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TRENDS OF ECOGEOLOGICAL RESEARCH. I. ECOGEOLOGY -
WHAT THIS MEAN?

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ABSTRACT

Ecogeology is a new interdisciplinary sphere of knowledge, originating at the boundary of geology and ecology. The subject of her research is the study about the natural connection of geologic environment and the components of natural medium (air, water, living organisms, soil) with an estimate of the influence of the activities of man in their numerous aspects. Ecogeology (syn. environmental geology) is interrelated with such scientific trends as biology, geography, hydrology, meteorology, landscapisme, health protection and economy. The term geologic medium or environment comprises the upper part of the lithosphere, where an interaction is realized between the atmosphere, hydrosphere and biosphere and most of all the variety of human activity is best evident.

INTRODUCTION

It can be stated exactly that inspite of the fact that the German biologist Earnest Hekel, as early as 1866, introduced in literature the term "ecology" as a science about the interrelations between living organisms and between them and their living environment (Sovetskii entsiklopedicheskii slovar, 1980), terms like "environment", "ecologic crysis", "ecologic problems", etc. had not been met in literature almost by the 40-ties of the present century (Yanshin, 1985). Man lived in perfect harmony with Nature as if not noticing the so-called environment. Even now in literature there still exists the concept of the English scolar Charls Lyell (1835) about the pettiness, with respect to natural forces and phenomena, of the role which the individual and mankind play as a whole, as well as the concept about the "inexhaustible" natural resources. No doubt, there were no meetings, symposia or others of the kind held on these problems at that time.

Vernandski (1926) is one of the first who had a correct understanding of man's role for the alternation and transformation of the natural environment. This author sees human activity gradually turning into a mighty geological force which can be compared with the most powerful natural processes. Even at that time he wrote: "We are witnesses of the astounding progress of mankind in geochemistry. The influence of human consiousness and collective mind on the geochemical processes become more and more clearly expressed. Man spreads his influence over all chemical elements. He changes geochemical history and each of the elements forms new

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compounds reproduces them in the same amounts characteristic only of natural reactions. This fact is extremely important for history of all chemical elements (Vernadskii, 1926).

In spite of these and some other warnings yet nobody paid any special attention to the necessity to restrict that constantly expanding influence of man on the natural environment and to the increasing irrational utilization of natural resources. Aiming at a maximal satisfaction of man's material and aesthetic needs and at economic development of the different countries, the utilization of the different kinds of natural resources considerably increased and the idea of "conquering" nature, not of protecting it predominated on the pages of newspapers and magazines.

The new scientific technical revolution that started after the second World War sharply changed the condition of the natural sites and man's interrelations with them. The previous influence of man's activity on air composition, ground and surface waters, condition of soils and forests on our planet has grown more and more evident and has led to the appearance of the term "man's environment". Geologically things also have become much clearer. Again it was Vernadskii (Vernadskii, 1946) who wrote on this theme: "The Noosphere - this is a new phenomenon on our planet. Here man for the first time is the greatest geological force. He can and must reorganize the sphere of his life with his hands and mind to rearrange it thoroughly in comparison with what was before. Wider creative prospects are facing him now. The Earth's effigy is changing now, virgin nature fades away".

For the first time the term "environmental geology" is introduced by Hackett (1967) and the first text on this subject is published three years later by Flawn (1970). Nowadays the problem of protection of the environment has become a global one, concerning not only separate countries or nations but the whole planet. The number of scientific publications (Todorov, 1991) increases. Most different meetings, symposia and conferences, vastly attended by world-known scientists and politicians, are held. The problem of the protection of environment has become very important in the numerous scientific and other UNESCO programmes (Zhivkov, edit. 1984), and the first Sunday of June is celebrated each year through the initiative of UNO (1972) as a Day of the protection of environment (Materialj zasedaniya..., 1985).

