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STANISŁAW LESZCZYCKI

Geographical Research on Behalf of Poland's National Economy

The present article is a review of the work carried out by Polish geographers to meet social, especially state needs. Work of this type by geographers can be divided into three groups. The first covers work completed in 1945—1949, and is connected, in the first place, with the rebuilding of the ruined country and with territorial changes. The second group consists of the work on regional planning. This work has lasted from the beginning — 1945 — up to the present. The third group is the work undertaken after the reconstruction of the country (from 1950) to aid and further social and economic development. Because of the limited space allotted to this article, it will be possible to do little more than list the works without being able to give their more detailed achievements or to describe the methods used. We refer those who are interested in the details to the literature cited and to printed bibliographies (*1*).

As a result of the Second World War, changes occurred in the social and economic system as well as in the boundaries and territory of the Polish state. As a result new problems arose which required rapid elaboration by the geographers. These included the following:

1. Compilation of data materials and arguments supporting the Polish point of view in the international discussion about the new state boundaries of Poland (*2*).
2. Participation as experts in delimiting the new boundaries after 1945 (*3*).
3. Elaboration of many articles and publications showing the value of the new state territory for the development of Poland's national economy and its contribution to the reconstruction and growth of the European economy as a whole (*4*).
4. Work on many articles and monographs about the recovered territories so that the Polish community might become more thoroughly and systematically acquainted with them (*5*).
5. Participation in working out plans for the rapid reconstruction and the rational settlement and economic development of the recovered territories. The geographers elaborated many reports for the Bureau of Studies of Resettlement Problems and for the Scientific Council of the former Ministry for the Recovered Territories (*6*).
6. Standarization of Polish place-names in the recovered territories (about 32,000 names) by participating in the governmental Commission

for Establishing Names of Localities and Physiographical Objects. The President of the Commission was a geographer (7).

7. Working out a new division of Poland into physical regions for the school purposes (*8*).

8. Participation in the discussion on the new administrative division of the country introduced after the end of the Second World War (*9*).

9. Participation in the studies organized by the Western, Silesian and Baltic Institutes concerned with regional problems of the western and northern territories investigating the opportunities for social and economic development.

10. Participation in the work of the State Hydrological and Meteorological Institute in organizing the meteorological and hydrographical services (for example regional weather bureaus, etc.).

11. Participation in the work of the State Geological Institute on a geological general map in the scale of 1 : 300,000 and in studies of quaternary problems.

* * *

The cooperation of Polish geographers with regional planning offices dates back to 1933. In face of the necessity for as rapid reconstruction as possible after the war, this cooperation became especially close. In the first period, up to 1949, geographers cooperated in the following fields:

1. Nine geographers worked in the Central Board of Physical Planning in official capacities. One of them was its Deputy Chairman.

2. Geographers headed Regional Planning Offices in Bydgoszcz, Katowice, Cracow and Wrocław.

3. A number of other geographers worked in regional planning offices in different capacities (*10*).

The participation of many geographers in the work of regional planning offices permitted them to become well acquainted with the methods used in regional planning as well as with the difficulties involved in their implementation. On the other hand, it provided opportunities for introduction of geographical methods of analysis and the geographical point of view into physical planning (*11*).

4. Geographers took part in physical planning of the whole country, completing studies on mineral resources, climatic relations, physiographic regionalization, means of transport, population structure, characteristics of the network and function of urban settlements, economic regionalization, etc. These studies were partly included in the two volumes of an atlas published by the Central Board of Physical Planning in 1947 and 1948, entitled, Studium Planu Krajowego (Studies for the National Plan) (*12*).

5. Studies were started in order to elaborate regional plans of all voivodeships. In this respect the best results were achieved for the regions of Warsaw, Cracow, Wrocław, Lublin, Poznań and Kielce.

6. Research on the spheres of influence of 18 larger cities in Poland was completed. This was organized by the Scientific Section of the Polish Geographical Society.

7. As a result of the experience gained, a number of theoretical articles on the scope and methods of geographical investigations for regional planning have been published.

After the completion of the Theree-Year Plan for Reconstruction of the Country, all efforts were concentrated on the Six-Year Plan (1950—1955). Physical and economic planning were reorganized and unified in the State Economic Planning Commission. The economic and physical planning bodies on a regional level were also reorganized. The preparation of new regional development schemes was limited to the most important areas from the economic point of view. The position and character of geographical work in the planning offices changed. Economists and economic geographers with a knowledge of Marxian economics now moved to the front. Within the framework of the Six--Year Plan main attention was directed to the current economic needs of the country (*13*).

8. Between 1950 and 1955, geographers took part in the preparation of about 20 regional plans (*14*).

9. To supply adequately trained geographers for regional planning offices a two-year geographical specialization course was established in the University of Warsaw starting from 1954 (*15*).

After the completion of the Six-Year Plan, a new planning period began in 1956. The main planning office was again reorganized into the Planning Commission of the Council of Ministers; greater emphasis was placed on decentralization and as a result regional planning centres on a voivodeship level expanded.

10. A special committee for a long-term plan was appointed with two geographers as members. Within the Planning Commission an Institute for Long-Term Planning was established, whose vice-director was a geographer; several other geographers were also employed there. An additional committee for regional planning was appointed which included five geographers. In this way geographers are actively participating in the preparation of the long-term plan (for 15 years i.e. from 1961 till 1975, in the localization of important investments as well as in the studies of the spatial structure of national economy and planning.

11. The intensified work of the voivodeship economic planning commissions especially on the preliminary concepts for the growth and development of particular voivodeships, treated as separate „economic regions", has revided cooperation with geographers, especially those connected with universities and economic schools (*16*).

12. In the work of this long-term plan, the need arose for better scientific data on different problems, especially from the point of view of the theory of regional economy. In this connection the Committee for Space Economy and Regional Planning was established by the Polish Academy of Sciences. Eleven geographers became members of this Committee and a geographer was appointed its chairman. The Committee organizes numerous research projects investigating different problems of the spatial structure of Poland's economy and the general theoretical foundations of space economy and regional planning. This offers new perspectives for geographical research.

13. The problems of the social territorial division of labour within the framework of the socialist countries are at present discussed within the Council for Mutual Economic Aid. Coordination of regional plans for the border areas is also being organized. Geographers are participating in this work. That offers to georgaphers a real opportunity to take part in regional planning on an international scale.

From this superficial review it can be seen that the role of geographers in regional planning in Poland is constantly growing in scope and importance.

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The third group of geographers' studies discussed here developed after the most urgent needs connected with the reconstruction of the destroyed country had been met. These studies deal with various fields of the geographical sciences, the most important of which are the following:

1. For a long time all university geographical centres have been working on monographs of towns or powiats (counties). Influenced by the needs of the country under reconstruction, these monographs took on special features in Poland. They define the possibilities for the social and economic activization of the area investigated.

2. Among these various monographs, emphasis was placed on studies of the economic geography of powiats as the smallest economico-administrative units. This pertains to the investigation of the powiat town, the seat of the unified territorial authorities as a centre and its hinterland, which for working purposes is assumed to be the area included within the administrative boundaries of the powiat. The conclusions of such studies usually are transmitted to the powiat and voivodeship economic planning commissions.

3. Detailed monographs of all the powiats within one voivodeship supply data for a monograph, similar in character, of the voivodeship, a political-administrative unit of a higher order (*17*). The framework of this monograph includes also topical studies on special problems of the social and economic pattern of the whole voivodeship.

4. Immediately after the changes in the economic and social system in Poland the functions and development of small towns have become quite a problem (*18*). Geographers devoted many studies to the problem of the so called „crisis of small towns"; they also worked for its solution on an equal footing with economists, sociologists and others.

5. Since 1946 geographers have been occupied with the question of land utilization. They prepared a land utilization general survey map in the scale of 1 : 300,000 useful for physical planning, and especially for regionalization of agricultural production. This was reduced photographically to the scale of 1 : 1,000,000 and printed (*19*). Work on detailed land utilization maps was also undertaken. Maps for cities as well as areas especially highly developed were drawn up in scales of 1 : 5,000 and 1 : 10,000. Work on a larger scale was undertaken from the beginning of 1954. So far maps in the scale of 1 : 25,000 in over 20 powiats were prepared according to uniform instructions. The maps are to be the basis for evaluating present methods of utilization of the geographical

environment as well as for establishing the possibilities of changes for its more rational utilization. Simultaneously some materials for the geographical typology of agriculture and for the regionalization of agricultural production are obtained (*20*).

6. Discussions about a detailed geomorphological survey were begun in 1946. Work in the field was undertaken in 1952 (*21*). In the course of seven years, one-fifth of the country was covered by the map in the scale of 1 : 50,000. A detailed map, using chronological classification of geomorphological forms enables to develop some very complex morphogenetic studies of the areas investigated. Since it contains at the same time certain morphometric elements and the areas of studies are chosen in agreement with the regional planning offices, it is of practical use and it has become one of the main bases for regional planning.

7. Similar work on a hydrographic map in the scale of 1 : 50,000 was started in 1950 (*22*). It is to contain complete data on the present state of surface and underground waters. One-eighth of Poland has been mapped according to standard instruction. The map includes data for the study of water conditions in the geographical environment transformed by economic activities as well as of the whole water cycle in the given territory. Prepared in agreement with regional planning offices this map has also become one of permanent bases for elaborating regional plans.

8. Geographers prepared a catalogue of Polish lakes, used in planning of the water economy and of the development of the fisheries (*23*). It contains 9,296 lakes with an area of at least 1 hectare ($2^1/_2$ acres). The central archives of the bathymetric plans of lakes was organized within the Institute of Geography of the Polish Academy of Sciences. These archives contain the plans of about 600 lakes.

9. Limnological studies conducted by geographers in cooperation with institutes of hydrology and of water economy have led to tentative formation of a new branch of geography, called the physical geography of lakes.

10. A rapid process of urbanization followed the last war. Many cities were expanded; many new housing estates were built — and even entire cities. Town planning developed vigorously. Together with this, physiographical investigations of the expanded cities were organized. These included the morphometry of the area, with special attention paid to the character of slopes, the hydrographic conditions with special consideration of ground waters, the geological conditions, especially from the engineering point of view, the geomorphological and soil relations and the problems of the local climate.

The results of the investigations are usually presented with numeral indices on detailed maps in scales from 1 : 2,000 to 1 : 5,000. A special institution "Geoprojekt" was set up. Many geographers participated in its work. In this way, a new field of physical geography called urban physiography has developed (*24*).

11. For two years, similar investigations have been conducted for large industrial enterprises. Again a new field of physical geography, called industrial physiography, is arising. It unites geography with economics, city planning and technical sciences.

12. In the sphere of climatology special attention has been paid to local climate. Investigations of local climate have been carried out in industrial areas and in cities, for health resorts and for agricultural regions. Some results of practical importance have been obtained. They deal mainly with atmospheric pollution in the cities. On the basis of the results obtained in the Upper Silesian Industrial District some steps have been taken by the authorities to improve climatic conditions in this so densely populated area (*25*).

13. Several geographers are participating in the work of the Upper Silesian Committee of the Polish Academy of Sciences (*26*).

The Chairman of the Committee is a geographer. Investigations bear among others upon the reclamation of the geographic environment destroyed by industrial exploitation. General improvement of the living conditions in this region of high industrial development is one of the main aims of the research undertaken.

14. Geographers have prepared a long-term forecast of population changes in the Upper Silesian Industrial District (to 1970).

15. Geographers have studied the functional structure of cities, the whole urban network as well as possibilities of further urban development. All these studies were undertaken in agreement with various town planning bodies (*27*).

16. Geopraghers have also undertaken studies of the proper location of industries and of individual enterprises. Problems of the industries producing building materials, textiles and food have been so far studied. These investigations were carried out in agreement with the interested ministries, industrial and planning offices (*28*).

Between 1957 and 1960 the Institute of Geography of the Polish Academy of Sciences, with the collaboration of the Central Statistical Office and the Planning Commission of the Council of Ministers prepared an unpublished industrial atlas of Poland. The atlas provides: (a) a cartographic synthesis of the present information on the spatial structure of industry in Poland; and (b) a cartographic starting point for discussions and studies concerning the locational changes in Polish industry in the time from 1960 to 1975.

17. Geographical studies of economic regionalization were undertaken in agreement with planning bodies. Some of the results obtained were presented at the international conference on economic regionalization held in Kazimierz (Poland) in 1959 (*29*).

18. Between 1950 and 1956 geographers participated repeatedly in the preparation of the reform of administrative division of the country.

19. Since 1957, 9 geographers have been taking part in the work of the Scientific Council of the Society for the Development of the Western Territories, just as they did in similar bodies during the first post-war years. These studies aimed at more effective and better social and economic development of these areas.

20. To exchange views about the experience in applied geographical research, a special seminar for British and Polish geographers was organized in 1959 under the auspices of UNESCO.

* * *

The above-mentioned trends in geographical research all undertaken for the welfare of the state and society indicate their very wide range. The research, however, was not exclusively of an applied character but it had a scientific value as well. They promote new research problems which use more precise research methods, expressing the results quantitatively. On the other hand planning of scientific research, the trend of specialization in geography and the concentration of research on limited number of problems favour the development of the applied geography (*30*).

Another favourable circumstance for the development of geographical research was the organization of the Institute of Geography of the Polish Academy of Sciences, which coordinates all the studies undertaken and is able in some cases to help research from its own financial means (*31*).

It should be recognized that positive results have been so far achieved in this way in Poland. In fact geographical studies undertaken to meet the needs of the state and society have also helped in the development of new research methods and of the theoretical basis of geography as a science.

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BOLESŁAW OLSZEWICZ

Les rapports entre les Pays Scandinaves et la Pologne dans le domaine de la cartographie, depuis la Renaissance jusqu'au XIX[e] siècle *

Maintes ressemblances se laissent constater dans le passé de la cartographie scandinave et dans celui de la cartographie polonaise. Comme dans le Nord de l'Europe, de même en Pologne la cartographie avait fait ses débuts à l'époque de la Renaissance. Ici et là, elle a evolué rapidement: déjà la première moitié du XVI[e] siècle connut les cartes géographiques des territoires nationaux respectifs à des échelles relativement grandes. Ici et là, suppléer à l'oeuvre de Ptolémée fut une tâche plus urgente qu'elle ne l'était dans le Sud ou dans l'Occident de l'Europe; c'est que, pour les pays de l'Europe du Nord et de l'Est, voir même de l'Europe centrale — les cartes de Ptolémée donnaient des renseignements non seulement rares et surannés, mais parfois même inexacts. D'autre part, les ambitions nationales ont joué à cet égard, en Scandinavie comme en Pologne, un rôle important: ce fut notamment le désir de documenter son appartenance à une civilisation qui remontait à la Grèce antique et à Rome. Et une ressemblance encore: les peuples de l'Europe du Nord, tout comme les Polonais, doivent les premières descriptions exactes et les premières cartes de leurs pays à ses propres géographes et cartographes, et non pas à des étrangers. Et ce furent justement ces prototypes scandinaves ou polonais, qui sont devenus des modèles ou des sources de renseignement primordiales pour les auteurs étrangers.

Les analogies cependant dont il est question ont fini au XVII[e] siècle. Dans les Pays Scandinaves, les levées topographiques ont été inaugurées alors, et continuées de manière de plus en plus précise. En Pologne, par contre, les circonstances politiques n'étaient point propices au développement des sciences. C'est dès cette époque que la continuité a manqué dans l'évolution de la cartographie en Pologne: aux périodes de progrès succédaient celles de carence, sinon de décadence. Mais beaucoup plus triste fut le sort de notre science après 1795, c'est-à-dire après le partage de la Pologne. Dans cette période tragique, la cartographie des territoires polonais — nous pensons aux levés fondamentaux — échappait souvent, et pour de longues années, aux Polonais. Néanmoins, les cartographes

* Les renvois bibliographiques sont limités, ici, aux strictement nécessaires; ils seront complétés dans le texte définitif du mémoire.

en fragments déjà en 1842 par M. Wiszniewski[6]; mais ce fut seulement F. Bujak qui en a apprecié l'importance pour l'histoire de la cartographie, dans une publication de 1900, qui a échappé alors à l'attention des savants suédois[7].

Rappelons qu'il résulte de ces lettres que Wapowski a travaillé à cette époque à la carte de l'Europe du Nord, qu'il avait reçu à cette occasion de Dantiscus quelques cartes de Scandinavie, et qu'il attendait encore un exemplaire „a reverendissimo d[omino] lincopensi ex Gedano quem, ut audio, summa diligentia perfecit".

On sait qu'à cette époque se sont trouvés sur notre territoire trois hauts prélats catholiques de Suède, venus se refugier en Pologne à la suite de la Réforme qui venait d'être introduite dans leur patrie. Ce furent les deux frères Magnus, successivement archevêques d'Uppsala. Jean, historien, et Olaus (né à Linköping), géographe et cartographe — ainsi que Jean Brask, évêque de Linköping. Que Wapowski et Olaus Magnus ont collaboré ensemble, qu'ils échangeaient entre eux leurs matériaux, ceci est établi et ne présente aucun doute. Mais il n'est pas encore déterminé qui a été l'auteur de la carte dont Wapowski attendait l'arrivée, de Gdańsk, le 15 mars 1533: fut-ce l'évêque de Linköping, c'est-à-dire Brask (inconnu pourtant comme cartographe), ou bien Olaus Magnus, originaire de Linköping? Peut-être en effet ce dernier, comme le suppose M. Haglund.

Il est invraisemblable qu'Olaus Magnus, qui avait déjà depuis 1527 travaillé à sa grande carte de Scandinavie, en six feuilles (achevée en 1539), n'ait rien entendu des travaux cartographiques de Copernic relatifs à la Prusse et la Warmie, qu'il n'ait point profité des résultats de l'éminent astronome dans ce domaine[8], et que, ayant personellement connu le chanoine de Warmie, Alexandre Scultetus, il n'ait pas pris connaissance de sa carte de Livonie, de 1529.

Il faut admettre, au contraire, que les Magnus durant leur séjour en Pologne ont eu de nombreuses connaissances parmi les savants polonais. Certainement, Wapowski n'a pas été le seul savant polonais avec lequel les prélats suédois étaient en rapport. Déjà en 1518 Jean Magnus était en relations épistolaires, au sujet de l'origine des Gothes et des Suédois, avec le plus distingué des géographes polonais, Mathias de Miechów, auteur du traité classique sur les deux Sarmaties, mort en 1523.

Au XVII[e] siècle, l'influence de la cartographie militaire suédoise sur celle de Pologne semble incontestable. Rien d'étonnant, puisqu'à cette époque nos troupes se sont, hélas, très souvent rencontrés sur les champs de bataille avec l'armée suédoise; celle-ci disposait d'excellents et nombreux ingénieurs-cartographes et était, pour l'époque, largement pourvue en matériel cartographique. Lors des opérations militaires sur les terri-

[6] M. Wiszniewski: *Historia literatury polskiej (Histoire de la littérature polonaise)* vol VII. Kraków 1842, p. 567 et suiv. Dernièrement, en 1957, ces lettres ont été publiées *in extenso* par W. Pociecha. Acta Tomiciana XV, p. 155 et suiv.

[7] Cf. F. Bujak, op. cit., p. 110 et suiv.

[8] Résultats beaucoup plus importants, à en juger d'après les recherches récentes, que l'on ne le croyait auparavant.

toires de la Pologne, les ingénieurs suédois ont effectué plus d'un levé cartographique. De leurs travaux, une partie insignifiante seulement est connue des savants polonais, et même en Suéde ces travaux n'ont pas encore suscité, autant que je sache, un interêt spécial. Un seul cartographe, Erik Dahlbergh, est souvent mentionné par les historiens polonais, car ses cartes et ses plans — concernant, entre autres, la Pologne et Varsovie — ont été reproduits dans le célèbre ouvrage de Pufendorf, consacré au roi Charles-Gustave. Quant aux travaux manuscrits de Dahlbergh, qui se trouvent aux Archives Royales de Guerre à Stockholm. aucun Polonais ne les a consultés, excepté peut-être A. Czołowski.

Notons encore un autre cartographe distingué, Olof Hansson Swart (Örnehufvud), quartier-maître général suédois, qui a dressé en 1626, d'après les levés originaux, une carte de la région de Gdańsk, de Elbląg et de Warmie. Cette carte a été utilisée maintes fois en Pologne: par Frédéric Getkant en 1643, par Samuel Donnet en 1722 et par Jean-Frédéric Endersch en 1753.

Tous les ouvrages consacrés a André Bure mentionnent la carte de la Lithuanie, due à Thomas Makowski, comme une des sources dont s'est servi le père de la cartographie suédoise dans son *Orbis arctoi nova et accurata descriptio*, de 1626. Et ce n'est pas probablement le seul cas au cours de ce siècle, où un travail polonais a été utilisé par les cartographes suédois; les cartes polonaises, emportés en Suède comme butin de guerre, auraient pu y contribuer.

De ces cartes, emportés de la Pologne et qui se trouvent aujourd'hui dans les collections suédoises, quelques-unes sont de grande importance pour l'histoire de notre cartographie. Notons à titre d'exemple l'atlas manuscrit de Frédéric Getkant, la *Topographia practica*, aux Archives Royales de Guerre à Stockholm, et l'unique exemplaire connu de la première édition de la carte de Lithuanie de Thomas Makowski, de 1613, à la Bibliothèque universitaire d'Uppsala. Qui sait si les autres collections en Suède, les moins importantes surtout, n'abritent-elles pas d'autres documents relatifs à l'histoire de la cartographie polonaise.

Le XIX^{e} siècle apporte des vestiges évidents de la collaboration polono-scandinave dans le domaine de la cartographie. En 1835 s'est établi en Norvège Joseph Alexandre Waligórski (1794—1873) qui, dans la guerre polono-russe de 1831, avait gagné son grade de capitaine d'artillerie. Après la chute de l'insurrection, il a dû quitter sa patrie. Il a passé en Norvège un quart de siècle, engagé comme ingénieur à la construction et à la conservation des canaux. Mais il s'occupa également de cartographie. En collaboration avec un officier d'artillerie norvégienne, Harald Nicolai Storm Wergeland (ensuite général et chef de l'Etat-major général), il a edité en 1847 une carte routière de Norvège, *Veikart over Norge*. Que cette carte a été favorablement accueillie par le public norvégien, huit éditions successives en tèmoignent. La dernière apparut en 1893, après la mort de Waligórski. Celui-ci a quitté sa patrie adoptive en 1863, pour prendre part à l'insurrection polonaise comme général. Il mourut emigré à Paris. Le période de son séjour en Norvège est presque inconnue en Pologne. De même

la carte de Waligórski et Wergeland. Je n'en ai trouvé aucun exemplaire dans les bibliothèques polonaises.

Inconnus sont, de même, en Pologne, les exemplaires d'un travail intéressant et paraît-il apprecié des savants contemporains, Stéphane Baranowski (1817—1881), Polonais établi en Finlande: *Klimatologische Karte der Erde* (Helsinki 1849, 4°, 2 tables lithographieés suivies de texte). Ce travail ne nous est connu que par la bibliographie. L'auteur fut de 1840 à 1863 professeur de langue russe à l'Université de Helsinki, écrivain, inventeur, animateur d'oeuvres sociales, et en outre auteur des atlas historiques et géographiques à l'usage des écoles.

Et encore une contribution aux rapports polono-scandinaves. En 1887 parut à Stockholm, par les soins de G. E. Klemming, un beau facsimilé de la carte de Scandinavie d'Olaus Magnus, de 1539, effectué à l'échelle originale par Generalstabens Litografiska Anstalt. D'après les notes d'un bibliographe de Cracovie, d'habitude bien informé, Żegota Pauli (Ms. de la Bibliothèque Jagellonne 5383), à cette publication a contribué un antiquaire polonais établi à Stockholm, Henri Bukowski (1839—1900), ancien insurgé, qui a eu d'importants mérites dans le rapprochement culturel entre la Suède et la Pologne.

Les exemples que nous venons de citer témoignent suffisamment de l'existence de contacts séculaires dans le domaine de la cartographie, entre les Pays Scandinaves et la Pologne. S'il est vrai que les collections d'atlas et de cartes géographiques en Scandinavie abritent des documents qui sont très précieux pour nous, les bibliothèques polonaises gardent d'autre part, des documents qui ne sont probablement pas sans intérêt pour les savants scandinaves: la preuve en est la découverte faite par Nordenskiöld. Aussi une collaboration plus étroite entre les historiens de la cartographie, scandinaves et polonais, est-elle sans aucun doute fort désirable.

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Analyse de l'exactitude de quelques cartes du XVII[e], XVIII[e] et XIX[e] siècle, couvrant les territoires de l'ancienne Pologne

La carte, comme chaque instrument de travail scientifique, doit être connue en ce qui concerne son degré de précision. Cette exigence apparaît depuis quelques temps dans les publications, non seulement géodésiques [1], mais aussi celles qui représentent l'opinion des géographes [2]. On voudrait que la carte, et avant tout la carte topographique moderne, atteigne un degré de précision qui soit à la hauteur de l'exactitude des moyens utilisés à obtenir les données qu'elle représente. Des études de cette exactitude se multiplient, analysant non seulement les erreurs ayant origine dans les procédés du mesurage, du dessin et de la reproduction des cartes, mais aussi celles que l'on commet en les utilisant [3].

La question est importante non seulement pour les cartes topographiques modernes employées comme bases d'études scientifiques, techniques et statistiques, mais aussi pour les cartes plus anciennes. En effet, les cas sont nombreux dans lesquels les historiens, les économistes et les géographes utilisent les cartes en tant que registres de divers éléments de la surface terrestre, et étudient les modifications des longueurs, des formes et des superficies de ces derniers, pour obtenir des caractéristiques numériques des changements survenus dans le paysage soit à la suite de phénomènes physiques, soit économiques. De telles comparaisons, exigeant souvent une juxtaposition de cartes exécutées à des dates très différentes, auraient des résultats illusoires si le degré d'exactitude de ces cartes ne serait soumis à une minutieuse analyse. Cette dernière permet d'établir les limites dans lesquelles une comparaison de ce genre est réellement utile. Elle peut être utile aussi aux historiens cherchant à établir le tracé d'une ancienne frontière, la position d'un objet disparu depuis, le lieu d'un événement, etc. Enfin, le développement même du degré d'exactitude des cartes à travers les siècles présente un intérêt tant pour les géodètes comme aussi pour les géographes, représentant un indice du degré de la connaissance de notre planète à diverses époques.

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[1] Cf. Shewell: „Journal of the Royal Institute of Chartered Surveyors" 31 (1951): Thuma: „Vermessungstechnik" H. 4—6, 1959.

