Geological data infrastructure for spatial planning in Poland

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1 GEOLOGICAL DATA

1.1 Serial maps

Activity of Polish Geological Institute (**PGI**) as the geological mapping was concerned, has been generally focused on the construction of multisheet, serial maps, covering the whole territory of Poland or some specific regions. Serial maps, in scale of 1: 300 000 to 1: 10 000, present geological, hydrogeological, engineering - geological, geo-environmental, economic - geological, geophysical and geochemical problems. Presently, basic multisheet serial maps, covering the whole country, are constructed in the scale of 1: 50 000. They include three 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. 1:50000 *Detailed Geological Map of Poland* (**DGMP**) database as the most important and basic geological map exist in E-information market as professionally prepared product, as a final result of advanced, computer-aided processes. This program (DGMP) started in 1994 and have been developed with advanced GIS systems. DGMP database contains data depicting lithology, stratigraphy and the origin of rocks on:

- geological surface map (2 meters below ground level)
- boreholes and mineral resources map
- geological crossections
- synthetic geological profiles

All geological data are gathered during field works using 1:25000 topographic base-maps. Poland is divided into 1069 sheets of 1:50000 geological map. 715 sheets of DGMP have been digitally prepared, that gives app. 67% of database content (fig.1). Except geological data DGMP contains topographic and hydrological raster datasets. This year all field works will be finished but final digital processes are to be ended in 2014.

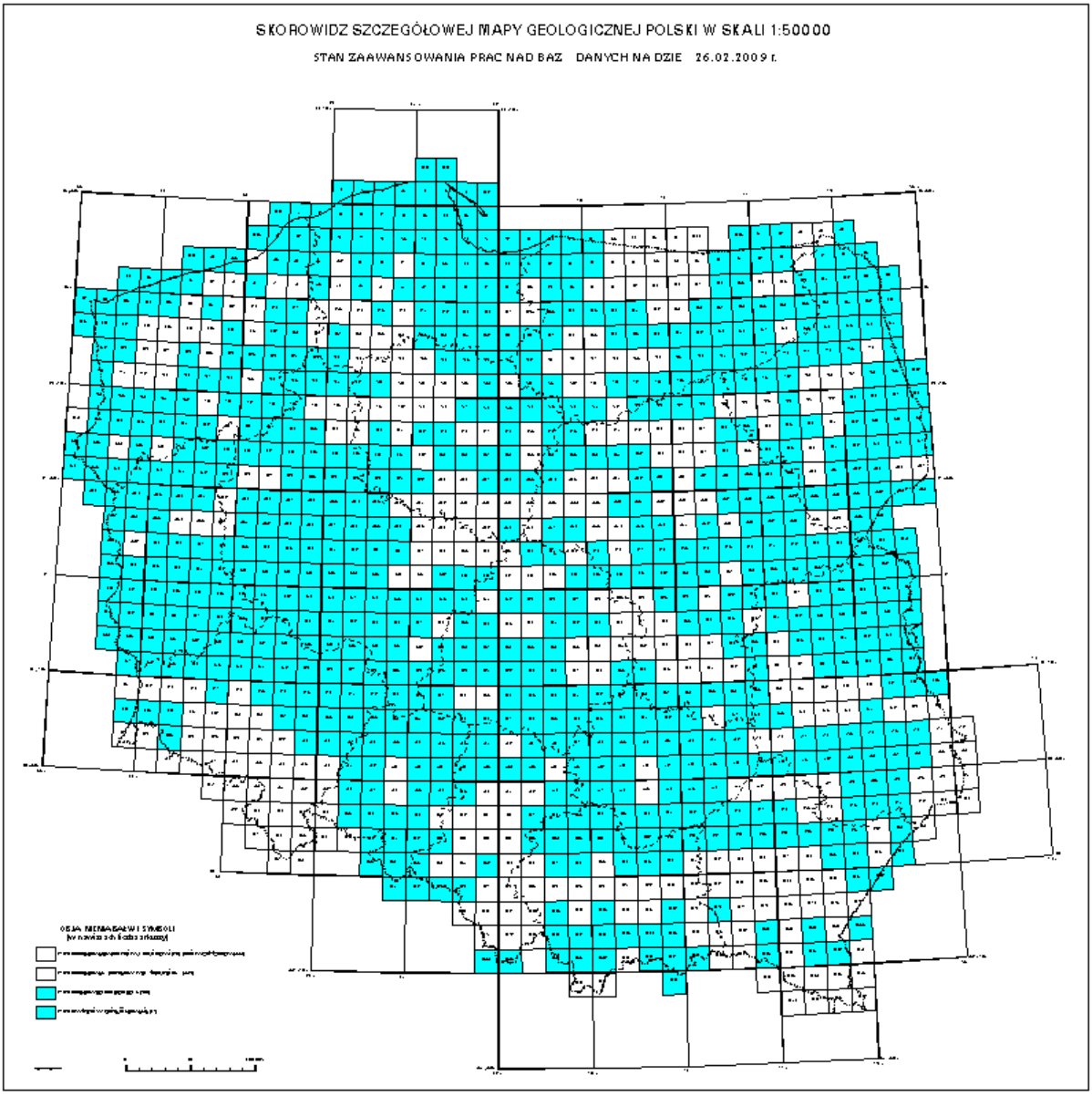

Fig. 1: Blue color – sheets of 1:50 000 Detailed Geological Map of Poland loaded to database (26.02.2009)

