

**ATLAS OF THE WORLD FOR THE BLIND AND VISUALLY IMPAIRED - THE LATEST  
TYPHLOGRAPHICAL PUBLICATION OF HEAD OFFICE OF GEODESY AND  
CARTOGRAPHY ON POLISH TYPHLOGRAPHY'S BACKGROUND**

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Over the period of nearly 30 years the Head Office of Geodesy and Cartography (GUGiK) has been developing and publishing special maps for the blind and visually impaired people.

When developing tactile maps, numerous factors, which do not occur in the process of preparing traditional maps, should be taken into consideration. Besides suitable selection of theme, scale, projection, and assumptions for map publication the special requirements of blind or visually impaired users should be remembered first of all. For the blind, the convex elements that are touched and enable reading the map cannot be smaller than 1 cm<sup>2</sup>, as tinier marks cannot be distinguished under the fingertips. For visually impaired people, the most crucial element is the proper selection of colour contrasts and distinctness of the text.

An essential element of tactile maps is their description. It enables introducing the reader into the issue, explains the abbreviations used, and makes the understanding of map content easier. Because of the specialist character of the work, both typhlographical maps and descriptions are developed in strict cooperation between cartographers, the blind themselves, and educators.

From 1980s, when the beginning of the activity of the Head Office of Geodesy and Cartography (GUGiK) concerning typhlocartography had begun, until today, the technology has developed, along with the evolution of published materials, which become more modern, due to more durable and resistant to destruction materials used for producing them.

In 1983, following the initiative of the Cartographic Commission of the Polish Geographical Association and Typological Department of the Polish Association of the Blind, a seminar was organised, devoted to the issues of maps for the blind and visually impaired. It was postulated that the Head Office of Geodesy and Cartography should start producing tactile maps. It was then that the Head Office of Geodesy and Cartography undertook, for the first time in Poland, the production of maps for the blind and persons with poor vision. It was to meet the obligation imposed upon the Office, to provide maps for special education, as well as to fulfill the resolution of the Polish parliament (Sejm) of September 16, 1982 on disabled and handicapped people.

The first maps, published by GUGiK in the years 1986-2000, were printed in the thermal-vacuum technology, consisting of press forming maps printed on polyester foil, having the thickness of 0.5 mm. Six colours were applied, with the assumption of their full saturation and contrast level necessary for people with poor vision. Models for three historical maps were made using that technique:

- *Ancient Greece,*
- *Roman Empire,*
- *Ancient East,*

as well as 43 titles for regions of the world, divided thematically:

1) physical, political, and economic maps for continents and their parts:

- *Europe, 1:12 000 000,*
- *Central and Eastern Europe, 1:6 000 000,*
- *Africa, 1:18 000 000,*
- *Asia, 1:38 000 000,*
- *Middle East, 1: 4000 000,*
- *Far East, 1:16 000 000,*
- *North America, 1:18 000 000,*
- *South America, 1:18 000 000,*
- *Central America, 1:7 500 000,*
- *Australia, 1:16 000 000,*

2) historical maps:

- *Ancient East, 1:6 000 000,*

- *Ancient Greece*, 1:1 500 000,
- *Roman Empire*, 1:11 000 000,

3) maps of Poland:

- *physical map*, 1:1 500 000,
- *administrative map*, 1:1 500 000,
- *transportation map - railways*, 1:1 500 000,
- *transportation map - roads*, 1:1 500 000,
- *economic map, extraction of raw materials*, 1:1 500 000,

4) historical maps of Poland:

- *the territory of Poland during the dynasty of Piasts, first period*, 1:3 000 000,
- *the territory of Poland in the 17th century (1684 r. Władysław IV Vasa)*, 1:3 000 000,
- *the territory of Poland during partition*, 1:3 000 000,
- *the territory of Poland after World War I*, 1:3 000 000.

In 2004, GUGiK published *Geographical Atlas of Poland* for schools, prepared in new technology of microcapsule paper, commonly known as swell paper. That technology is based on using a paper that has a special coating of heat reactive chemicals. Microcapsules of alcohol implanted in the paper fracture when exposed to heat and make the surface of the paper inflate. Placing black ink on the paper prior to a heat process provides control over the raised surface areas. That method additionally enabled connecting black concave elements with colour drawings.

The *Atlas* is composed of 25 map sheets, grouped into thematic blocks. Every block begins with an introductory sheet – a map with marked borders of the country, as well as major cities and rivers. Those elements are present on all maps. The first part of the *Atlas* presents Poland – its natural environment, as well as social and economic issues. Part two, entitled “*Poland in Europe*”, show Poland in a wider geographic and political context. An integral part of the atlas is the attachment in Braille font: *Geographical Atlas of Poland, explanations*.

