

THE MAP OF RELIEF CHANGES IN KATOWICE PROVINCE PART I: METHODOLOGICAL PRELIMINARIES

Katowice province covers the area of 6650 sq. km, that is 2.1% of the whole country area and it is inhabited by 3.9 mln. of persons that is 10.5% of the whole population. It is the area of the most intensive industrial and urban development. 100% of zinc and lead ore is mined and processed there, also 98% of coal is mined and 53% of steel, 46% of rolling products, 33% of coke and 26% of electric energy are produced in this area (*Statistic Annual*, 1986). Such great concentration of industry (in 1985 there were 2798 industrial plants, i.e. 7.7% of the total number of plants in the country, in the area) mainly heavy industry and raw materials processing, also a very dense road net have caused great transformation of the primary relief in larger part of the province. S. Żmuda (1973) assumes that 9% of the relief of the Upper Silesia conurbation has been anthropogenically transformed in 100% and the degree of transformation of the further 12% can reach 75—100%. Obviously it is the result of intensive mining and metallurgy activities that have been carried on in this region since the 12th century. First, Trias ore-bearing beds, then, since the 18th and the 19th century, Carboniferous coal beds have been exploited.

Previously it was generally strip mining. Wastes and slag were poured into excavations and also terrain unevennesses filled. Intensive development of mining and metallurgy in the 20th century caused that huge (the height over 100 m the area over 100 ha) dumping grounds (heaps) of gangue, metallurgical slag, postflotation and energy wastes emerged. The area of waste land is also enlarged by great sand pits (the area over 500 ha), where sand is mined for hydraulic filling of the underground workings left after coal mining. Vast mining subsidence

* Doc. dr hab. Andrzej T. Jankowski, Katedra Geografii Fizycznej Uniwersytetu Śląskiego, ul. Mielczarskiego 60, 41-200 Sosnowiec

Mgr Jerzy Zieliński, Okręgowe Przedsiębiorstwo Geodezyjno-Kartograficzne, ul. Kossutha 9, 40-950 Katowice

(subsiding troughs or sinking subsidence), that appear on the surface over workings, are the results of ground settlement. They are very often waterlogged or filled with water (overflow lands) drained from the surface or from the underground water level. The latter occurs when the bottom of the trough is below the water level. And subsidence hollows, of trench like shape, sharp terrain faults and movement of the overlay strata occur when the roof of a shallow workings collapses.

Plans of recultivation of post-industrial waste lands include their partial reduction, bringing into cultivation heaps and workings by their backfilling, planting and afforestation. Workings are also often drowned forming water reservoirs. Recultivation activities tend to adapt post-industrial waste lands to fulfil different functions as: leisure, sport and recreation, forest, industrial (storing area), farm and building grounds.

In the 20th century a man has become a great relief forming power that can significantly change a landscape. He participates in creating new morphological forms that are called anthropogenic, which has already been mentioned in many geomorphology handbooks (e.g. Klimaszewski, 1978; Galon, 1979; Rathjens, 1979; Dov Nir, 1983). A man joined the process of relief modelling many years ago, almost at the beginning of his economic activity but the effects were not so visible. Changes occurred slowly and did not cover such vast areas. It was only dynamic increase of productive forces and concentration of industry in the 20th century which caused a great scale transformation of natural relief evoking today serious anxieties that the changes may undesirably influence climatic, hydrographic, and soil conditions, and in consequence, man's living place.

The most significant changes of terrain are caused by mining industry, getting useful raw materials by means of open-cut and deep mining. The most important relief forms, that appear because of mining activity, are: workings of different sizes that are formed due to sand, gravel, rocks (quarry) exploitation, also muds and clays. There are also workings of metallic raw materials, collapse holes and subsiding troughs. Materials obtained in quarries, mines and sand pits etc. are transported to their destination where they are used in the process of production. A part of the obtained material (gangue), is stored close to the place of excavation as so called heaps. Great heaps, where waste materials are deposited, appear close to mines, steel, lead and zinc plants, power stations and big factories.

Anthropogenic forms that have been formed in that way may be classified as follows:

- according to the area which they cover: small — covering the area smaller than 50 ha, medium size — the area between 50 and 100 ha, and large above 100 ha.
- according to its shape we can distinguish the following heaps: cone

shape, rounded hills, easy humps, perches, table like hills and terraces.

according to the dumped material: gangue heaps (at mines), overlay formations heaps (at open-pits) slag and ash heaps and waste materials heaps.

according to their activity: active heaps, out of action including; mobile, stabilized, unstabilized, burning, hot, and burnt.

