



## DETAILED GEOLOGICAL MAPPING IN POLAND AS A BASE FOR SELECTION OF REPRESENTATIVE GEOSITES

Andrzej BER<sup>1</sup>

**Abstract.** The Polish Geological Institute (PGI) is the principal producer and editor of the geological maps in Poland. In the past decades, the PGI activity has been generally concerned with the elaboration of the multi-sheet serial maps covering the whole territory of Poland, fully compiled with the use of digital GIS technology. Especially, the *Detailed Geological Map of Poland* and *Geological-Economical Map of Poland* both in scale 1:50,000 are a basis for selection of representative geosites.

In the last decade, 15 Quaternary geosites in Northern and Central Poland of the European significance were selected, mainly on the basis of geological mapping conducted for *Detailed Geological Map of Poland*, 1:50,000 (Ber, 1999). Three geosites in category of “geological documentary sites” were selected entirely on the basis of 50 suggestions presented on specially prepared information cards for the geological exposure (Information card of the geological exposure). Most of these 15 objects are already protected. Within framework of the *Detailed Geological Map of Poland*, 1:50,000 and *Geological-Economical Map of Poland*, 1:50,000, numerous geosites were proposed in Central and Eastern Poland in the Cracow Upland, Polish Sudetes, Polish Carpathians, in Holy Cross Mts. and in the Nida Basin.

Established and proposed geological documentary sites, nature monuments and the valuable objects of inanimate nature are marked on *Geological-Economical Map of Poland*, 1:50,000. Among other, on the base of the detailed geological mapping, the booklets promoting the conservation issues in Carpathians, Holy Cross Mts. and Sudetes were published.

**Key words:** geological mapping, detailed maps, representative geosites, Poland.

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**Abstrakt.** Państwowy Instytut Geologiczny jest największym w Polsce wykonawcą i wydawcą kartograficznych opracowań geologicznych. W ostatnich dziesięcioleciach działalność kartograficzna Instytutu koncentrowała się na opracowywaniu numerycznych (w technologii GIS), wieloarkuszowych, seryjnych, szczegółowych map pokrywających obszar całego kraju. Do wyróżniania i przedstawiania najważniejszych geostanowisk w Polsce najbardziej przydatne są: *Szczegółowa mapa geologiczna Polski*, 1:50 000 i *Mapa geologiczno-gospodarcza Polski*, 1:50 000.

Na podstawie wyników szczegółowego kartowania geologicznego, w północnej i środkowej Polsce wyróżniono 15 geostanowisk o znaczeniu europejskim (Ber, 1999). Większość tych obiektów została wzięta pod ochronę. Na podstawie 50 propozycji przedstawionych na specjalnie opracowanych kartach informacyjnych odsłonięcia geologicznego, wytypowano i wzięto pod ochronę 3 stanowiska dokumentacyjne. Częściowo, w czasie terenowych prac kartograficznych nad *Szczegółową mapą geologiczną Polski*, 1:50 000 i zestawczych nad *Mapą geologiczno-gospodarczą Polski*, 1:50 000 wyróżniono i opisano szereg nowych geostanowisk różnego wieku w środkowej i wschodniej Polsce, na Wyżynie Krakowskiej, w polskich Sudetach, w Karpatach i w Górach Świętokrzyskich z basenem Nidy. Chronione i proponowane geostanowiska różnej rangi i wieku są przede wszystkim zaznaczone na *Mapie geologiczno-gospodarczej Polski*, 1:50 000. Również w dużym stopniu na materiałach szczegółowych prac kartograficznych zostały oparte wydane w 2000 roku opracowania książkowe dotyczące pomników przyrody nieożywionej w Karpatach, Górach Świętokrzyskich i Sudetach.

**Słowa kluczowe:** kartowanie geologiczne, mapy szczegółowe, reprezentatywne geostanowiska, Polska.

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<sup>1</sup> Polish Geological Institute, ul. Rakowiecka 4, 00-975 Warszawa, Poland

## INTRODUCTION

The Polish Geological Institute, established in 1919, has been the principal producer and editor of the geological maps in Poland. In the past decades, the Polish Geological Institute activity has been generally concerned with the elaboration of the multi-sheet serial maps, covering the whole territory of Poland. At present four maps: *Detailed Geological Map of Poland*,

*Hydrogeological Map of Poland*, and *Geological-Economical Map of Poland*, fully compiled with the use of digital GIS technology, are prepared in scale 1:50,000. Especially, the *Detailed Geological Map of Poland* and *Geological-Economical Map of Poland*, 1:50,000 are basis for selection of representative geosites.