In 2005 GUGiK prepared and published the *City map of Warsaw* – based on vector graphics, on swell paper. The city plan, meant for the blind and persons with poor vision, was prepared in the form of an atlas, and contains 12 map sheets, presenting Warsaw, as well as a separate sheet with legend.

The next publication – *Geographical Atlas of Poland*, in 2007 was awarded a prize from the International Cartographic Association (ICA). The *Atlas* is divided into two volumes and provides the explanations in the form of attachments. The *Atlas* contains information concerning location of Europe in reference to the terrestrial globe, as well as elements of geographical environment, such as: land relief, river network, political division, and settlement, both for the entire continent and for specific regions. It consists of 46 sheets of the A3 format, divided into three thematic sections.

First section presents the location of the continent of Europe on the globe. It comprises sheets concerning cartographic grid, a map of the world, and a map of Europe with parts of neighbouring continents.

Second section presents Europe in thematic approaches. It contains the following maps: general map of the continent – with the shoreline, main rivers, and the geographical grid; map of land relief, hydrography, political division, and settlement.

Third section is composed of 35 sheets, providing an overview of 19 regions of Europe, a majority of which is presented on two maps: the general map and land relief map. The general map contains such elements of content as: rivers, lakes, main cities, and regions. The map of land relief depicts: areas located higher than 200 m above sea level, courses of major mountain ranges, highest peaks, as well as elements characteristic for the geography of a given region, e.g. groups of lakes, marshlands, or diversified shoreline.

A similar conventionality and division into topics have been applied in the latest publication of the Head Office of Geodesy and Cartography, entitled *Atlas of the World*, the work upon which began in 2007. It is the third atlas – following the *Atlas of Poland* and *Atlas of Europe* – published by the Head Office of Geodesy and Cartography for the blind and visually impaired people. During its preparation, many experiences gained before were put to use, as well as solutions and methods of graphic presentation.

The *Atlas* is meant for blind and visually impaired people, who are interested in the subject of geography, and spatial distribution of natural, economic, and social issues. When selecting topics for the sheets, special attention was paid to the issues useful for pupils. In connection with that, the assumptions for the *Atlas of the World* (concerning topics of map sheets, as well as manner of presentation and level of detail)

have been consulted with and received the opinion of the Polish Association of the Blind as well as educators teaching blind and visually impaired youths.

That publication was made using relief technique, with the application of colour first-print. That new technology, not applied before in tactile atlases published by GUGiK, consists of applying points and lines of transparent lacquer on printed colour sheets. Unlike the methods used before, it enables superimposing Braille fonts onto traditional descriptions read by visually impaired. That technology allows to save space, which extremely important on maps of the world, where many features need to be presented and described in limited space.

The Atlas has a form of loose sheets stored in a binder. Attached to the binder is a CD with “*Supplement*” containing supplementary information. The basic format for maps in the *Atlas* is A3 format, namely 420 x 297 mm. Map numbers are provided in the right lower corner of each sheet. To make it easier for the blind to work with maps of the *Atlas*, each map has, in its right upper corner, a black triangle that enables distinguishing the top and bottom of the sheet. Some sheets have the so-called “flaps” attached to them, with explanations of symbols used on the map. Those “flaps” are attached in a manner that easily enables finding the sheet number, that is on the top or at the left side of the map.

To meet the needs of correct and readable presentation of political issues and land relief, maps have been made on double size sheets (2xA3). What is more, most of matching areas are presented in the same scale for both issues – politics and relief – which provides the possibility of making comparisons. A legend and list of explanations of abbreviations is provided on a separate sheet.

The *Atlas* is provided with a “*Supplement*” containing a description of the issue described, as well as methodology of map reading. The previously used form of book-attachment in Braille fonts has been replaced with an electronic file, which can be played using a speech synthesizer. Thanks to the novel solution, an interesting information can be found easier and quicker.

The “*Supplement*” contains:

1. Table of contents.
2. List of abbreviations of geographical names used on maps.
3. Explanations of the sign key applied.
4. Preface for the user.
5. Descriptions of each sheet, containing:
  - title of sheet and scale,
  - description of topic with remarks concerning presentation and tips for the blind on how to read the map,
  - list of abbreviations applied on the map,
  - description of capitals (applies to political maps).

Due to the fact that the *Atlas* has the form of loose sheets, at the back of sheet a footnote is provided, with title of the publication and publisher. Having in mind visually impaired users, the back side of the sheet contains sheet description provided in the “*Supplement*” in big font size.

The map of the world, which is not able to reflect true spatial relations, should meet the condition of rendering approximately the surface relations between areas presented, as well as the condition of approximately rendering the relations depicted on the main map. In connection with the above, it has been necessary to select the best solution, as the selection of projection will leave a durable trace in typhlocartography.