Relief is one of the components of environment, which is destroyed, transformed, and recultivated in certain areas. Maps are used for space and qualitative registration of the phenomenon. The maps of anthropogenic relief may be divided, according to the scale similarly as topographic maps:

a) detailed — at scales of 1 : 100 000 and larger used for urban planning mainly urban and industrial agglomeration. The example is the map of surface changes in Katowice province (appendix) the scale 1 : 50 000, or the maps of surface changes and the green belts in environmental atlases of towns in GOP (Upper Silesia Industrial Area) (e.g. Sosnowiec, Świętochłowice, Chorzów etc.) the scale 1 : 10 000.

b) reconnaissance maps — at scales from 1 : 100 000 to 1 : 500 000, used to regional planning in regions and provinces.

c) general — at scales from 1 : 500 000 to 1 : 250 000, covering the whole country or a group of countries. They have demonstrative character and they are used to prepare great-area plans, namely national and international ones (e.g. the map of destructions and pollutions edited in the National Atlas of Poland).

Maps of relief distortions, because of their subject, belong to the group of maps concerning pollution and geographic environment degradation. To present anthropogenic relief changes all the forms that have appeared in Katowice province due to man's activity must be studied attentively. The map of relief changes in Katowice province at the scale 1 : 50 000, in the opinion of the authors and the sponsors — the Department of Environment Protection, Water Economy and Geology, Bureau of the Provincial Government in Katowice — has been supposed to be a document presenting intensity of anthropogenic changes of relief. The map is also a source material for space planning, geographic environment recultivation, agriculture, mining, administration and governing.

This elaboration covers the area of Katowice province in its administrative boundaries. The map consists of 12 sections of A1 format. It must be also mentioned that it is one of the series of maps of Katowice province prepared at the scale 1 : 50 000 concerning environmental changes. Two of them have already been published: the map of spatial planning, and the map of air pollution.

Such precise and homogenous elaboration covering the area of the whole province is unique in the country. It was possible thanks to pre-

cise, for maps of this scale, and effective method of collecting homogeneous data for the particular time period — the method of aerial photographs interpretation. The results of photointerpretation were supported by verifying field investigations and the records from the files collected in the Bureau of the Provincial Government, particularly in the Department of Environment Protection, Water Economy and Geology. Therefore the map content is homogeneous as far as the subject and time (the turn of the years 1970 and 1980) are concerned and sufficiently precise. Description of workings, used in the legend, apart from their origin give also the information about rocks lithology. It is very useful when planning recultivation and usage of these anthropogenic forms. It also concerns dumps and storage yards.

The used aerial panchromatic photographs had been previously made for photogrammetric works, carried out by Regional Geodetic and Cartographic Company in Katowice and National Geodetic and Cartographic Company in Warsaw. Scales of aerial-photos vary from 1 : 3000 to 1 : 18000 for different areas. Anthropogenic forms are clearly visible in the photos. Aerial photos have given the opportunity to register almost simultaneously and very precisely current state of the relief also some other elements connected with the relief can be observed i.e. soil dampness, sanitary state of forests, settlement, cultivation structure etc. Later and current aerial — photos of the province enable to observe following changes of the relief with the simultaneous registration of changes. When preparing the map a working scale 1 : 25000 based on a topographic map was used. The photographs were interpreted according to the map legend with a stereoscope and a stereopanthometer.

Photo interpretation of aerial photos was performed by a group of photointerpreters from Regional Geodetic and Cartographic Company: Stanisław Aloszko, Marian Aparta and Jerzy Zieliński, cartographic edition was prepared by Grzegorz Strycharz, Andrzej Tchórz and Jerzy Zieliński, while Jacek Jania and Andrzej T. Jankowski, from Silesian University, were charged with scientific consultation. When completing edition at the scale 1 : 25000 the map was reduced to the scale 1 : 50 000 with an optical pantograph. Such original drawings were the base for fair drawings prepared for editing by means of widely known methods — drawing, stripping film and preparation of masks for surface colours.

The map content (appendix) consists of 31 separations where 21 ones concern anthropogenic forms of relief and the rest: boundaries of mining areas, administrative boundaries, forests and water problems (Jankowski, Zieliński, 1981).

All the elements present the current state and the stage of human interference in the environment in Katowice province. The map presents results of human activity noticeable as anthropogenic forms, gives information about their range, degree and character of relief changes. Such

map is one of the basic components necessary to prepare a general environmental map, presenting objective estimation of the current state of the environment in Katowice province.

