informator
information newsletter

CENTRE OF EXCELLENCE: RESEARCH ON ABIOTIC ENVIROMENT

bimonthly **No 10**
NOVEMBER/ DECEMBER 2004

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1000 copies

ISSN 1731-7177

PROTECTING THE ENVIRONMENT
Introduction to the 2nd English issue of the REA INFORMATOR

Increasing industrial production, overuse of the chemical substances in agriculture, and urban development have a general negative impact on the environment.

The Polish Geological Institute, represented by its Centre of Excellence REA, for many years has been engaged in the research on and the prevention of the impact of the economic and everyday living human activities on environment. The Institute is systematically registering all the dangerous to the environment processes and phenomena caused by the human activity. It covers the chemical pollution of soils, and surface- and groundwater, caused by mining, metallurgy and other industries, then – pollution of arable lands by an excessive use of fertilisers and pesticides, risk of pollution caused by these chemicals stored in improper conditions, by oil products in gasoline stations, military bases and so on, and finally, hazardous storage of mining, industrial and communal wastes.

Having all those hazards registered in computerised databases as well as on the maps, Institute forwards the information to the government agencies, regional and local authorities, and eventually, to general public. At the final stage, complex monitoring systems are established at the national, regional, and local scales, providing systematic and still growing on-line observations of changes in the environmental well-being.

Contemporary Biebrza river swamps

This issue of the PGI's Centre of Excellence REA *INFORMATOR* / Information Newsletter, the second one in English language, presents the most important Institute's activities in the field of the environmental protection. In short communications, a review of the REA Working Group: *Human Induced Hazards* investigations, achievements in the systematic geochemical surveys at the country-wide, regional and urban scales, and actual status of the complex geoenvironmental mapping, have been described. The activity of another REA Working Group: *Global Change: Climate and Environment* has also been characterised.

Finally, the engagement of the Institute's regional Branches: Upper Silesian, Lower Silesian and Pomeranian, in the geoenvironmental research and protection as well as in the transboundary cooperation, especially with the western neighbours of Poland, has been exemplified.

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REA WORKING GROUP:
Human Induced Hazards

Investigations on the soil, surface water, water sediments and groundwater pollution and their causes, have been carried out by the Polish Geological Institute for many years, and since 2001 are coordinated by the Working Group: Human Induced Hazards of the PGI's Centre of Excellence REA.

The investigations are carried out mainly in the areas transformed by mining activities connected with lignite and hard coals, copper and zinc-lead ores, and industrial minerals. They are expanded also on the areas surrounding power stations, various polluting industrial plants such as copper, zinc and lead metallurgical plants, chemical plants, gasworks as well as on the areas adjacent to the industrial and municipal dumping grounds. The densely urbanised areas became the investigation targets as well.

Working Group: *Human Induced Hazards* concentrates mainly on geochemical investigations of the environment pollution with toxic elements and the persistent organic pollutants, and on waste management. They are carried out in the form of geochemical mapping and geochemical monitoring. The results are published as reports and atlases. A systematic reconnaissance geochemical survey covered already the entire Poland. More detailed surveys were performed in the largest industrial agglomerations, e.g. Warsaw, Łódź, Wrocław, Szczecin, Gdańsk and Cracow. The outcome of the PGI geochemical surveys was published also in international and national journals and presented at international and national conferences.

All necessary analyses are performed in a modern chemical laboratory of the Polish Geological Institute which quality is constantly highly appreciated during the national and international ranking tests. The results obtained and relevant follow-up publications are used in Poland by public authorities, business, and general public for land use planning and for solving various agriculture, forestry, water supply, and health protection problems. They are also helpful in education.

Storage of old agrochemicals, Ostrowiec, Western Pomerania

In the coming years, detailed geochemical investigations will be continued in the Upper Silesia, the most polluted area in Poland. The results will form the basis for the assessment of its land's suitability for industrial, agricultural, commercial or recreational purposes. They will also be of help for reclamation of the devastated mining and industrial areas and for evaluation of the environmental pollution impact on human and animal health.