For maps of the *Atlas* presenting a global approach, the projection of the Topographic Services of Polish Army (Służba Topograficzna Wojska Polskiego) has been used. In the projection, the length of the equator has been reduced, while the parallels are bent curves dividing the prime meridian into parts, the lengths of which increase in proportion to the distance from the equator. The parallel lengths are gradually increased, so parallel 40° has the size slightly bigger than the original. At higher latitudes, the elongation of parallels increases in comparison with the original, so poles are projected in the form of curves. Although it is not equal real mapping, it turned out to be the best compromise for application in the *Atlas of the World*. That projection results in slight distortions of surface areas and distances, with simultaneous “loosening” of areas in mid-latitudes – where most issues occur, and their presentation is the most difficult. The projection allows to avoid substantial distortions in continent shapes. In order to simplify map reading for those studying the *Atlas*, the image of poles has been simplified from curves to straight lines.

Due to the fact that the map of the world does not render true relations of distances, no linear scale has been placed on the sheets, which would encourage to measuring distances. A figure scale has been placed there which is reflection of the main scale of the map.

Under the title of each map, a black square has been placed, serving the purpose of surface area presentation. The following relation has been applied: one to the square of the denominator of main map scale. In each point of the map, that relation assumes a slightly different value (main scale in reference to surface areas, and local scales) thus it does not reflect local scales, by approximately renders the surface relations. For a blind or visually impaired reader the black square may be helpful for approximate assessment of the size of the area analysed, although it cannot serve the purpose of measuring the surface of territories.

For maps that cover the regional overview has been used the Lambert equal area projection. On each map a contour of Poland has been inserted, which allows for making a comparative analysis of sizes of natural areas and territories, in reference to the surface area of Poland.

The cartographic grid of meridians and parallels is printed on all maps. In relief print, the grid has been simplified due to the necessity of adjusting the amount of concave elements of the map to the perception of the blind. In order to make the Braille fonts readable, in some maps it was required to break the grid lines, whereas breaking shorelines of continents was avoided. On political maps, one hundred percent of state border continuity has been maintained.

The specificity of cartographic projects for the blind and visually impaired calls for far-fetched generalization, quantitative and qualitative one, of content presented on those maps. That is why it was necessary to reach a compromise and to maintain optimal level of proportions between the manner and scope of presentation of the issues of physical, socio-economic, and regional geography.

The *Atlas* contains 38 map sheets, divided into two parts. Part one is devoted to nature and socio-economic issues from global perspective. It consists of 23 map in the scale of 1:90 000 000. The first 12 sheets are devoted to natural issues, the next 11 deal with socio-economic issues. Part two is the overview of regions, it consists of 15 depicting relief and political division of continents. The applied scale range from 1:10 000 000 to 1:40 000 000. To provide the possibility of comparing political issues and relief for a given area, the same scales have been applied to those maps for most regions.

The part devoted to thematic maps consists of sheets in A3 format, covering the following topics related to nature:

1. The Earth – cartographic grid,
  2. The Earth – continents and oceans,
  3. Tectonics – lithosphere plates,
  4. Earthquakes and volcanism,
  5. Land relief,
  6. Biggest rivers and lakes,
  7. Sea currents,
  8. Climate – air temperature in January,
  9. Climate – air temperature in July,
  10. Climate – annual rainfall,
  11. Climate regions,
  12. The Earth – landscapes,
- as well socio-economic ones:
13. Biggest cities/ conurbations,
  14. Population density/distribution,
  15. Races,
  16. Religions,
  17. Energy resources – 1 (oil and gas),
  18. Energy resources – 2 (coal),
  19. Metal ores/resources,
  20. Agriculture,
  21. Transport,
  22. Economy,
  23. Social and economic development.

All thematic maps of the world have equal scale of 1:90 000 000, which enables the blind to make easy comparisons of ranges and distribution of features presented.

Relief print has been used for publication and description of the main elements of cartographic grid, namely the Equator, tropics, Arctic and Antarctic circles, as well as the 0° and 180° meridians. Additionally, in order to make it easier for the blind to read maps, the above lines of the grid have been prolonged outside the contour of the globe, in the form of the so-called “runners”. Surfaces of oceans are rendered as smooth surfaces, free from paint (the exception being map 6. Biggest rivers and lakes), whereas the surfaces of land are depicted in two ways, depending on the requirements for presentation of a given issue in the form of filling a continent, or outline of continent border.

