



*The Paleolithic composition of " the Horses of the Chaos hall " is an example of East European unique Paleolithic painting. Two stylized horses and an abstract sign, typical of the Kapova Cave – an original "trapezium" are seen.*

## Problems of geosite protection and usage in Russia

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The end of the 20th century and the beginning of the 21st century are characterized by the increased interest and attraction to the nature in many countries. It is evident that the artificial urbanized landscape cannot be favourable for normal functioning and full-fledged life of man, who is actually part of nature. As a result, tourism, various kinds of sport and rest linked to the nature become more and more attractive. The amount

of tourists, who vacate in forests and in mountains, is constantly increasing and the anthropogenic pressure on the last areas of virgin nature increases as well.

Accordingly, the nature protection intensifies: the networks of protected areas are constantly growing. In Russia this development is slightly slowed down because of economic difficulties of the transitional period. There are cases of illegal use of specially protected environmental areas (SPEA) as commercial excursion-tourist objects.

There is nothing negative in the fact that nature qualities are used for tourism, but many remarkable geo-

sites perish because they lack reasonable control and good management. It is a worry that this process often seems to be spontaneous. Businessmen do not think of their role and responsibility to nature and society. Those who understand it, often have no governmental scientific and methodical support.

It is necessary to state that in Russia the methodical and legal base of geosite usage is applied insufficiently. There are very few practical scientific elaborations aimed at the harmonic combination of protection and positive humanistic use of nature, and those available are used very rarely in practice. At the same time, geosites preservation is a most important national task. It is necessary to bear in mind that it is impossible to renew the geosites, and when losing them, we also lose irretrievably unique information and their aesthetic and inspiring wealth.

The situation with geosites triggers concern. They are protected poorly and to give them the status of SPEA, do not influence the status of these geosites in reality.

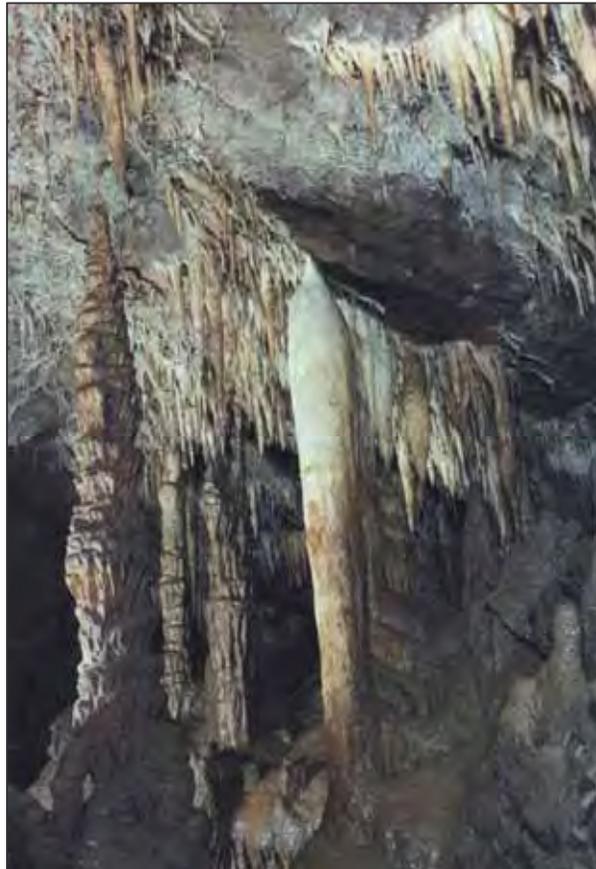


Fig 1. Dripstone decoration of the Egyptian Room, the Labirintnaya Cave, the Vorontsovskaya Cave System (stalagmites, stalagnates, stalactites).

There are many examples of the unfavorable situation concerning SPEA usage. For example, caves are very attractive for commercial usage owing to their aesthetic properties and great interest of tourists. Unfortunately, at the same time they are the most vulnerable objects. Each geosite is unique and non-renewable by nature. It is possible to grow a forest, to revivify a population based on several species, but a geosite, an evidence of our planet's history of great scientific value, a source of perception and inspiration, disappears for ever when destructed. Suffice it to remember an instance when a grandiose gypsum grotto of the Bornukovskaya cave was destroyed by explosion.