Clearing of old agrochemicals storage , Dratów, Lublin region

It is also planned to examine the concentration of harmful elements and persistent organic pollutants in the sediments of dam water reservoirs which serve as the source of drinking water, above all of the Zegrze Overflow Lake and Sulejów Water Reservoir.

Work on another field of the Working Group studies: waste management, has so far resulted in an extensive inventory of the hazardous waste landfills. At the same time, the investigators have evaluated degree of the landfills pollution threat to soils as well as to surface water and groundwater. Since 1999, Polish Geological Institute has been also participating in liquidation and reclamation of the most dangerous repositories of fertilisers and plants protection chemicals (so-called *tombs*).

Besides, the tasks executed by the Group include co-ordination and preparation of a multi sheets *Geoenvironmental Map of Poland* in 1:50 000 scale constructed of several information layers on mining, quality of water, natural hazards risks, geotechnical quality of construction areas, nature protection and the cultural heritage of the studied areas. In addition, this map contains information layers presenting geochemical and radiometric data and delinaeation of areas environmentally acceptable for storing waste.

The Centre of Excellence REA Working Group: *Human Induced*

Hazards cooperates with numerous national and foreign academic centres, research institutions and specialised companies. In cooperation with the European National Geological Surveys, the Group has prepared and published several atlases, e.g. *Atlas: Geology for environmental protection and territorial planning in the Polish-Lithuanian cross-border area, Geochemical Atlas of Europe* and *Agricultural Soils of the Northern Europe*. Cooperation with the United States Geological Survey concerned emission of the hazardous radioactive gas, radon. The Group actively participates also in the execution of several European Union sponsored projects.

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Storage cleared of old agrochemicals, Tworzymirki-Gaj, Wielkopolska region

GEOCHEMICAL MAPPING OF POLAND

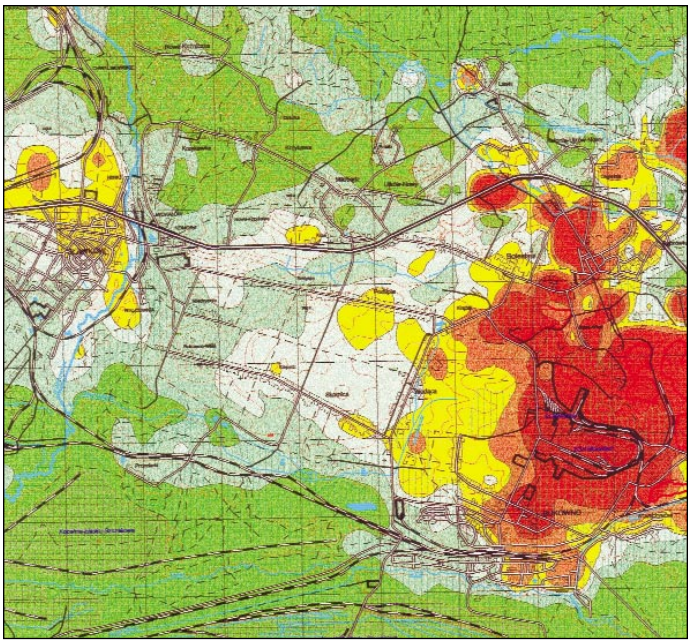
Effective protection of the Earth's natural environment requires proper information on the occurrence, distribution and concentration of the harmful chemical elements and compounds. Such information has been gathered by the Polish Geological Institute since the early 1990-ies through the systematic geochemical investigations of soils, rocks, surface water and groundwater, bottom sediments of surface water etc.

These studies cover geochemical soil and water sampling, their chemical analyses, storing the results within computer databases and, finally, constructing geochemical maps presenting distribution of harmful chemical elements. Geochemical maps are constructed in different scales: reconnaissance (1:5 000 000-1:500 000), regional (1:300 000-1:100 000) or detailed ones (1:25 0000-1:10 000). Completed maps may be traditionally published in printed forms. Recently, they are commonly plotted from computer databases, disseminated on CD-ROMs or made available on the Internet. Usually such maps are published in form of geochemical atlases supplemented with explanatory notes.