One of the main problems of modern geology is also the one concerning the protection of the environment. The most important geological scientific events during the past decade - 27th and 28th Sessions of the International Geological Congress respectively in Moscow (1984) and Washington (1989) - are very representative in this respect. One of the plenary meetings of the Moscow Congress was dedicated to the problems concerning the geological aspects of protection of environment. Within the frames of this meeting an independent section was formed, at the sessions of which very interesting and deep papers were delivered. These papers dealt with the problems of estimation of the conditions and prospects of the anthropogenic influence on the geologic environment and the development of effective measures for its protection, for the rational usage of the wealth of Earth's womb, including ground waters, of geological problems and the increase of productivity of agriculture and prospects, warning and decreasing the negative consequences from the catastrophical geological processes (Salchev, 1985; Kozlovskii, edit., 1987).

The theme of the geological aspects in the protection of the environment was even wider presented at the session of the International Geological Congress in Washington. The most important of the problems discussed there were: geological aspects of the en-

vironment and influence of the alterations of the latter on human health; geological catastrophes related to anthropogenesis and losses caused by them; geological problems of urbanization; burial of radioactive, anthropogenic and wastes of living; and exogenic natural geological processes having a devastating effect for mankind (muddy flows, landslips, downfalls, collaps of the earth's surface, marine abrasion, etc.) (28th International Geological Congress..., 1989; Geoekologicheskie isledovaniya..., 1989; Inzhenernaya geologiya..., 1989).

Thus, nowadays we may speak of the appearance of a new interdisciplinary sphere of knowledge, originating at the boundary of geology and ecology. This new scientific branch of geology can be most suitably called "ecogeology" to underline the closeness with geology. The term "geoecology" which is accepted in USSR (Saichev, 1990), is wider and according to us it includes the ecological trends of all sciences about the Earth (geology, geography, geophysics, geodesy, etc.). Ecogeology is the most precise term exhausting the meaning of notions such as: "geology of the environment" or "environmental geology" in western literature and "geologiya okruzhajushtej sredy" in Soviet literature. The meaning of the term "geologiya okruzhajushtej sredy", used in Bulgarian literature, is the same.

The subject of ecogeological research is the study about the natural connection of geological environment and the components of natural medium (air, water, living organisms, soil) with an estimate of the influence of the activities of man in their numerous aspects. Ecogeology is interrelated with such scientific trends as biology, geography, hydrology, meteorology, landscapisme, health protection and economy. The term "geological medium (environment)" comprises the upper part of the lithosphere, where an interaction is realized between the atmosphere, hydrosphere and biosphere and most of all the variety of human activity is best evident.

TRENDS OF ECOGEOLOGY

Summarizing the available numerous literature (Todorov, 1991) the following trends of ecogeological reserches could be formulated:

1/ Study on the condition of geological medium with prospects about the anthropogenical effect on it and development of effective measures for its protection;

2/ Rational and complex utilization or the minerals of our planet and protection of earth's womb and environment when carrying out geological researches and mining activities;

3/ Engineering geological aspects of protection of geological medium including both observations on its natural state and observations on the activation of recent geological processes under the action of anthropogenic effects;

4/ Hydrogeological aspects of protection of environment with two main trends: protection of surface resources, ground, mineral and thermal waters against exhaustion and also with respect to their pollution by different natural and anthropogenic sources; a subject of ecohydrogeological researches are also the problems of ecological changes in seas and oceans;

5/ Estimate of the natural hygien-geological potential of the different territories, for example the cities, mining areas, rural-landscapes, the zones close to or far from AEC, the areas of ecological disaster, the resort areas, etc.;

6/ Ecogeological reserches with respect to detachment of appropriate groun or other stores of radioactive and hazardous anthropogenic wastes;

7/ Problems of the cryosphere with respect to its easy vulnerability from all possible views;

8/ Working out a network for observation, estimate and control of geological medium, i.e. monitoring of geological processes and phenomena, as well as of the closely related changes in different areas on our planet (a more precise term here is "lith-monitoring");

9/ Ecogeological mapping and methods;

10/ Problems of the regional ecogeological researches;

11/ The problem of geo-phenomena (intresting geological sites).

