

Bulgarian Geological Heritage: Some specific features and problems at present day

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Introduction

At present day Bulgaria has about 410 geosites under state protection. They belong to all categories, ranging from such of national to world value. Together with the national parks they cover a territory of about 4% of the country. The first geological site under state protection (since 1937) is the "Pobitite Kamuni" ("Dikili-tash", the upright stone columns, see Iliev et al., 1998, in this volume). Since the protection of the geological sites has been regulated by different legal acts and under the control of different state institutions. It is a pity, but in practice much less attention has been paid to the geosites, in comparison to the other natural sites. In general, Bulgaria has a significant geodiversity which has led to the occurrence of diverse geosites, part of the national geological heritage. However, the different groups of geosites are quite irregularly represented in the list of the protected sites:

Type of geosite	total number
Caves	107
water-falls	73
ground "pyramids"	6
rock "pyramids"	44
upright rocks	4
rock "mushrooms"	4
karst valleys and canyons	12
rock bridges	18
single rocks of specific feature	65

lakes, marshes and limans	20
dunes	17
fossil site	12
karst springs	9
upright rock columns	4
other (moraines, palaeo-volcanoes; mineral occurrences, etc.)	3

An overview of the most interesting geosites has been published by Iliev et al. (1996), but a full list has not been compiled and published yet.

As seen from above data, these are mainly geosites of geomorphological features. No more than 5% of the State-protected geosite are such of Special Scientific Importance (Iliev et al., 1996). Besides the already protected geosites, numerous ones, mostly of scientific value, remain unprotected and need to be listed, and some of them protected. At the same time some geosites, which are still under legal protection have already lost their value, due to different reasons and must be excluded from the list of protected sites.

In 1995 an initiative of the Geological Institute of the Bulgarian Academy of Sciences with the financial support of UNESCO and collaboration of ProGEO led to the organizing of the First Subregional Meeting "Conservation of the Geological Heritage in South-East Europe", which took part in Bulgaria. As a result, the Working Group 1 of ProGEO was created, including the countries of the region. This meeting had a quite positive influence on the understanding of the problem in Bulgaria, and led to the integra-

tion of the efforts of people mainly from scientific institutions (Geological Institute of the Bulgarian Academy of Sciences, Sofia University, University of Mining and Geology) to the elaboration of a national list of the geosites and a national strategy for geoconservation.

Bases of the geodiversity

In general the diversity of interesting geosites is controlled by numerous natural agents. Among the most important are the geological setting and the relief.

The geological setting determines the richness of geological formations which contain the traces of the geohistorical evolution as well as the richness of structural elements. However, many areas possessing quite interesting geology do not have important geotopes, due to the lack of well expressed relief and good outcrops. Other areas with marvellous geomorphological sites are missing geosites of scientific importance due to the lack of diversity of rock formations or poor geodynamic evolution. A third quite active creative force of geosites is the man activity through the creation of artificial outcrops during road constructions, house-building, mining, etc. In many cases the human activities are also the main destructive force of interesting geosites and sometimes constitute the main problem for the preservation of the geological heritage. Evidently, a reasonable balance should be established between economical activities, collecting and geoconservation. Therefore, an important role of geoconservation is also in the education of a broad public in the basics of geology, as well as in the protection of geosites of esthetic and scientific interest for the next generations.

The relief plays a very important role, on one hand, for the formation of the land forms, and for their preservation, on the other. Being the product of a broad ranges of processes, the most important being the time of origination, the rock composition of the land, the rate and type of erosion, some peculiarities of the climate, the availability and type of vegetation cover as well as the mankind activity. Properties of the relief as: type (flat, hilly or mountain), differentiation and present-day state are of first-order importance for the occurrence and preservation of interesting geotopes. These factors may be quite variable even on small territories. This is quite well expressed on the Balkan Peninsula, and in particular for the territory of Bulgaria. On the other hand, broad territories may remain flat and monotonous, without well-expressed land forms. In the different conditions the understanding of geotope could be quite different. In a flat area even a relatively gently expressed land form or rock pinnacle may be a geotope, subject of geoconservation at the local or regional level. The same forms in an area of well-expressed relief probably will never attract the attention of a geoconserva-

tor. Different conditions lead to different problems for the conservation of the geotopes. In this sense, the European continent possesses a large diversity of areas with specific relief and landforms: broad and flat plains, mountain lands of different ages and levels of peneplainization, and young mountain systems with extremely expressed differentiation of the relief (the Alps, the Carpathians, the Balkan Range, etc.).