The Polish Geological Institute began systematic geochemical mapping of the entire country in 1990. The first stage (1991-1993) included a general assessment of the contamination of soils, surface waters and their bottom sediments at the reconnaissance scale of 1:500 000 (published as *Geochemical atlas of Poland 1:2 500 000*). Due to different concentrations of chemical elements in soils, water and sediments (Ba, Co, Cr, Cu, Fe, Mg, Ni, V and Y), two distinct geochemical provinces were distinguished in Poland's territory: southern – covering the Carpathians, and the Upper and Lower Silesia, and northern – covering the remaining parts of the country.

Generally, detected land areas polluted with toxic metals did not exceed 1% of the country's area. At the same time, however, alarmingly high concentrations of other chemical elements (phosphates, sulphates, Ba, K, Na and Zn) were

Geochemical soil sampling



A map of Pb content in soil, 1:25 000; Upper Silesia

discovered in surface waters. Higher concentrations of toxic elements occur in the areas with heavy concentration of industry, especially there where metallic ores were and are extracted, processed and smelted, and in large urban agglomerations.

The follow-up regional and detailed geochemical surveys have already covered several important regions and agglomerations in Poland: the Upper Silesia (1:200 000) and Legnica-Głogów Copper (1:50 000) regions, and a number of urban centres (1:100 000 scale): Warsaw, Cracow, Kielce, Łódź, Szczecin, Wałbrzych, Wrocław, Gdańsk and Częstochowa. The results of the above mentioned, geochemical investigations have been published in the years 1991-2003 in the form of geochemical atlases.

For the next stage of geochemical survey, the detail investigations (1:25 000) are planned to cover the areas with heightened Pb-Cd-Zn concentrations in the Silesian-Cracow region, in the Głogów and Legnica copper smelters impact zones, and in some areas of the Lower Silesia region with former mining and metallurgy centres.

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GEOENVIRONMENTAL MAPPING OF POLAND

To satisfy the needs of the state ministries and agencies as well as local authorities, responsible for planning and implementation of various elements of the country's sustainable development programmes, the Polish Geological Institute started in 1997 to prepare a multi-sheets Geologic-Economical Map of Poland at the scale of 1:50 000. The map contains necessary information on the present status of the environment, including location of mineral resources, mining activity, surface water and groundwater resources, geotechnical characteristics of the construction areas, the nature protection areas, and the existing relics of culture heritage.

Till the end of 2004, 847 sheets of this map, covering 80% of the country, will be completed. It is planned that the whole mapping will be finished by 2007. In 2002, began work on a multi-sheets *Geoenvironmental Map of Poland* at the scale of 1:50 000, supplementing the previously mentioned map with the information on environmental geochemistry and on the areas suitable for waste storage facilities. In the future, the map will also provide information on the protected areas within the European network NATURA 2000, and on flood and surface mass movements (landslides) hazards. Both maps will soon be available via the Internet. Information included in the maps is stored in the computer databases located in the Voivodships Systems of Spatial Information, and will be constantly updated.

Still another program for construction of the detailed geoenvironmental maps at the scale of 1:10 000 (*Maps of degraded and of increased natural risk areas*) is presently being prepared. The maps will cover areas endangered by landslides and floods, the post-industrial, highly urbanised areas, as well as areas foreseen for large investments in the future.