[2] Cf. Auden-Close, „Geogr. Journ." f. 2, 1952.

[3] Cf. N. M. Volkov: *Principy i Metody Kartometrii*, Moscou 1950, pp.155—168; Modrinsky et Trautsolt, „Przegląd Geodezyjny" (Revue Géodésique Polonaise) 9, 1958.

Le rôle de pionnier dans ces études incombe, en ce qui concerne les cartes du territoire de l'ancienne Pologne, à Henri Merczyng, professeur à l'Institut Électrotechnique de Saint-Pétersbourg [4], qui a publié en 1913 une analyse d'une carte de Lituanie à 1 : 1.300.000 dressée au commencement du XVII-e siècle par Thomas Makowski, géomètre au service du prince Christophe-Nicolas Radziwiłł et publiée dans l'atlas de Blaeu. Cette carte [5], intéressante surtout à cause des informations politiques et administratives qu'elle contient, fut étudiée par Merczyng spécialement en ce qui concerne le degré d'exactitude des positions des principales localités qui y sont marquées, au nombre de 33. Les carrés des déviations de ces positions par rapport aux données modernes furent additionnés, leur somme divisée par le nombre des cas considérés et la racine carrée extraite de cette somme, selon la formule de Gauss:

$$\mu = \pm\sqrt{\frac{\sum_1^n [\varepsilon^2]}{n}}.$$

En appliquant ce procédé aux déviations des latitudes et des longitudes et en calculant la valeur de la diagonale du rectangle établi par juxtaposition à angle droit des valeurs moyennes de ces déviations, Merczyng a évalué cette diagonale, c'est-à-dire l'erreur moyenne de la position des localités sur la carte de Makowski, à 51 km. Il faut

[4] H. Merczyng, professeur d'électrotechnique de 1895 à 1914, auteur de manuels de cette matiere (1888, 1889, 1899, 1905) et de plusieurs études du domaine de la physique (C—R. Ac. Sc. Paris 1883 et 1909, Ann. der Physik 1890 et 1912, etc.), s'est occupé aussi d'études historiques (Diss. Ac. Sc. Kraków 1907, Warszawa 1910, etc.). L'étude en question (*Mapa Litwy z 1613 r.*, Sprawozdania Tow. Nauk. Warsz. — C. R. Soc. Sc. Vars. — W. mat prz. VI. 1913) appartient a cette dernière catégorie. Quant aux études qui ont precédé celle de Merczyng, il faut citer avant tout celles de Wolf. (Geschichte der Vermessungen in der Schweiz, Zürich 1879) et de H. Walser (Veränderungen der Erd-Oberfläche im Umkreis des Kanton Zürich seit der Mitte des 17. Jahrhunderts, Untersuchungen auf Grund der topographischen Karte von J. C. Gyger; XV Jahresbericht der Geogr. Gesellschaft von Bern, 1896); ces études ne concernent toutefois que l'exactitude des distances et l'uniformité de l'échelle.

[5] *Magni Ducatus Lithuaniae caeterorumque regionum illi adiacentim exacta descriptio... D. Nicolai Christophi Radziwill cura ac impensis facta ac in lucem edita.* 1613 (fig. 1).

EXPLICATION DES FIGURES CI-CONTRE

1 — Carte de la Lituanie de Makowski (éd. de 1613)
2 — Carte de l'Ukraine de Beauplan (marge de l'édition à 1 : 1 800 000, 1650)
3 — Carte de la Pologne de J. A. Rizzi-Zannoni: partie de la feuille 14 (dressée vers 1760, publiée 1772)
4 — Carte du Palatinat de Lublin, par Ch. de Perthées (vers 1790)
5 — Carte topographique du Royaume de Pologne: feuille VI-10 (dressée vers 1835, publ. 1839—43)
6 — Carte topographique de la Russie d'Europe à l'échelle de 3 verstes au pouce anglais: feuille XX—1 (dressee 1870—76, revisée 1900)
7 — Carte topographique de la Russie Occidentale à l'échelle de 2 verstes: feuilles XXVI—12 et XXVII—12 (dressées 1887—8, revisées 1911)
8 — Carte topographique („Spezialkarte"). feuilles 3469 et 3569 (dressés en 1908, en 1912 et 1917)

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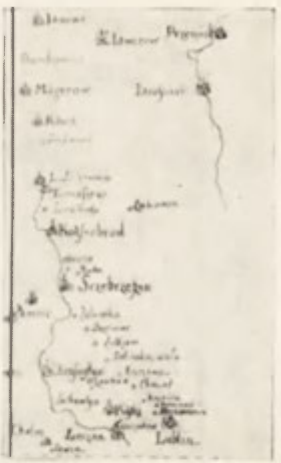
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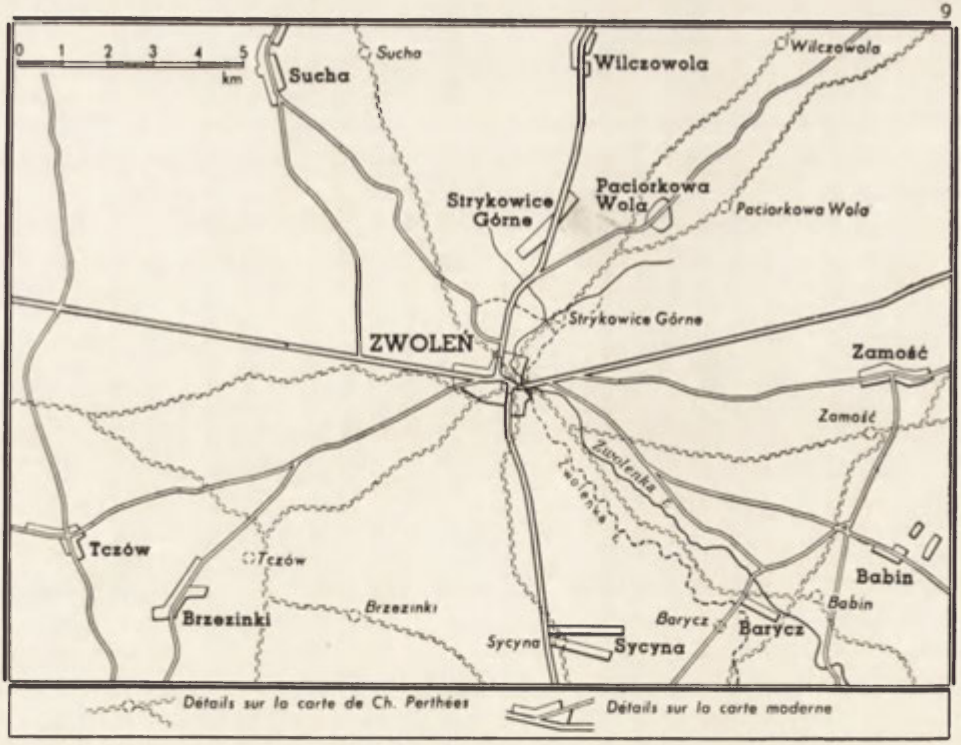

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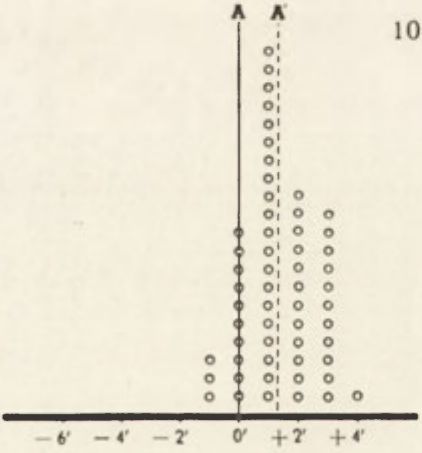

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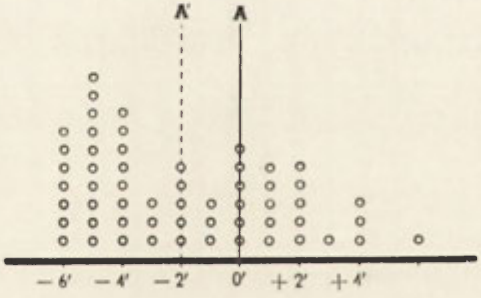

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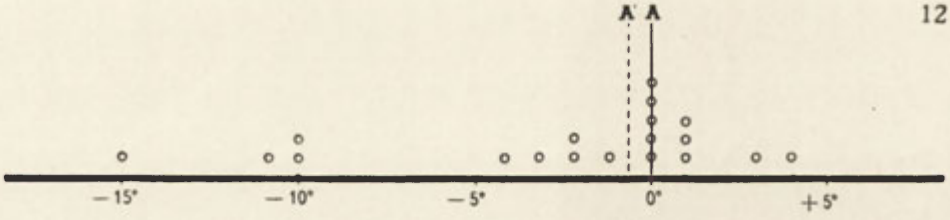

remæmarquer que six seulement des positions des localités marquées sur cettette carte paraissent avoir été établies astronomiquement.

l Une seconde étude fut entreprise par Roman Jacyk, élève de Ee E. Romer, en 1932[6]. Elle concerne une carte de l'Ukraine en huit feuileuilles, dressée en 1648 par Guillaume Levasseur de Beauplan, cartcartographe militaire français au service du roi Jean-Casimir de Polognogne[7]. Jacyk étudie tour à tour diverses caractéristiques de la carte, en comommençant par l'échelle, qui dans certaines parties de la carte s'écarte jusqusqu'à 0.4% de la moyenne (1 : 453.000). Quant aux positions des 115 localitalités prises en considération, Jacyk évalue l'erreur moyenne de leur latitatitude à 12′, c'est-à-dire à 22 km, de leur longitude à 16′, c'est-à-dire à 18 18 km, et l'erreur de position à $\pm \sqrt{22^2 + 18^2} = 28$ km, en éliminant l'écécart des longitudes dû à une évaluation erronnée de la position du 1er ter méridien (de 6° 13′ vers l'est). Il étudie séparément les erreurs moyoyennes des différentes sections de la carte, qui varient de 16 à 62 km, ce ce qui est compréhensible, vu que la carte embrasse des régions très divdiverses, tant au point de vue de leur peuplement et de leur culture, comomme aussi de celui du degré de leur connaissance d'alors[8].

l Les études en question furent continuées à partir de 1955 au Laboratoatoire de Cartographie de l'Université de Varsovie, où l'on les a appliquéquées aux cartes provenant du XVIII-e et du XIX-e siècle. La première de de ces cartes est celle de J. A. Rizzi-Zannoni, en 21 feuilles à 1 : 700.000 (1 : 696.000)[9], dressée entre 1753 et 1765 d'après des matériériaux amassés par J. A. Jabłonowski, Saint-Hillers et Et F. F. Czaki. Ces matériaux étant assez disparates, les valeurs des errerreurs moyennes, obtenues par la comparaison des positions des localités mamarquées sur cette carte avec leurs positions sur les cartes modernes

[6] R. Jacyk: *Analiza mapy Ukrainy Beauplana* — Carte de l'Ukraine de Beaubeauplan du XVII-e siècle. „Polski Przegląd Kartograficzny" (Revue Cartogr. Polonaonaise), 35, 1931, pp. 66—83 (rés. fr. pp. 83—91).

[7] *Delineatio specialis et accurata Ukrainae*, gravée par Hondius à Gdańsk 1650.650.

[8] L'étude de Jacyk fut vivement critiquée par l'historien Charles Buczek („Wi„Wiadomości Służby Geogr." — Bull. du Serv. G. — 1933, f. 1, pp. 20—53); cette critcritique vise principalement les détails historiques cités par Jacyk; en outre, Buczeczek attribue les irrégularités des écarts des longueurs géographiques au mode de de travail de Beauplan, qui s'appuyait surtout sur ses itinéraires.

[9] Carte de la Pologne divisée par provinces et palatinats et subdivisée par distdistricts, construite d'après quantité d'arpentages, d'observations et de mesures prisorisses sur les lieux (fig. 3). Voir B. Olszewicz: *Polska kartografia wojskowa* (La La Cartographie militaire polonaise, étude historique, Warszawa 1921), pp. 25—26 et Et III; Drapeyron („Revue de Géogr". XLI, 1897) et Blessich („Boll. della Soc.Soc.. Geogr. Italiana", XXXV, 1898) ne consacrent à cette carte que peu de place.

EXPLICATION DES FIGURES CI-CONTRE

9 - 9 — Comparaison du dessin d'une carte de Ch. Perthées avec celui d'une carte moderne

10—0—11 — Diagrammes de la dispersion des erreurs de latitude et de longitude de la carte de Ch. Perthées. *A* — position primitive, *A′* — position modifiée de l'axe des coordonnées, *AA′* — erreur du canevas

12 - 2 — Diagramme de la dispersion des erreurs des directions sur une des feuilles de la Carte du Royaume de Pologne

à échelle rapprochée, varient sur les feuilles étudiées de 4′ à 13′, c'est-à-dire de 7 à 24 km, pour les latitudes, et oscillent autour de 12′, c'est-à-dire de 15 km, pour les longitudes: l'erreur moyenne de position y varie ainsi de 15 à 28 km. On voit que le degré d'exactitude de la carte de Rizzi-Zannoni ne diffère pas beaucoup, à une ou deux feuilles près, de celui de la carte de Beauplan.

Pour une seconde analyse on a choisi une carte de Charles de Perthées, cartographe du Roi Stanislas Auguste, actif en Pologne entre 1783 et 1895. Pendant ce temps, il a dressé des cartes au 225.000^e de quatorze voïévodies polonaises, dont cinq furent publiées [10]. Une de ces dernières cartes, celle de la voïévodie de Sandomierz [11], soumise à une analyse analogue aux précédentes, accuse une erreur moyenne des latitudes s'élèvant à ± 1′,93 ou 3,6 km, et une erreur des longitudes de ± 3′,8 ou 4,4 km. En déterminant ces erreurs, on a remarqué que leur distribution par rapport à zéro n'est pas symétrique; pour les latitudes, le nombre des écarts positifs est dix fois plus grand que celui des écarts négatifs, et pour les longitudes — le nombre des négatifs deux fois et demi plus grand que celui des positifs. Il en fut déduit qu'il y a des erreurs de canevas; leur valeur fut déterminée à 1′.5 pour les latitudes et à 2′ pour les longitudes. En éliminant ces erreurs (v. fig. 10 et 11) et en faisant encore une fois le calcul des erreurs moyennes, on les a évalué à 1′,5 = 2,9 km pour les latitudes et à 2′,9 = 3,4 km pour les longitudes, et obtenu ainsi une erreur moyenne de position de ± ± 4,75 km, trois fois plus petite que celle des meilleures feuilles de la carte de Rizzi-Zannoni.

Afin d'évaluer dans quelle mesure la carte de Perthées fut basée sur des mesures prises sur les lieux, on en a superposé certains secteurs à des secteurs correspondants d'une carte moderne, réduits à la même échelle (v. fig. 9) [12].

Une troisième analyse concernait une carte topographique du Royaume de Pologne à 1 : 126.000, dressée par le Quartier-Maîtrat de son armée en 1822—1830, achevé après l'Insurrection de 1830—31 par les topographes russes (en 1833—1839) et publiée en 1839—1843 [13]. Ici l'erreur moyenne des latitudes, évaluée à ± 29″,4 en vertu des comparaisons directes d'une des feuilles de la première série avec une carte moderne à 1 : 100.000, est tombée à ± 11″,8, c'est-à-dire à 310 m, après élimination de l'erreur du canevas, qui était ici de 25″. L'erreur moyenne des longitudes, ± 61″,6 sans tenir compte de l'erreur du canevas (50″).

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[10] Cf. B. Olszewicz: „Polski Przegląd Kartograficzny" 40, 1932, pp. 249—252.

[11] *Mappa szczególna woiewództwa sandomierskiego ... przez Karola de Perthées Pułkownika Woysk Koronnych JKMci Geografa.* Gravée à Paris par A. F. Tardieu.

[12] Cette méthode de surcharge convient peut-être mieux au but de la comparaison des cartes que la méthode de la distortion des quadrillages introduite dernièrement dans les travaux suisses, méthode très utile d'ailleurs quand il s'agit de représenter d'une façon claire l'ensemble des erreurs (Voir per ex. Wyder, Mitt. d. Naturforsch. Ges. Schaffhausen XXIV, 1951—52, pp. 32—38).

[13] *Topograficeskaïa Karta Carstva Pol'skago — Topograficzna Karta Królestwa Polskiego* — Carte Topographique du Royaume de Pologne — *sostavlennaïa i gravirovannaïa v* 1/126.000 *doliu nastoïašceï veliciny* 1839 ... *pod rukovodstvom General'nago Štaba General-Maiora Richtera.* 59 feuilles complètes et 4 partielles, gravées par Minter à Varsovie (fig. 5).

tombe à ± 36″, c'est-à-dire à 680 m, après élimination de cette dernière erreur. On obtient donc ici une erreur moyenne de position de $\pm\sqrt{310^2 + 680^2} = \pm 747$ m. Pour une feuille de la seconde série, on a obtenu des erreurs moyennes ± 7″,5 ou de 230 m pour les latitudes et de ± 44″,2 ou de plus de 800 m pour les longitudes avec distribution nettement asymmétrique; en éliminant l'erreur du canevas qui en était cause et qui s'élevait à 40″, on a abaissé cette dernière moyenne à 34″,4, c'est-à-dire à 650 m, et l'erreur de position à

$$\pm\sqrt{230^2 + 650^2} = 690 \text{ m}.$$

En prévision d'une necessité de travaux cartométriques on a essayé aussi d'évaluer les erreurs moyennes des détails de cette carte. Celles de leurs dimensions linéaires se sont révélées oscillant entre 3 et 8%, donc celles des surfaces — entre 6 et 17% (v. aussi fig. 12).

La carte russe à la même échelle et à aspect semblable, commencée en 1845 [14], accuse des erreurs de position beaucoup moindres. Pour la partie S du Royaume de Pologne, elles se chiffrent en moyenne à ± 3″, donc à 90 m pour les latitudes, et à 8″, c'est-à-dire à 150 m, pour les longitudes. L'erreur moyenne de position est donc ici de $\pm\sqrt{90^2 + 150^2} = 175$ m; elle l'est sans doute moindre encore pour la partie E du Royaume, où l'on a fait passer en ce temps un embranchement de la grande triangulation de Tenner [15].

La carte russe en question possède en outre des cotes d'altitude, qui ne figurent pas sur les cartes précédentes. Ces cotes présentent des erreurs considérables, s'élèvant dans les régions de collines souvent jusqu'à plus de 25 m; leur moyenne atteint 7 sajènes (15 m) [16].

Des erreurs d'une importance semblable ont été trouvées aussi sur plusieurs feuilles de la carte autrichienne à 1 : 75.000 dressée entre 1869 et 1887 [17]. Les maxima des erreurs de position constatées sur des échantillons de 11 minutes à 1 : 25.000 de cette carte [18] s'élèvent à 50 m en moyenne en ce qui concerne le levé primordial des voies de communication; des erreurs plus grandes encore caractérisent le tracé des vallées de certaines parties des Karpates et les détails introduits sur la carte ultérieurement pendant les mises à jour [19].

Les cartes russes à 1 : 42.000 et à 1 : 84.000, commencées en 1881 [20], ne présentent plus d'erreurs de cette importance dans leur dessin original; il n'y a que certaines formes du relief qui y sont imprécises dans

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[14] *Topograficeskaïa Karta Evropeïskoï Rossii, masštab 3 versty v diuïme.* 517 feuilles (fig. 6).

[15] Voir à ce sujet *Zapiski Voénno-Topograficeskago Depo* (St. Pétersbourg) XXIII, 1862, pp. 5, 17 et 269.

[16] Il paraît qu'une grande partie de ces cotes provient des mesures barométriques (Cf. *Zapiski*).

[17] La *„Specialkarte"* (fig. 8).

[18] Les *„Aufnahme-Sektionen"*.

[19] Voir à ce sujet Babiński: *Reambulacja dawnych map austriackich.* „Wiadomości Służby Geogr." f. 1—2, 1935, pp. 123—135 et résumé all. (Berichtigung der österr. Vorkriegs-Karten) pp. 135—137.

[20] *Novaïa topograficeskaïa Karta Zapadnoï Rossiï (odnovërstka, dvuchvërstka,* fig. 7).

les régions boisées. Mais dans les détails introduits pendant les mises à jour on y trouve parfois des erreurs tout aussi grandes que sur la carte autrichienne.

Des trois cartes de base établies à l'époque en question sur le territoire de l'ancienne Pologne, il n'y a que la carte prussienne à 1 : 25.000, commencée à l'E de l'Oder en 1875 [21], qui peut-être regardée comme pratiquement exempte des erreurs de position. Ces dernières n'y dépassent généralement pas la grandeur des imprécisions découlant de la reproduction et de l'impression de la carte, c'est-à-dire 1/3 de mm, ce qui correspond à 8—10 m sur le terrain. Il n'y a que certaines feuilles des plus anciennes, remplacées depuis par des nouvelles, qui accusent des écarts plus grands. La comparaison d'une de ces feuilles anciennes avec la carte nouvelle a donné une erreur moyenne de position de 4 m, c'est-à-dire de moins de 0,2 m sur le papier, ce qui correspond à peu près aux résultats d'un essai entrepris pendant les levés par les Prussiens eux-mêmes [22]. L'écart moyen des hauteurs s'est révèle être de 0,5 m (son analyse fut restreinte aux points cotés). Certaines erreurs notables n'apparaissent sur cette carte que quand on analyse le dessin des isohypses, car celles-ci — dans un effort des cartographes à obtenir une représentation claire du relief — furent généralisées plus fortement que les détails de la situation.

Le développement de l'exactitude des cartes dont nous avons essayé de donner ici l'image est intimement lié au développement de la technique du levé. Les cartes du XVII-e siècle n'étaient, à quelques exceptions près, pas encore basées sur des triangulations, et même les mesures astronomiques ne comprenaient généralement que les latitudes [23]. Au XVIII-e siècle, les triangulations apparaissent, et les mesures de longitude deviennent plus fréquentes, mais on ne sait pas encore faire une balance efficace des erreurs [24], et le travail topograhpique consiste surtout en itinéraires. Au commencement du XIX-e siècle, le levé du détail se développe, les erreurs de direction ne dépassent généralement plus un maximum de 2°; on commence aussi à mesurer les hauteurs, mais ces mesures ne sont pas encore précises, et ce n'est que dans le second quart du siècle que se développent les réseaux de triangulation formant dans les pays avancés une base vraiment précise pour le mesurage des détails. En s'appuyant sur ces réseaux, les cartes topographiques augmentent notablement leur degré de précision, et leurs erreurs moyennes tombent, comme nous l'avons vu sur l'exemple des deux cartes à 1 : 126.000. à moins d'un quart des erreurs des cartes de la période précédente.

Mais ce n'est que vers la fin du siècle que ces cartes atteignent un degré de précision qui rend leurs erreurs imperceptibles, et cette imperceptibilité, cette réduction des erreurs aux dimensions moindres que celles des imprécisions dues aux procédés du dessin et de l'impression,

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[21] *Messtischblätter.*

[22] Cf. Pehnack, „Mitteilungen des Reichsamts für Landes-Aufnahme" 1937. pp. 77—88.

[23] Cf. Buczek: op. cit. — Pour les méthodes du levé, voir l'intéressante lettre de Beauplan citée en entier par L. Gallois dans son article sur les origines de la carte de Cassini („Annales de Géogr." XVIII, 1909, pp. 195—196).

[24] Voir par ex. Hogreve: *Praktische Anweisung zur topographischen Vermessung eines ganzen Landes* (Hanovre et Leipzig 1773).

n'est pas encore atteinte par tous les pays. Il n'y a qu'un groupe restreint de pays avancés qui atteignent à cette époque ce degré de perfection cartographique. Même après introduction de la stéréophotogrammétrie des imprécisions subsistent, surtout en ce qui concerne les hauteurs. Une antinomie se développe entre la tendance des photogrammètres d'atteindre la plus haute précision possible et celle des cartographes qui veulent obtenir un dessin clair [25]; cette antinomie présente un intérêt vital pour les géomorphologues, qui doivent se rendre bien compte dans quelle mesure la carte topographique donne une image vraiment fidèle des formes du terrain. Des études de détail s'imposent, qui auraient pour but de donner des caractéristiques précises des cartes modernes sous ce point de vue.

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[25] Cf. R. Finsterwalder: *Morphologische oder exakte Schichtlinien?* Kartographische Studien (Haack-Festschrift), Gotha 1957.

JERZY KONDRACKI

Types of Natural Landscape (Geographical Environment) in Poland

In 1956, in a special issue of „Przegląd Geograficzny", devoted to the International Geographical Congress at Rio de Janeiro, I have presented the division of Poland into natural regions, based on differences in: geological structure, relief of the earth surface, and in hydrographical, climatic and geobotanical conditions (5).

In geography, however, as well as in other branches of natural sciences there also exists a second, parallel manner of taking into considering phenomena not according to their individual differences, but on the basis of their similarity of type. This typological point of view is represented by studies of the geographical landscape; to this latter term Polish geographers do not attribute merely a regional significance, but they rather comprehend it in a general sense as a physiognomical type of a certain geographical complex. In this conception, individually different regions may belong to one landscape type, and the analysis of landscape types assists in the defining of boundaries between regions belonging to different types. Similar landscape types (or, according to other authors: types of the geographical environment) are characterized by a similar course of physico-geographical processes, and by a similar character of connections and dependences between the individual components of such a natural complex; thus, analyses of such types are not without practical significance for economic activities and the planning of all kinds of artificial changes of the landscape. Last year I have attempted to analyse the geographical environment of a relatively small region, and to determine the correlation of its component parts, and of the role played by anthropogenic changes in the total group of natural features [1].

I now intend to demonstrate the landscape structure of all of Poland on the basis of the similarity of the type of relief, the type of rock substratum and, related to them the regime of hydrological conditions which, in turn, determines the natural vegetation and, subsequently, the types of soils. As far as the climate is concerned, in conditions existing in Poland, it shows no marked differentation as to its type; and it is locally modified, chiefly by the relief of country. Thus the sculpture of the

[1] J. Kondracki: *Studies of the Natural Landscape of the Masurian Lake District.* „Przegl. Geogr." XXXI, Supplement (1959).

territory inseparably connected with the character of the rock substratum, is as though the index feature of landscape differentiation.