Base of Bulgarian geodiversity

Geology and geomorphology

The territory of Bulgaria although small (110 000 km²) is located in the bosom of the Alpine orogen and contains the traces of numerous Alpine and older rock complexes and structural events (Zagorchev, 1996). This geological diversity would be at a great point lost without the biggest friend and at the same time the biggest enemy of the geologist: the erosion and the relief-building. In our case the nature has been well imposed to us locating Bulgaria in an area of recent relief forming, determined by active extension (Zagorchev, 1992; Tzankov et al., 1996). Therefore, we have a quite lucky superimposition of geohistorical evolution and relief-building, determining the richness of Bulgaria in geosites of both geomorphological and scientific importance.

The territory of Bulgaria is a typical example of an extreme diversity of landforms and differentiation of the relief (Table I, Fig. 1), with relatively high mountains, hilly areas and plains. In the Rila Mountain is located the highest peak of the Balkan Peninsula - Mousala (2925m). The gorge of Iskur River north of Sofia, entrenched about 1300 m in the Balkan Range, is the deepest on the Balkans and exhibits a geological section from the Palaeozoic to the Tertiary. Many examples could be given.

This diversity reflects directly on the character, the number and the location of the geological and geomorphological sites of scientific and large public interest. The highest concentration of geosites is in the young mountain systems with active reliefbuilding. This is very well expressed for the Rila, Pirin and Stara Planina Mountains. In these regions, the recent land-forming processes have led to the formation of natural phenomena on relatively broad territories. This makes possible the delimitation of relatively broad protected areas, having the status of natural reserves under local or state administration. In many cases these are geomorphological forms, sometimes included in natural parks and their protection is under legal regulation of different level ("Belogradchishki Skali", "Melnishki Piramidi", "Pobitite Kamani", etc.) (see pictures in Tronkov; Iliev et al., in this volume).

The conditions occurring in the plains and low-hilly areas of the country (Upper Thrace Plain, Danu-

bian hilly Plain, as well as in some intra-mountain plains and valleys) are quite different. In these areas the already protected geosites or these needed to be protected are usually isolated and do not have a significant geomorphological expression. Their protection is much more difficult, due to the lack of directly pointed administrative control as it is in the broader areas of the first type (Plate I, Figs 1, 2).

A third type of conditions occurs in the mountain massives of intermediate elevations, being on different stage of denudation. In this case the interesting geosites occur more often, than into the flat areas and have only partly expressed geomorphological features.

Mineralogy and petrology

The territory of Bulgaria has not only interesting and spectacular land forms, but also a diversity of mineralogical geosites. So far about 700 minerals have been found from the about 3000 known in the world. Eight minerals have been found for the first time in Bulgaria (bonchevit, kostovit, strashimirit, vasileit, balkanit, hemusit, ardait and orpheit). Some of the ore deposits of Bulgaria contain rare and interesting mineralizations. The Vratsa ore district is famous with its sulfides, secondary Cu-arsenates and Cu-carbonates. In the Madan ore district unique galena-sphalerite-chalcopryrite druses are found, and the galena crystals are among the most beautiful and expensive of the world (Plate II, Fig. 2). Many areas of Bulgaria are known for their mineralogical richness: the Bourgas ore district for the unique tabular calcite crystals (Plate II, Fig. 3); South Pirin, with its marvellous amethysts; The Eastern Rhodopes, with the precious stones, zeolites and petrified trees. The most spectacular mineralogical geosite is the higher part of Rila Mountain, where on a surface of 50 km² so far some 110 mineral species have been found. Among all discoveries the most spectacular is one of the few occurrences of smaragds in the world, situated near Ourdini Ezera (Ourdini Lakes) (Plate II, Fig. 1), related to desilicified pegmatites. In difference to the other world deposits, this one has not an economical value, but is a scientific geosite of first order and is the first mineralogical geosite of Bulgaria that has been put under protection and, unfortunately, devastated very soon, after being proclaimed protected site. Unfortunately sometimes the geosites are destroyed quite soon and have lost forever as the mineralogical found of turquoise and other relatively rare phosphates near the village of Gorno Bryastovo, East Rhodope. Due to the light blue color, low quality and mixing with caolinite the turquoise was of low value and the occurrence had only a scientific value (Курнов, 1996) (Plate III, Fig. 1). However the entire outcrop was blown and destroyed by studious persons, probably with geological background.

