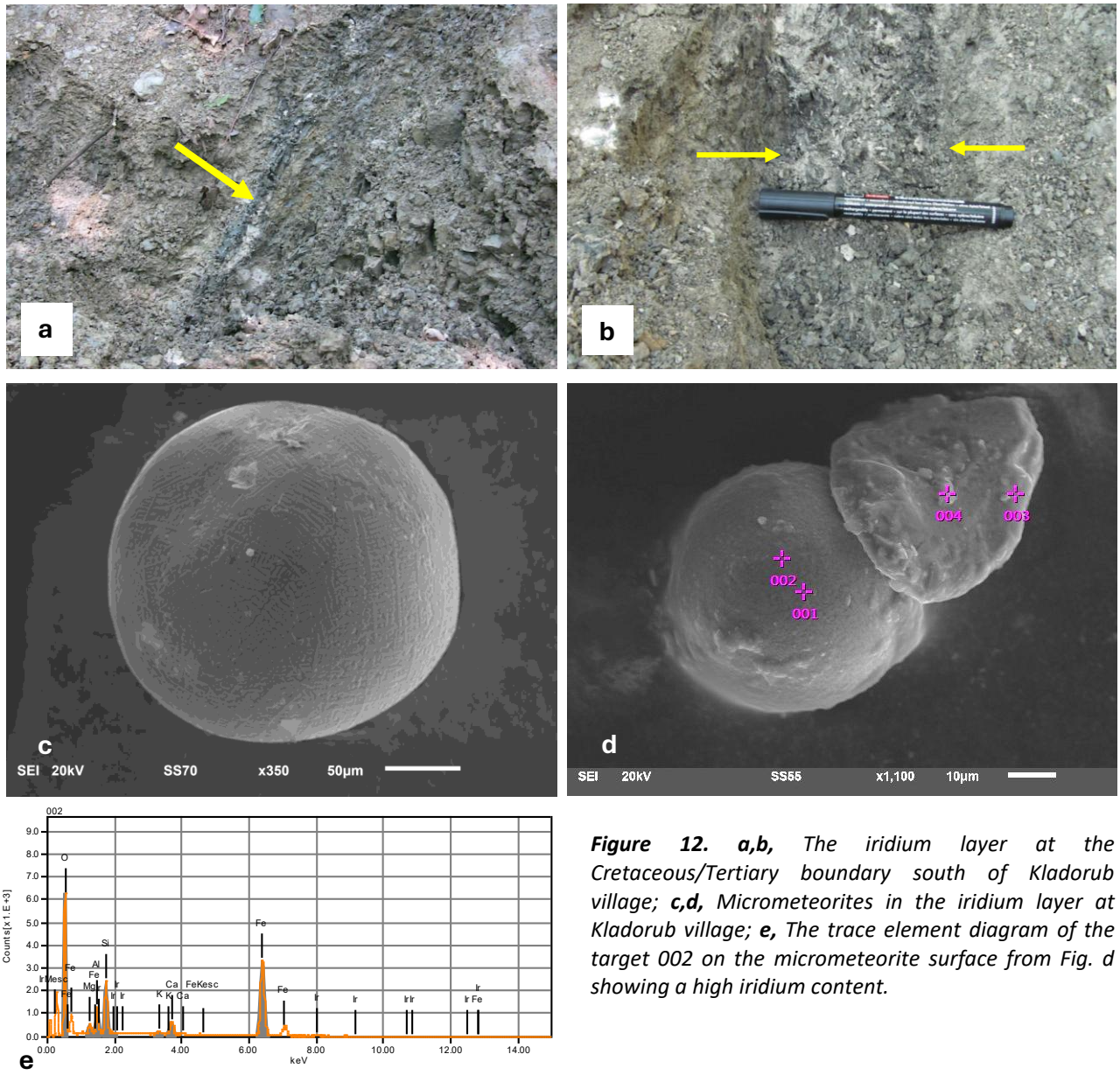


Figure 12. a,b, *The iridium layer at the Cretaceous/Tertiary boundary south of Kladorub village;* ***c,d,*** *Micrometeorites in the iridium layer at Kladorub village;* ***e,*** *The trace element diagram of the target 002 on the micrometeorite surface from Fig. d showing a high iridium content.*

Microscopic coccolithophores, whose drastic change coincides with the Cretaceous-Tertiary boundary, are a perfect tool of establishing the iridium layer under a microscope with an accuracy of centimeters (Figs. 12a,b). In addition to microtektites, the iridium layer also contains micrometeorites accompanying the main meteorite body, such as those discovered by Rosen Avramov in the iridium layer near the village of Kladorub (Fig. 12c), containing significant amounts of iridium (Fig. 12d).

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