There are several excursion caves in Russia, but they are often used and arranged without relevant legal basis, without agreement with nature conservation bodies and sometimes without agreement with governmental entities, and what is more important, without a competent project, based on detailed studies and elaboration of rules of usage. The elaboration of the speleological underground excursion route must be based on detailed studies of morphology, stability of the natural roofs, hydrology, hydrochemistry, mineralogy, microclimatology, microbiology, peculiarities of the radiation background, radon hazard, etc. It is clear that speleological engineering is a crown of scientific speleology and this problem cannot be solved by a commercial company or by tourist-speleologists.

Meanwhile, a lot of caves in Russia can be used for excursions. In the Caucasus, Urals and the Far East there are areas of classic karst landscapes. It is many gypsum caves in the Pinego-Kuloi region, Arkhangelsk Oblast. In the Caucasus, in the Sochi National Park and in the area of the Logonaki Ridge there are the Vorontsovskaya (Fig. 1) and Krestic-Turist caves that is more than 10 km long. In the East Sayan, there is the Oreshnaya cave (ca. 60 km), the world's largest cave in conglomerates. The unique suffosion-erosion "Svyataya" cave is situated on the tribute of the Oredez River, not far from the Nabokov's estate. This is a large picturesque grotto with a small stream. It is highly competitive with some karst caves of the Caucasus or the Urals in dimensions and aesthetic characteristics. At present, this cave is not protected and there are no organized excursions there, but this unique pseudokarst site is worthy of attention (Fig. 2).

In summer 2005 the Academy of Sciences of Bashkortostan held a very interesting workshop devoted to nature monuments under the aegis of the Russian "ProGEO" Group and arranged a tour to the well-known "Icy Askyn Cave". This is a huge grotto with microclimate of a "cold bag", where perennial ice is accumulated. During the last years, with relative warm winters, the amount of leakages decreased, but ice stalagnates up to 15 m high have been preserved (Fig.

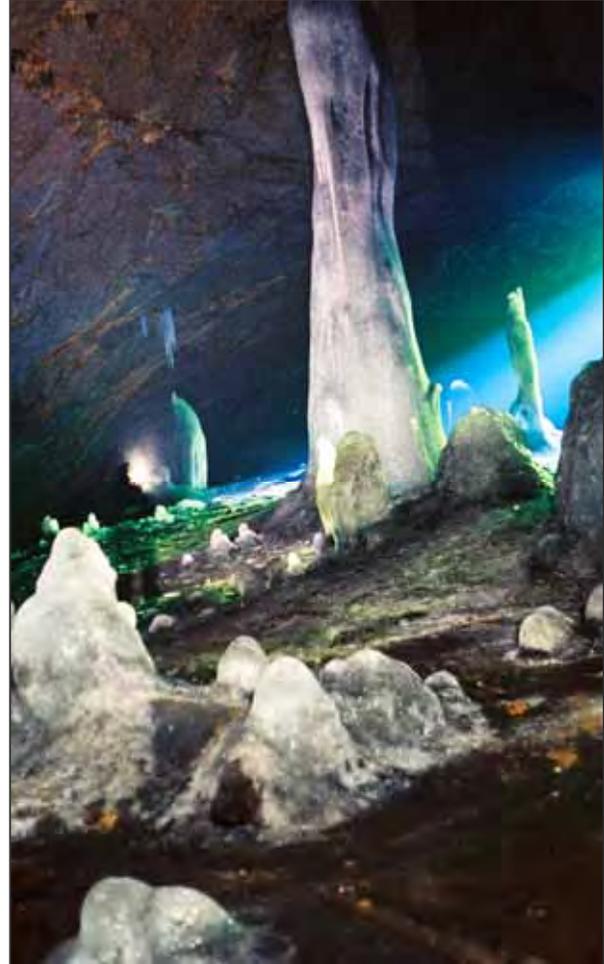


*Fig. 2. "Svyataya" cave in Rozhdestvenno, Oredezh River tribute. Rare case of a large pseudokarst grotto formed by erosion and suffosion of Devonian sandstone*

3). The cave floor is covered with "sculpture groups" of whimsical ice stalagmites. This object is worth of attention, but it is impossible to make it a target of general tourism. The ice will start thawing and its value will be destroyed. Who can guarantee that tomorrow an adventurous businessman won't arrange general tours there? The protection of this cave has not been arranged.