As the basis for the present paper I have taken into consideration: the map of types of relief of the territory of Poland, prepared by the Chair of Physical Geography of Warsaw University [2], the map of Quaternary deposits prepared by the Geological Institute (*8*), and the map of soils (*7*), — additionally utilizing geomorphological maps (*3*, *4*), sheets of the „Atlas of Poland" („Atlas Polski") (*1*), and the map of land utilization prepared by the Geographical Institute of the Polish Academy of Sciences (PAN) (*9*).

The differentiation of both the relief and the geological structure, and in consequence also all remaining components of the landscape (i.e. the local climatic conditions, hydrological, biogeographical and soil conditions), proposes the general division of types of the geographical environment into lowland landscapes, as well as upland and mountain landscapes.

Within the lowlands there are not the hypsometric conditions but the morphogenetic ones that exert a decisive influence upon the differentiation of landscape types. Thus, fundamental geographical differences may be observed between areas affected by the youngest glaciation and the areas of older glaciations; their relief, as well as their hydrographical conditions underwent essential transformations under the conditions of a periglacial climate. The landscape of areas of the youngest glaciation is characterized by the appearance of hillock forms, by a large number of depressions without superficial drainage partly filled by lakes, by a feebly developed natural drainage, by a relatively large content of *calcium carbonate* in the surface deposits, and by the predominance of brown soils. These features appear in a higher or lower degree in three types of the environment: in the hummocky drift with lakes district one, in the outwash plains lake district one and in the young morainic plains. A characteristic class of vegetation are here mixed forests of the *Querceto-Fagetea* type replaced by coniferous forests of the *Vaccinio-Piceetea* class on outwash plains; to this association is related the process of podsolizing of the primarily dominant brown soils. The numerous lakes belong chiefly to the eutrophic type (with the exception of the deepest lakes which still maintain their primary oligotrophic type). The evolution of the lakes leads to their transformation into low peat bogs; in an acid environment with the absence of alimentation by mineralized water, they change into high moors (class of vegetation: *Oxycocco-Sphagnetea*) (*2*). The present-day status of utilization of the natural environment is such that agriculture prevails on the more fertile soils developed on boulder clay. On the sandy outwash plains there prevail forests where, until recently, the forest service almost exclusively favoured coniferous trees; on the other hand, in the post-lake depressions and on the valley floors there appears much meadow land, while the lakes are being exploited by the fishering economy. These types of the geographical environment are characteristic for three great natural regions, distinguished in the physico-geographical division of

[2] The original of this map was prepared on a 1 : 500 000 scale by Mrs. E. Grzeszczakowa by order of the Institute of Agricultural Economy.

Poland (*5*, *6*): the Pomeranian Lake District (extending between the Lower Odra and the Lower Vistula rivers), the Mazurian Lake District (eastwards from the Lower Vistula), and the Wielkopolska (Greater Poland) and Kujawy

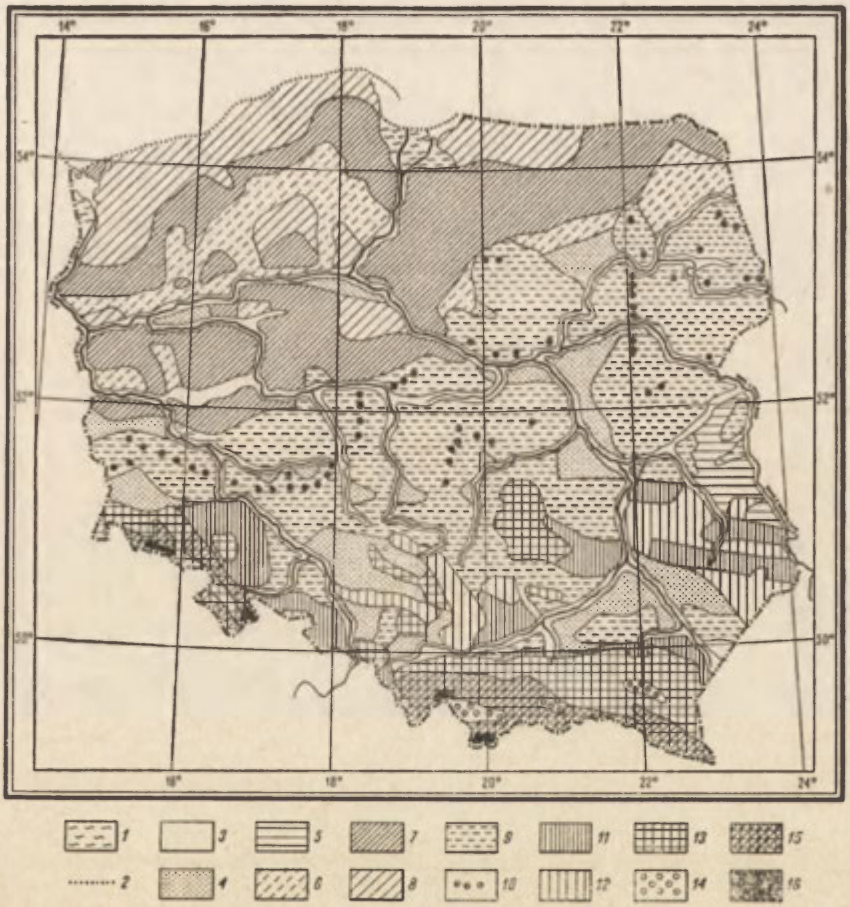

Fig. 1. Types of landscapes: *1* — delta landscape, *2* — dune landscape, *3* — flood terraces, *4* — dune terraces, *5* — lake and river accumulative plains *6* — outwash plains with lakes, *7* — hummocky drift with lakes, *8* — morainic plains, *9* — periglacial plains, *10* — periglacial buttes, *11* — loess uplands, *12* — carbonate rock uplands, *13* — silicate rock uplands, *14* — intramountain plains, *15* — lower forest stage, *16* — upper forest stage. Subalpine and Alpine landscapes

Lake District (situated between the Middle Odra and the Middle Vistula, south of the Torun — Eberswalde old marginal valley).

In the Baltic littoral zone there additionally appear two, or even three, types of landscape connected solely with this part of the country. They were formed by the youngest geomorphological processes which took place in this littoral zone. Thus, along the mouths into the Baltic

sea of both the Vistula and the Odra rivers there developed a delta-type landscape. The land surface is built here by fluvial deposits;the soils belong to the alluvial soil type. The ground water table is high, the

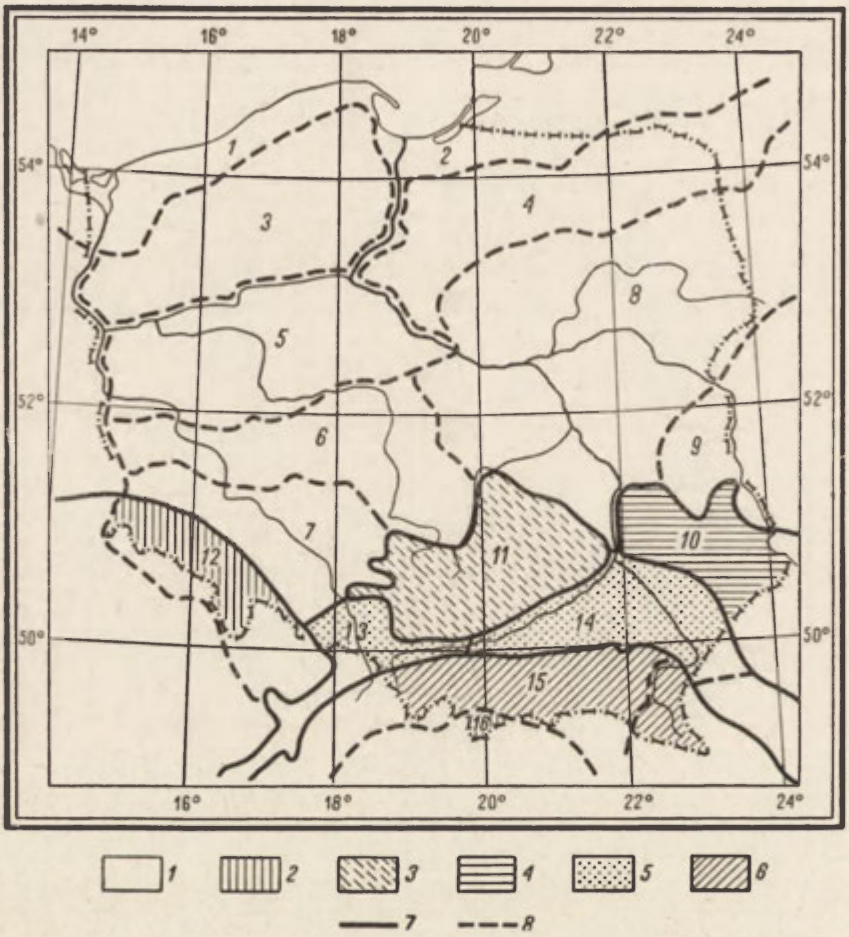

Fig. 2. Regional division of Poland. Natural areas: *1* — Polish lowland, *2* — Bohemian massif, *3* — Upland of lesser Poland, *4* — Plateau of Black Sea, *5* — Subcarpathian basins, *6* — Carpathians, **7** — limits of areas, *8* — limits of regions Natural regions: *1* — West Pomeranian Lowland, *2* — East Pomeranian Lowland, *3* — Pomeranian Lake District, *4* — Masurian Lake District, *5* — Greater Poland and Kujawy Lake District, *6* — Southern Greater Poland Lowland, *7* — Silesian Lowland, *8* — Masovian Lowland, *9* — Lublin Polesie, *10* — Upland of Lublin, *11* — Lesser Poland Upland, *12* — Sudeten and Sudetic Foreland, *13* — Basin of Racibórz and Oświęcim, *14* — Basin of Sandomierz, *15* — Outer Western Carpathians, *16* — Central Western Carpathians

natural vegetation belongs to the *Alnetea glutinosae* class; forests appear but sporadically, arable fields or meadows predominate.

An entirely different type represent dunes and littoral sands; their narrow zone extends (with insignificant breaks) along the entire

stabilized Polish coast. This is a dry, partly halophile environment, occupied by either a grass formation of the *Ammophiletea* class, or by a forest formation of the *Vaccinio-Piceetea* class. The dunes have cut off from the sea two shallow, brackish lagoons, the Vistula and the Szczecin bays, as well as a number of shallow littoral relic lakes with freshened water, overgrown by aqueous and moor vegetation *(Potamogetea, Phragmitetea, Oxycocco-Sphagnetea)*. Locally there extends, as far as the shore, a landscape of young morainic plains and hills. These landscape types are characteristic of two natural regions: the Eastern Pomeranian Coastal Region and the Western Pomeranian Coastal Region; incidentally, both show certain different individual features.

A landscape type characteristic of the entire Polish Lowland, as well as partly for upland and mountains too, are flood terraces. They are featured by a shallow ground-water table and by periodical inundations by river waters rich in mineral compounds. Due to this, these landscapes are the domain of forests of the *Alnetea glutinosae* class, and of meadows of the flood type, partly transformed into arable fields. Here landscapes are the domain of forests of the *Alnetea glutinosae* class, and peats, too. The flood terraces occupy considerable areas on the floors of the old valleys of rivers like: the Vistula, Odra, Warta, Noteć, Bug and Narew, and likewise of their smaller tributaries, too.

A somewhat similar distribution discloses the type of landscape called the dune terraces type. It is connected with higher terraces, built chiefly of sand forming dunes, but it also occurs in the shape of extensive accumulative plains on mountain foothills, on uplands, on outwash plains of older glaciations, etc., such as the Silesian Lowland, the Silesian Upland, and the Sandomierz Basin. Here ground water appears at the depth of several meters, whereas swamps, sometimes even small shallow lakes, occur between the dunes. Within the ground, water permeates downwards from the surface; due to this the soils belong to the podsol type, the vegetation to the *Vaccinio-Piceetea* class. Owing to the scanty fertility of the soils they have not been utilized for tillage and, as to utilization, there predominate forests which, in this particular type of region, occupy the largest areas.

This landscape type is found in the entire Polish Lowland and partly on the Upland too, where in mountainous regions it is replaced by the landscape of intramountain accumulative plains, built of gravels and clays, partly occupied by high moors, such as in the Nowy Targ Basin in the Sub-Tatra region (Podhale). On the other hand, no dunes are found in the mountains.

A further landscape is represented by river and lake accumulative plains of the Polesie type. They extend widely eastwards beyond the frontiers of Poland; on the Polish territory, they actually occur in one natural region only, in the so-called Lublin Polesie region. In the quite flat and often impermeable area the ground-water table is high, frequently forming overgrown lakes and swamps; in the southern part of this region there appears a substratum of Cretaceous limestone on which karstic forms develop in the shape of sink-holes often deep and filled by water of lakes which at times occur in the vicinity of flat swampy lakes. Thus, here we encounter a greater differentiation

of trophic lake types than in the lake districts, and besides carbonate (oligotrophic) lakes there are observed humus (distrophic) or eutrophic lakes. The natural vegetation belongs to the swamp association of the classes *Vaccinio-Piceetea, Oxycocco-Sphagnetea, Phragmitetea, Scheuchcerio-Caricetalia Fuscae* and *Alnetea glutinosae.*

The soils belong mostly to podsols or to bog soils. The land utilization consists in widespread meadows or in arable fields assigned to poorer fertility classes.

In the area of the Polish Lowland, south of the limit of the last glaciation, there predominate types of landscape connected with the periglacial denudation. These are, in the first place, denudative morainic plains (partly older outwash plains, too), and periglacial buttes which, most frequently, are relics of terminal moraines and of other forms connected with the glaciation (kames, eskers, etc.). In upland areas situated between valleys, the groundwater table lies at the depth of several meters, thus there predominates water penetration from the surface into ground. Due to this, the soils belong to the podsol type; their silty character is often ascribed to processes of mechanical weathering under the conditions of a cold climate. The forests are represented by the *Vaccinio-Piceetea* class, althoguh in more favourable trophic conditions the *Querceto-Fagetea* class is also found. Still, landscapes of this type are extensively being exploited for agricultural purposes and represent one of the most intensively deforested area in Poland. These landscapes appear in several natural regions: in the Mazovia Lowland, the Lowland of Southern Wielkopolska (Greater Poland), the Silesian Lowland, partly in Lublin Polesie and in the Sandomierz Basin.

Within the belt of uplands and mountains, a separate group of landscapes occurs, connected with the specific character of its rock substratum, its relief, and its altitude above sea level.

In the altitude zone from 200 to about 600 m., climatic conditions do not clearly influence the type of vegetation which in a higher degree depends on the character of the substratum. Thus, in this zone, we may distinguish three main types of the natural environment: loess uplands, carbonate uplands, and silicate uplands.

The landscape of loess uplands appears in patches on the Lublin upland, the Lesser Poland (Małopolska) Upland, the Sudeten foothills, and along the margin of the Carpathians. The basis for its formation are silty rocks of loess type, which are subject to erosion and contain, besides quartz material, a considerable admixture of *calcium carbonate.* These formations are permeable and, as a rule, their groundwater table lies fairly deep; still, the soil cover on the top of the loess belongs to the fertile, or very fertile, soils (partly they are steppe chernozem soils). The natural vegetation is repsented either by the *Querceto-Fagetea* class, or — especially on slopes with southern exposure — by *Festuco-Brometea* (steppe type). In their large majority, the loess soils are being used for agricultural purposes.

The landscape of carbonate uplands is chiefly found on the Lublin Upland and the Lesser Poland Upland. This landscape has various varieties, depending on the rock type of its substratum which

may consist of marl, limestone, dolomite, gypsum, etc. All these rocks are however in a higher or lower degree subject to karstic processes, the ground-water assuming the role of fissure waters. The soils belong to the rendzina (carbonate) type. The natural vegetation is represented by the *Querceto-Fagetea class*. As to land utilization, arable fields predominates.

The landscape of uplands built of silicate rocks also shows varieties depending upon the rokcs of the substratum; there may be various kinds of crystalline or metamorphic rocks, quartzites, sandstones, shales, etc. Owing to the relief of the region, the coefficient of the flow-off is usually high, especially on feebly permeable crystalline rocks and on shales of every kidn. The ground-water table is usually high (in the layer of waste material). The soils belong to the mountain type, disclosing certain features of both podsols and brown soils. The natural vegetation consists of the *Querceto-Fagetea* class, however, mostly the forests have been destroyed, replaced by arable fields. This landscape type we find on the foothills of the Sudeten, and of the Carpathians, in the Holy Cross Mountains and, partly, in the Silesian upland, too.

Above the altitude of 600 m., there commence in Poland the mountainous landscapes. Here hypsometric conditions bring about a characteristic stage formation which has been adopted as the basis for distinguishing environment types. The lowest stage (up to 1150 m. in the Sudeten, and up to 1350 m. in the Tatra Mountains) is the so-called lower forest stage i.e. a formation of fir and beech forest *(Querceto-Fagetea)*. Here, hydrological and soil conditions are similar to those in the uplands of silicate rocks; however, here is already felt the influence of the climate, expressed in a distinct drop of temperature, an increase of precipitation, a shortened vegetative period, a longer duration of the snow cover, etc. In this landscape, forests predominate over arable fields which extend, in the Podhale region, up to a height of 1000—1100 m.

The upper forest stage i.e. the formation of spruce forests reaches in the Sudeten and the Beskid Mountains up to an altitude of 1300—1350 m., in the Tatra Mountains — of 1550—1600 m. Here hydrological and soil conditions are not much different from those in the previous stage; climatic conditions, however, are so much worsened that agriculture is out of the question, and amongst dominant forests merely mountain pastures occur.

Finally, the highest stage of mountain landscapes is represented by the sub-Alpine or Alpine stage. Here the soils disclose an undeveloped profile, bare rock is a common feature. The climatic conditions are very severe. Above the tree line there extends a stage of dwarf mountain pines, assigned to the *Vaccinio-Piceetea* class *(Pinion mughi)*. In the Tatra Mountains this stage reaches as high as 1800 m. Higher up there merely occur formations of herb vegetation of the *Elgnio-Seslerietea* and the *Caricetea curvulae* class [3].

Our survey of types of the natural landscape enables us to define

[3] W. Szafer: *Szata roślinna Polski* (Vegetation of Poland), Vol. II (In Polish only). Warszawa 1959.

a typological system of taxonomic units, analogous to the long-established geobotanical or soil units; although not identical with them. Thus it seems that as the highest units of this system should be considered climatic types of landscape, connected with climatic zones and with the altitudes above sea-level. Let us call them landscape classes. Within them we may distinguish landscape genera, due to geological structure, relief, hydrological conditions, and by further subdivision we may speak of landscape varieties. As the lowest units might be considered types of sites and facies.

As far as Poland is concerned, it must be stated that, in contemporaneous conditions, climatic zones are not distinctly in its area; therefore we can take into consideration but two main classes: a lowland landscape (zone of mixed forests) and a mountain landscape. assigning to the latter likewise the upland landscape. Genera of the lowland landscape are the following:

1) littoral landscapes (varieties: littoral dunes, lagoon type, delta type);

2) young-glacial landscapes (varieties: morainic plains, hummocky drift with lakes, outwash plains);

3) old-glacial landscapes (varieties: periglacial plains, periglacial buttes);

4) landscapes of valleys and alluvial plains (varieties: flood terraces. dune terraces, river and lake accumulative plains of Polesie type);

Within the domain of upland and mountain landscapes we are distinguishing the following genera:

5) loess upland landscapes;

6) landscapes of uplands built of carbonate rocks (varieties: marl, dolomite, gypsum and limestone rocks);

7) landscapes of uplands built of silicate rocks (varieties: crystalline rocks, sandstones shales, etc.);

8) mountainous landscapes (varieties: intramountain plains, lower forest stage, upper forest stage, sub-Alpine and Alpine stage).

It should be stressed once more that typological systematization of landscapes is by no means identical with the systematization of regional divisions based not on the similarity of features but on particularities of origin, evolution and geographical situation. In this conception of ours, regional taxonomical units are: geographical zones, areas (provinces), natural regions, subregions and microregions.

The typological analysis of landscapes enables us to define the structure of regional units, i.e. the connections, dependences and processes occuring between the individual components of the entire geographical landscape (the landscape cover of the Earth). Hence its marked significance for the understanding in the regional physical geography. Yet frequently these two points of view have been intermingled, causing numerous misunderstandings. As an example may serve the paper published in 1954 in Beograd by B. B. Z. Milojevic *On the Division of the Earth's Surface into Geographical Regions* which — notwithstanding its title — discusses not the regional, but rather the typological

division [4]. In the Soviet literature it is Milkov who payed special attention to the problem of landscape types [5]; this author also discusses the types of regions, types of sites and facies as typological units of a lower grade. S. Kalesnik [6] reports that, preceding Milkov, still in 1946, a fully developed system of a typological classification has been suggested by A. Mieshkov (part, type, class, formation, group of facies); however, this author's suggestion has not found any wider application.

The essay in a certain degree refered to the mentioned publications. Analogous notions on landscape as a repeatedly occuring type however have long existed in the German literature; here idiographically contemplation of the country (of a region) is put in opposition to the normative treatment of the earth's surface in the form of landscapes. On the other hand, much confusion has been introduced into this controversy by the manifold meaning of the German (and the Russian, too), term "Landschaft" which is being used in various denotations. Among others, K. H. Pfaffen [7] gives an interesting comment on this subject.

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[6] S. W. Kalesnik: *Principles of a General Physical geography.* (In Russian only). II ed., Moscow 1955.
[7] K. H. Pfaffen: *Die natürliche Landschaft und ihre räumliche Gliederung.* Remagen 1953, p. 37.

Scheme of Typological Classification of Natural Landscape in Poland

CLASS I: Landscapes of the lowlands of the mixed forest zone

Genus and Variety	Accompanying features		
	Water	Vegetation	Soils
1. Littoral landscapes			
a. dune type	fairly deep, without superficial net	*Vaccinio-Piceetea*, *Ammophiletea*	podsolized sands
b. delta type	shallow	*Alnetea glutinosae*	alluvial soils
c. lagoon type	on surface	*Potamogetea*, *Phragmitetea*, *Oxycocco-Sphagnetea*	bog soils
2. Young-glacial landscapes			
a. morainic plains	layered	*Querceto-Fagetea*	brown forest soils
b. hummocky drift with lakes	variegated (with lakes and bogs)	*Querceto-Fagetea*, *Oxycocco-Sphagnetea*	brown forest soils
c. outwash plains with lakes	fairly deep (with lakes and bogs)	*Vaccinio-Piceetea*	degraded brown soils, partly podsolized
3. Old-glacial landscapes			
a. periglacial plains	layered, superficial net fairly rare	*Vaccinio-Piceetea*	podsolized soil on clays or sands
b. periglacial buttes	deep, without superficial net	*Vaccinio-Piceetea*	podsolized soils on sands
4. Landscapes of valleys and alluvial plains			
a. flood terraces	shallow, periodically flooded	*Alnetea glutinosae*	alluvial soils
b. dune terraces	variegated deep, without superficial net, sometimes bogs	*Vaccinio-Piceetea*	podsolized soils on sands
c. river and lake accumulative plains of Polesie type	shallow, with lakes and swamps	*Alnetea glutinosae*, *Oxycocco-Sphagnetea*	podsolized soils and bog soils

CLASS II: Landscapes of uplands and mountains

Genus and Variety	Accompanying features		
	Water	Vegetation	Soils
5. Loess uplands	deep, rare hydrographical net of perenial waters, but thick net of episodic waters	*Querceto-Fagetea, Festuco-Brometea*	tchernosem, or brown soils
6. Uplands of carbonate rocks			
a. of marl			
b. of limestone	karst conditions, rare hydrographical net, springs	*Querceto-Fagetea, Festuco-Brometea*	rendzinas
c. of dolomite			
d. of gypsum			
7. Uplands of silicate rocks			
a. crystalline			
b. sandstone	shallow: high coeficient of water carried off	*Querceto-Fagetea*	brown podsolized soils
c. shale			
8. Mountains			
a. intramountain plains	shallow	*Vaccinio-Piceetea, Oxycocco-Sphagnetea*	bog soils, podsols
b. lower forest stage	variegated deep, high coefficient of water carried off, thick hydrographical net	*Querceto-Fagetea (Fagetum carpaticum, Fagetum subhercynicum)*	mountain soils of undeveloped profile on various types of substratum
c. upper forest stage		*VaccinioPiceetea (Piceetum tatricum)*	
d. Subalpine and Alpine stage		*Mughetum carpaticum, Trifido-Distichetum (on limestone—Seslerion Tatrae)*	

MIECZYSŁAW KLIMASZEWSKI

On the Influence of Pre-Glacial Relief on the Extention and Development of Glaciation and Deglaciation of Mountainous Regions

Certain regularities in the course of the snow-line are generally accepted. The line rises from the polar regions to the equator and from west to east as well as from the edges of mountains toward their centres. These regularities, regarded by J. K. Charlesworth as rules, can be traced across the whole globe and many mountain massifs. In general the extent of the glaciation of mountainous regions decreases eastwards due to the course of the snow-line and it is greater on the northern side than on the southern.

Nevertheless there are mountains where the extent of glaciation increases eastward and it is greater on the southern side than on the northern. Among these mountains were the Tatra-Mts. during the Pleistocene period.

The Tatra Range, the highest mountain group in the Carpathians, is 50 km. (about 30 miles) long and is divided into two parts: the Western Tatra Mts, 2000 metres (6100 ft.) high on the average and the Eastern (or High) Tatra Mts. 2300 metres (7000 ft.) high on the average. In the Last Glacial age the Western Tatra Mts. received more precipitation, the snow-line lay at an altitude of about 1500 metres (4920 ft.), but the extent of valley glaciers was less than in the Eastern Tatra Mts. situated in the precipitation shadow; their snow-line lay at an altitude of about 1650 metres (5410 ft.) (Table 1). Contemporaneously there was a certain regularity in the reach of Tatra glaciers, viz. glaciers of the Eastern Tatra Mts. extended into the foreland of the Tatra Mts., however, the extension of glaciers slowly and definitely decreased westwards (Fig. 1, Table 2).

Many more discrepancies with respects to the regularities mentioned and observed are visible from a comparison of the extent of glaciation on the northern and southern slopes. On the southern slopes of the Tatra Mts. the snow-line lay at a height similar to that on the northern slopes and the glaciers were generally longer than those on the northern slopes. Meanwhile the diffenrence between the heigth of the snow-line on the northern and the southern slopes was from 300 to 500 metres (985 to 1640 ft.) in the Alps, at about 600 metres (1970 ft.) in the Pyrenees, from 200 to 350 metres (655 to 1150 ft.) in the Caucasus, etc.