Palaeontology and stratigraphy

Bulgaria has also a diversity of palaeontological occurrences, representing scientific and broad public interest. One of them is the Carboniferous Megaflora (trunks) (Tenchov, 1977) which crops out on the main road Sofia-Mezdra, in the Iskur Gorge, 35 km North from Sofia. The site is formed in the continental Svoqe Formation (sandstones with pebbles of quartz and lydrites, fining upwards) and is of Late Carboniferous, Westphalian Age. In the upper part of the beds are included casts of stems, up to 6 m long (Plate III Fig. 2) that belong to from Lepidophyta (*Lepidodendron*, ?*Sigilaria*) and Articulatae - *Calamites*.

Many sites with Neogene marine fauna in the region of Pleven, etc. need to be protected. In South Bulgaria exist exposures of continental fluvio-lacustrine sediments with many remains of Mammals. One of them is the site near the village of Dorkovo (Plovdiv District, Western Rhodopes Mountains) in the Lower Pliocene sands (Toma et al., 1986) where a Bulgarian-French team studied rich fauna, consisting of over 20 species of vertebrate (*Anancus arvernensis*, etc.). Another famous site of Mammal fauna is located in the Meotian lacustrine sands with gravel of the Ahmatovo Formation near the village of Ezerovo, District of Plovdiv (Nikolov, 1985). Here bones of *Deinotherium thraciensis* Nikolov (exposed in the University of Sofia (Table III, Fig. 3) with *Choerolophodon* (*Synconolophus*) *serridendens* Cuvier, etc. have been collected. This finds are among the most priced and could be seen in the museums, but numerous rich fossil sites of the same age remain unprotected and unstudied yet, being among the important in Europe.

Among the most important are also: the graptolites in "black shales"; numerous Jurassic fossil occurrences (ammonites, brachiopodes, bivalves, etc.) in the Stara Planina Mts; Lower Cretaceous corals, bivalves from the Lovech Urgonian Complex; ammonites and brachiopods of Late Cretaceous age in NE Bulgaria; Palaeogene benthonic fossils).

Problems

The preservation of the mineralogical and palaeontological geosites is quite difficult, due to the increased interest to them, as an easy source of incomes in the deteriorated economics of Bulgaria. In difference to the geomorphological geosites some mineral and fossil samples can be preserved in the museums (Plate II, III). This diversity of geosites is setting different problems and approach for their protection. This is not only a national problem, because evidently this is a problem for most of the European countries. Therefore, we consider that the elaboration of

some prescriptions for the geoconservation in different natural conditions should be subject of consideration of ProGEO, UNESCO as well as for the national organizations involved in the protection of the geosites. Probably the Geopark Program (Patzak, Eder, 1998, in this volume) is a new virtual step to this direction.

About 90% of the protected geotopes of Bulgaria are located in the mountainous and forest lands of Bulgaria, and only 10% are located on agricultural lands. This facilitates their protection, but they are under the rule of state organizations with different specific activities, which are not related to geoconservation. A problem for the geoconservation in Bulgaria is still the lack of a specialized state organization pointed to the geoconservation. Usually the problem is treated outside of the state organizations involved in the nature protection. The lack of geological education in the Bulgarian school has been missing since 1962, which is also a problem for the understanding of the problem by the broad public. This reflects quite clearly in the mass-media, which do not express any interest on this problem, but usually are quite sensitive to the problems of the protection of the animate nature.

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References

- Iliev, Z., Todorov, T., Zagorchev, I., Dzheurova, E., Petrov, P. 1996. The geological heritage of Bulgaria (overview). - *Geologica Balc.*, 26. 1.; 63-68.
- Nikolov, I. 1985. Catalogue of the localities of Tertiary Mammals in Bulgaria. - *Pal., Strat., Lithol.*, 21; 43-62.
- Tencov, Y. 1977. Flora und Biostratigraphie des Oberkarbons in Svoje Becken (VR Bulgaria). - *Schriftenrh. Geol. Wiss., Akad. Verlag Berlin, H. 7*; 162 p., 23 pl.
- Tzankov, Tz., Angelova, D., Nakov, R., Burchfiel, C.B., Royden, L. 1996. The Sub-Balkan graben system of central Bulgaria. - *Basin Research*, 8; 125-142.
- Zagorchev, I. 1992. Neotectonics of the central part of the Balkan Peninsula: basic features and conceptions. - *Geologische Rundschau*, 81/3; 633-654.
- Zagorchev, I. 1996. Geological Heritage of the Balkan Peninsula: Geological setting (an overview). - *Geologica Balc.*, 26. 2.; 3-10.
- Кунов, А. 1996. Природата - творец и ние. - *Еко*, 2; 16-17.
- Тома, Э., Спасов, Н. et al. 1986. Неогеновая позвоночная фауна из с. Дорково, Западные Родопы (первые результаты). - *Geologica Balc.*, 16, 6; 79-86.