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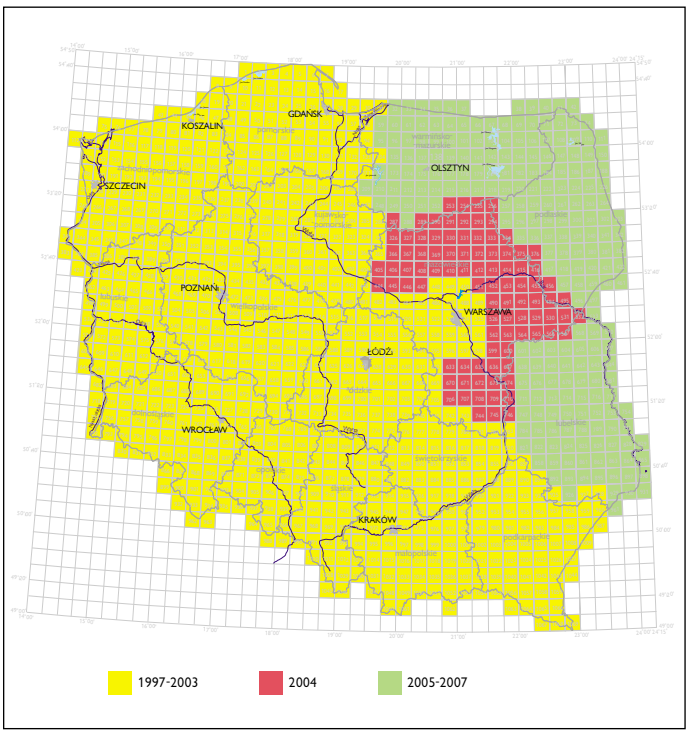

Geologic-Economical Map of Poland 1:50 000. Actual coverage

PGI UPPER SILESIAN BRANCH
Hard coal geology research centre in Poland

Polish Coal Basin in the Upper Silesia region has been an interest of the Polish Geological Institute from the very beginning of its activity that is since May 1919. The research started with constructing a geological map of the Basin in 1:25 000 scale. Until September 1939, the Institute's team prepared 13 sheets of the map. This task provided also a lot of data on the Carboniferous coal-bearing formation in Poland. It was used in 1935 for a Detailed Map of the Polish Coal Basin. The Second World War interrupted those geological investigations.

Subsided and flooded mining area. Szczygłowice coal mine, Upper Silesia

The Institute's Regional Station was reactivated in Będzin in spring of 1945. It started with continuation of geological mapping and the investigations of the Carboniferous coal-bearing formation. Some results: the detailed lithostratigraphic subdivision of the Carboniferous of the Upper Silesian Coal Basin (USCB) and a registry of numbered coal seams are still used during the coal mining. In 1960, the Institute's Upper Silesian Regional Station moved to a new, present building in Sosnowiec. Since then, the Station, upgraded in 1965 to the Institute's Branch, has discovered several new hard coal deposits in the Upper Silesia region and a new Coal Basin in Lublin area (LCB). For the feasibility study of a hard coal deposit in LCB - „Łęczna" – the Branch has been awarded the *I*st *Degree State Prize*.

The Upper Silesian Branch geological investigations resulted eventually in a monograph on Carboniferous formation in Poland, published in 1970, as well as in other thematic monographs and atlases. The investigations of the Upper Silesian Branch included also ore mineralisation on the north-eastern border of the USCB. A copper, molybdenum and tungsten ores deposit was discovered there, in the vicinity of Myszków.

During late 1980-ies and early 1990-ies, intense geological investigations on the coal-bed methane in the USCB were carried out, partly in cooperation with foreign, mainly American, companies.

Since the mid 1950-ies, the Branch has been also conducting investigations of groundwater in the coal-bearing series and in the vast zinc-lead deposits, occurring at the border of USCB and the Cracow-Częstochowa Jurassic Belt. These investigations have also resulted in publication of several hydrogeological monographs. The Branch's geothermal investigations of the Upper Silesian Coal Basin are also worth mentioning.

Lately, a large portion of the Upper Silesian Branch work focuses on geological mapping of the USCB: the selected sheets of the *Detailed Geological Map of Poland*, *Hydrogeological Map of Poland*, *Geologic-Economical Map of Poland* and *Geoenvironmental Map of Poland,* all at the scale of 1:50 000, and other thematic maps in different scales.