Table 1

The snow-line of the Last Glaciation in the Tarta Mts.

The northern slope (according to B. Halicki		The southern slope (according to J. Szaflarski)	
metres	valley	valley	metres
1657	a. Jaworowa	1. Kieżmarska	1656
1597	b. Szeroka	2. Jaszczerzyca	1715
		3. Kamienny Staw	1698
		4. Staroleśna	1648
1609	c. Biała Woda	5. Sławkowska	1658
		6. Wielicka	1647
		7. Batyżowiecka	1686
		8. Mięguszowiecka	1623
		9. Furkota	1696
		10. Ważecka-Handlowa	1702
		11. Koprowa	1635
1508	d. Sucha Woda	12. Cicha	
1423	e. Bystra	13. Tomanowa	1585
1518	f. Mala Łąka		
1545	g. Miętusia	14. Kamienista	1546
1489	h. Kościeliska	15. Bystra	1553
		16. Raczkowa-Jamnicka	1460
1502	j. Chochołowska	17. Smreczańska	1496
1478	k. Zuberska	18. Jałowiecka	1528

These irregularities in the Tatra Mts. cannot be explained by climatic conditions, by precipitation and thermal conditions, by anemologic conditions, or the blowing away of snow by the wind. The northern slopes of the Tatra Mts. received more precipitation just as they do today and they became less than the southern slopes. Even the removal of snow by the wind does not explain such great irregularities. Moreover, E. Romer supposed that the snow was more likely blown away from the southwest and that this fact ought to influence the increase in the extent of glaciation on the northern slopes. Actually it was the other way around. Thus the reason for these irregularities must be a different one and we have to seek it in the orographic conditions and the Pre-glacial relief of the Tatra Mts.

Systematic and detailed investigations (1 : 10,000) over many years on the northern slopes of the Tatra Mts. enabled the reconstruction of this relief. In the Pre-glacial relief of the Tatra Mts. there have been recognized both older forms representing a late mature stage of evolution of the relief and younger forms in various stage of youth or early maturity. The older forms are represented by dome-like elevations and smoothly rounded forms occuring on the watersheds in the Western Tatra Mts. as well as the upper and high parts of Tatra valleys. Their hanging floors lie at similar heights, rising from west to east from

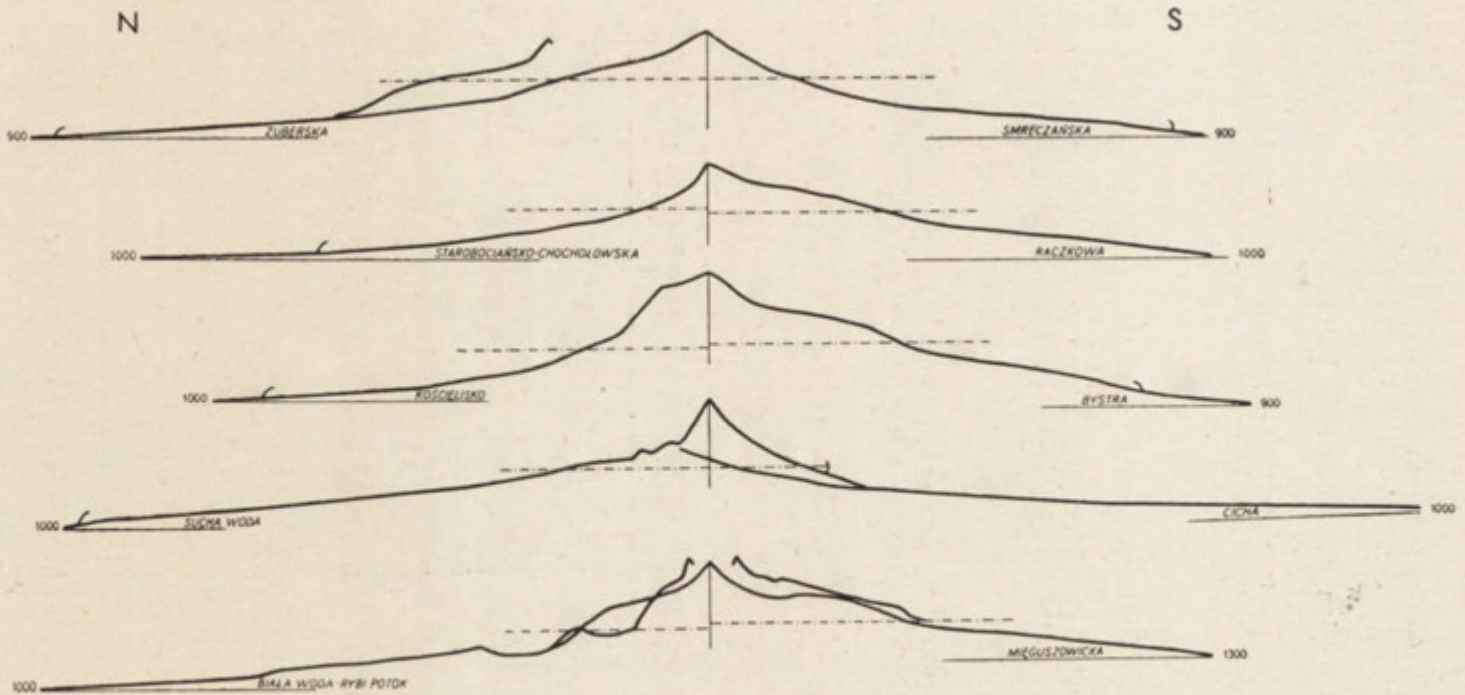

Fig. 1. Long profiles of some Tatra valleys and the location of the snow-line in the last Glacial age

1400 to 1700 metres (4590 to 5580 ft.). These floors pass into terrace plains as well as into an extensive surface cut on the northern slopes of the Tatra Mts. between 1500 and 1200 metres (4920 and 3935 ft.). This surface of planation stretching back in valleys to the central part of the Tatra Mts. may be traced on the summit plane of the Sub-Tatra region (Podhale) at altitudes descending northwards from 1100 to 700 metres (3610 to 2295 ft.) above sea level. This uneven surface of planation with the features of a piedmont surface came into existence in the Lower Pliocene epoch.

This Lower Pliocene surface of planation was dissected by rivers in the Middle and Upper Pliocene epoch as the result of an inclined uplift of the Tatra Mts. as well as a climatic change producing more humid conditions. The Eastern Tatra Mts. were uplifted higher than the Western Tatra Mts. as can be seen from the distribution of remnants

Table 2

The length and farthest extent of Tatra-glaciers during the Last Glaciation (according to E. Romer, J. Partsch, B. Halicki, J. Szaflarski, M. Klimaszewski, M. Lukniš)

Southern slope			Northern slope		
extent to a height of (in metres)	length	glacier of the valley	glacier of the valley	length	extent to a heigth of (in metres)
1020	10.3 kms	a. Jaworowa	1. Kieżmarska	7.5 kms	1020
1172	4.3 kms.	b. Szeroka	2. Jaszczerzyca	3.6 kms.	1080
			3. Kamienny Staw	3.5 kms.	1080
			4. Staroleśna	8.0 kms.	994
914	14.2 kms.	c. Biała Woda	5. Sławkowska	3.5 kms.	1194
			6. Wielicka	5.0 kms.	1261
			7. Batyżowiecka	6.2 kms.	980
			8. Mięguszowiecka	11.0 kms.	900
			9. Furkota	4.2 kms.	1103
			10. Ważecka--Handlowa	5.0 kms.	1190
			11. Koprowa	10.8 kms.	1030
1094	8.0 kms.	d. Sucha Woda	12. Cicha	1.0 kms.	
1060	4.6 kms.	e. Bystra			
1150	3,5 kms.	f. Mała Łąka	13. Tomanowa	2.5 kms.	1250
1050	3.7 kms.	g. Miętusia			
1040	4.2 kms.	h. Kościeliska	14. Kamienista	7.0 kms.	1020
			15. Bystra	5.0 kms.	1030
1040	5.5 kms.	j. Chochołowska	16. Raczkowa-Jamnicka	8.0 kms.	950
920	9.0 kms.	k. Zuberska	17. Smreczańska	6.5 kms.	920
			18. Jałowiecka	4.3 kms.	1093

of the Lower Pliocene surface. The dissection (rejuvenation) of the Tatra Mts. and their foreland developed headward from the tectonic Nowy Targ basin and it extended into the headwater region of Lower Pliocene valleys within short Tatra valleys as well as in valleys cut in less resistant (mainly sedimentary) rocks. On the other hand, in major valleys the upper parts of Lower Pliocene valleys, cut largely in more resistant (chiefly crystalline) rocks, were not rejuvenated (Fig. 2).

In the Upper Pliocene epoch these valleys were distinguished by a characteristic stepped profile because non-rejuvenated parts of the valleys were seperated from rejuvenated parts by erosive edges.

I suppose the southern slopes of the Tatra Mts., which were recently studied by M. Luknis, were modelled in a similar way. This part of the Tatra Mts. slopes southward in a fault along which it was raised in the Middle and Upper Pliocene epoch. During the course of the uplift the old (Lower Pliocene) parts of valleys were dissected headwards but this dissection occured less quickly because of the greater resistance of crystalline (mainly granitic) rocks. As a result of the inclined uplift of the Tatra Mts. the nonrejuvenated parts of the old and Lower Pliocene valleys lay higher on the southern slopes of the Tatra Mts. than valleys of the same age on their northern slopes.

Due to their high situation these non-rejuvenated parts of Lower Pliocene valleys lay above the snow-line in each glacial period and became excellent reservoirs of firn masses. Thus less completely rejuvenated valleys were glaciated in the Pleistocene epoch, whereas the completely rejuvenated valleys were not glaciated.

These reservoirs — the non-rejuvenated parts of Lower Pliocene valleys — were of different capacity owing to their dimensions and depth in relation to the surrounding ridges. Reservoirs occupying long and non-rejuvenated valleys surrounded by ridges about 2000 metres (6560 ft.) high and, consequently, between 400 and 500 metres (1310 — 1640 ft.) deep were very capacious. Less capacious were the small reservoirs surrounded by ridges between 1800 and 2000 metres (5910 — 6560 ft.) high and, consequently, up to 200 to 300 metres (655 to 985 ft.) deep.

These reservoirs — the upper and non-rejuvenated parts of Lower Pliocene-valleys were transformed into corries which resulted from the destructive activity of firn and glacier masses. The degree of transformation depended both on the capacity of the reservoirs and the volume of the firn and glacier masses stored up in these reservoirs.

In the Eastern (High) Tatra Mts. where the dimensions of Lower Pliocene rejuvenation were relatively small and long sections of the non-rejuvenated valleys are still preserved, there were very big and very capacious firn reservoirs. The extent of glaciation was, therefore, very important in this part of the Tatra Mts. too. Glaciers were up to 10 km. (6.25 miles) long and flowed in valleys on the foreland at an altitude of even 900 metres (2950 ft.).

In the Western Tatra Mts., in spite of the more abundant precipitation and a lower snow-line, the extent of glaciation was minor

because of the small capacity of the firn reservoirs. Here the glaciers were far shorter and did not leave the area of the Tatra Mts. (Fig. 2).

The Western Tatra Mts. were not, therefore, more heavily glaciated, although they were exposed to winds bringing precipitation. It was the Eastern Tatra Mts. situated in the shadow of precipitation that were heavily glaciated although they were but little rejuvenated.

The great dimensions of non-rejuvenated valleys parts and, consequently, the existence of big firn reservoirs on the southern slopes of the Tatra Mts. also explain the great dimensions of glaciers on that sunny side. These reservoirs were larger and more capacious than the more strongly rejuvenated reservoirs on the northern slopes because they are partly built of less resistant sedimentary rocks. On the southern slopes of the Tatra Mts. there were glaciers of great dimensions both in the eastern and western parts. This anomaly in relation to climatic conditions is here especially distinct. On the northern slopes of the Tatra Mts. the glaciers ended in the Tatra Mts. sometimes at a great distance (1 to 6 km.) 5/8 to almost 4 miles from the outlet of Tatra valleys between heights of 1040 to 1150 metres (3410 to 3775 ft.). Only the Zuberecki glacier was longer and it by way of exception had a big firn reservoir in the little rejuvenated granitic part. On the other hand, on the southern slopes of the Tatra Mountain glaciers up to 11 km. (almost 7 miles) long, extended to the outlets of the Tatra Valleys and flowed downwards to a height of 900 metres (2950 ft.). Among these strongly glaciated valleys there is the very long and non-glaciated Cicha Valley. For a long time researchers have been seeking the reason for this phenomena and, among other things, they have explained the lack of a glacier by the blowing away of snow from this valley and its accumulation on the northern side. Now this valley, cut across little resistant crystalline schists and their contacts with sedimentary rocks, was deeply rejuvenated in the Pre-glacial period, nearly as far as its headwater region. For that reason it had no adequate firn reservoir and the reason for its not being glaciated was morphological, but not climatic (Fig. 2).

The data quoted above show that in the glaciation of the Tatra Mountains morphological conditions played a larger part than mesoclimatic conditions or climatic exposure.

The Pre-glacial relief of the Tatra Mts. not only decided the extent of their glaciation, but also influenced the course of deglaciation.

During the Last Glaciation's maximum, glaciers of the northern slopes of the Tatra Mts. flowed down to heights of 914 to 1150 metres (about 3000 to 3775 ft.) common to heights of 1050 to 1090 metres — 3445 to 3575 ft. (Table 2). The farthest extent of the glaciers is indicated by double end-morainic mounds giving evidence of two advances of the tongues of glaciers.

In the cataglacial period the retreat of glaciers was contemporaneous but irregular in the whole area. Glaciers retreated in several phases, divided by phases of stage advances, or recessional

Fig. 2. The extent of glaciation of the Western and Eastern Tatra Mts. in the last Glacial age (according to B. Halicki, M. Klimaszewski, M. Lukniš, J. Szaflarski): *1* — main watershed ridges, *2* — secondary ridges, *3* — glaciers of the last glaciation (Wurm), *4* — river valley bottoms, *5* — limit of the Tatra Mts

stagnations. The contemporaneous retreat of glaciers, which was caused by the rising snow-line, is evidenced by coincident end-moraines occurring at similar heights (Table 3).

It follows from their distribution that glaciers diminshed earlier in the lower and less glaciated Western Tatra Mts. (chiefly after Stage III, Daun?). In the High Tatra Mts. however, they wasted down only after Stage VI (Eggessen?).

The course of deglaciation was connected in a high degree to the relief of valleys, too, especially to their long profile and depth. In the Tatra valleys there occurred both a frontal and areal deglaciation. In the first case glaciers retreated as the result of melting, mowing "headwards" from the ice margin; in the second case the tongues of glaciers changed into patches of burried ice, whose surface lowered over wide areas. The frontal retreat of glaciers occured in those parts of the valleys where the slope along their length was great. On the other hand, in parts with a slight slope, especially on old valley plains, glaciers stagnated, died off and became separated into patches of buried ice. This is evidenced by pseudo-morainic mounds, numerous forms created by the melting of buried ice as well as huge ablation moraines.

Table 3

Recessional moraines of glaciers during the Last Glaciation on the northen slopes of the Tatra Mts.

Farthest extent	914 to 1150 metres
Stage I	1280 to 1370 metres
Stage II	1540 to 1580 metres
Stage III	1660 to 1730 metres
Stage IV	1770 to 1840 metres
Stage V	1930 to 1960 metres
Stage VI (Eggessen?)	2160 metres

In former publications (Drygalski, Machatschek, Morawetz) the influence of the relief of the background on the glaciation of mountainous regions has been taken into consideration as one condition of glaciation. The dominant part played by this element, the deciding influence of the Pre-glacial relief on the course and extent of glaciation as well as deglaciation may be shown on the example of the Tatra Mts. It may be suggested that the geomorphological predisposition also played a similar part in the glaciation of other mountainous regions. Views on the glaciation of mountains situated above the snow-line ought, therefore, to take into account the condition that adequate forms existed enabling the storage of snow masses, sufficient big firn reservoirs.

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BOGUMIŁ KRYGOWSKI

Old Structures in Young End Moraines

The fact that glacio-tectonical structures occur in end-morainic zones of the Middle-Polish glaciation area has long been recognized. In general the strikes of these structures (anticlines, synclines, scales, squeezings) conform to the course of the end-moraines. Among the examples which establish this fact are the Fläming hills in the German Democratic Republic, and the Mużaków-bow, the Góry Trzebnickie (Trzebnica Hills) and the hillocks near Łódź in Poland. It can also be seen in part from the attached map (Fig. 1).

The measurements of the strikes of structures recently made in the Góry Ostrzeszowskie (Ostrzeszów Hills) the easternmost part of the Góry Trzebnickie (Trzebnica Hills) indicate a high conformity to the course of the main morphological axis of these mountains. Hence it follows that the structures of the ridge and the ridge itself probably originate from one force — the pressure of inland ice from one side. The structures and the ridge, therefore, lie at right angles to the direction of the force and their course consequently conforms to that of the margin of inland-ice forming the end-morainic zone which in this instance is called the Góry Ostrzeszowskie (Ostrzeszów Hills).

This conformity between the structures and morphological axis of end-moraines ought to be regarded as the basic feature of moraines dating from the Warta-stage or, more generally the former glaciation.

But no one has yet proved that the origin of the glaciotectonical structures of these moraines is due only to the Middle-Polish glaciation. They may be structures far older than the moraines in which they occur.

That this is possible is indicated by the fact that in Baltic moraines occur structures which in many instances are undoubtedly older than the moraines themselves.

Here are some examples for it: in the area of the Baltic glaciation there were recognized beautifully developed glacio-tectonical structures viz. the Lønstrup Klint in Denmark [1], in the Isle of Rügen [2], in the

[1] A. Jessen: *Lonstrup Klint.* Danmarks Geologiske Undersogelse, II, Raekke, no 49, København 1931.

[2] P. Woldstedt: *Norddeutschland und angrenzende Gebiete im Eiszeitalter.* Stuttgart 1950.

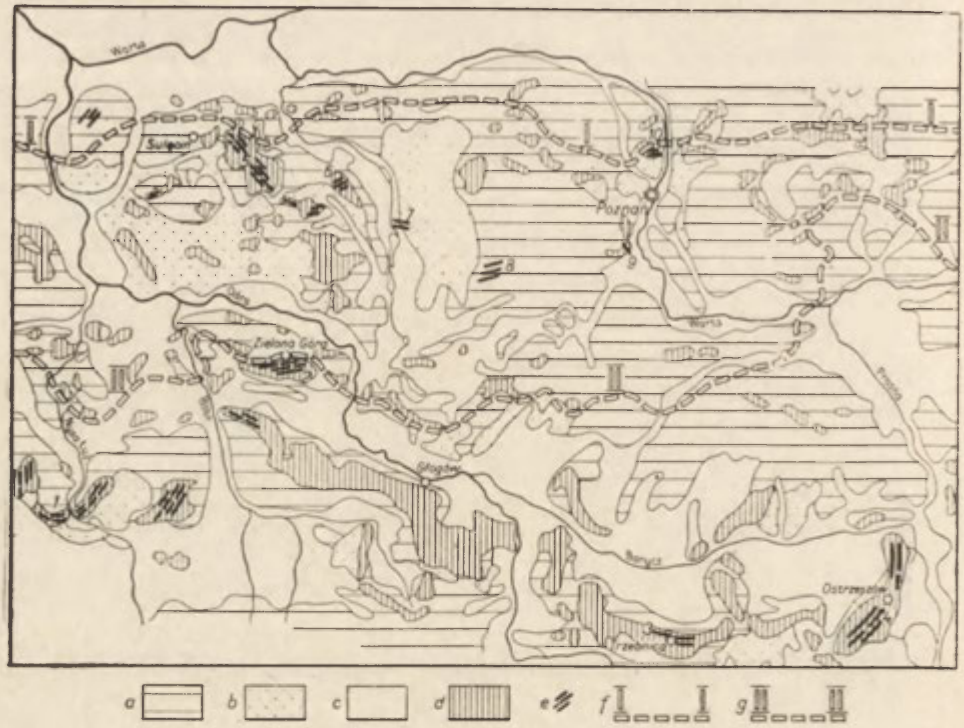

Fig. 1. Schematic map of glacio-tectonical structures in the Nizina Wielkopolska: *a* — ground-moraine, *b* — outwash plains, c — valleys and old marginal valleys, *d* — end-morainic zones, *e* — main strikes of glacio-tectonical structures, *f* — major end-moraines (Poznań or Brandenburg-stage), *g* — major end-moraines).

Names of zones and ridges quoted in the paper (in brackets there are names persons carrying out measurements)

1 — Mużaków-bow (K. Keilhack, T. Bartkowski)
2 — Zielona Góra-ridge (T. Bartkowski)
3 — Trzebnica-ridge (A. Karczewski, W. Stankowski)
4 — Ostrzeszów-ridge (K. Rotnicki)
5 — Zone of end-moraines between Sulęcin and Sulechów (B. Dammer, S. Żynda)
6 — Denudative hill at Bukowiec (T. Bartkowski)
7 — Denudative hill at Strzyżew (Zbąszyń) (W. Stankowski)
8 — Rakoniewice-ridge (Wioska) (W. Stankowski)
9 — Pożegów-ridge (B. Krygowski)
10 — Morawska Góra (A. Karczewski)

The conformity between the strike of structures and the course of end-moraines in the area of the older glaciation is conspicous. It is differently in the area of the younger glaciation where the conformity is only partly

Beech Forest near Szczecin[3], and the Dębowa Góra near Bydgoszcz[4] etc. Owing to the occurence of these structures in the area of the last glaciation they are most often being joined in a mechanical way to this glaciation and, however it will follow below, rather incorrectly.

Here are some examples: in the Isle of Wolin the end-moraine runs from south-west-south to north-east-north in its southern part but it runs more or less parallel in its northern part. The strike of structures (scales, anticlines) is conform to the morphological axis of the southern part of the end-moraine, but it crosses the axis of its northern part. This suggests the different age of both the structures and the end-morainic ridge itself. The accumulative top part of the end-morainic ridge may be far younger than its glacio-tectonically disturbed bottom part on which it is resting.

There may be observed a similar and partly conformity in the Ziemia Lubuska where the end-moraine of Sulęcin (the main end-moraine of the Poznań-stage) running more or less parallel reflects itself in glacio-tectonical structures showing the same trend. On the contrary, structures in the end-morainic zone of Sulęcin and Sulechów, a certain southward trending branch of the Sulęcin-moraine, run from north-west to south-east and cross a moraine belonging to the Poznań-stage running parallel in the Ziemia Lubuska.

This disconformity suggests that the Baltic moraine dating from the Poznań-stage as well as structures occurring within it may be of different age and their partly or even remarkable conformity may be often only an incident.

We cannot exclude the connection of structures in the end-morainic zone of Sulęcin and Sulechów to a lobe extending southwards from the line of the Poznań-stage into Obra-depression. Moreover, the conception already devoted is seen to be incorrect when considered in relation to strong glacio-tectonical disturbances on a scale of disturbances recognized in the Góry Trzebnickie (Trzebnica Hills) (Warta-stage).

The inland-ice southwards the Poznań-stage was weak and it could not be the reason for such important disturbances. There are numerous arguments for it. The Baltic inland-ice leaning against the Zielona Góra-ridge scattered small end-morainic hillocks of an accumulative type[5] at its foothills. For it was an inland-ice which could not cross a relatively small hindrance like the Zielona Góra-ridge. The forming of scale-structures and folds is, therefore, hardly attributable to such an inland-ice. There is no question but these structures represent elements belonging to the former glaciation though their course is, in general, in conformity with the Baltic end-moraine, too, leaning from north against the ridge.

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[3] A. Czekalska, B. Krygowski: *Przewodnik do wycieczek XXVIII Zjazdu Polskiego Towarzystwa Geologicznego w r. 1955 w Szczecinie.* Rocznik Pol. Tow. Geol. z. XXV, 4, Kraków 1957 (Guide of Excursions of the XXVIIIth Congress of the Polish Geological Association).

[4] J. Szupryczyński: *Relief and Geological Structure of Dębowa Góra.* „Bulletin de l'Academie Polonaise des Sciences", Serie des Sc. Chim. Geol. et Geogr., VI, 6, 1958.

[5] T. Bartkowski: *Budowa geologiczna a morfologia środkowego odcinka Walu Zielonogórskiego.* Series: Badania Fizjograficzne nad Polską Zachodnią, V, Poznań 1959.

If we add to it that in the Ziemia Lubuska there have been recognized posts where the youngest morainic clay lies discordantly on a strongly glacio-tectonically disturbed series, it is an important argument supporting the conception of the older age of structures.

A typical example of discordance, worked up in more detailes, has been recognized in the vicinity of Poznań. It is the Pożegowo-ridge

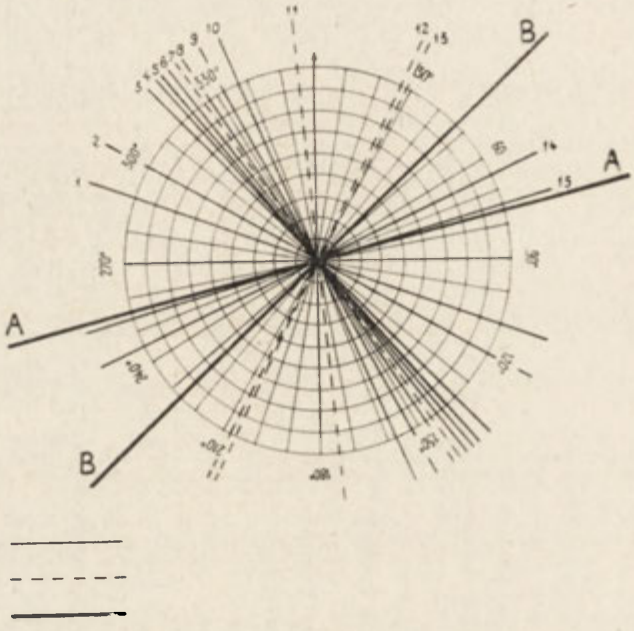

Fig. 2. Diagram showing the relation of strike of glacio-tectonical structures to the morphological axes of the Pożegów-ridge near Poznań: *a* — strikes of structures (scales, squeezings), *b* — strikes of breaks (faults), *c* — courses of morphological axes.

There are visible distinct crossings of structures No. 3 to 10 with morphological axes. On the contratry, the strikes of structures from No. 12 to 15 approach the course of morphological axes.