### THE DETAILED GEOLOGICAL MAPPING IN POLAND

**The Detailed Geological Map of Poland, 1:50,000**, the basic detailed geological map of the country, is elaborated on the base of geological mapping, especially useful for selection of representative geosites, with research boreholes drilled to the Quaternary bedrock as well as geological and geophysical surveys, and laboratory analyses. The whole edition comprised of 1069 sheets is published since 1954. Up to the present, 880 sheets of the map have been completed and 507 sheets have been published. The cartographical works became significantly intensified in the last years, and this means that the whole edition is to be completed in 2009. In geological mapping geologists of the Polish Geological Institute, universities, Polish Academy of Sciences, and national and private enterprises are involved.

The *Detailed Geological Map of Poland* is published in Polish and forms a compendium of geological knowledge of the area. It constitutes a basic map used for other consecutive thematic maps of the country, in detailed or in regional scales. The map is supplemented with one or two geological sections, typical for the area. Each sheet is supplied with text explanations, presenting geological description of the area, logs of more significant boreholes, and results of field and laboratory analyses.

**Geological-Economical Map of Poland, 1:50,000**, published since 1990, is a cartographical presentation of mineral deposits distribution and development against selected elements of mining and mineral processing, hydrogeology, engineering geology, nature, landscape and cultural monuments. Map is constructed in cartographical projection 1942. The aim of the map is presentation of perspectives and prognosis of the

deposits appearance, classification of mineral deposits and state of their development, present and potential natural hazards connected with the appearance of mineral deposits, their exploitation and mineral processing, selected hydrogeological elements for the groundwater protection purposes, engineering geology, geochemistry, nature, environment protection elements and cultural monuments. This map contains information for present and environment protection purposes, as well as for the use by local and regional administration. Geological documentary sites, nature monuments and the valuable objects of inanimate nature are marked on particular sheets of the *Geological-Economical Map of Poland*, 1:50,000.

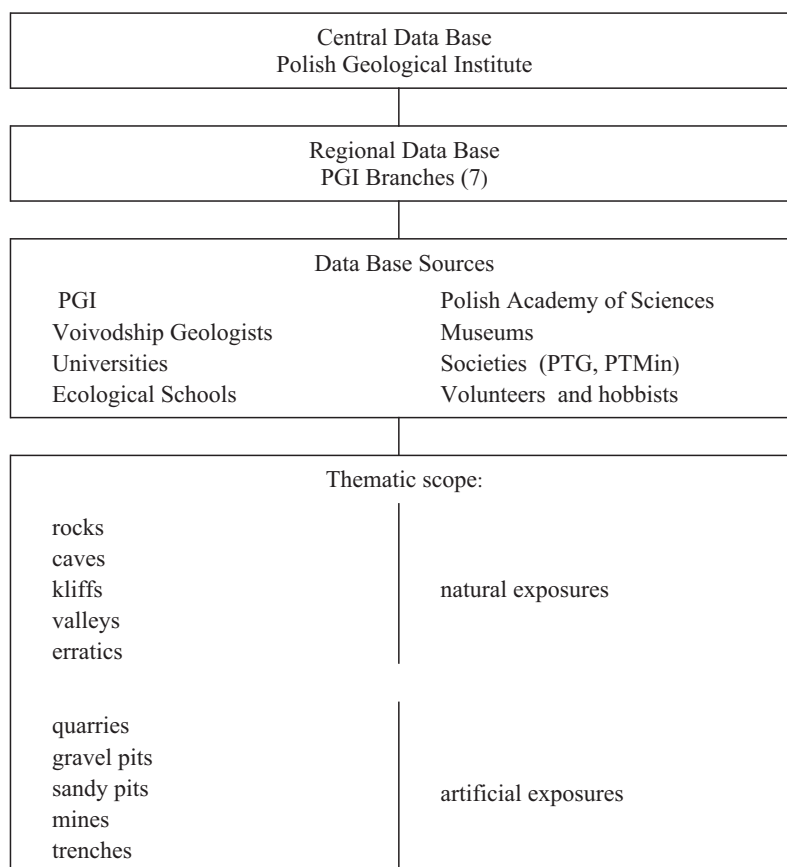
**Hydrogeological Map of Poland, 1:50,000** covers the territory of whole Poland. Map is constructed in cartographical projection 1942. The first sheets of this edition were prepared in 1989. Since 1996, the map is systematically constructed in accordance with the approved instruction. The completion of the map is expected in 2004. The map is a synthetic hydrogeological presentation, with aquifers and description of groundwater resources, their dynamics, quality and hazards. The map provides information to local administration and for territorial planning purposes.