On maps presenting issues by means of isolines and ribbons (e.g. maps of temperatures, rainfall, transport) land surfaces are filled with uniform hachure, in the form of concave points, the so-called pearl-like hachure. For the blind, isolines have been supplemented with the so-called “runners” showing the direction of temperature drop. In case of surface-related issues (agriculture, economy, landscapes) differentiation of hachures is applied. For uninhabited areas, only the shoreline of the continent has been marked (e.g. Antarctica on the map of “races”). For presentation of point-related phenomena (e.g. urban centres, mining of resources) a double line has been used for marking land shores – pearl-like from landside, continuous from waterside. The application of double shoreline allows the blind to indicate unmistakably the areas of land. Usefulness of that making cannot be overestimated in insular areas. The same markings have been used for presenting land relief in global and regional form. For visually impaired users, substantial colour contrast has been used, along with large size fonts.

The part devoted to overview of regions consists of sheets, which present individual continents from the point of view of relief and political division:

24. Europe – political division, scale 1:12 000 000 (2xA3),
25. Europe – relief, scale 1:20 000 000 (1xA3),
26. Asia – political division, scale 1:30 000 000 (2xA3),
27. Asia – relief, scale 1:30 000 000 (2xA3),
28. South-East Asia – political division, scale 1:15 000 000 (1xA3),
29. Africa – political division, scale 1:20 000 000 (2xA3),
30. Africa – relief, scale 1:20 000 000 (2xA3),
31. North America – political division, scale 1:20 000 000 (1.5xA3),
32. North America – relief, scale 1:20 000 000 (2xA3),
33. Central America – political division, scale 1:10 000 000 (1.5xA3),
34. South America – political division, scale 1:20 000 000 (1xA3),
35. South America – relief, scale 1:20 000 000 (1.5xA3),
36. Australia and Oceania – political division, scale 1:20 000 000 (2xA3),
37. Australia – relief, scale 1:20 000 000 (1xA3),
38. Antarctica – relief, scale 1:20 000 000 (1xA3).

On political maps the cartographic grid remains present on water areas, which enables reading the indicative latitude and longitude. On land areas, the grid has been neglected, due to map clarity for the blind. Exceptions here are the political maps of North America and Australia, as in those cases the big area of the country allowed it. This will enable teaching and practising the provision of coordinates both in Northern and Southern hemisphere.

On political maps, where small surface areas of countries precluded presentation of full names of countries together with full names of capitals, abbreviations have been applied. Names of countries are provided in full names on the map, if space was scarce, abbreviations have been used, identical with the internet domain of a given country. Abbreviations are explained next to the map. Capitals have been marked, and their full names are provided in the “*Supplement*”. In cases where it was necessary to move the name of the country outside its territory on the map, it has been preceded with the Braille sixth dot. For visually impaired people, substantial colour contrast has been applied, along with simple fonts of proper size.

On maps presenting relief, abbreviations have been applied for object types, e.g. dots 3, 5, and 6 – precede lakes, g – precedes mountains. For geographical names of objects, abbreviations are used, in the form of first letters the given name, e.g. WPP – Wielka Pustynia Piaszczysta (Great Sand Desert). Abbreviations of geographical names which contain names of cardinal points of the compass, abbreviations of those names used in Polish are applied in Braille fonts, e.g. for Nizina Wschodnioeuropejska (East European Lowland), the abbreviation NWE. Abbreviations are explained in Braille fonts, and in black print, outside the map frame, in black print they are additionally marked with a symbol of rectangle. For visually impaired users, substantial colour contrast has been applied, along with simple fonts of proper size.

As has been mentioned in the beginning, the content of the *Atlas* is adjusted to school curricula, however, most maps may serve also younger pupils, while adult readers may also find a lot of interesting information in the *Atlas*. The authors' intention has been to make the publication possibly best suited to the specific needs and abilities of the readers. Maps must not only meet the cartographic requirements, but also the typhlological ones. An important feature of the *Atlas* is such presentation of content, that makes the maps readable for the blind, visually impaired, and well as people with normal vision.

Providing blind and visually impaired pupils with cartographic teaching aids is of prime importance, in particular as blind and visually impaired children have to follow the same curricula and children with normal vision. Cartographic aids are indispensable to execute the curricula in such subjects as geography.

Preparation of maps in strict cooperation and consultation with the blind, and visually impaired people resulted in obtaining tactile and visual markings adjusted to the perception of users. Those qualities make the information contained there easily acquired by children and youths.

Bearing in mind blind users, elements of the content and inscriptions are provided in concave form, abbreviations and geographical names are published in Braille fonts. For visually impaired people, colour contrast has been suitably applied, along with black letters of proper size.

In the process of developing orientation in space, and teaching to move around independently, the provision of cartographic information for children and adults is of extreme importance. Maps for the blind and visually impaired people, besides simplifying the mastering of the curriculum, are a source of information, which contributes to more complete rehabilitation and will provide the possibility of adjusting better to living without sight. The Head Office of Geodesy and Cartography hopes that the *Atlas of the World* shall contribute to widening the horizons of cognition for the blind and visually impaired, and will be a source of useful information, performing an important role in their lives.

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