(15 kms. south-west from Poznań) regarded as an end-moraine of a lobe moving forward from the line of the Poznań-stage. The ridge runs from south-west to north-east and structures occuring within it run into two directions as it may be seen in a diagram (Fig. 2): 1) from south-west to north-east, consequently conform to the morphological axis of the ridge and 2) from south-east to north-west, consequently crossing the morphological axis of the ridge.

If we presume that wall-like form, its orientation and arrangement results from the action of inland-ice, we may suppose that structures conforming to the course of the morphological axis of the ridge are rather joined to the pressure of this inland-ice. In favour of this hypothesis may vote the fact that these structures occur mainly on the western bordering of the ridge from the side of the inland-ice which transgraded from

north-west. It is worth to emphasize that eskers and kames [6] running near by the Pożegowo-ridge repeat this direction, too.

The second group of structures ought to be joined to the force of pressure which came from another side viz. from north-east from a direction vertical to the strike of these structures.

If both the ridge and the structure conform to the morphological axis of the ridge they may be regarded as contemporaneous, and structures discordant with it ought to be connected with former events. I do not exclude their connection with the former glaciation.

The ridge represents as it has been at least supposed — a young form with older structures inside it. It is worth to mention that the ridge almost quite consists of Pliocene clays. Their surface lies at an altitude of about 40 m. in the Równina Poznańska (Plain of Poznań) but it rises up to 130 m. above sea level in the Pożegowo-ridge. Pliocene clays have, therefore been squeezed by the inland-ice (we do not know for certain which inland-ice it was) above the general level of the Pliocene surface at a rate of about 90 m. The scale of glacio-tectonical disturbances is, therefore, important and it resembles the scale of glacio-tectonical disturbances in the Góry Trzebnickie (Trzebnica Hills) dating from the Warta-stage.

Is it permitted, therefore, to regard disturbances as large as disturbances occuring in presumably young moraines as results of activity of the scanty Baltic inland-ice? It seems that we cannot do it. This problem needs, therefore, a fundamental revision as well as further penetrable researches.

There was a rather weak accumulative action of the Baltic inland-ice along the line of the Pożegowo-ridge as may be evidenced by Pliocene clay occuring in its culmination covered by a layer of outwash only some metres thick. A somewhat stronger glacial accumulation may be observed against the proximal side of the ridge where, beside fluvio-glacial deposits, drift is occurring, too.

It may be suggested on the basis of the quoted above and shallow analysis that in the described case there is an old form — we cannot exclude it — which in the last glacial age was modified by only certain disturbances resembling the *roches moutonnes* process.

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[6] K. Rotnicki: *Oz Bukowsko-Mosiński. (Esker between Buk and Mosina).* Series: Prace Kom. Geogr.-Geolog. Pozn. Tow. Przyj. Nauk, II, 2. Poznań 1960.

LESZEK PERNAROWSKI

Application of Statistical Methods in Investigating Dune Forms

While carrying out, in the period from 1948 to 1958, my field investigations on stabilized dunes in Lower Silesia, I applied statistical methods in order to define the degree of correlation between these dune forms and the modern regime of aerodynamic conditions. I intended to find out whether the — at present lifelles — Lower Silesian dunes might have been produced in conditions of the modern aerodynamic regime. These dunes are admirably suited for the application of statistical methods, due to their numerous occurrence in a relatively small area. I decided to utilize J. Czekanowski's method of differentiation [1]. Selecting this method for my dune studies I was well aware of the fact that dunes exposed to winds from one side only, i.e. heaving an identical exposure of their gentle slopes formed by the action of identical wind directions, must resemble each other. For this reason I desisted from examining the resemblance between dune groups which disclosed differences in the exposure of their gentle slopes.

A very important matter is the choice of suitable morphometric indices which, being characteristic for the dune relief, would make it possible to distinguish features of both resemblance and disparity between groups of dune forms. The most characteristic feature of dunes is their asymmetrical cross-section (Fig. 1). I therefore chose as morphometric indices:

1. The index of inclination of the windward slope

$$W_d = 100 \operatorname{tg} \alpha.$$

2. The index of inclination of the leeward slope

$$W_0 = 100 \operatorname{tg} \beta.$$

3. The index of asymmetry

$$W_a = 100 \frac{\alpha}{\frac{\alpha}{\beta}}.$$

[1] J. Czekanowski: *Zur Differentialdiagnose der Neanderthalgruppe.* Korrespondenzblatt d.D.Ges. f.Anthr. u. Urgesch., XI. Jahrgang, No. 6/7, 1909, Braunschweig.

The group of dunes disclosing an identical exposure of the gentler slope is characterized by the arithmetical mean of the enumerated morphometric indices.

The comparison of values for the asymmetry index, carried out in areas of migrating dunes along the Baltic shore and in Central Asia

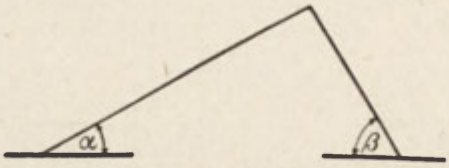


Fig. 1. Profile of dune cross-section

deserts, and of lifeless dunes of Central Europe respectively, indicates that the asymmetry index for typical forms should not exceed the value 50. On this basis I was able to introduce a further index merely characterizing dune groups [2]. This index refers to the percentage of forms disclosing an asymmetry index lower than, or equalling 50.

The above discussed indices I used for analyzing the dunes occurring in three well known dune areas: in the Lower Silesian forests, in the

Fig. 2. Silesian dune regions

Barycz depression, and in the Turawa forests. My investigations did not comprise the entire surface of the mentioned areas, being limited

[2] L. Pernarowski: *Les recherches sur les dunes de la Basse Silesie* (Wydmy śródlądowe Polski). Part I. PWN, Warszawa, 1958.

to the following representative regions: the region of Leszno Górne, of Sułów, and of the meridional zone Smardy — Osowiec (Fig. 2).

The morphometric characteristic of dune groups in the representative regions are presented in Tables I, II and III.

These tables are the starting point for the analysis of dune resemblance, according to J. Czekanowski's method of differences.

Table I

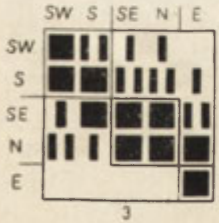
Leszno Górne

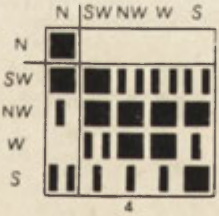
Exposure of gentler slopes	Number of dunes	Average relative height, in m.	Mean value of indices of inclination of slopes		Mean asymmetry indices	Typicalness in %
			gentler	steeper		
Northern	18	4.5	6.1	10.5	59	61.6
Southern	23	4.0	4.4	7.5	55	73.9
Southwestern	13	4.9	4.7	9.9	48	69.2
Western	28	5.1	4.5	10.5	47	78.6
Northwestern	8	5.1	5.2	11.7	48	75.0

This method is based on computing the sum of differences d, occurring between the individual features k of the compared units (i, j), and on dividing this sum by the number of features taken into account, according to equation:

$$\Delta i,j = \frac{1}{n} \sum_{1}^{n} . d_k.$$

After arranging the elements according to the increase in differences, the result is presented in the form of a square-shaped diagram, in which





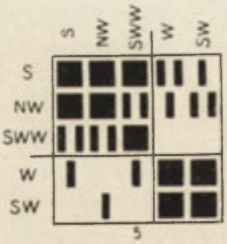


Fig. 3. Diagram showing similarity of dune groups for region of Leszno Górne
Fig. 4. Diagram showing similarity of dune groups for region of Sułów
Fig. 5. Diagram showing similarity of dune groups for region of Turawa

the intensity of shading of a field corresponds to the degree of resemblance of forms appearing in the respective columns and horizontal rows.

The diagrams shown in Figs. 3, 4 and 5 are the results of applying

the above described method to the investigated representative Silesian dune regions. On these diagrams it is an easy matter to indicate similar dune groups. Average values of morphometric indices derived from the diagram of similar dune groups are presented in Table IV.

Table II

Sułów

Exposure of gentler slopes	Number of dunes	Mean value of indices of inclination of slopes		Mean asymmetry indices	Typicalness in %
		gentler	steeper		
Northern	32	15.3	26.4	60	58
Eastern	2	15.8	24.0	69	0
Southeastern	5	18.2	32.3	63	60
Southern	95	16.4	34.0	51	78
Southwestern	12	11.2	28.3	43	92
Western	5	—	—	—	—

Examining the above diagrams and Table IV we distinctly note that, in general, in all the Silesian dune regions the dunes may be divided into two groups. The first group comprises dunes produced by winds from S, SW, W and NW; their mean asymmetry index in the three discussed regions is 49 — 50. The typicalness of forms in this groups is high too, oscillating between 75 and 80. — The second group consists of dunes formed by winds from N, NE, E and SE, where the mean asymmetry index is 59 — 60, whereas the typicalness is from 37.9 to 61.1%. Only in the Sułów region a third dune group may be distinguished wind-blown from E. This group shows the lowest asymmetry (index = = 69), and an absence of typical forms. On the other hand, the mean values of the indices of inclination of both the windward and the leeward slopes depend on the regions where the dunes occur.

Table III

Region of Turawa

Exposure of gentler slopes	Number of dunes	Average relative height in m.	Mean value of indices of inclination of slopes		Mean asymmetry indices	Typicalness in %
			gentler	steeper		
Northern	30	4.2	13.9	23.8	58	36.6
Northeastern	19	4.1	12.5	23.5	62	42.1
Eastern	8	6.4	15.3	23.8	65	37.5
Southeastern	9	5.4	11.2	20.3	58	33.3
Southern	31	5.0	10.7	25.7	52	71.0
Southwestern	35	5.3	11.2	27.4	48	77.2
Western	58	7.5	11.2	23.8	47	75.8
Northwestern	14	3.8	11.7	26.1	46	92.9

In our endeavour towards establishing the extent to which the determined grouping of dune forms may have been brought about be the modern aerodynamic regime, we necessarily must apply, to the winds too, an analogous method of differential analysis.

In this instance, a fundamental part is played by the selection of the coefficients emphasizing characteristic features of the winds and the symptoms accompanying these winds.

Meteorological tabulations recording averages from over 50 years' observations report the frequency of winds from individual directions, observed for each month and year. When taking into consideration the average frequency of wind directions during a year, we indeed must acknowledge one direction as predominant. On the other hand, when contemplating for the same region the frequency of wind directions for individual months we note that, during monthly periods of the year, there occur other dominant wind directions too which undoubtedly must have had their effect upon the dune forms.

Table IV

Region	Group and its composition	Mean indices of inclination of slopes		Mean asymmetry indices	Average typicalness in %
		gentler	steeper		
Leszno	I. S, SW, W, NW	4.6	9.8	50	75.0
Górne	II. N	6.1	10.3	59	61.1
	I. SW, S	15.6	33.1	49	80.0
Sułów	II. SE, N	15.7	27.2	60	58.3
	III. E	15.8	24.0	69	—
Turawa	I. S, SW, W, NW	11.2	25.8	49	76.8
	II. N, NE, E, SE	13.2	23.2	60	37.9

Winds of this type have been termed "periodically predominant", and it is these winds which, in my statistical analysis of the aerodynamic regime, play a fundamental role. These winds have been characterized by three indices:

The first is the index of duration of the periodically predominant wind — T_x; it equals the number of months of duration of the prevalence of this wind over other winds — m_x, and is expressed in per cent of the 12 months of the year, according to the following equation:

$$T_x = \frac{m_x}{12} \cdot 100 = 8.33\, m_x.$$

The next index for the frequency of periodically predominant winds is C_x; it is being computed according to equation

$$C_x = \frac{\Sigma W_x}{\Sigma W_n} \cdot 100,$$

where W_x = the sum of frequencies of the monthly chosen periodically predominant wind blowing from direction x, for the duration of its

prevalence over winds from other directions; — whereas ΣW_n indicates the sum of monthly frequencies of winds prevailing for the duration of their predominance over the remaining wind directions.

Table V

Leszno Górne

Directions of prevalent winds	Number of months of duration of prevalent wind, expressed in % of the 12 months of the year	% of frequency of periodically predominant wind, in proportion to the yearly sum of frequencies of prevalent winds	% of yeraly precipitation occurring in the months of duration of the prevalent wind
S	16.7	20	13
SW	33.3	28	26
WSW	8.3	9	9
W	25.0	30	31
NW	16.7	13	21

Finally, the movement of sand grains caused by wind action depends on the degree of humidity, and is directly connected with precipitation. The precipitation index characterizes the amount of precipitation occurring during the periods of activity of various periodically predominant winds. This index is expressed by equation

$$O_x = \frac{O_{Tx}}{O_r} \cdot 100,$$

where O_{Tx} is the amount of precipitation occuring during the months of prevalence of a periodically predominant wind blowing from direction x, — and O_r is the yearly total of precipitation.

Table VI

Sułów

Directions of prevalent winds	Number of months of duration of prevalent wind, expressed in % of the 12 months of the year	% of frequency of periodically predominant wind, in proportion to the yearly sum of frequencies of prevalent winds	% of yearly precipitation, occurring in the months of duration of the prevalent wind
SW	33.4	30	26
NW	16.6	11	16
WNW	8.4	2	12
W	16.6	28	25
S	16.6	19	14
SSW	8.4	10	7

By means of these three indices I have characterized, for the above mentioned three representative regions, the periodically predominant winds. These data have been presented in Tables V, VI and VII.

Applied in a similar manner as before, J. Czekanowski's[3] method of differential analysis made it possible to obtain diagrams of similarity of winds (Figs. 6, 7 and 8), and to define average values of indices for the elements appertaining to the distinguished groups of winds showing similar effects of activity (Table VIII).

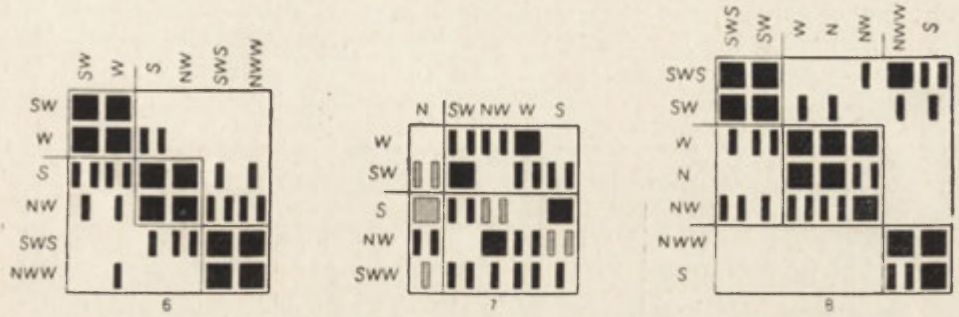


Fig. 6. Diagram showing similarity of winds for region of Leszno Górne
Fig. 7. Diagram showing similarity of winds for region of Sułów
Fig. 8. Diagram showing similarity of winds for region of Turawa

In the region of Leszno Górne two groups of similar winds may be distinguished, and three each in the remaining two regions. At Leszno Górne and Turawa, to group I, i.e. the group of winds of longest duration

Table VII

Region of Turawa

Directions of prevalent winds	Number of months of duration of prevalent wind, expressed in % of the 12 months of the year	% of frequency of periodically prevalent wind, in proportion to the yearly sum of frequencies of prevalent winds	% of yearly precipitation, occurring in the months of duration of the prevalent wind
SSW	16.7	17	11
SW	16.6	8	16
N	8.4	4	8
WNW	16.6	22	26
NW	8.4	13	9
W	8.4	7	11
S	24.9	29	19

of prevalence and highest frequency, must be assigned winds from W and SW. In the Turawa forests, this group I is represented by winds from NWW and S. The remaining groups II and III of similar winds

[3] J. Czekanowski: op. cit.

disclose a diversified picture. Still, it is worthy of note that, in all three regions, the gradient of periodically predominant winds comprises winds from S, SW, W and NW.

In order to define the correlation between dunes and the distribution of present-day winds I have computed diagrams showing the effect of periodically predominant wind on dunes (Figs. 9, 10 and 11).

In a diagram of this kind, of rectangular shape, the vertical columns show successively dunes according to the distinguished groups of similarity, whereas the horizontal rows contain winds, also arranged according to the sequence of groups of similarity. At the points of intersection

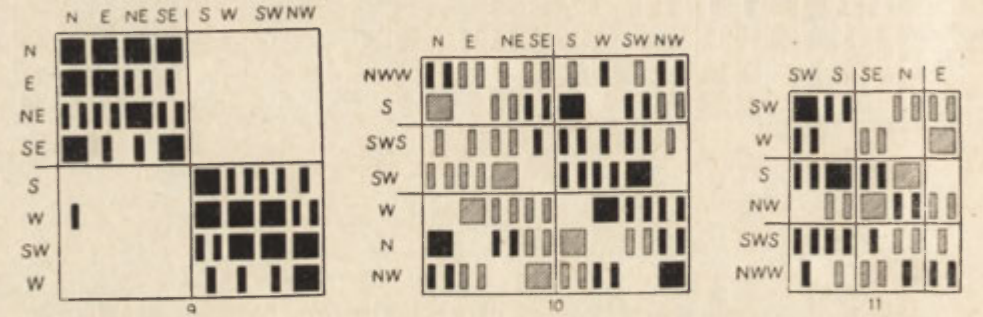


Fig. 9. Diagram showing influence of prevalent winds on dunes of region of Leszno Górne

Fig. 10. Diagram showing influence of prevalent winds on dunes of region of Sułów

Fig. 11. Diagram showing influence of prevalent winds on dunes of region of Turawa

of a column with the corresponding row, a symbol indicates the effect of the wind upon the dune slopes. Where the wind acts upon the windward slope of the dune, the symbols indicating the intensity of this action are shown in black. To be sure, a wind of this type acts constructively upon the dune, — in other words, it takes part in the formation of this dune. On the other hand, winds acting upon leeward dune slopes show a negative effect, i.e. they are bound to destroy the existing form, or to alter it into a new one, conformable to altered aerodynamic conditions. Intersections of this type are left blank on the diagram.

Winds acting perpendicularly to the dune ridge are marked by a black or grey square, in view of the fact that the entire force of the wind acts constructively or destructively upon the dune. The white spots in the diagrams represent places exposed to the winds blowing parallely to the ridge. These winds can't change the forms of dunes. Where the wind hits the dune ridge at an angle of from 0 to 45°, only part of the force of the wind comes into action; this is indicated in the diagram by two small rectangles within the square. In instances where the angle is smaller than 45°, i.e. where the action of the wind is smaller still, one rectangle only is shown within the square (see Figs. 9, 10 and 11).

Analyzing the diagrams computed in the above described manner we are in a position to look for an explanation for the mutual resemblance of dune groups in the investigated regions.

In the region of Leszno Górne, the N dunes make up a separate group; in view of the diagram showing the effect of winds upon the dunes of this region (Fig. 9), this seems to be fully justified. In general in the present-day wind regime N dunes are being destroyed, while a constructive effect upon their windward slope is exerted solely by NW winds. SW, NW, W and S dunes represent one group of similar dune forms, because even today both the I and II wind group of Leszno Górne operate more or less identically, exerting a constructive effect upon the gentler (windward) slopes of these forms. Even this superficial survey of the diagrams for the Leszno Górne region proves that, in in this region, the dunes were formed in similar, but not identical, aerodynamic conditions.

More complicated is the image of wind effects upon the dunes of the Sułów region (Fig. 10). Present-day aerodynamic conditions might be responsible for the formation of the dunes of Group I, i.e. of the S and SW dunes. By no means, however, can it be imagined that in today's aerodynamic conditions might have been formed the SE and N dunes,

Table VIII

Region	Groups of similar winds, and their direction	Number of months of duration of prevalent wind of a given group, expressed in % of the 12 months of the year	Average % of frequency of periodically predominant wind for a given group, in proportion to of the yearly sum prevalent winds	Average % of yearly precipitation occurring in the months of duration of the prevalent wind of a given group
Leszno Górne	I. W, SW	29	29	28
	II. S, SW W, NW	14	15	15
Sułów	I. W, SW	25	29	26
	II. S, NW	17	15	15
	III. SSW, WNW	8	6	9
Turawa	I. W, SW, S	21	25	22
	II. SSW, SW	17	13	14
	III. W, NW, N	8	9	9

although their mutual similarity is fully justified by the identical constructive and destructive effect of the periodically predominant winds of all the distinguished groups.

The dunes of the third, the E group, are different from the preceeding groups due to the fact that at present times they are only subject to destruction. Different dune forms could not possibly be produced in today's aerodynamic regime.

The diagram showing the effect of prevalent winds upon the dunes of the Turawa region (Fig. 11) is a synthesis of the preceding diagrams.

In the interpretation of this diagram the dunes of the S, SW, W and NW gradient, especially the W dunes, might have been formed in present-day aerodynamic conditions. The dunes of the N, NE, E and SE gradient, especially the E dunes, are mostly being destroyed in today's wind regime. Present-day winds could not possibly have formed them.

Thus, on the basis of an analysis of the effect of the present-day aerodynamic effect upon existing dunes, we may formulate the following three fundamental conclusions:

1. The dune forms disclose a full reciprocal relation with present-day aerodynamic conditions.

2. That part of dune groups upon the gentle slopes of which prevalent winds operate today, might have been formed during the period in which the present-day aerodynamic regime became stabilized. In this manner the dunes of the S, SW, W and NW gradient might have taken their origin.

3. The remaining part of groups, i.e. the N, NE, E and SE dunes which in today's wind distribution are being destroyed, might have been formed solely in completely different aerodynamic conditions. Therefore. these dunes should be looked upon as forms surviving from a previous, older, dune-forming period.

In an era where natural science strives at the concise understanding of phenomena and of connections existing between them, it seems probable that statistical methods are going to be introduced at an increasing rate in geomorphological investigations too, especially in the examination of abundantly appearing landscape forms.

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RAJMUND GALON

Problem of Geomorphological Classification of the Polish Coast

I

The coasts as contact zone of land and sea morphogenetic agents are subjected to particularly intense geomorphological transformations. They manifest themselves in the instability of the shoreline and in the diversity of its morphological character, both of which are observed also along the southern shore of the Baltic Sea. It is an interesting and important problem to classify the forms of the Polish coast (ca 500 km. long) in order to establish their genetic typology and to indicate the distribution of the types distinguished. The Swedish geographer Behrens, whose interesting study has recently appeared (*1*), has distinguished six types of coast along the Swedish shore, viz. the skjär coast, fiord coast, fault coast, klint coast, sand coast and morainic coast. In his division Behrens considers in the first place the dependence of the present shoreline landforms on tectonic and litological structure accepting the present shore as starting point of his description. In the present classifying study besides that the old shorelines and the present dynamic tendencies of development of the coast are also taken into account and the present morphological situation of the littoral zone is regarded as one of the stages of the ever changing border face between land and sea. Dynamic criteria are preponderant in the classification of the coast of the German Democratic Republic made by the German geologist K. v. Bülow (2).

Researches have shown that the extent of the sea has been undergoing a great number of essential shifts from the very moment of the formation of the first Baltic Ice-Lake. These shifts of the shoreline of the southern Baltic Sea are overlain by transformations of the shoreline occurring in historic times.

These transformations are favoured by the shore outline which exposes the shore to the generally strong north-west, north, north-east winds. Moreover, the invading of the sea is favoured by the differentiated surface of the glacial sediments and by the weak resistance to marine erosion of the moraine material.

Consequently, the Polish coast as a submerged on shows a considerable differentiation of its forms both perpendicular to the present

shoreline and along the present coast. The perpendicular direction corresponds to the littoral transformations which have been occuring in the course of development of the Baltic Sea, i.e., to transformations in the geological sense (in the course of time).

The differentiation of the shoreline landforms representing the contemporary borderline between land and sea is the consequence of the diversity of development going on along the present shoreline. This diversity results from the geological and geomorphological character of the coast on one hand, and from the intensity and kind of shore processes on the other. So the morphological transformations along the present shoreline are of a dynamic, complex nature. This dynamic modelling of the forms of the present shoreline is also affected by the contemporary vertical movements which are decisive for the intensity and course of the shore processes.

Both the above directions of development of the littoral forms of the southern Baltic Sea, viz., the geological development and the contemporary dynamic development must be taken into account in any attempt at classification or regional division of the Polish coast.

II

From the point of view of geological development the Polish coast as a fragment of the southern coast of the Baltic Sea must be regarded as a zone from ca 20 to ca 60 km wide. Within this zone are probably contained all the shorelines of the Baltic Sea from its origin till now, viz., from the oldest Subarctic Ice-Lake stage through the Yoldia (Preboreal) stage, the Ancylus (Boreal) and the Litorina (Atlantic) ones up to the present shoreline [1]. Only in the Gulf of Gdańsk (Zatoka Gdańska) the shoreline of the Ancylus Lake and the Litorina Sea occur beyond the oldest land border. Consequently, the present shore outline should be regarded as the result of all the developmental process in the relations between the land and the Baltic Sea (see map).

The present shore of the southern Baltic Sea, which occupies a rather intermediate position in relation to the preceding shorelines, cuts along its line geologically and geomorphologically different land units manifesting themselves on the shore mostly in the form of boulder-clay abrasive cliffs, or sand ridges. We have got used to considering the Pomeranian coast a graded one, but this definition is only partly true. The effacement of the old glacial relief by the shore processes has however, affected rather the minor landforms. The main features of glacial relief between the Odra and the Vistula are still reflected in the present lobate shore outline. With the projecting northwards central part of the Polish coast are in contrast the low gulf sections of the coast by the lower Odra and the lower Vistula known under the name of the Gulf of Pomerania (Zatoka Pomorska — Pommersche Bucht) and the Gulf of Gdańsk (Zatoka Gdańska). The latter are huge terminal basins of inland

[1] According to the latest publication of M. Sauramo (*26*) the stage and spatial development of the Baltic Sea was more complicated.