Among other activities in detailed geological cartography of the Polish Geological Institute, the detailed thematic geological, geophysical and geochemical maps as well as atlases for regions and town areas (in scale 1:10,000 to 1:50,000) are published, presenting aspects of engineering geology, hydrogeology, lithology, environmental protection and territorial planning.

### SYSTEM OF DATA COLLECTION

The main role in data collection during the detailed geological mapping is assigned to the Polish Geological Institute (Central Database — CDB) and its regional branches (Regional Databases — RDB) — Fig. 1. These central and regional databases are enriched by other institutions: Polish Academy of Sciences, Voivodships Geologists, universities, geological enterprises, ecological schools, museums, societies,

and also by volunteers and hobbyists. For the data collection, the most useful are natural and artificial exposures (Fig. 1) of the Quaternary sections (outcrops) or pre-Quaternary type outcrops such as tors, cliffs, ravines, erratic boulders, quarries, gravel and sandy pits, mains and trenches. Also landforms such as kames, eskers, end moraines etc., and landscape features are objects of geosites selection.



**Fig. 1. System of data collection**

## SELECTION OF REPRESENTATIVE GEOSITES

The geosites selected during the detailed geological mapping are generally subdivided into 3 group:

- landforms and landscape features;
- Quaternary sediments outcrops;
- Pre-Quaternary sediments outcrops.

The main criteria defining value of the particular object are generally based on scientific, educational and aesthetic value (Urban, 1990; Urban, Wróblewski, 1999). In order to compile list of the representative geosites, also historical-etnographical and tourist attractiveness are taken into account.

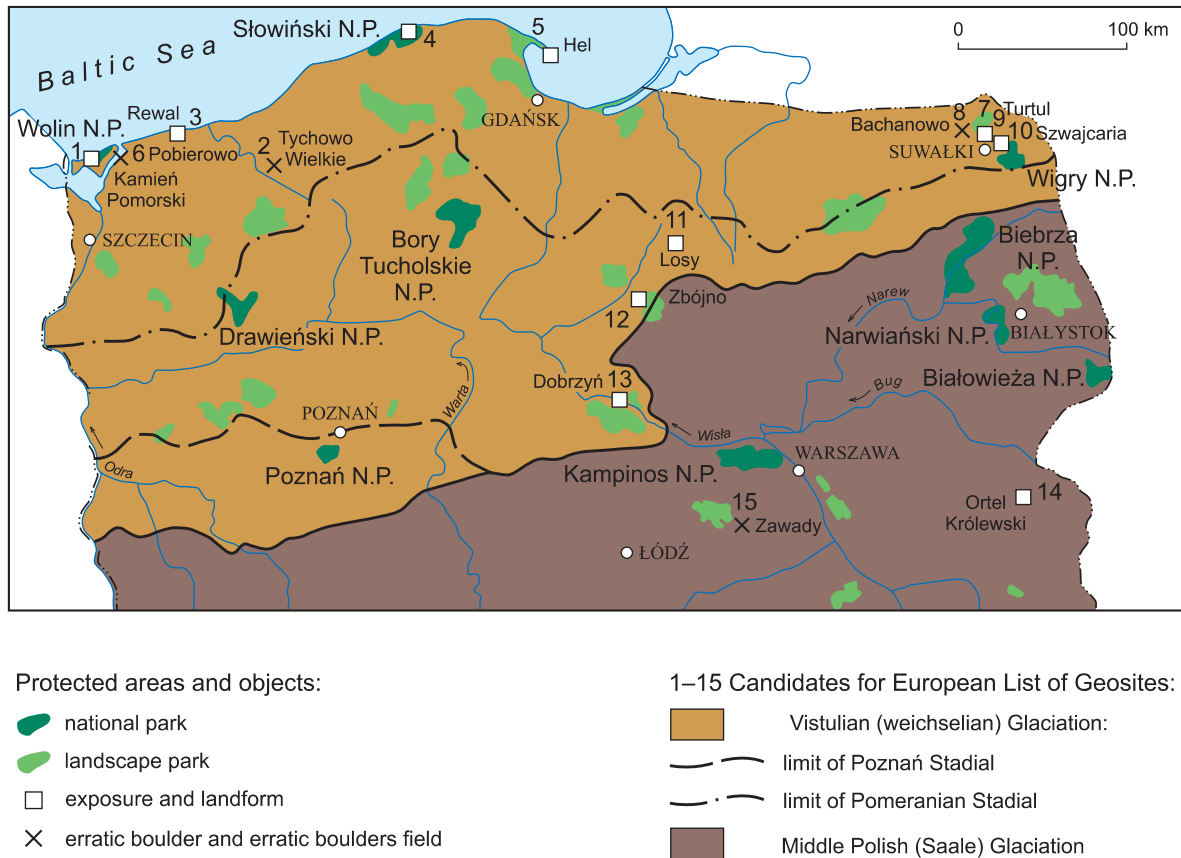
Most geosites in Poland is selected during geological mapping performed during field work for the *Detailed Geological Map of Poland*, 1:50,000, as well as in process of compilation of the *Geological-Economical Map of Poland*, 1:50,000. The selected geosites are described on the specially prepared *Infor-*