Within the framework of the intensive international co-operation, the Upper Silesian Branch developed with Czech geologists an unified picture of the USCB geological structure, cut into to parts by the Polish-Czech border. Similarly, the geology of the Lublin Coal Basin and its south-eastern extension: the Lviv-Wolhynia Coal Basin, was jointly re-worked with the Institute of Geological Sciences of the Ukrainian Academy of Sciences in Kiev. Finally, in 1995, the Branch organised the XIII International Congress on Carboniferous and Permian, and in 2000 – 4th European Coal Conference.

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Subsided and flooded mining area. Szczygłowice coal mine, Upper Silesia

PGI LOWER SILESIAN BRANCH
Centre of the Institute cooperation with Poland's western neighbours

The PGI's Lower Silesian Branch was established in 1949. From the beginning, the Branch has dealt with geological and hydrogeological investigations of south-western Poland, primarily of the Sudetes Mts. and Fore-Sudetic area. This region is characterised with an unusually complex geological structure and is rich in mineral resources. That is why the primary specialisation of the Branch is geological mapping and mineral exploration.

The results of many years' Branch's work are summarised in the *Detailed Geological Map of the Sudetes Mts. 1:25 000*, updated within the *Detailed Geological Map of Poland 1:50 000*, and numerous other geological maps, such as a multi-sheet *Geological Map of the Lower Silesian Region in 1:100 000 scale, covering the adjacent areas of the Czech Republic and Germany* (1995), joint Polish-German-Czech *Lausitz / Jizera / Karkonosze Geological Map 1:100 000* (2001), *Atlas of the Lower Silesian Coal Basin*, and *Tectonic Map of Sudetes Mts. and Fore-Sudetic Block 1:200 000* (2004).

Mineral exploration carried out by the Lower Silesian Branch resulted in discovery and/or feasibility studies of several mineral deposits. For instance, of the only Polish tin ores deposits, barite and fluorspar deposits, unique kaolin deposits, potter and fire clay deposits, and numerous deposits of building and road stone, agglomerates, quartz, feldspathic materials etc. A large portion of the Branch's investigations dealt with groundwater. Between others, it runs the Lower Silesian part of the country's groundwater observation networks, constructs a considerable part of the *Hydrogeological Map of Poland 1:50 000*, and so on.

The seat of the Lower Silesian Branch, Wrocław

A lot of Branch's interest is devoted lately to the geoenvironmental problems of the Lower Silesia region such as environmental geology, natural hazards (e.g. floods), geotourism and conservation of inanimate nature. During the last decade, it included construction of several sheets of the *Geologic-Economical Map of Poland 1:50 000*, and environmental impact assessment of mining dumps and tailing pods. The Branch participates also in the preparation of the national and regional Lower Silesian waste management plans.

Present Branch's international cooperation focuses mainly on geological mapping, research on the geological structure of the Sudetes Mts. and Fore-Sudetic area as well as on natural hazards (floods) and protection of inanimate nature. The Lower Silesian Branch takes also part in international research programs, such as *PACE, POLONAISE, EUROPROBE,* involving interpretation of the geological structure of Poland's deep basement.

Cooperation with the Czech Geological Survey has so far resulted in the publication of geotourist maps of two Sudetes regions: Śnieżnik Massif (1997) and Stołowe Mts.-Adršpašsko-Teplické Skály (1999), both in 1:50 000 scale. Recently, establishment of a Polish-German geopark *Mużaków Arch* is in preparation. It will be the first transboundary object of this type in Europe.

Flood damage in Lower Silesia

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PGI POMERANIAN BRANCH
An important link of a European regional cooperation

The Pomeranian Branch of the Polish Geological Institute was established in Szczecin in 1995 to replace the Marine Coast Geology Unit, operating since 1964. The Branch generally concentrates on the geologic mapping of the western Pomeranian area. So far, the Branch has constructed 70 sheets of the Detailed Geological Map of Poland in 1:50 000 scale, and the Szczecin sheet of the Geological Map of Poland in 1:200 000 scale. The western part of the Geodynamic Map of the Polish Baltic Coast Zone in 1:10 000 scale, has also been prepared.

