



## Programme of geodiversity conservation in Poland

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**A b s t r a c t.** Geodiversity conservation programme aims at working out the foundations of the future convention which should be an equivalent for the Convention of Biodiversity Conservation, and the first international document in the field of geological heritage protection. The programme assumes assessment of geodiversity and evaluation of a current state and possibilities of protecting natural elements of the environment of Poland, related to geology, relief, soils, water and landscape. The changes undergoing in the geosphere induced by human impact lead to impoverishing of the natural diversity and to irreversible damage of the geological environment. The studies planned within the programme framework closely correspond with international proposals, i.a. of sustainable development, with ProGEO/IUGS project in the domain of conservation of more important geosites, with the Pan-European Biological and Landscape Diversity Strategy as well as with environmental monitoring.

**Key words:** geodiversity conservation, programme of studies, Poland.

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Stefan Kozłowski (1999) — **Program ochrony georóżnorodności w Polsce.** *Polish Geological Institute Special Papers*, 2: 15–18.

**S t r e s z c z e n i e.** Realizacja programu ochrony georóżnorodności zmierza do określenia podstawowych zasad przyszłej konwencji, która powinna być równoważnikiem względem Konwencji Ochrony Bioróżnorodności, a zarazem pierwszym tego rodzaju międzynarodowym dokumentem na rzecz ochrony dziedzictwa geologicznego. W założeniach programu jest waloryzacja różnorodności oraz stan i możliwość ochrony elementów środowiska Polski związanych z budową geologiczną, rzeźbą, glebami, wodami i krajobrazem. Dokonujące się zmiany w geosferze pod wpływem działalności człowieka prowadzą do ubożenia różnorodności przyrodniczej i nieodwracalnych skutków zniszczeń środowiska geologicznego. Badania przewidziane w omawianym programie ściśle nawiązują do propozycji międzynarodowych, m.in. zrównoważonego rozwoju projektu ProGEO/IUGS w zakresie ochrony ważnych geostanowisk, Paneuropejskiej Strategii Różnorodności Biologicznej i Krajobrazowej oraz prac monitoringu środowiska.

**Słowa kluczowe:** ochrona georóżnorodności, program badań, Polska.

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In 1995 Poland ratified the Convention of Biodiversity Conservation. Then, geodiversity protection, i.e. conservation of abiotic environment, became an issue. Strategies on conservation of biodiversity and geodiversity are the basis for a sustainable development of the globe, continents and regions.

The discussed issues are continuation of the Project on lithosphere conservation that has been in progress in the Polish Geological Institute since 1990 (Kozłowski, 1992, 1996; Wyrwicka, 1994). Protection of geodiversity is one of the tasks of the ministry policy in the field of geological investigations (Kozłowski *et al.*, 1996).

The programme of geodiversity conservation is carried out by the Polish Geological Institute in collaboration with Institute of Nature Conservation, Polish Academy of Sciences and the Adam Mickiewicz University in Poznań (Kozłowski, 1997).

### Concept of geodiversity

The subject of the study is epigeosphere (the outer layer of the Earth) and the lower layer of the atmosphere (troposphere) which form a manifold geocomplex. Thus, we are dealing here with problems of management of abiotic natural resources which are termed geocology. In this approach, the term geocology is complementary to the term biocology.

Protection of geodiversity is sometimes perceived as geozoology. It is a science about protecting and conservation of the Earths environment, and it focuses on protection of the upper part of the lithosphere. The aim of the geodiversity protection is preserving abiotic conditions giving way to further development of organic life on the Earth. Geodiversity applies to a series of interlocked spheres: atmosphere, lithosphere, morphosphere, pedosphere, hydrosphere, biosphere and anthroposphere. The above spheres are autonomous subsystems, which are interrelated and which can be identified by qualitative and quantitative detection of energy and mass circulation in various spatial and temporal scales. Because of constantly undergoing interrela-

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tions and dependencies between the referred spheres, there are formed specific assemblages (assemblage aggregates) which have different spatial extents and which differentiate landscape pattern of the Earth in time.