In the early 90s, geologists of VSEGEI, St. Petersburg State University, and speleologists of our city started the operations in order to save the Sablino nature monument. It had been announced to be a nature monument as far back as 1976, but it was poorly protected and it was severely degraded. The territory around the cave was built. It was filled with abundant dumps, the cave ceilings were collapsing, and hooligans and Satanists made themselves at home there. People often were lost there, and it was very dangerous to conduct tours.

Now the situation is quite different. The Sablino complex nature monument is one of the most valuable in the north-west of Russia. It is situated 40 km from St. Petersburg. There are twelve artificial caves (former mines essentially reworked by natural processes), two



*Fig. 3. Askyn "ice" cave in Bashkortostan. Long-lived stalagmites and stalagmites are preserved in it owing to the microclimate of the cavity.*

waterfalls, canyons of the Sablinka and Tosna rivers, and numerous rock exposures with cross-sections of Cambrian and Ordovician rock series typical of the sediments of the northwestern margin of the Russian plate, paleontological and mineralogical objects, spas, and places of interest associated with Russia's history and culture.

In 1992, on the initiative of public organizations, the administration of the Leningrad Oblast made a decision to create the Sablino nature conservation excursion-tourist centre (geoenvironmental reserve). The main concept of the enterprise was the arrangement of efficient control of the SPEA state and its protection using funds obtained from regulated excursion-tourist activity.

A team of geologists, speleologists, ecologists, mining engineers of VSEGEI and other enterprises under the leadership of the author, implemented successfully the



*Fig. 4. Long-eared bat spending the winter in the Levoberezhnaya cave. The cave protection and the tours do not disturb the wing-handed animals*

feasibility studies based on budgets for environmental protection of the Leningrad Oblast and the Tosno Region. The set of investigations consisted in geo-environmental, topographic, biological, speleological, microclimatic, radiation, radon, hydrological, hydrochemical, mining and other studies. Projects were elaborated by specialists of design and research institutes such as "Giprogor", Giproruda, and the All-Russian Mine Institute. Special measures were elaborated for safety wintering of wing-handed animals (Fig. 4). The designed project was positively estimated by the Environmental Expertise, the administration of the Tosno Region, environmental community, geologists, and speleologists.

Then the process of regulated arrangement of the cave complex started. In the Levoberezhnaya cave an underground tour route was prepared (Fig. 5) including securing of unstable areas, concreting of upper parts of entrances, regulation of hydrologic and microclimatic regimes, creation of the excursion path, etc. After that, stone staircases on steep slopes of the route were made and fencing of the most valuable areas of the site was constructed. The established regime favours the conservation of the ecosystem localizing the visitors' flow on the routes in the cave and in the recrea-



*Fig. 5. Levoberezhnaya cave labyrinth. Cavity walls are composed of white Cambrian glass-melting sandstone of the Sablino suite, roofs, of Ordovician ferruginous cross-bedded sandstone.*

tion halls. These measures also promote education of students from the State University during geological practical training in summer. The students examine the most fresh and accessible outcrops in the cave with fine facial features of ancient Cambrian and Ordovician sediments (cross bedding, rewashing structures, collectors, etc.)

For the control of the monument state and its protection, a public non-commercial organization was created with the participation of speleologists, geologists, ecologists, tourists, and cultural workers. Based on the agreement with the Government of the Leningrad Oblast, this organization started the conservation of the nature monument and conduction of tours. The work is made using funds received from tourism. Now the round-the-clock guarding of the Levoberezhnaya cave is arranged, the territory of the monument is patrolled, the tours are conducted all the year round. Several variants of the tours were elaborated. Coach and working tours are made as well as "speleological trip" including the water (boating) area of underground lakes, etc.