*mation card of the geological exposure* (Kozłowski, 1997). Information card, filled during mapping by geologist, contains many very important, general and detailed information as follows:

- name of sheet of the *Detailed Geological Map of Poland*, 1:50,000;
- name of the topographical map sheet;
- name of object and its localisation;
- type of object with owner name and geological classification;
- proposed conservation method;
- literature.

The presented “Information card of the geological exposure” (Fig. 2) could be very useful example for other countries performing detailed geological mapping for selection of the representative geosites.





**Fig. 3. Distribution of selected important geosites and areas in Northern and Central Poland (acc. to Ber, 1999)**

(Holy Cross Mts.) and the Nida Basin. Geological documentary sites, nature monuments and valuable objects of inanimate nature are marked on *Geological-Economical Map of Poland*, 1:50,000. An example of selected and then protected geosite is an artificial exposure of the Eemian Interglacial sediments in Szwajcaria, in the vicinity of Suwałki town (Fig. 4).

Detailed geological maps are basis of the constructed review thematic geological maps with geosites and other geological heritage protection objects marked. An example of the thematic review map is *Map of evaluation of inanimate nature of protected areas and objects in Poland*, 1:750,000 (Alexandrowicz *et al.*, 1992). Legend of the map contains such elements as:

- nature reserves;
- inanimate nature monuments (erratic boulders, tors and rock walls, geological exposures, water objects, caves and rock crevasses);
- evaluation of nature reserves and monuments;
- scientific value of large space categories of nature protection;
- evaluation of museum exhibitions of inanimate nature;
- teaching trails.

In numerous geological-touristic and tourist maps in different scales, geosites and elements of protected inanimate nature are also presented in explanations.



**Fig. 4. An example of the selected representative geosite — outcrop of the Eemian sediments, Szwajcaria, NE part of Poland (Photo. A. Ber)**

On the base of the detailed geological mapping, booklets promoting the conservation issues in Carpathians (Alexandrowicz, Poprawa, 2000), Holy Cross Mts. (Wróblewski, 2000) and Sudetes (Gawlikowska, 2000) were published. These booklets contain geological maps in scale 1:300,000 with location of the existing and proposed sites/areas of pro-

tected inanimate nature, and in explanations elements of the nature conservation are shown, such as:

- inanimate nature reserves;
- nature reserves with abiotic elements;
- planned inanimate nature reserves;
- inanimate nature monuments;
- nature — landscape complexes;
- planned documentation stands.

## CONCLUSIONS

The most important geosites in Poland are selected mainly on the base of the detailed geological mapping and/or of data selection performed for *Geological-Economical Map of Poland*, 1:50,000. In the nearest future, a broad co-operation of

different geological, environmental and ecological institutions as well as financial support of the Polish Ministry of Environment and European Commission will be required for selection of the important geosites and for their conservation.

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