PLATE I

Fig. 1. Geographical map of Bulgaria, after Kartproekt, Sofia, 1963

Fig. 2. "The Mushroom", rock sculpture formed into Paleogene coarse sandstones; Benkovski Village, Eastern Rhodopes. Photo of Z. Iliev.

Fig. 3. "Saraya" (The Palace), specific landscape formed in Middle Triassic carbonates near Zlogosh Village, Zemen Gorge of Struma River, West Bulgaria. Photo of Z. Iliev

PLATE II

Fig. 1. Ourdini Ezera (Lakes), Rila Mountain. A national park with the first protected mineralogical geosite, an occurrence of smagards in desilicified pegmatites. Photo Sv. Petrussenko

Fig. 2. Druse of chalcopryite overgrowing quartz; Exhibit #1 of Goroubso Mining Company mineral collection, Madan Ore District. At present day exposed as donation (exhibit #3854) in the National Natural-scientific Museum, Sofia. Photo of Sv. Petrussenko

Fig. 3. Calcite (paperspar), fine tabular crystals along axe a (basic pinacoid), Bourgas Ore District. Exhibit of the National Natural-scientific Museum, Sofia. Photo of Sv. Petrussenko

PLATE III

Fig. 1. A former mineralogical geosite. Turquoise near Gorno Bryastovo Village, East Rhodopes. Photo A. Kunov

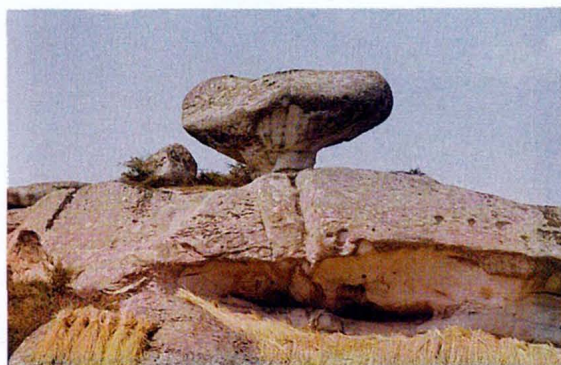
Fig. 2. Trunks of Lepidophyta near the road Sofia-Mezdra, Iskur Gorge; Carboniferous, Westphalian A. Photo I. Lakova

Fig. 3. *Deinotherium thracensis* Nikolov; village of Ezerovo, Plovdiv District; Meotian; skeleton exposed in the museum of Palaeontology, University of Sofia. Photo T. Nikolov

PLATE I



1



2



3

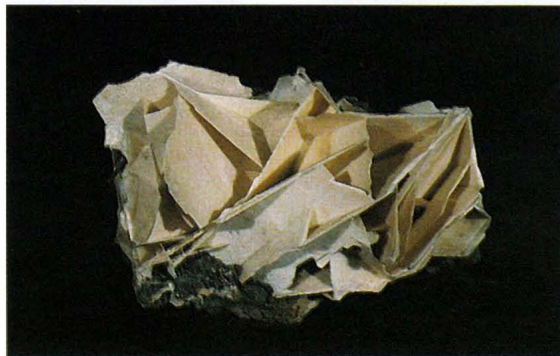
PLATE II



1



2



3

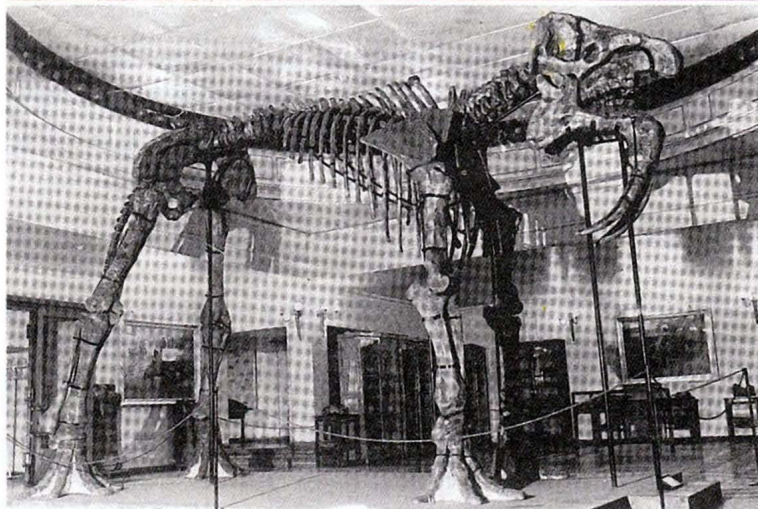
PLATE III



1



2



3