Geodiversity may be studied, examined in analytic and synthetic manners. The analytic approach in the investigations on geodiversity involves an analysis of particular elements of the Earth surface (geology, relief, climate, soils, waters, anthropogen), determination of their real state and hazards to them, and indication of protective measures. On the other hand, as determination of their real state, hazards to them and identification of protective measures. Thus, analytic and synthetic investigations should be carried simultaneously. The results of the investigations combined together provide an integral documentary of geodiversity of a particular geographic region or an administrative unit.

The conditions occurring within the lithosphere and at its surface are, therefore, fundamental for life formation and its functioning. The role of a geosystem in supporting life functions becomes more and more appreciated. The recently performed investigations of our solar system evidently showed a peculiar role of the earth ecosystem in processes of life creation and evolution (Sagan, 1996). Therefore, it is mandatory to pay more attention to the role, significance and future of the earth geosystem. Determination of rules of functioning of the geosystem of the planet Earth is particularly important. It refers to recognition and to qualitative and quantitative determination of interrelations and interactions between elements, phenomena and objects as well as subsystems and neighbouring systems. Changes occurring in the geosphere can be divided in four groups: planetary, endogenic, exogenic and anthropogenic (Tab. 1). The anthropogenic changes, which start to destroy an equilibrium in the lithosphere that have formed for the last milliard years at least, are particularly significant. The changes caused by human activity, initiated in the 19th century, undergo faster and faster and include newer and newer domains. The human activity triggered devastation and destruction of the natural environment of our planet.

The process of releasing chemical elements which have been bound in the lithosphere until present become more and more intense. The excessive concentration of these elements

results in toxic contamination which spreads over larger and larger areas and causes destruction or mutation of organic beings.

The effects of these changes, even nowadays, make extinction of humans in the Earth (e.g. by a nuclear war) possible. It is necessary to work out the strategy for protecting geosphere of the Earth. This strategy, first of all, refers to solicitude for keeping the geosystem functioning in agreement with diversity formed by natural geo-forming processes. Thus, we can talk about a need for protecting the geodiversity of the Earth, friendly and essential for development of life, and a man especially.

Consequently, we confront the requirement of defining the geodiversity as *differentiation of the Earth as to geological structure, relief, soils, climate, surface and ground waters combined with demands and impact of humans*.

Geodiversity and biodiversity are two constituents understood as *being in agreement with inherent stipulation of the nature, based on optimum use of natural resources and environmental attributes, not disturbing the life environment of humans in a significant and irreversible manner, reconciling the laws of nature with economy, with admiration for values of nature* (Kozłowski, 1996).

Thus, it can be said that the future of the Earth depends on reasonable usage of natural resources and values of natural environment. This environment consists of biotic and abiotic realms. Their close and direct interrelations force to treat the geosphere and biosphere unitedly.

The values of the Earth have to provide conditions for renewal of internal forces. A mental revival of man grows to the most important problem the humanity is facing at the break of the 20th and 21st centuries.

### Aims of geodiversity conservation

Increasing human impact causes irreversible changes not only in biologic environment but also in geologic environment. We witness disappearance of lithosphere diversity, its geologic, morphologic, hydrologic and landscape aspects. That brings about serious consequences for further development of organic life on the Earth, causes documentary sites (stratigraphic, lithologic and morphologic) to disappear, leads to degradation of landscape structures. The outcome of these processes is a loss of areas important for preserving quality of life of human beings on the Earth.

A necessary condition to uphold biological diversity is to maintain diversity of lithosphere, atmosphere and hydrosphere. The main aims of the lithosphere protection can be listed as follows:

- ability to developing diversified organic life,
- preservation of characteristic landforms (glacial, eolian, fluvial, marine and denudational ones),
- preservation of standard documentary sites of inanimate nature,

Table 1. Changes in geosphere

Spheres	Processes and events
Planetary	Changes in radiation of the Sun and Supernovas Fall-out of cosmic dust, falling of meteorites, collisions of celestial bodies
Endogenic	Convection in metallic core Plate tectonics volcanic phenomena Earth magnetism
Exogenic	Vertical movements of the crust — denudation and sedimentation weathering edogenic processes
Anthropogenic	Triggering of circulation of chemical element, including toxic ones Concentration of radioactive radiation

— preservation of a present structure of the landscape being important element of the notion of sustainable social and economic development (eco-development).