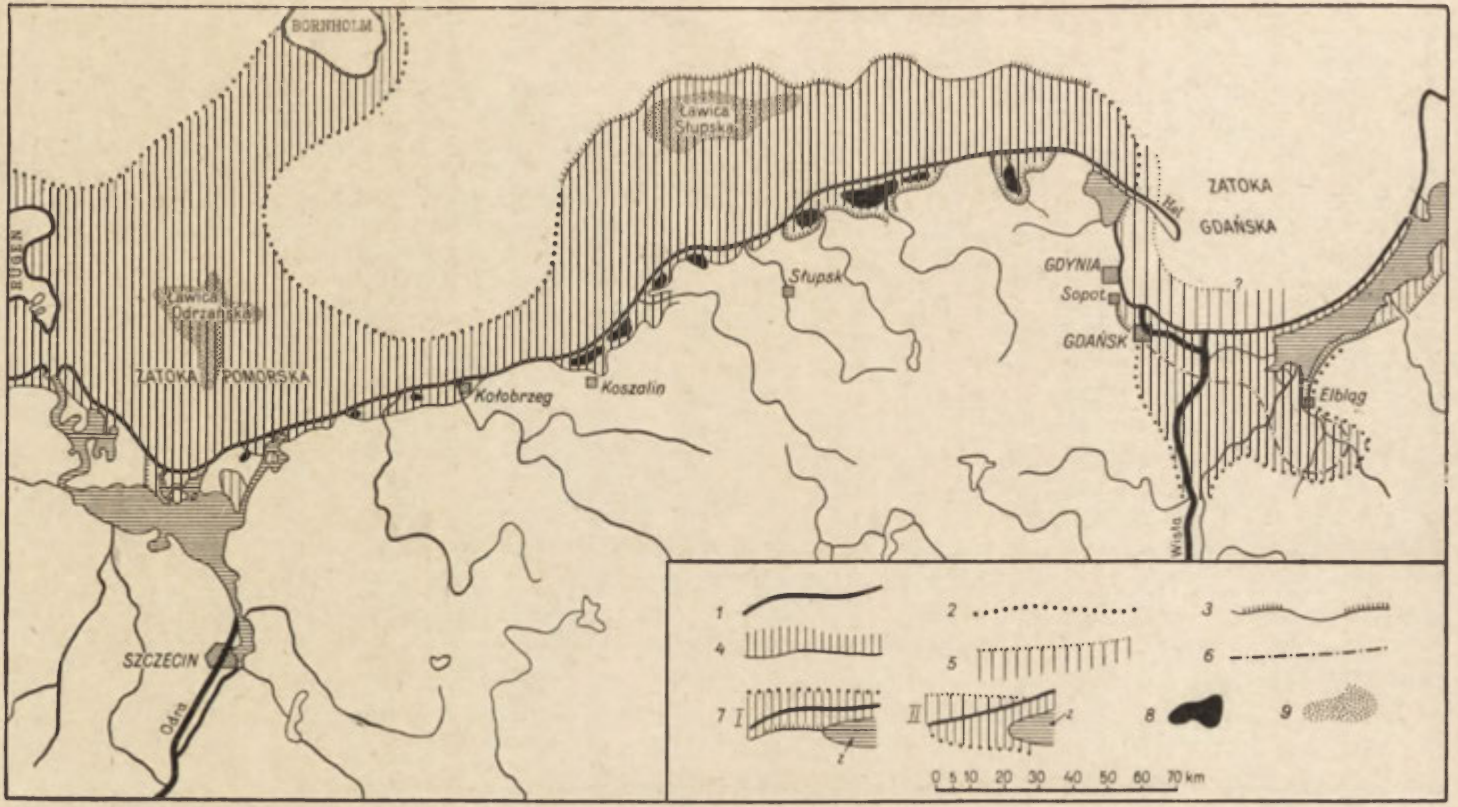

Fig. 1. Geomorphological outline of the Polish coast: *1* — contemporary (outer) shoreline of the Baltic Sea, *2* — earliest late-glacial border between land and sea (according to different authors), *3* — ancient cliffs (submarine and on land), *4* — maximal former extent of the sea (mainly Litorina Sea) on land (according to different authors), *5* — supposed extend of the Ancylus Lake in the Gulf of Gdańsk and the related costal zone (after B. Rosa), *6* — supposed extent of the Litorina Sea in the Gulf of Gdańsk (after B. Rosa), *7* — coastal zone embracing the more important shorelines of the southern Baltic Sea of varying arrangement (*I*, *II*) with pertaining lagoons (haffs) — (*Z*), *8* — coastal lakes, *9* — sand banks

ice formed during the Pomerania Stage of the last glaciation. Some part in their formation was played by the local sinking movements of the Baltic area, while the region of Pomerania projecting between the two of them in that time showed a tendency towards uplifting (*6*), and was attacked only by later minor glacial lobes (7) moving along the depressions in the Pleistocene substratum.

There are obvious differences between the Gulf of Pomerania and the Gulf of Gdańsk. The first of them is wider and shallower, it has a submarine elevation in the middle called the Odra Bank (Ławica Odrzańska); a series of morainic islands marking one of the halts of the retreating inland ice helped to close the Lagoon (haff) of Szczecin by bay bars (*4, 11, 12*). However, the Gulf of Pomerania is a relatively young form. In the period of retreating of the inland ice to the present area of the Baltic Sea the primary land reached farther to the north (see map) and the waters of the Odra collected earlier on in the ice-marginal lake of Szczecin flowed away down the ice-marginal streamway to the north-west, which is evidenced by the course of the submarine ice-marginal streamway bordering the island Uznam (Usedom) and the eastern shore of the island Rügen. The southern shore of the Ancylus Lake according to H. K l i e w e (*11*) already reached to the present shoreline, and in the stage of the Litorina Sea in consequence of a sinking down of the mouth bay area of the Odra the sea invaded deep into the land through the so called Gate of the Swina. It is only then that originated the Lagoon (haff) of Szczecin.

The more distinct and symetric Gulf of Gdańsk, on the other hand, has old tectonic predispositions and its depth even exceeds 100 m. As an open and relatively deep gulf it has existed ever since the late-glacial stage being transformed from an ice-marginal lake into the oldest gulf of the Baltic Ice Lake. The Ancylus Lake, and the Litorina Sea did not reach so deep into the land any more. The shallowing of gulf speeded up the process of deltaic deposition, which was also favoured by the formation of a bay bar. Consequently, here, as in the Gulf of Pomerania, only the inner part of the gulf has been sealed off. Any further progress of the closing of the Gulf at its entrance by the spit of Hel, which is a prolongation of a bay bar resting on a slightly submerged platform, encounters growing difficulties on account of the depth which increases towards the east. Accordingly, the peninsula of Hel consists of two different parts, viz., the landside part is a bay bar and the outer prograding part is a spit. The Bay of Puck separated from the open sea by the bay bar of Hel and from the Gulf of Gdańsk by a ridge partly submerged undercut by waves has the nature of a lagoon or haff (*14*).

However, even the graded coast between the gulfs just mentioned is to some extent diversified, in the first place by two shallow bays viz., the Bay of Koszalin and the Bay of Słupsk. However, the greatest peculiarity of the present Polish coast is its d o u b l e s h o r e l i n e. That means that besides a borderline between the land and the open sea there exists another shoreline dividing the land from the bays and a range of coast lakes separated from the sea by young moving ridges

of bay bars. Some of these lakes (Żarnowiec, Łeba, Gardno) occupy the terminal basins of minor oscillating glacial lobes (see map).

What are the former shorelines in relation to the present seashore just described? Only two shorelines preceding the present one and morphologically clearly fixed have been found so far. The first of them occurs on the sea floor in the form of a distinct cliff (*24*) ca 40—50 m. deep, the other one occurs mainly on the land at a small distance from the present shore in the form of ancient denudated cliffs and littoral sand ridges. The submarine shoreline is considered according to current opinions to be the shore of the Ancylus Lake. It certainly represents the older, or even oldest shoreline of the southern Baltic Sea. The shoreline in the backland of the present shore is in its major part the shore of the Litorina Sea. The shore of the Litorina Sea has a lobate outline and embraces from the south some of the coast lakes (e.g., the lakes Gardno, Łeba, Żarnowiec).

However, both the former shorelines are discontinous. The submarine shore is marked only in the foreland of the northernmost part of Pomerania. Also the Litorina (Atlantic) shoreline is marked on the land surface in a continous manner in the form mentioned above mainly between Ustka and the cape of Jastrzębia Góra, i.e., in the same part of the littoral zone where also the Ancylus shore has been fixed. Further eastwards the Litorina shore takes on the character of a cliff partly submarine, partly projecting from water, then it disappears covered by river sediments of the Vistula delta and it reappears again at the edge of the Elbląg Plateau. By the lower Odra the submerged shoreline of the Litorina Sea rests upon the morainic islands of Wolin and Uznam (Usedom).

According to B. Rosa (*25*), who has lately studied the old shorelines of the Polish coast, the vertical differentiation of their surface, which is higher than the present sea level in the area of the projecting part of Pomerania and about the Plateau of Elbląg, but situated below this level about the mouths of the Vistula and the Odra, is due to recent vertical movements which caused the positive and negative differentiation of those shorelines. This thesis is confirmed by the fact that the shoreline of the Ancylus Lake shows a similar differentiation. It must also be reminded that positive or negative vertical movements of similar localization were taking place already during the last glaciation. This is evidenced by the deep lobation of the margin of the inland ice, and particularly by the existence of the Odra Lobe and the Vistula Lobe (*6*). The vertical movements have continued until the present times, as the morphological differences between the projecting coast of Pomerania and the gulfs are still increasing.

In consequence of the changing situation of the shoreline of the southern Baltic at the Polish coast two types of littoral zone can be distinguished.

Along the part of Pomerania projecting northwards extends a nearly semi-circular littoral zone including at least three shorelines. The present shore is one of them. Between these shorelines spread glacial forms, viz., ridges of end-moraines, ice-marginal stream valleys, subglacial channels and river valleys. These forms are for the most part on the

sea floor, forming there wide basins and flat elevations (e.g. the Bank of Słupsk or Odra Bank), but they are a continuation of the glacial and fluvioglacial relief on the adjacent land. Towards the south the glacial forms have been gradually emerging from the sea, but those of them which are situated lower are still covered by shore dunes or filled by coast lakes and peat bogs. Thus a specific coincidence of Pleistocene and Holocene forms and sediments has come into being which must be distinguished in our classification of coastal forms.

The other type of littoral zone is represented by the Gulf of Pomerania and the Gulf of Gdańsk, where the old shorelines have disappeared to a considerable extent, or in a great many places, they coincide with the present shoreline. The present coast forms broad indentations and has besides the actual seashore an inner shore going along the Lagoon (haff) of Szczecin, the Bay of Puck and the Lagoon of the Vistula. The existence of a double seashore in both gulfs is a consequence of the river mouth deposition of the Vistula, the Odra and other rivers, and particularly of the littoral deposition of the sea. Here we approach the problem of forming the coast by contemporary shore processes.

III

Unsteadiness of shoreline — this is the characteristic feature of the southern shore of the Baltic Sea. The destroying of the shore landforms and the building up of the shore regulated by the circulation of the rock material through swash and shore drifting make a complete process whose fluctuations and intensity, varying in time and in different sections of the Polish coast, determine the morphological face of the contemporary shoreline and the course of modelling the shore landforms.

The dynamics of development of the Polish coast is dominated by the continuing marine transgression, which causes that the destroying processes prevail over those constructing the seashore and that land is being constantly lost in favour of the sea by one meter a year on the average, and in some more prominent sections of the coast even by two meters a year. The process of marine erosion reaching down to 10 m. deep is, as a matter of course, particularly intensive along the projecting part of Pomerania, and the slightest in the Bay, or rather Lagoon (haff), of Puck sheltered by the bay bar of Hel.

Under the influence of the swash, which attains maximal efficiency when the prevailing angle of the wave to the shoreline is 45° [2], and in consequence of the operation of bottom currents the washed material is drifted along the shore or towards the open sea. The longshore drifting resembles to a certain degree the movement of the water in a river with the only difference that one of the borders is steady, accumulative or erosive (abrasive), while the other is dynamically changing. The parallel submarine sand reefs, which are being formed in the coastal zone and whose shape and constituent material are constantly changing,

[2] Which occurs e.g. in the Bay of Koszalin and in the Bay of Słupsk.

show the direction of the drifting. As we know, on the amount of the drifted rock particles depends the development of the shoreline, and when the amount of sand heaped together into submarine reefs decreases, the swash destroys the shore more vigourously.

According to the Russian oceanographer W. P. Zienkowicz (*30, 31*) the shore drifting of sand material along the Polish seashore is in its major part directed to the ENE, i.e., towards the Gulf of Gdańsk and to the WSW, i.e., towards the Gulf of Pomerania. In the last case the material drifted in the coastal zone is deposited about the mouth of the river Swina, in the other case it is transported to the region of the lake Łeba and the peninsula Hel constituting its base of further development. It is surmised that the place of divergence of the two currents of drifting rock particles is a zone about 40 km. wide situated between Ustroń and Mrzeżyno, i.e., in the environs of Kołobrzeg. According to D. Piasecki (*20*), a part of the drifting material coming from the east is carried away from the divergence zone towards the Bank of Słupsk, which, according to this author, is built up not so much of morainic material, as rather is a product of a recent sea deposition. This original view contradicting all we have known so far about the origin of the Bank of Słupsk, needs more evidence.

As already said, the contemporary seashore is built up mostly of sands of marine deposition, which have been formed into dunes by winds. The dunes are particularly developed in the neighbourhood of Łeba and on the bay bar of Hel. Only 1/4 of the Polish coast is constituted by high abrasion cliffs of moraine plateau. It is mainly from there that came the sand material drifted by the longshore currents and made into bay bars connecting the peninsulas and the islands of the moraine plateau. At present, however, as the shoreline is more or less a graded one, the rock particles are washed out from high morainic shores, as well as from low dunes covered ones. In a great number of places they are also undercut by waves. In the Gulf of Gdańsk acts as inhibitor of the destroying shore processes the delta cone deposited by the Vistula, and the bay bar and morainic ridge sealing off the Lagoon (haff) of Szczecin is supported on the landward side by the storm delta of the Świna.

Consequently, the contemporary seashore shows a negative balance of development. To the rather small section of prograding beach with the characteristic convex outline belong in the first place the environs of the mouth of the Świna, the environs of Mrzeżyno and Kołobrzeg, the sand bar of the lake Wiecko, the bar of Łeba and the spit of Hel. These prograding sections are outweighed by the numerous concave sand bar sections of retrograding beach, with the Bay of Koszalin and the Bay of Słupsk at the head, supported by the peninsulas and islands of moraine plateau destroyed by abrasion. Along with the receding of these vigorously attacked cliff shores, where the shore is subjected to maximal destruction by oblique swash (45°) or by a system of local compensation currents [3] a shrinking back of the zone of bay bars has been going on leading to their complete obliteration (*5*), which is parti-

[3] Described by K. v. Büllow (*2*) on the German Coast (Mecklenburg).

culary obvious in the Bay of Koszalin and in the environs of Kołobrzeg. This increases the importance of the areas of beach deposition transformed into complexes of dunes, particularly the complex of Łeba (*8*), as store of material for longshore drifting. These sands can keep down the value of the negative shore balance and inhibit to some extent the process of land losing (*28*).

The marine shoreline processes [4] are accompanied by land shoreline processes. Besides the river mouth deposition as shore drifting agent another shore agent deserving special attention is the wind. It removes from the circulation of shoreline materials the sands heaping together on the beach forming them into sand dunes and removing them from the beach to the land. On the other hand, the denudative and erosive processes modifying the cliff walls inhibit marine abrasion heaping up at the foot of the morainic cliffs undercut by waves landslide material and alluvial fans of torrents. The valleys of these streams causing deep incisions in the cliff edges have an older, hanging bed and another younger one cut in the former and adjusted to the present sea level. These two beds represent two different stages from the point of view of both climatic change and shoreline development (*3*).

IV

The multiplicity of the above forms and processes of the coastal zone makes it difficult to classify these forms and to divide the Polish coast into multigrade typological and regional units, the more so as besides historical criteria *(sensu lato)* also dynamic ones must be applied. Any typology of shoreline landforms, however, should take into account the fundamental fact that the basis of the contemporary developmental dynamics of the present shoreline landforms is constituted by the diverse geological and geomorphological character of the wide littoral zone which was formed in the time from the decline of the Pleistocene till the last marine transgression.

In the above sense an in accordance with the characteristics made earlier in this paper two fundamental types of coast can be distinguished within the littoral zone of Poland (cf. the enclosed table 1) related to the glacial and Pleistocene origin of the Baltic area. They are: *A* — the terminal basin coast (the Gulf of Pomerania and the Gulf of Gdańsk) and *B* — the ground moraine coast (the projecting part of Pomerania). From the point of view of the development of the shoreline of the southern Baltic we can distinguish correspondingly: *A* — the ingression coast foming gulfs, and lagoons and *B* — the transgression coast with a number of shorelines.

Within the above basic typological and regional units secondary form categories have been distinguished on the base of the geological and geomorphological features of the particular shorelines. These categories can in turn be divided into tertiary units with special regard to litological and geomorphological differences. E.g., within the gulf shore the

[4] Less important shore processes as, e.g., ice pressing, have not been taken into account.

Table 1

Typological classification of the landforms of the coastal zone of Poland

	Units of I order	Units of II order	Dynamic characteristic of the distinguished units of II order and their further (regional) differentiation
A	The terminal basin coast or the ingression coast forming gulfs and lagoons (haffs)	The gulf shore	Shore modified by local compensatory currents —cliffs Zone of cumulation of rock particles drifted by longshore currents. Deviation of the mouth of the river Dziwna effected by western shore drifting. Decreasing progression of the spit of Hel. Slight deltaic deposition of coastal rivers.
		The bay bar shore or the bay bar-morainic island shore	Difference between the developmental processes along the bay bar-moraine shore of the Gulf of Pomerania and along the double-bay-bar shore of the Gulf of Gdańsk: storm delta at the mouth of the Świna as compared with the delta cone of the Vistula. Loss of marine sand caused by eolic processes — sand cliffs and dunes.
		The (haff) shore (with terraces of ice-dammed lake on the landside — in the Lagoon of Szczecin)	In consequence of the low intensity of the destroying shore processes softening of the shore by land erosive and denudative processes and processes of river deposition. Local cliffs.
B	The ground-moraine coast or the transgression coast with a number of shorelines	The ancient submerged shore with submarine glacial relief at the back	Effacing of submarine shore and glacial landforms effected by denudative bottom processes, marine sedimentation and drift deposition.
		The contemporary bay-bar-moraine plateau mostly cliffed with partly submerged glacial relief at the back	The western shore exposed to western shore drifting directed towards the Gulf of Pomerania, the environs of Kołobrzeg are the zone of divergence of shore drifting, the eastern shore exposed to eastern drifting directed by towards the Gulf of Gdańsk. The scanty sections of convex beach prograded by shore deposition are in contrast with the numerous sections of intense land loss under the form of retreating small caps belonging to moraine island and peninsulas and of concave beaches and bay bars (e. g. the Bays of Koszalin and Słupsk). The negative shore balance increased by the loss of materials of marine deposition in the consequence of eolic processes. Sand dunes invade the land.
		The ancient shore on the form of inactive cliffs and flat shore ridges (bay bars)	Gradual effacing of shore landforms: the cliffs are softened by denudative processes, and the sand ridges are planed by human interference.

following varieties can be distinguished: beach (of bay bar nature), the sand-cliff shore, the morainic-cliff shore, the morainic-cliff shore cut small erosive valleys, the peat-valley shore, the delta-fan shore. And within the contemporary shore on the plateau coast: the beach, the sand-cliff shore, the bay-bar shore closing up a peat-bog or a lake, the bay bar-cliff shore, the valley-peat shore. But, such a particular classification is not the object of the present study.

However, a dynamical classification of landforms must be made by suitable interpretation of the secondary litological and geomorphological division; a more particular classification of lands-forms has been carried out where it was implied by dynamical criteria (cf. Table 1). The present classification of the landforms of the coastal zone of Poland is not regarded as the final step of a particular stage of development of the problem of classification of the shore landforms of Poland, but rather as an encouragement to similar, perhaps more detailed essays both on the terrain of Poland and on the coast of the neighbouring countries.

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Hydrographic Problems at the Polish Baltic Coast

The Polish Coast

The Polish coast is 497 km. long and stretches along the Southern Baltic Sea from the Odra mouth at Świnoujście to the Vistula Lagoon (haff). It is composed of rocks subject to abrasion and dissolving. The ground moraine diluvial plateau edges create cliffs along 1/4 of the coast lenght, the remaining 3/4 of the coast are dunes and parts of peatificated valleys. Sand wandering along the shore forms spits and sand-bars. Sand is carried into river mouths and ports, making the lagoons (haffs) and lakes more shallow.

Observations of several Polish hydrographic stations (Fig. 1) as well as of the deep sea stations, carrying out at least 4 full program investigations yearly, allow to determine the hydrographic regime of the Southern Baltic coastal zone.

The hydrographical conditions in the northern Scandinavian coastal zone of the Baltic Sea and those in the southern Polish zone are entirely diverse because of the different course of the coastal line facing the predominating winds, and the activity of the hydrographic frontals.

Hydrographic description of the Southern Baltic

The Southern Baltic stretches from the Gedser-Darss sill (12°E) in the west to the southern extremity of the Gotland Deep (56°30 N) and comprises the basins where the inflow of oceanic water is distinct in the bottom layers, and the shoals and shallows have a uniform isohalin layer of water.

The thickness of the isohalin layer increases toward East; it is 20 m. deep in the Arkona Basin, 45 m. in the Bornholm Basin and up to 60 m. in the Gdańsk Deep (Fig. 2). The deeper, more saline layer lowers the amplitude of salinity oscillations of the near bottom layers toward East. The difference in the salinity of the surface and near bottom waters in 1902—1958 amounted to maximum 16,8‰ in the Arkona Basin, 14,4‰ in the Bornholm Basin, 10,9‰ in the Gdańsk Deep (6).

The regime of the surface waters is influenced by atmospheric factors. Thermically the Baltic Sea is similar to lakes with a typically devoloped thermocline (thermowedge) in summer. River water influences the isohalin water layers, where vertical currents appear.

The oceanic inflow influences the regime of the deep water. These inflows depend upon the shifts of hydrographic fronts in the zone of western straits.

The system of hydrographical conditions is subject to cyclic oscillations (*16*), usually 11-year ones, which depend upon the weaker (a) or stronger (b) solar activity; the above may be formulated in the following synthesis:

(a) The first corresponds to the increase of the eastern continental type of atmospheric circulation and anticyclonic systems. Precipitation is smaller and the salinity of the bottom layers of sea-water is lower owing to weaker oceanic inflows, as is the displacement of water masses; the level of sea is lower and the ice-bound areas increase in size in winter.

(b) The second corresponds to the increasing of the western, oceanic circulation of air masses, with the cyclonic systems predominating; masses of air saturated with vapour are more active, this brings more abundant precipitation and an increased inflow of river waters. The animated activity of the meteorological fronts develops the hydrographic fronts, the salinity of bottom layers, therefore, grows; the water level rises, the undulation of waves increases and the state of sea is more rough. Owing to the strong stormy winds the masses of surface water are shifted to the opposite sections of sea. It has been noted by the coastal stations that the more saline bottom waters occupy the place of the diminishing surface waters; in summer they are cooler, in winter warmer, than the surface ones. The western circulation brings warmer masses of air and this phenomenon is accountable for the weaker freezing of the sea.

The Southern Baltic Sea particularly the deeper basins of the Bornholm and Gdańsk Deep reflect the climatic oscillations quite distinctly and cyclic changes are easily discerned. The stratification of water density in the Arkona Basin often disappears; the near bottom waters become similar to the surface ones owing to the mixing of waters by the strong stormy waves.

The material collected from the Bornholm Basin in 1902—1958 and elaborated by Głowińska (*6*) points to the oceanization of the bottom waters in the recent decades; this is confirmed in the growth of salinity and water temperature. This was apparent in 1922—25, and most distinct in 1937 (S = 19,3‰, t = 12,7°C) and throughout 1947 (18,4‰ and 13,6°); the maximum (S = 20,8‰) was reached in 1952. This caused biological changes (*12*); 12 new species of animal plankton were brought in from the North Sea; the cod reproduced and dispersed rapidly.

Hydrographic conditions at the Polish Coast

The coastal shallows are covered by uniform waters as regards their temperature and salinity, belonging to the surface isohalin layer. Owing to the nearness of the deeper basins their water penetrates into the coastal zone.

The Polish rivers spill about 58 cubic km. of water into the Baltic Sea and thus lower the salinity of the coastal water and cumulating

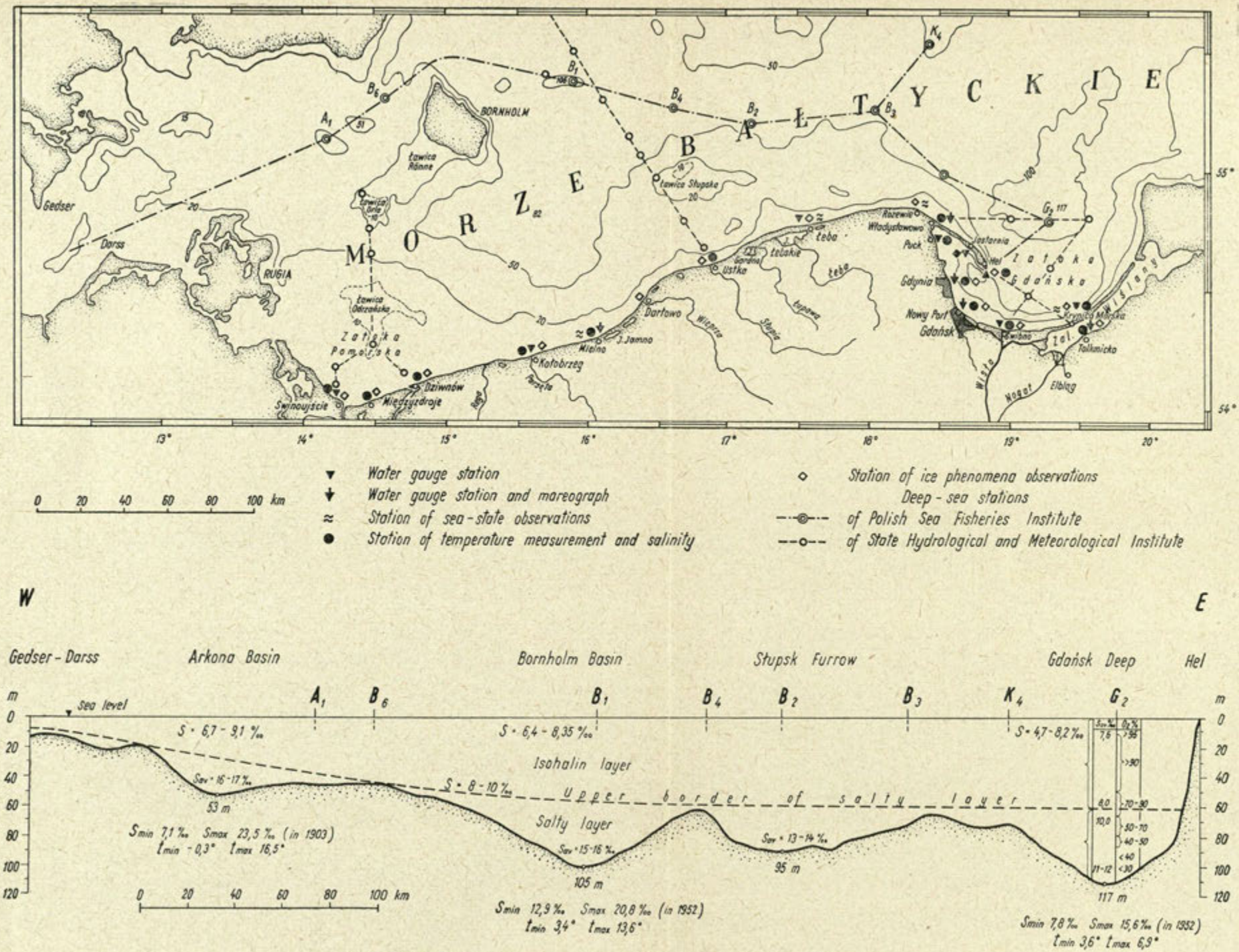


Fig. 1. Net of Polish Hydrographic Stations on the Southern Baltic Sea

Fig. 2. Cross-Section through the Southern Baltic Sea (absolute values in near bottom layers are presented beneath the line of sea bottom)

their debris in the river mouths forming cones of the kind similar to that recognized in the Vistula mouth. The transitoral features of the zone contacting both with the inland and the sea water are still more predominent in the Vistula and Szczecin Lagoons (haffs). Oscillations in the hydrographic conditions depend upon the anemobaric situation, sort of coastal sections of sea and some situations influenced by inland water.