In addition to the cave, sightseers visit two canyon-like river valleys, waterfalls, picturesque cliffs, mineral ferrous hydrosulphuric springs. They are shown outcrops of blue Cambrian clays with pyrite crystals, Ordovician organogenic limestones with orthoceratites, brachiopods, trilobites, etc. There are also very interesting historical places: the camp of Alexander Nevsky before his battle with the Swedes, the place, where previously there was an estate of Aleksey K. Tolstoy – "Pustynka", the famous boulder of the philosopher and poet V.S. Soloviev, near to which he liked to have a rest, to write verses, etc.

Protection of the territory is conducted preserving the existing level of anthropogenic loading in the urbanized zones and does not suppose it's strengthening. The zones of strict protection manage to be preserved against excessive visiting by tourists.

The experience of the creation of the Sablino nature-protection excursion-tourist center, on the whole, testifies that the chosen types of activity answer the posed task and promote both to the improvement of the nature monument and carrying out of educational works. It improves the general ecological and social situation in the area. In spite of the area has not got the official status of a geopark, in reality it can be considered as a geopark.

It was visited by tens of thousands of schoolchildren, family groups, people of various ages and professions. It is of particular importance that Sablino is visited by schoolchildren, teenagers, and to many of them these excursions "open eyes" to the beauty of nature, geol-

ogy, ecology, speleology. During the excursions they listen to lectures during 3 or 4 hours and simultaneously they examine remarkable natural objects. The educational benefit of such excursions exceeds greatly the results of visiting museums and school lessons.

Another example of a positive geosite transformation is an attempt to save the Palaeolithic painting in the Kapova Cave (Shulgan Tash), Bashkortostan, unique in East Europe. It is situated on the bank of the Belaya River in its latitudinal stream, in the area of the Sulgan Tash State Reserve (Fig. 6). This site is a complex monument (geological and cultural) of world significance. This is the only cave in the Russian Federation with diverse, relatively well-preserved ancient paintings ca. 17,000 years old (Front picture). Not long ago, tourists had to pass through the non-appointed cave in water and mud to see the Paleolithic paintings. Now, due to the activities of the Ministry of Culture and National Policy of Bashkortostan with the participation of specialists from VSEGEI and Russian Geographical Society (RGO), it has been possible to elaborate a local tour at the entrance into the cave and to block the entry into the cave to the original paintings.



*Fig. 6. First Kapova Cave Gallery: an example of a large underground canyon in Carboniferous limestone. Figures of people are lost in the huge volume of a karst cavity.*

Tourists look round numerous copies of ancient drawings, the giant Main Gallery and the grand grotto "Portal". Careful arrangement of the second-order tour with a vertical component is well elaborated and justified as result of comprehensive research. Sightseers will be able to ascend onto the intermediate terrace of the gallery and to see the entrance into the cave from above. The concept of the regulated tour entrance area of the cave was approved by French experts, who visited the cave in 2004.

Unfortunately, part of the drawings is perishing because of excess water inflow into the cave, but a set of measures has been elaborated for water drainage and paint fixing, correction of hydrological regime and microclimate of the cave. The restoration of the paintings is planned.

The project is also being designed to create on the basis of this unique monument an up-to-date historical and archaeological, landscape-speleological, cultural, educational centre, whose infrastructure will be situated beyond the PPNA territory, so as sightseers do not cause damage. We hope that the implementation of this project will be a considerable contribution to Russia's nature and historical monuments protection.

Another project elaborated by a group of researchers of VSEGEI and RGO is related to the Staraya Ladoga cave arrangement, the Leningrad Oblast. It is situated in the territory of the Staraya Ladoga Reserve Museum and the geosite of the same name.

An interesting project on the creation of the Mining Geological, and Speleological Museum in the Mine of the Pechelansky gypsum plant "Décor-1" in the vicinity of Arzamas was implemented by our specialists in cooperation with local miners. The activities were financed by the "Sin' Rossii" Holding Company. This is Russia's first mine museum where visitors will have a possibility to familiarize themselves with the ABC of this branch of sciences, little known to the common public and to enjoy the beauty of the underground kingdom.