The need for introducing a programme of geodiversity protection became evident during execution of three research projects: on protection of lithosphere — realized by Polish Geological Institute (Kozłowski, 1992); on complex, integrated environmental monitoring — executed under the State Environmental Monitoring and led by prof. A. Kostrzewski (Kostrzewski, 1995a, b); in relation to works associated with geoconservation — carried out in the Institute of Nature Conservation, Polish Academy of Sciences (Alexandrowicz, 1994a, b; Alexandrowicz *et al.*, 1996).

The major goals of the Geoconservation Programme have been approved as follows:

1. Working out of the notion and rules of protecting geodiversity of inanimate nature in Poland in relation to European outlines (European Association for the Conservation of the Geological Heritage — ProGEO and Pan-European Biological and Landscape Diversity Strategy).
2. Evaluation and assessment of geodiversity in the fields of geology, pedology and surface and ground waters.
3. Presentation of the structure of Polish landscapes in relation to geodiversity preservation.
4. Development of geoconservation network.
5. Preparing of a draft inventory of Polish candidate geosites for the list of European Geological Heritage.
6. Setting up information system about geodiversity in Poland.
7. Preparing informative booklets and cartographic leaflets.

The thematic scope of geodiversity includes such elements as:

- geological structure,
- relief,
- soils,
- surface waters,
- groundwaters,
- landscape and
- climate.

The undertaken efforts aim at adoption of the international convention about geodiversity protection.

### Implementation of geodiversity conservation

Geodiversity conservation is one element of the Pan-European Biological and Landscape Diversity Strategy. Following this strategy the efforts aiming at protecting landscape diversity should allow for preserving and improvement of natural and cultural landscapes important in European scales by dint of:

— assessment of main geomorphic forms in particular geologic/climatic zones based on four criteria: rarity, uniqueness, representativeness, and natural character; geologic features may comprise intact river systems, pingos, eskers, dunes, coasts, domes, folds and fossils;

— integrated implementation of environmental friendly technologies and sustainable management of natural resources;

— land use and rural settling appropriate for a given culture and region, including agricultural land layout, terraces, histori-

cal houses and other buildings; cultural features may comprise local rural architecture, historical parks, old trails, channels, ditches, fishery ponds, artificial waterways, traditional pattern of settlements and fields;

— outstanding picturesque scenery being a visual asset of natural and cultural landscape.

The goal of the strategy is to achieve protection and balanced management of biodiversity and landscape diversity in the whole European continent in 20 years.

Using competence as a criterion of geodiversity protection the following levels are distinguished:

— international (geosites of European and World Geological Heritage — the list of these geosites is to be prepared by the Institute of Nature Conservation of the Polish Academy of Sciences in Cracow),

— domestic (reserves and individual forms of protection).

Legal regulations of geodiversity protection are gradually developed. The Nature Conservation Act of 1991 introduced a new category — geological documentary site. This category comprises mineralogical, stratigraphic, lithologic, morphologic and tectonic sites. The new category is gradually implemented by working out the registers of regional administration authorities. A country-wide database of geological documentary sites is expected to be formed. International Union of Geological Sciences started to compile the list of sites of World Geological Heritage. The first list of this type, elaborated by J. W. Cowie, was published in *Przegląd Geologiczny* (Cowie, 1994).

Geological documentary sites are proposed as work on geological-geological map in scale 1 : 50,000, co-ordinated by Polish Geological Institute, is progressing. Experts in the fields of Archaic, Proterozoic to Quaternary have been invited to suggest the candidates as well.

Another task of the geodiversity protection programme is elaboration of regional booklets promoting the conservation issues and actually text about the Carpathians, Holy Cross Mts., Sudetes are under preparation. The booklets are presumed to contain a geological map with existing and proposed sites/areas of protected inanimate nature (reserves, nature monuments, documentary sites) marked on it. A model might be here the text entitled "Geoconservation of the Beskid Sądecki Mountains and the Nowy Sącz Basin, Polish Carpathians" (Alexandrowicz *et al.*, 1996).

The prepared publications aim at registration of the valuable objects of inanimate nature and providing them with an adequate protection. Dissemination of nature protection problems among local societies, pupils, local nongovernmental organizations, and local authorities has to result in proper protection conditions. As the local administration will develop, the awareness of the assets of the local natural environment should be better and better perceived.

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