Table 1

Absolute oscillations of water level off the Polish coasts in 1880—1958

Hydrographic	Level of water in cm compared with Amsterdam O		Amplitude in cm.
	maximum	minimum	
Świnoujście	+ 196	— 125	321
Kołobrzeg	+ 216	— 124	340
Ustka	+ 167	— 104	271
Łeba*	+ 168	— 97	265
Gdańsk	+ 168	— 105	269

* Water-gauge in Łeba founded in 1890.

The level of water mounts to the maximum of 216 cm. above the Amsterdam O (NN = 500 cm.), and falls to 124 cm. below it. The displacement of cyclones in the North Sea basin, the wind velocity of 8—9 according to B. scale from West through North to North-East sector cause a sudden piling up of water off the Polish coasts. Both the highest and lowest levels of water are observed in the autumn-winter season. The absolute amplitude of oscillations reaches up to 3,4 m.

Table 2

State of sea off the Polish coasts in 1953—1958
(number off days in year in percent)

Hydrographic station	State of sea		
	0—1	2—3	4—8
Rozewie	14	67	19
Krynica Morska	29	68	3

River water oscillation have practically no influence on the level of sea water. The piling of sea water off the coasts hinders the flowing of river water into the sea; the sudden increases of river water are often greater than the level of sea water. The sea water flows into the Vistula up to 11 km.

The state of the sea is determined according to a 0—9 scale on the basis of height, morphology of waves on 4 coastal stations and observations of sailing units.

The Baltic Sea is a stormy one, the prevailing state is 2—3; the majority of storms (state of sea 5 and more) falls to January, then November and December. There are about 23 stormy days off the Cape of Rozewie (18° 20'E), yearly; the sea is most calm in June, next in May, July and August.

Table 3

Water salinity off the Polish coasts in 1950—1958 (in ‰)

Hydrographic station	Mean yearly	Absolute of oscillations		Amplitude
		maximum	minimum	
Międzyzdroje	6.65	11.13	2.72	8.41
Mielno	7.49	9.65	3.75	5.90
Władysławowo	7.53	9.67	6.44	3.23
Hel	7.45	9.24	5.19	4.05
Gdynia	7.35	8.91	4.18	4.73
Gdańsk	5.54	7.83	1.56	6.27

A distinct difference may be observed in the state of sea between the zone of coastal water, subject to open sea undulations and the partly protected Gulf of Gdańsk (Zatoka Gdańska). Observations in the Krynica Morska station (19° 27'E) are an example of it.

The state of the sea is an index of the regime. The activity of the storm waves and currents brings sands into the coastal zone and the shifting of shoals and reefs are a grave obstacle for shipping, and work in the ports.

Table 4

Water temperature off the Polish coasts in 1950—1958 (in C°)

Hydrographic station	Mean yearly temperature		Absolute oscillations		Amplitude
	water	air	maximum	minimum	
Międzyzdroje	9.4	8.0	24.5	—0.4	24.9
Mielno	9.1	7.5	23.1	—0.5	23.6
Władysławowo	8.4	7.0	22.2	—0.6	22.8
Hel	8.8	7.7	22.4	—0.5	22.9
Gdynia	9.0	7.8	23.9	—0.6	24.5
Gdańsk	9.1	7.4	23.0	—0.5	23.5

The salinity of water has increased to a mean value of 7,5‰ as result of the oceanization of the Baltic waters. Basin water, having a more intense concentration of salt, appears in the coastal zone mostly in winter. The influence of river water on the chemical composition of water in this zone is apparent in spring and summer.

Amplitude of salinity in the open sea is comparatively high, it is on an average of about 5‰, at Międzyzdroje (14° 27'E) over 8‰. Władysławowo (18° 25'E). whose amplitude amounts only to 3,23‰, is the

most maritime of all; it is situated at the base of the Hel Peninsula. The Gdańsk port water is sweetened to below 2‰.

The salinity of the Szczecin and Vistula Lagoons oscillates considerably owing to the wedging in of waters even up to the total filling out of the basins.

The coastal water temperature amounts to about 9,0°C and is higher than the mean yearly air temperature by about 1,4°C. The warmest water, has a mean maximum of 20,3°C, and appears in August as a rule; the February temperatures (0,4°C) are lowest. The extreme amplitudes are comparatively high reaching in summer the values characteristic for warm climates (24,5°C), in the bays and lagoons 26—27°C; in winter they become similar to the polar waters (—0,4° to —0,6°C).

The waters off the western coast are slightly warmer (Międzyzdroje). The water temperature in the coastal zone depends upon the temperature of air in the various seasons, as do the various features of the open or half-closed sections of sea, transition of water from the deep layers and the blending with river, bay and lake waters.

The freezing of coastal zone waters of a mean salinity 7,5‰ takes place at a water temperature of —0,3° to —0,4°C and, sometimes, even when the water is cooled down to —0,6°C.

The ice period varies and depends upon the severeness of the winter. The ice cover remains on the coastal shallows and port basins for a longer period of time. The average number of ice days is 20—25; in case of very severe winters — over 100 days; there is no freezing in a mild winter.

Table 5

Freezing of water off the Polish coasts in the years 1903/04 to 1956/57 winters

Hydrographic station Aquaenae	Ice period Extreme dates of ice phenomena		Mean length of ice period	Number of days with ice		Number of days without ice
	earliest	latest		max.	mean	
Świnoujście	10.XI	11.IV	70	101	43	0
Kołobrzeg	4.XI	28.III	42	75	15	8
Ustka	16.XI	4.IV	49	96	25	1
Gdańsk	16.XI	2.IV	50	135	30	3
The Lagoons:						
Zalew Szczeciński	10.XI	13.IV	68	121	60	0
Zalew Wiślany	5.XI	24.IV	106	147	90	0

The ice cover does not form at all on the neighbouring deeper sections of the sea e.g. Gdańsk Deep owing to the vertical currents comprising the isohalin layer. It would form if the temperature dropped to at least —0,3°C in a 60 m thick layer. During the very severe winter of 1955/56 the air temperature dropped to —28,1°C in February, the lowest in 80 years. The temperature of water in March 1956 was observed to be —0,2°C at a depth of 60 m, down at the isohalin layer. The Gotland Basin never freezes owing to the above mentioned reasons.

Regional hydrografphical problems

The Gulf of Gdańsk (*9*) together with the Vistula Lagoon (haff) (Zalew Wiślany) have been exactly investigated. The configuration of the gulf bottom, the contact with open waters and the outlet of Vistula

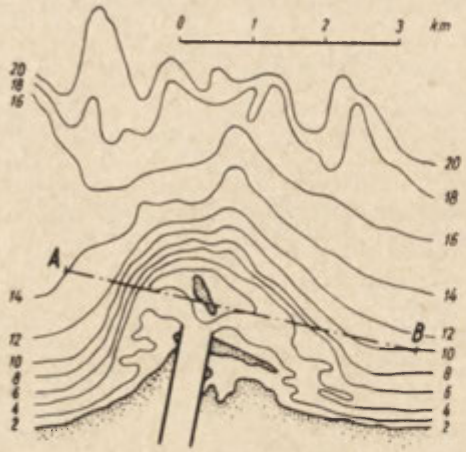
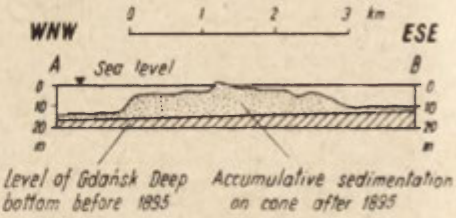


Fig. 3. Vistula mouth cone in 1957 (depths in metres)



4. Cross-section through the Vistula mouth cone (along *A*—*B* line)

waters have a decided influence on the hydrographic conditions. A part of the gulf is protected by the Hel Peninsula. Owing to this fact the Puck Bay has a transitory regime between the sea and logoons waters.

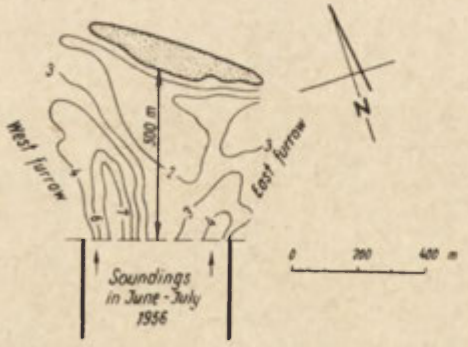


Fig. 5. Island and furrow in the Vistula mouth in 1956

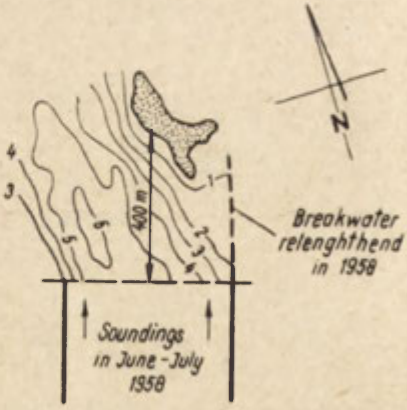


Fig. 6. Shifting of island and reshaping of Vistula mouth furrows in 1958

The interior of the Gulf of Gdańsk is distinctly influenced by the Vistula sedimentation which make the mouth of the river more shallow.

The Vistula mouth (*10*) is an example of the system of hydrographical conditions in the zone of inland and sea water contacts. The

Vistula waters influence the chemical composition, gas contents, appearance of plankton, transparency and hue of sea water.

The Vistula denudes the material from an area of 194, 112 sq. km. surface of the river basin and deposits a part of it on the estuarial cone in the Gulf. It used to fill up the delta and in turn make the Vistula Lagoon (haff) more shallow. The Vistula waters were directed to the Gulf by digging in 1895 an outlet near Świbno (18° 57'E) and building sluices on the Nogat in 1915. The river brings about 2 million cubic m. of debris yearly. Within 64 years the coastal line has shifted about 1,5 km. into the sea; the volume of the cone at the river mouth is about 135 million $m.^3$ (Fig. 3 and 4). The fine suspended materials wander mostly into the gulf. The sea sediments contribute to the forming of the cone. In 1958 owing to difficulties the river had its outlet through two shallow furrows encircling the island (Fig. 5). Owing to the animated activity of high Vistula waters, when their velocity amounted up to 3,8 m./sec. at the mouth, they eroded an independent outlet. The level of the sea became lower by 50 cm. owing to the activity of the southern winds; an outlet for the river was opened (Fig. 6). The sea water penetrates far into the river, even fishermen find jellyfish in their fishing gear. Only the building of steps along the Vistula can limit the carrying in of debris on the cone.

The Vistula waters sometimes join the sea calmly; the waters then flood the area even as far as the Hel traverse. These waters are cooler

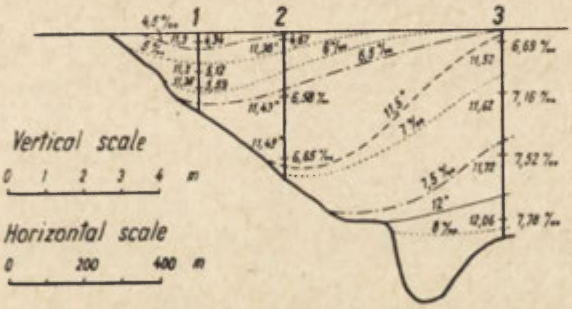


Fig. 7. Activities of Vistula waters in the Gdansk Deep off Stegna (October 24.1956)

than sea water from autumn thoughout the winter and therefore sink deeply in the coastal zone (Fig. 7); when the sea level is a high one they are pressed to the coast.

The level of the sea, dynamic factors of the atmosphere and sea determine the conditions in which the river water joins the sea. This is true for many of our rivers.

The Vistula Lagoon (haff) (*8*) an area of 838 sq. km. surface and 91 km. long is a shallow basin about 2,6 m. deep; it was cut away from the inflow of Vistula waters in 1915; since then it has been under the predominant influence of the sea, which even appears in the western part particularly when the wind blows from North-East, along the logoon axis. This explains the necessity of building up and renovating of the

walls protecting the depression polders in the Vistula delta. Continental climatic features have been observed on the lagoon (haff).

The Szczecin Lagoon (haff) an area of 952 sq. km., 52 km. wide, on the average 4 m. deep constitutes as (well as the Dąbie Lake) an estuary basin for the Odra River which spills about 18 cubic km. here yearly. Three furrows connect the lagoon (haff) with the sea, Świna, the middle one, is the main route connecting the Szczecin port with the sea. The hydrographic regime of the lagoon (haff) depends upon the displacement of the hydrographic fronts from the sea; particularly during stormy periods the sea water is pressed into the basin; it sometimes embraces the whole of the lagoon (haff). This phenomenon is similar to the passing of the fronts through the Danish straits. The slime in the water-way, the forming of a retrograde delta in the lagoon (haff) is due to the reverted motion of water and frequent storm-transgressions of the sea.

On the whole, the lagoons are transitory regions between the continental and sea waters.

Conclusions

The hydrographical conditions at the Polish Baltic Coast are characteristic for a great variation which depends upon the situation of the particular sections of sea in respect to the open sea. The predomination of the marine regime or the continental one is conditioned by the meteorologic and climatic factors as well as the periodic dynamics of the open-sea waters.

Owing to the oceanization of the Baltic waters in the last decades the motion of the sea water has become animated. This caused a stronger abrasion of the Polish coasts, an intensified accumulation, sanding up of river mouths and port areas. In the zone of contacts of both the continental and sea waters animated inflows have taken place.

Investigations on the hydrographic problems have allowed to explain a number of changes of a biological nature; this contributes to the improving of fisheries conditions, shipping, protection of coasts and work in ports.

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Zones géographiques des eaux phréatiques

Cet article a pour but d'éclairer deux contradictions dans nos présentes connaissances des eaux souterraines. Nous parlerons ici seulement des eaux qui se meuvent dans les pores du sous-sol dans les fissures des roches solides ainsi que dans les fissures de celles-ci qui possèdent une nappe continue et libre.

Ces deux contradictions sont les suivantes:

1. Les chercheurs soviétiques constatent l'existence des zones géographiques latitudinales de la profondeur jusqu'à la nappe et de la minéralisation des eaux souterraines; cependant ils expliquent ces zones surtout par la géomorphologie.

2. Selon la règle classique (*15*) de l'hydrologie des eaux souterraines, celles-ci doivent s'écouler dans la direction de la pente du substratum. Cependant, depuis les études de Daubré (3) dans les Landes de Gascogne et de Keilhack (*11*) dans les moraines sous-alpines, on a constaté la convexité de la nappe phréatique sous les éminences. De même les études détaillées effectuées depuis sept ans en Pologne à l'occasion du levé hydrographique (*5, 12, 19*) constatent dans nos plaines la conformité générale de la nappe phréatique avec la surface du terrain.

Les contradictions formulées ci-haut peuvent être résolues par l'application au bilan des eaux souterraines, de la notion de l'équilibre hydrodynamique de leur nappe libre. Cette notion est basée sur la loi du mouvement provoqué par la différence positive des pressions hydrostatiques; cette loi constate que l'eau dans les pores de la roche mobile ne peut s'écouler autrement que dans la direction de la pente de sa nappe libre, sans suivre la pente du substratum, si celui-ci n'est pas en état de former une nappe phréatique conforme à ses pentes. Cette règle, formulée par Koehne (*13*) est comprise dans la loi de Darcy de la vitesse du mouvement proportionnelle à la pente de la nappe.

Le bilan d'une nappe phréatique quelconque dépend de l'abondance de l'alimentation des eaux souterraines par les eaux atmosphériques ou fluviales. Tenant compte de l'abondance et de la nature de l'alimentation, ainsi que de l'hydrogéologie et de l'hydrologie, on peut distinguer onze types d'équilibre de la nappe libre des eaux souterraines (fig. 1).

Une alimentation modérée maintient la nappe phréatique en dépendance directe de la couche sous-jacente imperméable, dans un equilibre de sous-gisement (P) ou, dans les cavités du substratum, dans un équilibre de remous (P_1).

Une alimentation quelque-peu plus abondante allonge sur toute l'étendue du bassin versant la courbe de dépression qui se produit toujours dans les lieux d'écoulement et donne un équilibre de drainage (*D*).

Avec l'accroissement de l'infiltration des eaux de surface, la nappe phréatique s'élève au-dessus de la courbe de dépression et devient conforme à la surface du terrain. C'est le type d'équilibre d'infiltration (*W*).

Lorsque l'alimentation est encore plus abondante et lorsque la zone de l'eau capillaire accompagnant la nappe phréatique atteint les racines des plantes, la nappe passe à l'équilibre d'évapotranspiration régionale (*E*).

Lorsqu'une rivière qui prend son origine dans la zone humide passe dans la zone arride, il se produit un équilibre d'irrigation par les eaux fluviales (*I*) et la nappe phréatique prend la forme d'une courbe de dépression avec son sommet touchant la rivière.

Dans les vallées des rivières la courbe de dépression peut en général changer périodiquement de sens. Pendant les étiages et les hauteurs moyennes de l'eau dans le lit de la rivière, regne un équilibre de drainage qui change de direction pendant les crues et alimente les eaux souterraines de la vallée. C'est le cas de l'équilibre périodiquement réversible (*O*).

Dans la zone des déserts, où l'eau s'écoule par voie souterraine, des montagnes vers le désert en conformité avec la pente de la couche imperméable qui forme le substratum du bassin géologique, la nappe phréatique se trouve dans un équilibre d'irrigation souterraine (*N* et N_1) ou l'équilibre de bassin, qui est analogique à l'équilibre de sous-gisement et de remous.

Dans les bassins versants des cuvettes assez plates qui ne possèdent pas d'écoulement superficiel, lorsque la nappe phréatique est à une petite profondeur et lorsqu'elle est conforme à la surface du terrain, la convexité de la nappe sous le seuil de la cuvette interdit l'écoulement souterrain et le bilan hydrique de la cuvette doit se former par évaporation du marécage ou du lac situé dans celle-ci. Il y a alors un équilibre d'évaporation localement accrue (*Elw*) ou d'évaporation locale (*El*) si la cuvette a des pentes abruptes et si hors de la cuvette la nappe phréatique est située à une profondeur, qui élimine la possibilité d'évaporation de sa surface.

Les eaux phréatiques situées à de petites profondeurs, à nappe conforme à la surface du terrain, alimentent surtout l'évapotranspiration et les petits cours d'eaux occupant des vallées à versants peu inclinés. Si ces eaux percolent vers un aquifère situé à une plus grande profondeur, qui alimente abondamment les rivières dans les vallées plus profondes, nous avons alors un équilibre de percolation ou d'étagement (*S*). Un cas intéressant d'équilibre de ce genre fut constaté dans les étages très différenciés des formations aquifères, à nombreuses fissures étroites, du crétacé des plateaux de Lublin (*2*) et de la Petite Pologne.

Le dernier type d'équilibre des eaux phréatiques, c'est l'équilibre de sous-gisement de gel permanent.

On a distingué ainsi onze types d'équilibre hydro-dynamique de la nappe phréatique depuis les types supérieurs, propres aux climats humides, jusqu'aux types inférieurs des climats arides (fig. 2).

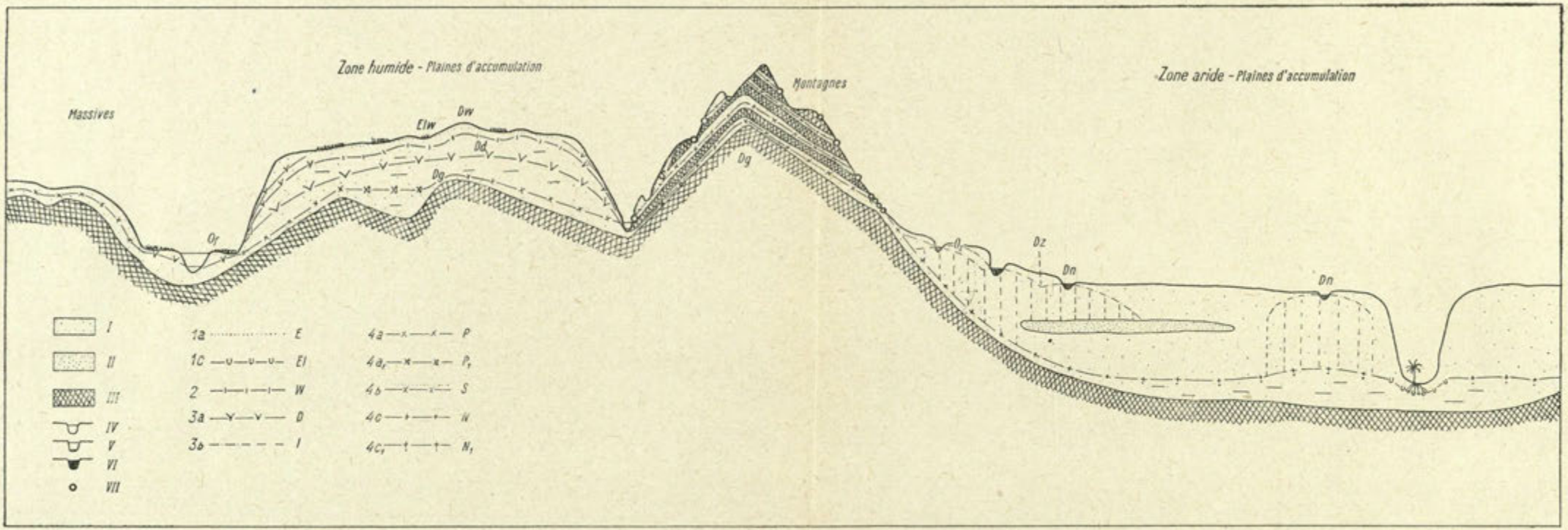

Fig. 1. Schème de l'origine des types d'équilibre hydrodynamique: *I* — couche superficielle du soil d'une perméabilité grande et uniforme, *II* — couche moins perméable, *III* — soussol imperméable, *IV* — lit d'une rivière qui draine, *V* — ditto pendant les crues, *VI* — lit d'une rivière qui irrigue, *VII* — source. 1a — 4c — nappe phréatique en divers types d'équilibre hydrodynamique, 1a — d'évaporation *E*, 1b — d'évaporation localement accrue *Elw*, 1c — d'évaporation locale *El*, 2 — d'infiltration *W*, 3a — du drainage *D*, 3ab réversible (dans les vallées fluviales) Q_1, 3ab — reversible (dans la zone) *O*, 4a — de sous-gisement *P*, 4a$_1$ — de remous P_1, 4b — de percolation *S*, 4c — d'alimentation souterraine-coulante *N*, 4c$_1$ — ditto — en remous N_1

Lignes de partage des eaux souterraines: *Dw* — conforme à la ligne de partage des eaux superficielles, *Dg* — géologique, *Dd* — de depression, *Dn* — sur la fleuve, *Dz* — d'alimentation fluviale

Les différents types d'équilibre hydrodynamique de la nappe phréatique se traduisent par l'hydrographie de surface.

L'équilibre d'évapotranspiration se traduit par de vastes marécages, par une nappe phréatique située à des profondeurs infimes ou par un réseau fluvial de grande densité, où les distances maxima entre les cours d'eau ne dépassant pas 1,5 à 2 km. La végetation dans les fonds des petites vallées sèches est drue. Les contrées aménagées sont coupées par un dense système de fossés drainant.

L'équilibre d'évaporation localement accrue se traduit par de petits marécages occupant toutes les cuvettes, même peu accentuées dans le paysage. A l'équilibre d'évaporation locale répond la végétation opulente des dépressions du terrain dans les steppes et les déserts.