TRENDS OF ECOGEOLOGICAL RESEARCH. II. TRENDS OF ECOGEOLOGICAL RESEARCH IN BULGARIA

ABSTRACT

In a number of areas environment is in bed even crisis condition. This suggests that ecological, including ecogeological studies recently have become more actual and have acquired priority. In this case the following most general ecogeological problems in Bulgaria may be given: estimation of the state and prognosis of the anthropogenic effect on the Black Sea and the Danube; geological aspect of protection of groung, surface, mineral and thermal waters; engineering geological aspect of protection of geological medium; ecogeochemical studies aiming at alucidation of the natural and anthropogenous hygien-geological potential of different territories, landscapes and agglomerations; recent seismotectonic processes and their activation as a result of anthropogenic activities; a new scientific and ecological view on the mineral base of country; lithomonitoring of geological environment; ecogeological, including ecogeochemical mapping in the different scales; and condition and protection of geophenomena also known as natural monuments.

INTRODUCTION

Ecogeological data constantly increasing in amount (Todorov, 1991) allow to draw the following conclusions with respect to the present state of ecogeological research in the world:

- Ecogeological mapping with respect to methodology as a whole has not been solved yet. A lot of the methods of this new-type of mapping are still under the condition of development and experiment, which could be quite misleading;

- A considerable experience has been gained in the field of ecogeological studies with respect to engineering, geology and hydrogeology. A great number of concrete estimates on alteration of engineering geological conditions in the areas of intensive agricultural activity or on the appearance of recent exogenous and endogenous geological processes as well on protection of the surface, ground, mineral and thermal waters against pollution and exhausting;

- Mineral resources are still considered to be restorable. The possibility for their exhausting under the conditions of the present rapacious exploitation presuposes their rational utilization, which on its part includes the problems of their better extraction from the earth's womb and complex utilization. A separate question here is the question concerning ecological purity

and mineral sources, as well ecogeological consequences from the use of minerals and protection of environment during their research, yield and processing;

- Recently even greater attention has been paid to geological monitoring (lithomonitoring) of geological environment. According to a concept in future lithomonitoring will prevail over estimating researches on the state of geological medium. The element of prospecting in ecogeological research at this next stage of improvement should become more powerful;

- Also a widening of ecogeological studies is observed, a particular attention being paid to danger of radiation, geochemistry of different landscapes, urbanized territories, other populated agglomerations, mining areas, resorts, etc. Also the question of geochemical estimation of mineral sources is posed with respect to the increase on the one hand of their complex utilization, and on the other hand - elucidation of their toxicity and a priori establishment of the danger of environmental pollution and their study, yield and particularly at processing of mineral sources. Due to the same reasons similar studies are now also for anthropogenic wastes, since they are not only potential raw materials but also a substantial contaminator of environment, especially within the range of their interaction with natural agents such as air, wind, water, etc.;

- A particular attention is now being paid to geophenomena as irrestorable natural resources and sites of scientific, recreational, aesthetic and other nature.

ECOGEOLOGICAL TRENDS IN BULGARIA

As a conclusion it is worth noting certain problems and trends of the future ecogeological studies in Bulgaria.

The lack of reliable ecogeological setting of a great number of agricultural units has sharply and negatively affected environment, human health, reliability and safety of equipments, improvement and protection of flora and fauna. Moreover, in a number of areas environment is in bad even crisis condition. This suggests that ecological, including ecogeological studies recently have become more actual and have acquired priority. The prospects of ecogeological studies turn to be more positive, being more widely included in the curriculum of Higher Institutes and Universities and becoming an obligatory component of industrial organizations (enterprises, firms, etc.). The Geological Institute at the Bulgarian Academy of Sciences could be a centre of coordinating of research work in the sphere of ecogeology. With respect to realization of ecogeological studies a leading role may be played by The Committee of Geology and Mineral Resources with the assistance of all their departments in the country. This conclusion is based on the complex nature and modern technical equipment of both organizations, which are an important prerequisite for the elaborate and complex ecogeological studies. As far as the trends and organization of these studies are concerned, the following most general considerations may be given:

- estimation of the state and prognosis of the anthropogenic effect on the Black Sea and the Danube. This problem comprises geological problems of protection of these two largest water basins on the territory of Bulgaria. The problems of protection of

the Black Sea and the Danube are not only of a national concern but are also internationally important. Hence, a better initiative on the part of Bulgaria is required for the working out of a concrete programme in this direction. This programme should be submitted to UNESCO through the International Geological Correlation Programme (IGCP), the International Geosphere-Biosphere Programme 5IGBP) or through the UNO programme for protection of environment (UNEP) aiming at receiving a financial support from these organizations and the engagement of foreign specialists assisting with solving the problem. At the Geological Institute of the Bulgarian Academy of Sciences there is a specialized team - "Marine Geology", who together with specialists from other scientific organizations (Sofia University, the University of Mining and Geology, the Institute of Oceanology at the Bulgarian Academy of Sciences, etc.) could undertake working on this concrete theme in this direction. Here contacts are possible to be created with the Programme of the Bulgarian Academy of Sciences for scientific research on the problems of ecology and protection of nature in Bulgaria by the year of 2000 (briefly Programme of BAS), the International Ecological Programme "Danube-Black Sea" and the National Programme for protection and reproduction of environment of the Ministry of Environment (briefly Programme of ME - it is now being worked out). The problem is very important since the waters of the Danube and the Black Sea "wash" the coast mostly of Bulgaria and after that of all neighbouring countries;

- geologic aspect of protection of ground, surface, mineral and thermal waters. This problem is a complex one and includes the questions both concerning the degree of pollution and the protection against exhausting of the types of waters cited above with a prognosis for their alteration in near and more distant future. At the Geological Institute of BAS there is a specialized team - section "Hydrogeology" with some concrete results in this direction. However, here is desirable a close coordination between this section and other similar teams at the Research Institute of ores and minerals, the University of Mining and Geology, etc. as well as contacts with the Programme of BAS (project), the project "Earth environment on the territory of Bulgaria - protection and rational use (geotechnical aspects)" of the Laboratory of Geotechnics of BAS and the ME Programme;

- Engineering geology aspects of protection of geological medium. The problem proposed lies in the base of the project now under realization "Earth environment on the territory of Bulgaria - protection and rational use (geotechnical aspects)" at the Laboratory of Geotechnics. The project is complex with respect to its nature and aims both as an estimation of the state of the earth medium on the territory of the Bulgaria at the present stage, and as a prognosis about its alteration under the action of the anthropogenic loading and the influence of the natural exogenous and endogenous geological processes and future realization of lithomonitoring over the entire territory of country;

- Ecogeochemical studies aiming at elucidation of the natural and anthropogenous hygien-geological potential of different territories, landscapes and agglomerations in Bulgaria. Here are concerned specialized geochemical studies of Sofia, and of other larger and smaller towns and villages, mining and industrial areas, types of agricultural landscapes, resort areas, etc. There

is a special team working at the Geological Institute of BAS - "Geochemistry" section who can start concrete studies in the field of "geochemistry-health". It is, however, advisable, that the tasks to be developed, should be concerted with BAS Programme, with the investigations of the Medical Academy, the Institute of Pedology and Agroecology "N. Pushkarov", the Institute for Geography at BAS and Sofia University;