Currently, the PGI's Pomeranian Branch conducts geological works and research in north-western and western Poland, including geological and hydrogeological mapping, economic and environmental geology, and groundwater monitoring. For instance, some 46 sheets of the *Hydrogeological Map of Poland* in 1:50 000 scale have already been constructed. The Branch runs also a *Regional Hydrogeological Data Bank* for the Western and Central Pomeranian and for the western part of Ziemia Lubuska and Wielkopolska regions. In the same areas, the Branch runs a network of stationary hydrogeological observations (70 points). The network contains a part of the national groundwater monitoring system, covering also the Polish-German cross-border area, from the Baltic Sea coast (Uznam island) in the North, to the Noteć and Warta rivers valley in the South.

A landslide on a Polish Baltic Sea cliff coast

The PGI's Pomeranian Branch closely cooperates with the Federal Geological Survey of Germany (BGR) and Geological Surveys of Brandenburg and Mecklenburg–Vorpommern Lands. Joint Polish-German geological and geoenvironmental research in the Odra River valley area is vital for the landuse management, utilisation of its resources and the environment protection. As the first result of the co-operation, a *Map of natural resources and geoenvironmental risks in the Polish-German cross-border area*, has been constructed (1997-98).

A mapping drilling

As a real achievement of the cooperation, the construction and publication of five sheets of the *Geological Map*, covering the Polish-German cross-border area in 1:200 000 scale, should be regarded. Quite recently (2004), a *Geological-tourist map of the Pomeranian region* in 1:200 000 scale has been published in cooperation with the Geological Survey of Mecklenburg-Vorpommern Land. At present, the PGI's Pomeranian Branch started the execution of an international project *Morphotectonic European Lowland Area MELA*, co-financed by the European Union. The project results will be used for the preparation of a *Morphotectonic Map of European Lowland Area*.

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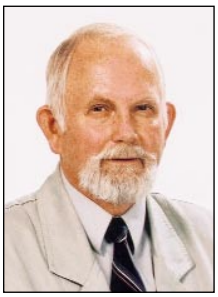
REA WORKING GROUP:
Global Change: Climate and Environment



The primary task of the REA Working Group: Global Change: Climate and Environment is the research on the climate from the geological past, and based on that knowledge – forecast of the future climatic changes, taking into concideration the human activities influence on these changes. The Working Group deals with these issues using its geological experience.

The climate changes, which have taken place during the last geologic period, Quaternary, are well recorded within the Quaternary marine, lacustrine, swampy and river deposits. They may also be detected in borehole cores taken from glaciers, in old tree rings, and even in the still preserved palaeomorphologic forms.

Initiated by the Polish Geological Institute in 1954, detailed geological and geomorphologic mapping of the country at the scale of 1:50 000, 1:25 000 and 1:10 000, with accompanying studies of the fossil and contemporary lacustrine and river deposits, resulted in the reconstruction of numerous old landscapes in Poland, and in identifying climatic changes in Pleistocene (older Quaternary).

Geological mapping and investigations resulted also in actions aimed at providing legal protection to several important geological and geomorphologic phenomena. For example, in 1999-2001, in the northern and central Poland, 15 areas and objects (landscapes, morphological forms, geological outcrops, erratic blocks etc.), which could constitute European inanimate nature heritage, were selected for further protection. The results of these investigations have been presented in numerous publications, lectures and posters prepared for national and international conferences, between others for an international conference *Geological heritage concept, conservation and protection policy in Central Europe* organised recently by the Working Group in Cracow, Poland.

At the moment, the Working Group works at reconstruction of former climate and forecasting on that base the future climatic changes. It includes studies on the contemporary deposits of the Baltic Sea bottom, inland lakes, rivers as well as on the fossil lacustrine deposits, on the impact of the ice-sheets cooling, on the climate changes during the late Pleistocene, on the sea and inland waters level changes as a result of contemporary climatic changes and their connection with changes in the level of fossil water reservoirs, and so on.

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Contemporary winter landscape, Mazury Lakeland

Merry Christmas

and

a Happy New 2005 Year

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