In 2006 new, complementary program of 1:50 000 Lithological Map of Poland (LMP) was implemented. LMP database will be generalized picture of DGMP emphasizing lithology and origin of surface deposits shown on shaded relief map. Advanced digital technology of joining separate LMP sheets will make possible to prepare seamless geological map for all country area and can be used for environmental analyses on selected areas (eg. communes, provinces, regions).

1.2 new projects

In 2009 also new, pilot program of 1:10 000 Geological 3D Model for 2 communes in western Poland will be implemented. This project will join additional field works, analyses of geological surface map, boreholes, water intakes and crossections (geological and geophysical) to obtain integrate picture of stratas down to 20-30 meters below the ground level. This model, containing data about mineral resources, lithology and thickness of stratas, first water table location and surface infrastructure and analysed with integrated information systems (*ArcGis* and *CommunityViz*), can be successfully use by authorities and decision makers. To show the real influence of geological data on decision making, author of this project decided to implement some examples of Dynamic Analyses of Influence (DAI) for selected investments using *CommunityViz* software. To show interactions between geology and spatial planning, the example of waste disposal location have been chosen. The following elements of DAI have been taken into consideration:

- geological data – infiltration map (fig.4); brown color – not permeable stratas

- topographic data – road network and buil-up area borders (fig.4); orange color – build-up area
- indicator data – costs and decision validity parameters (fig.4)
- dynamic attributer and their values (fig.4)

In this example, the following dynamic attributes characterize 2 variants of waste disposal location:

- isolation folia costs for permeable grounds (item: koszt_izolacji, costs in PLN)
- waste disposal distance from build-up areas (item: odl_zabud)
- area of not permeable grounds under the waste disposal in square meters and % (items: pow_np and procent_np)
- scoring system depending on validity of selected attributes (item: punktacja)