- A new scientific and ecological view on the mineral base of Bulgaria. It really concerns the realization of an entirely new estimation of the condition of storage of mineral raw materials in the country, bearing in mind that these are irrestorable resources, as well as the problem concerns the prognosis for their protection in the near and distant future, also widening their range (types of minerals) and amount by including those not being used so far in non-traditional types of natural raw materials, also elucidation of the complex nature of the known mineral raw materials with respect to more thorough utilization and at the same time - protection of their resources against exhaustion, also the problem concerns and ecological estimate of the available and new resources from differing in composition ores and minerals, i.e. it concerns their toxicity, estimation of the amount and composition of anthropogenic wastes and elucidation of the possible use of these wastes as a source of certain metals, components or resources and their simultaneous consideration as a hazardous polluting agent of environment. A specialized team in this respect at the Geological Institute has not been formed yet but in the sections of "Geochemistry" and "Mineralogy" there are specialists who are familiar with the problems cited and in future may undertake their realization. Qualified specialists who can carry out studies on ecological estimate of mineral and anthropogenic raw materials are also working at the Scientific Research Institute of Minerals, Institute of Applied Mineralogy of BAS, Sofia University and the University of Mining and Geology, which necessitates a coordination of the themes between all units and organizations cited here;

- Recent seismotectonic geological processes and their activation as a result of anthropogenic activities. The problem is very important with respect to building new APS (atomic power stations) and also the enlargement and exploitation of Kozlodui APS, with research work on the sites of storage of radioactive and hazardous industrial wastes, geotechnological output in Mirovo salt deposit, and construction of industrial, hydrotechnical and other larger sites in country. There is a specialized team at the Geological Institute of BAS in this field - "Laboratory of Seismotectonics". The main tasks of the laboratory are the cited problems themselves. The contacts of this Laboratory with the Laboratory of Geotechnics at BAS, University of Mining and Geology, Geophysical Institute of BAS etc. are a necessary prerequisite for working out the different aspects of the problem pointed out;

- Complex studies aiming at working out networks for observation, estimation and control of geological environment and sources of pollution and also of the unfavourable alterations of environment in Bulgaria as a result of the activation of recent geological processes under the action of anthropogenic influence. These are the problems of the so-called lithomonitoring, i.e. monitoring of geological medium. The researches here are necessary not only for prognosis, warning and lowering the negative consequences of

catastrophic geological processes and elimination of environmental pollution during study, yielding and processing of mineral raw materials, but also in virtue of supplementing to the now appearing in the country, through the Ministry of Environment, National Programme for monitoring and information about environment. Here the problems of lithomonitoring are not solved to a considerable degree. The studies on the problem cited should be carried out in close collaboration with the Laboratory of Geotechnics at BAS, the Scientific Research Institute for ores and minerals, Sofia University, the University of Mining and Geology, etc.;

- Ecogeological, including ecogeochemical mapping aiming to compile a set of maps of the scale of 1:50000 - 1:10000 and even of 1:5000 of the solid substrate, Quaternary deposits and the earth layer in individual endangered regions of the country. Ecogeological work in this field is also complex by nature and it is advisable that it should be carried out by specialized teams at the Departments of Committee of Geology and Mineral Resources with the assistance of specialists from the Geological Institute of BAS, the Laboratory of Geotechnics of BAS, the Research Institute of ores and minerals in the Universities, the Institute of Pedology and Agroecology "N. Pushkarov", the Geographic Institute of BAS, etc. The first task here could be interpretation of data from geochemical studies on the primary and secondary dispersion haloes in a number of regions in the country with a view to determining the local geochemical background and alterations having occurred during the years of geochemical loading of the respective territories;

- Condition and protection of geophenomena (also known as "natural monuments" or "interesting geological sites"). The scientists from the Geological Institute of BAS have been working for a long time on the problem. We can even say that this Institute is a pioneer in this direction. Concrete studies recently have been carried out also at the University of Sofia. Further studies on geophenomena could be performed in view of widening the number and area of natural geological phenomena (sites) including in their list new representatives, opening new natural geological and mineralogical museums and a more detailed geological study of each already protected geophenomenon in view of a special regime of protection against destruction by different natural agents (water, air, rain, recent geological processes, etc.), as well as by the direct human activity, who "with the one hand creates and with the other blindly and unreasonably destroys and deadens Nature" (as an ancient Greek philosopher said 2000 years ago). The problem is a complex one and well within the reach of the specialists of the Geological Institute of BAS and the scientific units at the Research Institute for ores and minerals and the University. The necessity of performing such studies is determined by the fact that geophenomena, like mineral raw materials, are a part of the so-called non-restorable natural resources and their extinction should be considered to be something entirely disappeared because it is impossible to restore and "grow up" geophenomena in a natural or in an artificial way.