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ANDRZEJ T. JANKOWSKI, JERZY ZIELIŃSKI

MAPA PRZEOBRAZEŃ POWIERZCHNI ZIEMI WOJEWÓDZTWA KATOWICKIEGO CZEŚĆ I: ZAŁOŻENIA METODYCZNE

Streszczenie

Występująca na terenie województwa katowickiego znaczna koncentracja ludności oraz obiektów przemysłowych, szczególnie przemysłu ciężkiego, spowodowała istotne przekształcenie środowiska geograficznego. Wynika ono z długoletniej (sięgającej XII wieku) i intensywnej antropopresji. Na terenie województwa występuje wiele form rzeźby terenu ukształtowanych gospodarczą działalnością człowieka: zwałowiska, wyrobiska poeksploatacyjne, niecki osiadania i inne formy, zwane ogólnie formami antropogenicznymi. W celu określenia ich wielkości oraz przestrzennego przedstawienia antropogenicznych przekształceń terenu opracowano mapę przeobrażeń powierzchni ziemi województwa katowickiego. Jest to mapa wielosekcyjna (12 arkuszy), wykonana w skali 1:50 000. Została opracowana wyłącznie metodą interpretacji zdjęć lotniczych. Treść mapy (załącznik) składa się z 31 wydzieleń, z czego 21 dotyczy antropogenicznych form rzeźby, a pozostałe odnoszą się do: granic obszarów górniczych, rejonów administracyjnych, obszarów leśnych oraz zagadnień wodnych. Mapa prezentuje więc skutki gospodarczej działalności człowieka widoczne w postaci nowo powstałych form antropogenicznych, informując o zasięgu, stopniu i charakterze zmian powierzchni terenu.

**КАРТА ИЗМЕНЕНИЙ РЕЛЬЕФА КАТОВИЦКОГО ВОЕВОДСТВА
ЧАСТЬ I: МЕТОДИЧЕСКИЕ ПРЕДПОСЫЛКИ**

Резюме

Наблюдающаяся на территории Катовицкого воеводства значительная концентрация промышленных объектов, в особенности тяжелой промышленности, а также населения привела к существенному изменению географической среды. Это вытекает из длительной (доходящей до XII века) и интенсивной антропопресии. На территории воеводства встречается много форм рельефа местности, образовавшихся в результате хозяйственной деятельности человека, как например, отвалы, послеэксплуатационные образования, мульды оседания и другие формы, обычно называемые антропогенными. Для определения величины и пространственного представления антропогенных преобразований местности разработана „Карта изменений рельефа Катовицкого воеводства”. Это много-секционная карта (12 листов), выполненная в масштабе 1:50 000. Карта разработана исключительно методом дешифрирования аэрофотоснимков. Содержание карты (приложение) состоит из 31 выделений элементов, из чего 21 касается антропогенных форм рельефа, а остальные — границ шахтных полей, административных районов, лесных территорий и водных явлений. Таким образом, на карте представлены результаты хозяйственной деятельности человека, заметные в виде возникших антропогенных форм, а также распространение, степень и характер изменений поверхности района.

Maszynopis złożony Radzie Redakcyjnej w kwietniu 1987 roku, przyjęty do druku przez Wydawnictwo UŚ w marcu 1989 roku.

The legend of the map — appendix
The map of relief changes in Katowice province

1 — administration boundaries of countries, provinces and communes, 2 — forests and stands of tress, 3 — industrial areas, 4 — sand and gravel dumps, 5 — power plant waste dumps, 6 — coal mining waste dumps, 7 — dumping grounds of iron, zinc and lead industry, 8 — municipal waste dumping grounds, 9 — other dumping grounds, 10 — wet dumping grounds, 11 — minor dumping grounds, 12 — sand and gravel workings, 13 — clay formations workings, 14 — limestone workings, 15 — dolomite workings, 16 — old workings left after open-cut coal mining, 17 — other workings, 18 — minor workings, 19 — other industrial waste-lands, 20 — levelled grounds, 21 — direction of exploitation or filling, 22 — recultivated grounds, 23 — rivers, water reservoirs, dams and weirs, 24 — industrial water reservoirs, 25 — marshes, 26 — drained areas, 27 — relief forms smaller than 1 ha, 28 — limits of hard coal mining areas, 29 — limits of non-ferrous ores mining areas, 30 — isolines of ground subsidence, 31 — sewage treatment plants; A — map division into sections