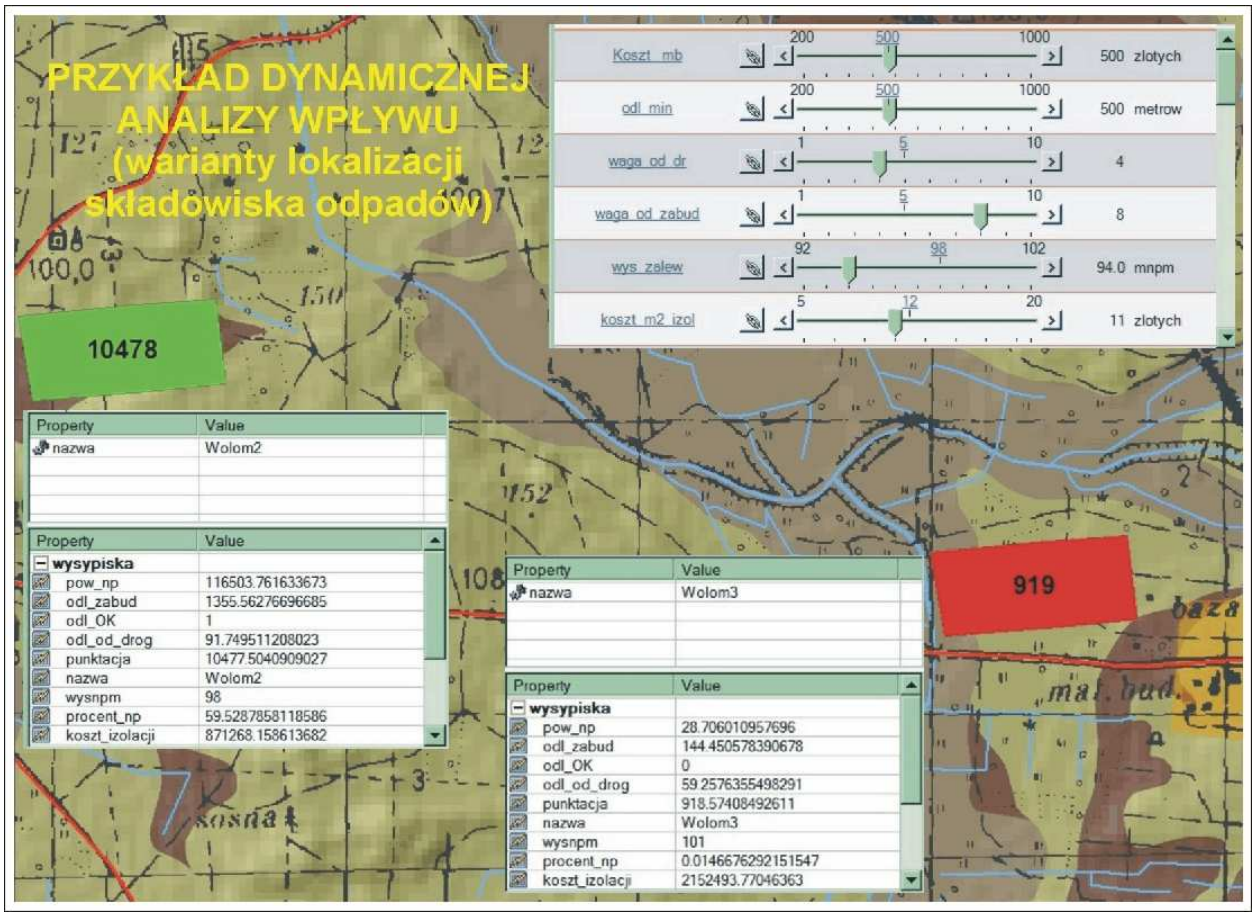

Fig. 4. Example of analysis of dynamic influence (ADI) showed for exemplary investment areas prepared with CommunityViz. Scale 1: 20 000

Wartości tych atrybutów zmieniają się dynamicznie wraz ze zmianami założeń (prawy górny róg Ryc. 4), ustalonych dla każdej analizy. W przypadku porównania obu wybranych lokalizacji (Ryc. 4), przy następujących założeniach: koszt izolacji bentonitowej – 11zł/m^2, odległości minimalnej od zabudowy – 500 m, wagi parametru odległości od dróg i zabudowy odpowiednio 4 i 8, wybrano, z 10-cio krotną (10487 do 919) przewagą punktową obszar Wolom2 (kolor zielony) na lokalizację składowiska odpadów. Oczywiście wszystkie parametry zmieniają się wraz z minimalnym przesunięciem obiektu myszką przez operatora, co umożliwia w ciągu paru minut przeanalizowanie kilkudziesięciu kombinacji wyboru warunków lokalizacji wybranego elementu przestrzennego. W tym szczególnym przypadku decydujące znaczenie miały parametry geologiczne (59,5% obszaru na gruntach nieprzepuszczalnych – koszt izolacji 871268 zł; w przypadku Wolom3 – 2152493 zł) oraz duża odległość składowiska od zabudowy – 1355 m (w przypadku Wolom3 – 144 m).

Dynamiczne analizy wpływu mogą być dowolnie rozszerzane, modyfikowane, wariantowane i parametryzowane w zależności od zapotrzebowań użytkownika oraz w krótkim czasie są wstanie pokazać

płynnie zmieniające się wartości wszystkich parametrów dynamicznych wraz z każdym przesunięciem dowolnego obiektu analizy.

2 IMPLEMENTATION AND PRODUCT AVAILABILITY

All sheets of DGMP which have been prepared both with analog and digital methods so far, are available for users. Price list settles the fees only for preparing database information. The costs are as follows:

- Plotter print of one map composition (B1 format) - 50 PLN, (12,5 EURO)
- Map explanations - 30 PLN, (7,5 EURO)
- Complete set of vector data for DGMP sheet (*.e00; *.shp) - 50 zł, (12,5 EURO)
- Map composition in raster format (*.tif) - 25 PLN, (6,25 EURO)
- Map explanations in raster format (*.pdf) - 20 PLN, (5 EURO)
- Polish Geological Institute makes digital data available in following vector and raster formats: ArcInfo *.e00, ArcView *.shp and *.png, *.tif , *.pdf. All information about geological maps are on POLISH GEOLOGICAL INSTITUTE web page: www.pgi.gov.pl

3 CONCLUSION

Many research teams, stakeholders, planners, officials and teachers ought to be interested in such prepared geological data which can be used in all projects concerning spatial planning, environmental studies, decision processes and education. Polish Geological Institute carries out preliminary works connected with geological data implementation in spatial planning. These projects deal with:

- location of point investments (eg. water intakes)
- location of line investments (eg. pipe lines)
- location of area investments (eg. waste disposal sites, housing estates)
- special-purpose maps (eg. flood-hazard map, building ground map)

Geological data are verified, complemented and analysed with integrated information systems (ArcGis and CommunityViz) and can be successfully use in many projects to solve environmental and planning problems.

4 REFERENCES

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