CONCLUSION

The trends noted above on the ecogeological studies in Bulgaria should be considered only as a programme-maximum in this respect. Its full realization can start provided all scientific

institutions and organizations rearrange as a whole their plans and projects with respect to future activities. At present, because of personnel and laboratory reasons this is impossible. That is why the most suitable at present version is to formulate certain tasks within each of the ecogeological fields listed here or even partially concerning them.

In the present part the author is trying to solve two main problems. The first aims at listing data on the nature and state of ecogeology and ecogeological studies in the world and in his country. Not less important is the second aim which is directed at the necessity of paying special attention to the existence of such a new and substantial problem as is the ecogeological problem. Ecogeological aspects of protection of environment are almost not registered and discussed in Bulgaria and that is why the negative results in this respect are evident. Ecogeological studies should be given in initial impetus to, so that they may be effectively included in most near future in the general complex of studies concerning protection of environment in Bulgaria.

TRENDS OF ECOGEOLOGICAL RESEARCH. III. EARTH SCIENCES CONSERVATION IN BULGARIA

ABSTRACT

The territory of Bulgaria is distinguished for its great variety of relief, geology and climatic factors, active ancient volcanoes and recent seismotectonic activity and also for its complicated morphostructural and morphosculptural compositions in the upper part of the lithosphere. All this makes it very rich in a vast number of other unique natural creations, named "natural geological monuments" or simply "geological sites". Over 360 of them are protected by the Government. Some of these geological sites may be proposed to be included in the List of the world geological heritage.

INTRODUCTION

In the literature the term "natural geological monument" is introduced by the German scholar and natural explorer Alexander Humboldt in the past century. Now for this someone uses the term "Earth science conservation" or simply "geological site". In it they include geological formations which are unique with respect to shape, structure, specific features and beauty. Usually here are included whole rock massifs or individual groups of picturesque rocks and formations of these rocks (earth and stone pyramids, stone forests, stone mushrooms, stone bridges, moraines and stone rivers, rock windows, niches and gaps in the rocks, karstic gorges, ponors and other karstic forms), eroded alluvial formations (driftages), river defiles and tectonic grabens, places with unique fossil finds and petrified trees, some extinguished volcanoes and products of their activity, complexes of sandstones, firths and coastal rock bands, lakes, swamps, waterfalls, karstic dams, abyses, places of ancient mines, classic geological sections and places known as natural geological museums, deposits of rare minerals and mineral having beautiful and large crystals (natural mineralogical museums) and also different genetic and material types of ore deposits, and caves. All these natural geological sites play an important role in geology as a whole. No less important is their role as objects of aesthetic delight. That is why they must be protected for the future as geological heritage of our present and future country.

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GEOLOGICAL SITES AND NATURE PROTECTION LAW IN BULGARIA

According to the Nature protection law in Bulgaria (1967) the protected natural sites are grouped in seven categories: a/ reserves; b/ national parks; c/ protected areas; d/ natural beauty spots; e/ historical sites; f/ protected animals; and g/ protected plants. The natural geological sites in our country are included in two of the categories, namely in the category of natural beauty spots and partially in the category of the protected areas.

Using of the Author's data and data by Iliev and Petrov (1989) the following groups of natural geological monuments may be divided more precisely:

- stone woods - the examples are: the "Thrust stones", "Churite", the "Frog", "Dikilitash", etc.;
- stone pyramids - the "Belogradchik Rocks", the "Zemen Rocks", "Chuklite", the "Three Brothers", the "Stack of sheaves", etc.;
- ground pyramids - "Melnik pyramids", "Kardzhali pyramids", etc.;
- stone cart-rails - "Cart-rails", the "Marvellous rocks", the "Bird's rock", "Lopyan towers", etc.;
- stone mushrooms - the "Stone mushrooms", "Dobrovan mushrooms", "Dzhugla", the "Mushroom", etc.;
- stone bridges - the "Marvellous bridges", the "God's bridge", the "Saddler", the "Rock window", the "Devil bridge", etc.;
- moraines and stone rivers - "Bistritsa moraine", "Golden bridges", etc.;
- individual rocks oddly shaped - the "Crooked fountain", the "Ring", the "Trivet", the "Maiden", the "Elephant", the "Lion head", etc.;
- karstic gorges and valleys - "Vratsata", the "River Erma gorge", the "Trigrad gorge", "Chernelka", "Topchiiska River", etc.;
- tectonic grabens - "Kalet", etc.;
- karstic springs - "Panega head", "Zhitoljub", "Zhabokrek", "Chirpan bunar", etc.;
- caves - "Ledenika", "Snezhanka" (Snow-princess), "Lepenitsa", "Saeva dupka", "Magurata", the "Devil gorge", etc.;
- dunes - the "Pearl", "Kavatsite" (a kind of popular tree), the "Old woman", "Alepu", the "Golden fish", etc.;
- extinguished volcanoes and products of their activity - "Fur coat", the "Volcano crater", "Kozhuh", etc.;
- lakes, swamps and firths - "Vaya", "Atanasovo Lake", "Srebarna", "Kaikusha", "Persin swamps", "Smolyan lakes", "Rhila lakes", etc.;
- waterfalls - the "Paradise sprayer", "Tufcha", "Skakavitsa", "Skaklya", the "Karlovo sprayer", etc.;
- mineral deposits - "Urduin circus";
- deposits of fossils and petrified trees - near the villages of Opanets-Iasen-Tarnene-Oryahovitsa-Staventsi; the village of Ahmedovo-Pracoslaven, the village of Dorkovo, etc.;
- trace of ancient mining activity - the most ancient copper mines in East Europe near the Stara Zagora mineral bath.

Of course, to draw a conclusion that everything concerning the protection of the natural geological sites in Bulgaria has been done is not correct. In comparison to some other countries the problem of the search and study of the interesting natural geological sites for the future generations, has not come yet to its natural end.

Besides those included in the List of geological phenomena protected by the law, yet there are a lot of most interesting and unique rock formations and places left, for example:

- the exotic rock mushrooms near the village of Tsarevets - Western Bulgaria;
- the pygmic folds amid the Precambrian metamorphites in the area of Velingrad - the North Rhodopes;
- the huge piles of pebbles and large river boulder in the valley of the Dalgodelska Ogosta River and in the spring-part of its tributary Treshtena near the village of Govezhda - Western Bulgaria, which were mute witnesses of the busy placer activities carried out here in the past;
- other places of ancient mining activities - the slags on the land of the towns of Malko Tarnovo, Etropole, Samokov, Bourgas, etc.;
- a large part of the Pliocene basalt hills in the Moesian platform (North Bulgaria);
- volcano apparatus near the village of Balgarovo in the district of the coastal town of Bourgas;
- some muddy volcanoes in East Thrace;
- the picturesque Iskar gorge as a whole;
- classic geological profiles of some geological formations, bearing abundant information about the geological development of the Earth, the territory of Bulgaria or separate areas during the different periods of earth history;
- special places, deposits or outcrops of rare minerals or bearing minerals with beautiful and large crystals.
- standard substantial and genetic types from deposits of different ores and minerals.

Independently from this over 360 natural geological sites (monuments) in Bulgaria are protected by the Government to this moment. In spite to their variety they most generally may be united

in following four large groups according to their origin and features: i/ picturesque rock formations; ii/ waterfalls; iii/ lakes, swamps, firths and karstic springs; and iv/ caves. All natural geological sites within the limits of the categories noted as reserves and national parks may be included in a separate fifth group.

The most numerous and varied in Bulgaria is the first group, within which nowadays about 150 picturesque rock formations are protected. The second group, with respect to variety, is the fourth one with about 100 protected caves, and the third - the group of the waterfalls, where about 70 protected waterfalls are included. The third and the fifth groups have as a whole about 40 different protected natural geological sites (on the average 20 per each group). Their distribution on the territory of the country is irregular and directly depends on the geological structure of the different district.