Work with the caves, similar to other natural objects, requires professionalism. Alas, our universities do not teach speleology. Only having passed the difficult way of self-instruction, based on the knowledge of geology, microclimatology, hydrogeology, results of numerous expeditions, relying on works and experience of speleologists and karstologists of older generation such as G.A. Maksimovich and V.N. Dublyansky it is possible to approach the problem of safe usage and arrangement of caves.

Now it is important not to waste time. The accumulated material allow us to solve the following most important

problems: professional inspection of geosites of world and federal significance, the organization of geosite monitoring, the elaboration of efficient juridical documents on the protection and employment of the geosites and the scientific and methodical base for the design of nature-protection excursion and tourist centers, the arrangement and employment of complicated and vulnerable natural objects. It is necessary that all the organizations and the individuals trying to use the geosites operate within the limits of rigid rules, "rules of play" similar for everybody, which do not give the possibility to cause damage to natural objects.

In Russia it is very important that the employment of geosites is done on the basis of regulated and strictly controllable use and that scientific and methodical principles are professionally approved after an environmental impact assessment.

A serious scientific approach is necessary for the estimation of the significance and the choice of the objects to be used and arranged. Systems of geosite estimation are to be developed concerning the commercial value and the scientific, nature-protection significance of a nature sanctuary and it is not obligatory that they must coincide. It is absolutely necessary to consider "the emotional-aesthetic potential", peculiarities of the geosite perception. Unfortunately, they are often believed to be "unscientific", superfluous and are often rejected while analyzing a geosite.

The arrangement of the Sablino nature-conservative excursion-tourist center is a good case of protection and utilization of a geosite. This experiment has given rather positive result, which can be widely used in Russia.

We have organized a group of scientists, researchers-speleologists consisting of researchers of VSEGEI and the Commission on Speleology and Karst History of the Russian Geographic Society, which has great experience in integrated study of large complex speleological systems and designing of ecologically harmless tours. It allows developing necessary scientific-methodical rules for safe use of geological heritage objects for excursions and for educational purposes. Our knowledge and experience can be very useful while deciding the fate of the most complex and valuable caves.

It is necessary to bear in mind that nature sanctuaries, being the most aesthetically and intellectually significant elements of a landscape, render very important emotional and educational influence on children, the rising generation, and that is why they are an ethniforming factor. To save them is our duty!

## Serifos island, Aegean Sea/Greece: a worldwide unique mineralogical and petrological geotope

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The Serifos island, located in the south Aegean Sea (Fig. 1), represents a multiple mineralized district including intrusion-hosted, skarn-, carbonate-replacement and vein-type ores. Serifos belong to the metamorphic core complex of the Attic-Cycladic Crystalline Belt, which represents a polymetamorphic terrane within the Alpidic orogen of the Hellenides. Further to the north, the Rhodope metamorphic core complex hosts several other skarn occurrences, like Vrontou/Drama, Kimmeria/Xanthi and Maronia/Rhodopi (Fig. 1).

All these skarn occurrences are related with the emplacement of I-type plutonic rocks, controlled by extensional kinematic conditions, when the metamorphic core complexes reached near-surface levels. The Serifos granodiorite is considered to be synchronous with Miocene extensional detachment faulting, and intruded

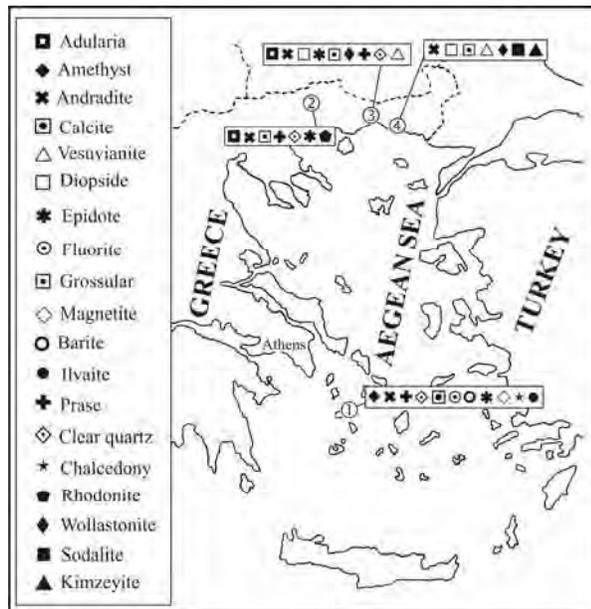


Fig. 1. Location and mineralogical characteristics of Serifos skarn (1) as well as of skarns in northern Greece: Vrontou (2), Kimmeria (3) and Maronia (4)