As the background of the general development of nature protection in Bulgaria, certain reserves also belong to the protection of natural geological monuments. For example, in 1964 the whole number of the protected phenomena of this kind was only 13 (Spasov, 1965), in the next years their number rapidly increased and in 1974 was 224, and nowadays, as we have already stated above, the number amounts to about 340 (Spasov, 1980). This data registered and give evidence of the vast and active activity of the Bulgarian geologists and nature-protectors in the search for and protection of the most interesting, beautiful and picturesque geological sites in this country.

respect also played the Commission for protection of nature at the Bulgarian Geological Society.

MONITORING OF GEOLOGICAL SITES

Another point which is worth mentioning is the utilization, restoration and protection of the natural geological monuments in Bulgaria. As it is known in their main part the geological sites are subjected to the constant influence of a lot of different agents: water, air, wind, rain, recent geological processes, etc. No less substantial here is the role man plays, who "with one hand creates and with the other unreasonably and blindly destroys and deadens Nature" (as an ancient Greek philosopher stated 2000 years ago). If we add here that nowadays man is a mighty geological factor, who by his activity is capable of changing entirely the outlook of a certain part of the earth surface, it becomes clear, that the upper part of lithosphere, including the considered unique geological creations of Nature, may gradually or instantly disappear into nothingness. The natural geological monuments are representatives of unanimated nature and their restoration by a natural way under natural conditions is impossible. However, the engineering knowledge of mankind can help for the elimination of certain threatening destructive factors and by a partial or more thorough strengthening of the geological sites - in an engineering-geological plan. This requires concrete data to be collected for each natural geological monuments with respect to its geological specific features and petrographical composition on the imbedding massifs and areas. On the bases of the data obtained then it is possible to work out a re-creation programme giving an expression of the necessary measures which should be undertaken for its protection now and for the future. Labour-taking, long duration and specificity of geological studies require that they should be started right away. The realization of the studies cited is advisable to be carried out within the range of the National system of ecological monitoring. It is envisaged to group the factors observed having an effect on the natural geological sites in the four information charts (Todorov, 1990):

- Form 01 - name, address (location), type of the site, number and date of the State newspaper, where the order for its protection is issued;

- Form 02 - geological description of the natural geological site itself and the area belonging to it, geological section, type, composition and age of its rocks (formations) and petrographical formation;

- Form 03 - level of study of the protected geological site, state, main factors causing destruction, recommendations for future studies and measures for its protection, necessary re-creation programme;

- Form 04 - references (main works on the protected natural geological site).

CONCLUSION

What are the main tasks in future Earth sciences monitoring in Bulgaria?

1/ It is necessary to carry out more active, purposeful and wider activities in the field of environment protection, including of the natural geological sites;

ii/ The study and protection of the natural geological sites, the enlargement and differentiation of some of them in higher categories, e.g. in national and regional parks and reserves, the finding out and proposing other similar monuments to be included in the National list of the geological sites. Bulgaria has a varied geological structure and is distinguished for a variety of minerals, which are an extremely important prerequisite for defining a great number of such places;

iii/ Steps should be taken on the part of Bulgaria so that a large number of its most famous natural geological sites can be included in the UNESCO' list of the world geological heritage;

iv/ All most notorious creation of Nature should be preserved for science and future generations. This could be achieved by compiling a book similar to that for animals and plants - "Red book of natural geological monuments of Bulgaria"; similar "Red book" could be compiled for each country and for the world as a whole.

GENERAL CONCLUSION

I would like to conclude by a sentention of the President of the new IUGS Commision on Environmental Geology "COGEOENVIRONMENT" F.Ch. Wolff who says: "In the Environmental Geology (the author note "Ecogeology") the principle of actualism of Hutton and Lyell 'The present is key for the restoration of the past' should be sound differently: 'The past and the present are key to predict the future' ".

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