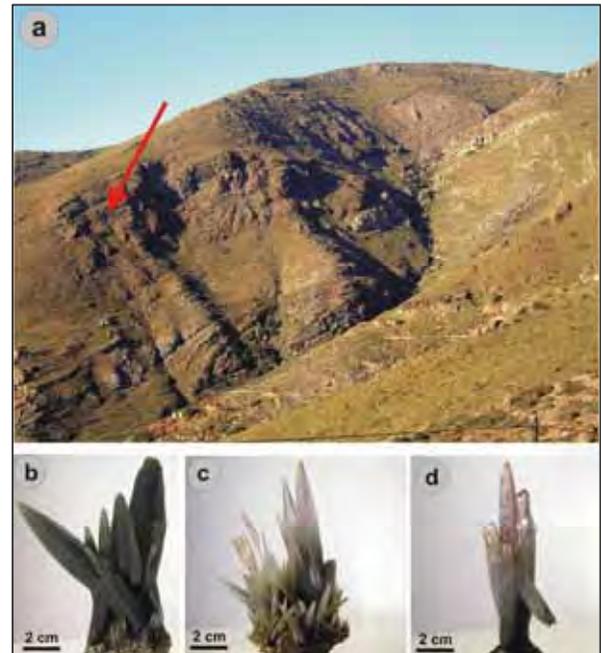


Fig. 2. (a) Neroutsika location at Avessalos, (b) green variety of quartz, (c,d) double-coloured prase-amethyst quartz crystals

schists and marbles causing an extensive contact metamorphic aureole.

The SW part of Serifos island including the Agia Marina-Koutalas, Megalo Livadi-Koundouro and Avessalos subaereas, displays all the criteria necessary to be characterized as a mineralogical and petrological Geotope. Serifos, is not only famous because of the mining activity during the past, it shows also unique mineralogical and petrological features: Its very rare and worldwide known skarn minerals (e.g. garnets, ilvaite, the green variety of quartz), attracted scientists and mineral collectors from all over the world.

The Avessalos area is the best site in the world in respect to the mineral green quartz (prase). The crystal forms, intergrowths and sizes (up to 40cm) of green quartz specimens from this locality are spectacular. The area is characterized by a granatitic and hedenbergitic skarn and by the development of huge geodes filled by prograde and retrograde skarn minerals. In the Neroutsika location in Avessalos area two forms of prase are observed (Fig. 2): the first variety refers to very deep green colored crystals accompanied by iron roses.

The second variety refers to double-coloured crystals of prase-amethyst. The transition between these two crystals is abrupt within the same crystal, where prase occurs at the base and amethyst at the top of the crys



Fig. 3. (a) Southern Avessalos location, (b) prase-platy calcite intergrowth, (c to g) various prase-amethyst combinations

tal. The amethysts are transparent and of gemstone quality. In the southern part of Avessalos area large geodes, containing unique quartz crystals, not only in

respect to their quality but also for their crystal forms, reflecting very special growth conditions, occur (Fig. 3). Rare combinations of prase-amethyst scepter crystals contain phase alternations, including transitions from prase towards amethyst and finally to prase even within a single composite crystal.

Scepters include both normal and reverse forms. Calcite-prase intergrowths, abundant within the southern Avessalos geodes, were found for the first time in Serifos island: Calcite crystals, either as rhomboeder, or in platy forms alternate with the prase suggesting contemporaneous deposition probably during boiling processes.



Fig. 4. (a) Agia Marina location, (b) andraditic garnet, (c) Semi-transparent quartz crystals

The Agia Marina area is characterized by splendid occurrences of andraditic garnets in association with quartz crystals (Fig. 4). The garnets (up to 5cm in size) accompany quartz and hematite in quartz veins cross-cutting hornfelsic gneiss or hedenbergitic skarn.

The Kondouros area is characterized by hedenbergitic skarn including the best ilvaite crystals worldwide. Geodes within the skarn are filled by idiomorphic crystals of ilvaite, hematite (iron roses), quartz and calcite. The ilvaite crystals replace hedenbergite, forming radial aggregates reaching sizes up to 50cm.

The geotouristic development of mineralogical and petrological geotopes at Serifos, combined with the foundation of a Mineralogy-Petrology museum, ensures the preservation of the geological heritage of Serifos island and also offers the opportunity for sustainable development.

The Serifos geotopes belong to the Greek mineralogical and geological heritage and can be considered as mineralogical treasures, unique in the world. They should become part of the European Natural Geoparks, following a policy which enhances the natural mineral wealth, so as to protect and promote it.

## Natural foundations: geodiversity for people, places and nature

Jonathan Larwood

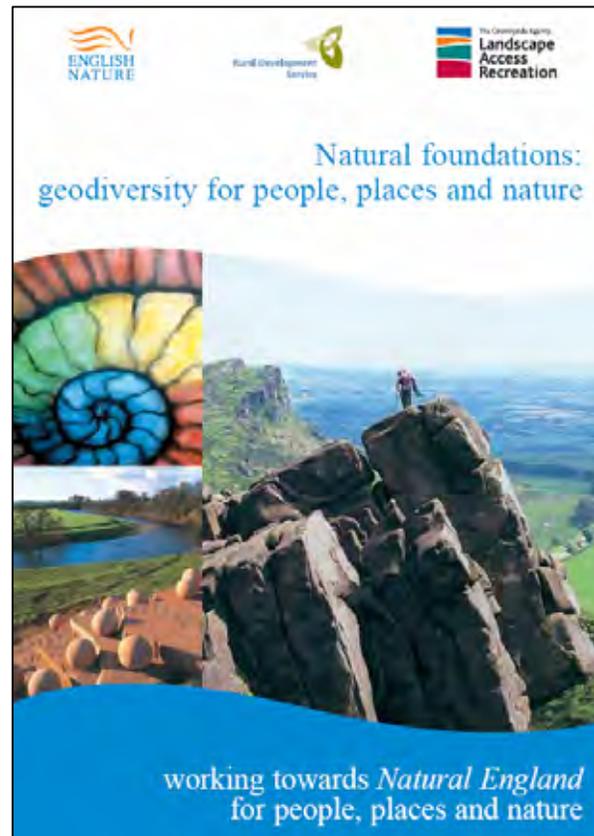
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In England in October 2006 English Nature, the Countryside Agency and the Rural Development Service came together to form a new organisation, Natural England. Natural England combined the functions of the three founding agencies including nature conservation, a landscape remit and a range of responsibilities in the agricultural sector.

As part of this process the three founding organisations came together to write the fourth in a series of publications – Natural foundations: geodiversity for people, places and nature – which follows English Nature's previous State of Nature reports on the uplands, maritime environment and lowlands of England.

Natural foundations takes a detailed look at geodiversity, its environmental importance and its influence on the way we live. Importantly, the report demonstrates how wide the influence of geodiversity is on our natural environment and landscape and explores the necessity, and challenge, of better understanding and using this cross-cutting resource across a range of environmental fields. This includes the role that geodiversity plays in sustainable development, the use of geological evidence in understanding past and present environments and informing the future environmental decisions we make and the crucial role that geodiversity has in providing environmental benefits from absorbing pollution, buffering climate change and managing water systems.

The report is aimed at a broad range of environmental practitioners and sets out priorities for the better conservation, management and enhancement of geodiversity.



Whilst written in the context of England the challenges and priorities Natural foundations sets out are global in their application – the integrated approach to environmental conservation, management and enhancement is likely to be important wherever you are.

If you would like a copy of this report please contact me at [jonathan.larwood@naturalengland.org.uk](mailto:jonathan.larwood@naturalengland.org.uk)

A pdf version is currently available at <http://www.english-nature.org.uk/pubs/publication/PDF/GeologySON.pdf>

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