La nappe phréatique restant dans un équilibre d'infiltration, conforme à la surface du terrain, a pour conséquence un manque de sources et de marécages; des sources à débit très faible apparaissent seulement

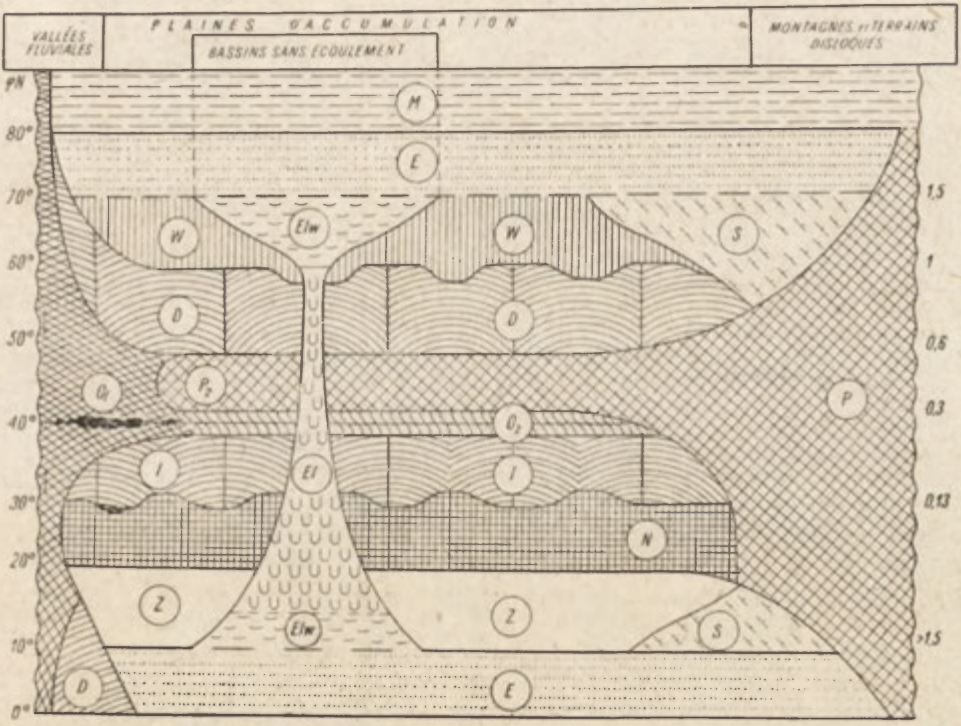

Fig. 2. Schème montrant l'extention sur l'hemisphère nord des types zones et azonés d'équilibre hydrodynamique de la nappe phréatique

aux pied de quelques collines morainiques et des dunes. Les eaux souterraines sont à une profondeur uniforme et médiocre; cette profondeur s'accroit au-dessous des éminences formant les lignes de partage des eaux; le réseau fluvial devient moins dense.

L'équilibre de drainage se traduit par des sources au pied des versants des vallées et par des marécages sur leurs terrasses; le réseau fluvia

est encore moins dense (les distances entre les cours d'eau atteignent 6 km). La nappe phréatique se trouve à une plus grande profondeur, surtout au voisinage des versants de vallées.

L'équilibre réversible est marqué par des rivières à écoulement périodique, l'équilibre d'irrigation souterraine — par des cours d'eau épisodiques; les rivières constantes peuvent y être uniquement allochtoniques, alimentées par les eaux venant de montagne ou d'autres régions humides.

Les caractéristiques des onze types d'équilibre hydrodynamique montrent que deux de ce nombre appartiennent à plusieurs zones climatiques. L'un c'est l'équilibre réversible des vallées des rivières de tous les climats sauf les climats purement océaniques où les hauteurs d'eau dans les rivières sont peu variables et les climats extrêmement continentaux où il n'arrive jamais que la rivière draine son bassin. Le second type d'équilibre qui appartient à toutes les zones, c'est l'équilibre de sous-gisement, qui se développe là partout où la couche des matériaux poreux est trop mince et le substratum trop incliné pour qu'un type supérieur d'équilibre puisse se produire.

L'équilibre géologique est propre surtout aux montagnes et aussi aux terrains où sous une mince couche de terre mobile la couche sous-jacente, tout à fait imperméable, possède localement une pente très forte. C'est le cas, par exemple, des limons pliocènes à glacitectonique perturbée, recouverts de sables glaciaires et marqués par des sources abondantes (escarpement de Varsovie, sources de la Łyna, environs de Poznań); ces phénomènes sont isolés dans de vastes régions qui possèdent une nappe phréatique conforme à la surface du terrain et qui sont complètement dépourvues de sources.

Je considère les autres neuf types d'équilibre hydrodynamique comme restant en strict rapport avec l'humidité du climat; on les trouve là, où la couche supérieure de terre est plus ou moins uniformément perméable et assez épaisse pour qu'il ne se produise pas d'équilibre de sous-gisement. Car, lorsqu'on compare les caractéristiques présentées plus haut qui résultent des spécificités de différents types d'équilibre, avec les descriptions des zones des eaux sou-terraines présentées par les chercheurs soviétiques, on remarque sans peine une concordance de mes définitions avec leurs descriptions.

Les zones des eaux souterraines furent décrites par Iliine en 1925 (*4*). Son idée fut développée et popularisée par les hydrologues L a n g e (*8, 9*) et L i t c h k o v, le géographe hydrologue D a v i d o w (*1*), par T u r e m n o v (*16*) qui étudie les problèmes concernant les tourbières et par la Grande Encyclopédie Soviétique.

Dans sa caractéristique des eaux souterraines Iliine distingue les eaux azonées et zonées et comme critères de leur caractère zoné il considère la profondeur jusqu'à la nappe phréatique, la minéralisation de l'eau et son chimisme; ces caractéristiques des eaux souterraines évoluent du Nord où dominent surtout les climats humides vers le Sud aux climats arides. Le chimisme des eaux souterraines évolue du Nord au Sud de manière que les eaux peu profondes du Nord possèdent des additions organiques, puis elles atteignent un grand degré de pureté, plus loin au Sud elles s'enrichissent en carbonates, puis — en sulphates et enfin — en chlorures.

TYPES D'ÉQUILIBRE HYDRODINAMIQUES DES EAUX PHRÉATIQUES

DES CLIMATS HUMIDES | DES CLIMATS FROIDS | DES CLIMATS SECS

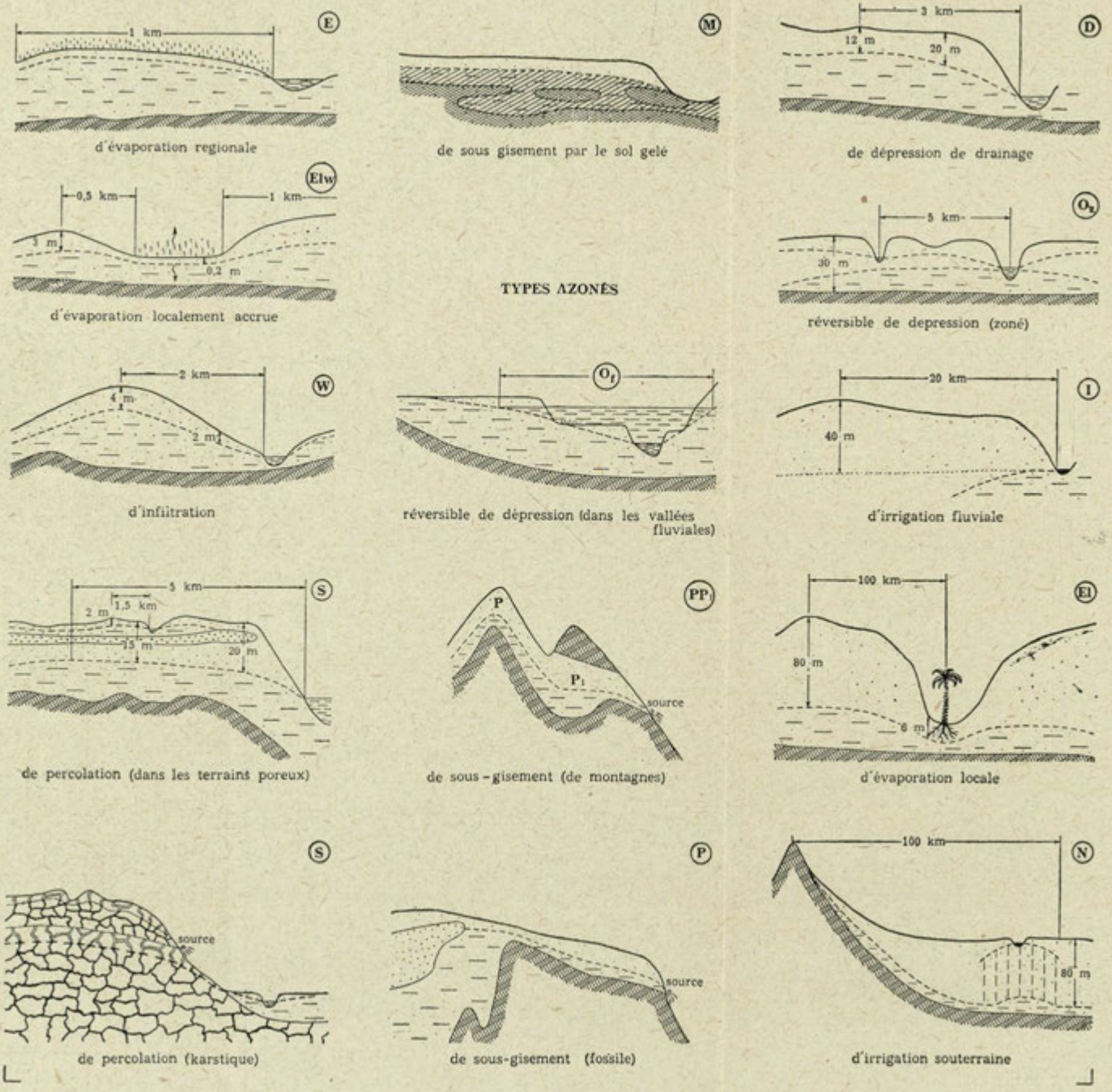

Fig. 3. Diagramme montrant l'extention sur l'hemisphère nord des types zonés et azonés d'equilibre hydrodynamique de la nappe phréatique

Je mets en parallèle les descriptions des zones des eaux souterraines presentées par Iliine, Turemnov et Lange aves ma notion des types d'équilibre exposée ci-haut, de manière suivante:

La zone des eaux de toundras répond — du moins dans sa partie nord — à l'équilibre géologique du gel permanent. La zone du nord des eaux peu profondes où selon Turemnov (*16*) la nappe phréatique se trouve à une profondeur uniforme de 2 m jusqu'à 4 m sous les lignes de partage des eaux, correspond à l'équilibre d'évapotranspiration régionale et en partie aussi à l'équilibre d'infiltration. Les eaux morainiques azonées de Iliine — c'est le domaines de l'équilibre d'évaporation localement accrue qui est formé par le caractère du relief et non pas par le climat. La zone des vallons semble être encore sujette à l'équilibre d'infiltration. La zone des profonds ravins, avec de nombreuses sources dans les vallées correspond à l'équilibre de drainage. La zone des ravins et balkas, dont les fonds n'atteignent plus la nappe phréatique et en conséquence ne subissent pas les effets de l'érosion, semble être le domaine de l'équilibre réversible. La zone des balkas avec les peu nombreuses rivières donts certaines sont allochtoniques, zone où sont exécutés de nombreux travaux d'irrigation — c'est celle de l'équilibre d'irrigation. Enfin la zone la plus sèche d'irrigation souterraine n'a pu être découverte par Iliine dans la partie européenne de l'URSS. En Asie Centrale un tel cas fut décrit par Lange dans l'un de ses articles (*8*) et dans son manuel (*9*).

Je considère alors que les types d'équilibre hydrodynamique de la nappe phréatique, appuyées sur la théorie, correspondent entièrement aux relations décrites par les auteurs soviétiques, quoique ceux-ci emploient comme critères les relations géomorphologiques.

Puisqu'il est facile d'expliquer par les onze types d'équilibre hydrodynamique de la nappe des eaux phréatiques, les traits caractéristiques de l'hydrographie des zones des eaux souterraines décrites par les chercheurs soviétiques, on peut aussi essayer d'enrichir les connaissances que nous possédons sur les eaux de ces zones par les observations faites dans les plaines de la partie européenne de l'URSS qui enferme plusieurs zones climatiques. Ainsi Litchkov compare la carte des eaux phréatiques de Iliine avec la carte d'humidité du climat, dressée par Ivanov (*6*) qui présente la répartition de l'index d'humidité déterminé par les rapports des précipitations atmosphériques à la capacité d'évaporation, ce qui s'exprime par les formules suivantes:

$$K = \frac{P}{E_p}\,;\; E_p = 0{,}0018\,(25 + t)^2 \cdot (100\text{-}a),$$

où a est l'humidité relative obtenue à l'aide du psychromètre d'Auguste. La comparaison de ces deux cartes montre la dépendance entre les zones des eaux phréatiques et l'humidité du climat. L'équilibre d'évapotranspiration se développe dans les climats très humides ($k > 1{,}5$), — d'infiltration — dans les climats à humidité suffisante (1—1,2), — de drainage — dans les climats à humidité moyenne (0,6—1), l'équilibre réversible — dans les climats à humidité insuffisante (0,3—0,6) ou selon Davidov — à humidité variable, l'équilibre d'irrigation — à humidité de

déficit (0,13—0,6) et l'équilibre de bassin — dans les climats à humidité infime ($K < 0{,}13$).

La concordance de la répartition géographique (*4*, *1*, *9*) et la logique de la circulation permettent d'ajouter aux caractéristiques des types d'équilibre le genre du processus pédologique et de la couverture végétale.

L'infiltration qui prévaut dans les climats humides amène le lavage des sels et leur migration vers les couches inférieures, ce qui aboutit à la formation des podsols à la surface et au règne des forêts conifères. Au contraire, dans la zone sèche la domination de l'évaporation, surtout des eaux de condensation et des eaux allochtoniques, amène la migration des sels vers la surface et la formation des sols salés et des sols gris des déserts, ce qui forme des conditions de vie favorables aux halophytes.

L'équilibre entre le lavage et la migration des sols vers la surface qui conduit à l'accumulation des sels à une profondeur moyenne et à la formation d'une couche d'humus à la surface, semble correspondre à la zone d'équilibre de drainage — pour les sols bruns et les forêts feuillées et à la zone d'équilibre réversible — pour les tchernosems et les steppes.

Les sols jaunes des climats de moussons et des climats subtropicaux semblent correspondre aux types d'équilibre périodiquement réversible qui doivent caractériser les régions à fortes variations d'humidité. L'équilibre d'évaporation de la zone équatoriale provoque la formation des latérites.

La figure 3 donne un aperçu des types d'équilibre zonés et azonés. Il exprime l'accroissement du rôle des types zonés de l'équilibre hydrodynamique avec l'accroissement de l'humidité du climat et la prépondérence de l'équilibre géologique dans la zone sèche.

Il faut remarquer aussi qu'il doit exister une épaisseur critique de la couche aquifère supérieure, cette épaisseur dépassée — l'équilibre géologique ne pouvant plus exister et la loi des zones décidant du caractère de la nappe phréatique. Cette épaisseur doit dépendre surtout du climat. Dans les régions humides elle doit être de petite dimension; dans les régions arides l'épaisseur de la couche poreuse doit être très grande pour qu'un type supérieur d'équilibre puisse se produire.

L'épaisseur critique de la couche sèche dépend probablement de trois groupes de facteurs:

1° de l'infiltration des eaux atmosphériques;

2° de la perméabilité; de la couche aquifère, supérieure et sous-jacente; tenant compte de la température du sol et de la pente du substratum;

3° du relief plus ou moins accidenté.

La typologie dynamique de la nappe phréatique peut etre appliquée comme critère pour la dénomination des régions du point de vue de la géographie physique. Les notions de zones géographiques et d'épaisseur critique permettent de définir le caractère des eaux souterraines et leurs lignes de partage d'après le caractère des eaux de la surface du terrain, ainsi que de définir *a priori* la profondeur où se trouve la nappe phréatique — si la couche poreuse est assez épaisse.

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Macro-, Meso- and Microclimate

I. Introduction

A general definition of climate should, besides a short explanation. cover in principle also the different variants of the meaning of the term, such as macro-, meso- and microclimate and in some degree special ones, e.g. paleo-, bio-, agroclimate a.o. The last three terms could be discussed also in their macro-, and microclimatological scale. However, only the first three of the abovementioned terms will be considered here, as they are fundamental ones, whereas the other terms represent special branches of climatology as a science (or some special parts of climatological practice) having been developed with particular regard to the geological past, or to special biological, agricultural, and other requirements. In the latter case, the general definition may obviously require some supplementary statements and explanations, because the object of investigations should comprise also some aspects and elements related to the geological past or should be connected with biological, agricultural or other subjects, the relation of which to climate has also to be taken into consideration.

Since the method of research is connected with the investigated object, the proper determination and interpretation of the terms under discussion should also indicate the inherent methodological differences in macro-, meso- and microclimatical practice.

II. Discussion

The following general definition of climate is proposed for discussion:

Declarational part of the definition

The climate is a characteristic regime — periodical and nonperiodical variation of the whole complex of atmospherical conditions and of weather states, peculiar for a given place (area, space) and a specified interval of time, usually determined on the base of long-period observations.

Explanational part of the definition

The climate is determined by sun radiation supply and earth-atmosphere radiation and heat exchange; by

the geographical situation of a given place, i.e. its latitude, altitude, distance to sea and/or continents, by its relationship to continental main relief structures and to the relief-units of its surroundings, by the physical character of the earth-surface and its cover (plants, water, snow, ice); by general and/or regional (local) atmospheric air circulation; by the kind and degree of atmospheric air pollution in the environs of a given place.

In the declarational part of this definition such terms as "variations of..." — beside "regime", or "atmospherical conditions" — beside "weather states", are purposely being used for the following reasons:

(i) In nature sciences the term "regime" is generally understood to signify a normal regular system of processes and phenomena, which may not always apply to the "variations" of atmospherical conditions characteristic for a given place, as e.g. in the case of a change of these conditions due to the action of some anthropogenetic factors.

(ii) Also, the whole complex of "atmospherical conditions" and that of "weather states" are not identical. Identical (i.e. nearly the same) atmospheric conditions may occur in different states resp. situations of the weather, as the latter word is usually understood in meteorological terminology. Similarily, with the same "state of weather" (in its general sense) there may simultaneously prevail different "atmospheric conditions" in relatively nearby places (*1*). The term "place" used in this definition should be understood in its broadest sense, as it may correspond also to the meaning of the terms "area" or "space", e.g. the climate of a determined space in aeroclimatology or aeronautical climatology.

In the first part of the definition the necessity of determining the period to which a given climate corresponds has been indicated. The expediency of this view, pointed out by H. Landsberg (*6*), is justified by the known phenomenon of climate changes, confirmed at present by indirect as well as direct observations. The direct observations allow us, however, to gather knowledge primarily about contemporaneous climatic conditions. For this reason we base the respective research in most cases on the results of observations of many years. In some cases, however, (not to mention climate characteristic of bygone periods when there were no meteorological observations made) we have to base climatological research on indirect premises, viz., the results of relatively short time comparative observations. This procedure, most frequently applied in investigations of microclimate and even of local climate, may in appropriately chosen observational conditions yield satisfactory results, especially for certain specific requiremetns. W. Mörikofer concurs with this opinion (*7*). It is for the above reasons that we stress in our definition the moment that, as a rule, we are trying to deduct climatic characteristics from observations covering many years, but that this does not apply to all cases.

The second, explanational, part of the definition stresses the roie of different geographical factors, the significance of regional or local air circulation (climate of some isles and coasts, mountainous regions) in the formation of climates. Finally, attention is drawn to the atmospheric air pollution factor which sometimes is decisive for the quality of the atmos-

pheric conditions in which develops organic, notably human, life. This factor is of great importance both in bioclimatology and in general climatology. Studies by E. Eriksson show that it can also serve as indicator for the magnitude of the influence of the sea on climate (*2*). It can facilitate investigation of the circulation, intensity and periodic variation of turbulence (*5*, *8*). This factor is also very important in agroclimatology. Some authors, emphasizing its significance in climatology, are propagating the concept of "chemical climate" (*2*, *8*). Taking this aspect in consideration, it may be pointed out that the expression used in our definition "whole complex of atmosperical conditions" may also be interpreted to signify the "whole complex of physical and chemical properties of the atmospheric environment", expanding thus the formulation given by E. M. Fournier d'Albe in his definition of microclimate (*3*).

In accordance with its initial assumption, the general definition of climate given above does not distinguish between the single meanings of this term in discussion nor does it differentiate the scales in which the climate may be considered. This definition does, however, contain elements permitting to subdivide the notion of "climate", more especially in regard to the scale of the climate under consideration. This is possible by chosing an appropriate scale of the factors forming the climate of an area (space) of arbitrary size (*9*), and by emphasizing those factors which in the given case are of primary importance. Thus, e.g., the local circulation may have no major significance for the formation of the macroclimate, but may be decisive for the character of the local climate (mesoclimate).

This approach appears to be reasonable inasmuch the essential difference between the notions of macro-, meso-, microclimate is primarily based on spatial size, on the scale in which we consider the climate when accentuating a given meaning in terminology. From this results another important consequence: the difference in scale, as expressed by the abovementioned terms is so great that it comprises in itself also quantitative differences. This can also be inferred indirectly from the well-known difference in the gradients observed in macro-, meso- and microclimatic conditions. Special attention to this problem was paid by S. A. Sapojnikova (*9*). For these reasons R. Geiger calls in his renowned book the microclimatic zone with its high gradients: the zone of disturbances (*4*).

In the works of the two lastmentioned authors the notion of local climate (mesoclimate) is discussed only in a general way, no definition being formulated by them. Some authors believe that special distinction of the term mesoclimate is not expedient in principle, and that it suffices to differentiate between macro- and microclimate, the mesoclimate being considered only as a local variety of the macroclimate (*1*). So we see that this question can be interpreted in various manners. Neverthelles, it seems more opportune to uphold the distinction between those three terms.

First of all, two different aspects characterize the microclimate — *the spatial* and *the physical* one. The first aspect limits the micro-climate to small or even smallest areas which practically can be investigated by

means of meteorological instruments. Only very few standard meteorological methods are suitable for application in this case. The spatial variability of the microclimate is so great, that is is only at a height of 2 m above a flat surface covered with short grass that macroclimatic measurements can be made to, yield results comparable with those obtained at points lying at a distance of several hundred kilometres (*4*, *9*). The range of the microclimates is limited to such small areas that they can heardly be assigned to the category of "geographical spaces", their reach may be "ageographic". Inversely, the physical aspect of the microclimate is a very general one. In similar external conditions, similar microclimatic conditions prevail. Thus, e.g., with similar exposition, time of insolation etc., the thermic conditions at the immediate surface of any sand dune show surprising reproducibility, the geographical position of the given dune being in this respect of relatively minor importance. For the abovementioned reason it is possible to apply in microclimatological investigations the principle of analogy, permitting marked shortening of observational time.

Mesoclimate is the climate of single geographical units, forming taxonomical units in geography which are not yet a region. We may therefore speak of the local climate of a valley, of a lakes- or forest-complex, a city etc., but we must not speak of the mesoclimate of a slope. In a somewhat similar way as in geomorphology, the slope constitutes an element which may form part of a system of different independent forms, without being an independent form itself. Also the climatic character of a slope — although connected with the local climate of a given unity — may still show certain specific features, independent of the local climate of the taxonomic unit of which the slope is a part. In this case the climate of the slope has also the features specific for microclimates which do not form single independent microunits. It is only interrelated groups of them which together form definite complex microclimatic entities (e.g. the climate of a wheat field, of a slope) and — summed up — a zone of disturbances according to R. Geiger's terminology, or *a near the ground translating layer* of the active earth surface, transmitting its influences on the processes occurring in the atmosphere. The concepts of macroclimate and mesoclimate (local climate) correspond to definite spatial geographical concepts. The first of them finds its counterpart in the concept of the geographical region, the other one in the units of lower order, forming components of a region, but being themselves independent taxonomical units in geography. That the above arguments are not just a formal analogy between geographical and climatological conceptions, appears e.g. from the fact that the climate of any arbitrary valley shows some similarity to the climate of any other valley, irrespective of the region (macroclimate) to which the valleys belong. We may, therefore, speak rather of certain types of mesoclimate in a much more general sense, than of individual local properties of an individual given region (macroclimate).

	Microclimate	Mesoclimate	Macroclimate
I. Spatial size	(i) Elemental entities — limited to smallest areas or spaces of "ageographical" size; (ii) if forming an aggregate (microclimates-complex) they are limited to elementary elements of geographical size, not representing an independent geogr. unit but only a component of some such unit; (iii) taken as a whole, they are limited to a near-the-ground layer of disturbancy, translating the influences of the active earth surface to the atmosphere (and vice versa). Note: (i) and (ii) do not accur on the sea.	Limited to the size of objects representing single independent units in geographical taxonomy (also of some complexes of such objects not large in size).	Beginning from areas (spaces) representing a large part of a geographical region, a subregion or region, corresponding to a climatolological subregion or region.
II. Distribution of physical properties	Very general, high degree of analogy, not limited to one climates-belt only.	General. Depending on degree of similarity of physical conditions of the surroundings, moderate to high degree of analogy, in the limits of the same type of objects (single independent geogr. units), but, in principle, not necessarily in the limits of one climates-belt.	General only in the limits of similar climate-structures and of the same climate-types, limited in principle to one climates-belt only; certain analogy of some features in similar geographical position, not limited to one climates-belt only.
III. Subdivision, structure and relation to other categories (scales) of climates	(i) no subdivision; related to other climates-categories only through (ii) or (iii) (ii) subdivision possible according to types (categories) of geogr. elementary elements, e. g. microclimate of a slope, of a wheat field etc.; (ii)+(iii)—polyelemental structure; (ii)+(iii) — intermediate factor of the earth-surface activity participating in the forming of meso- and macroclimates.	Different independent types of local climates, e. g. climate of a hill-, lake-, forest-complex, of a valley, of town; representing components of macroclimatological regions.	Subdivisions: (i) homogeneous macroclimate—coresponding in principle to one mesoclimate (monostructural) type, e.g. some steppe-climates, sea-climates; (ii) composed macroclimate—including a number of mesoclimate types one of which represents predominating type (polystructural type) e.g. climate of a steppe region crossed by valleys or a sea area with isles etc. (iii) collective-climates-complex composed by a greater number of mesoclimate types without marked predominance of any one type (fully developed polystructural type) e. g. climates of some mountains regions, of some postglacial land-scape regions etc.
IV. Methods, type of stations (accord. to definition of WMO Techn. Regulations)	Special methods, few possibilities for standarization; special climatological stations only.	Standarization of methods possible; principal and ordinary climatological stations with specific localization adapted to type of objects.	Standarization of methods recommend; case of monostructural type: a network of sparsely distributed principal climatitological stations; in case of polystructural type: a network of principal and ordinary, stations with distribution related to size-number and character of the components.

Every of the discussed concepts — macro-, meso-, microclimate — belongs thus to a different category. They are united by the concept of climate, which may be common, but divided by their totally different relation to spatial units, the basic taxonomical concepts in geography. Every one of the discussed objects may be investigated separately, every one have general or individual properties of a given type of macro-, meso- and microclimate, irrespective of its mutual spatial correlation.

III. Conclusions

The above discussion leads to several conclusions which perhaps may best be explained on examples. What is the climate of an extended homogeneous plain (forming a region)? — It is the mesoclimate of the plain which simultaneously is the *homogeneous macroclimate* of the given region. In the case of a wide plain, cut by valleys and /or partly covered by lake- and forest complexes — there will be a *composed macroclimate,* comprising mesoclimatic components of several types. Finally,

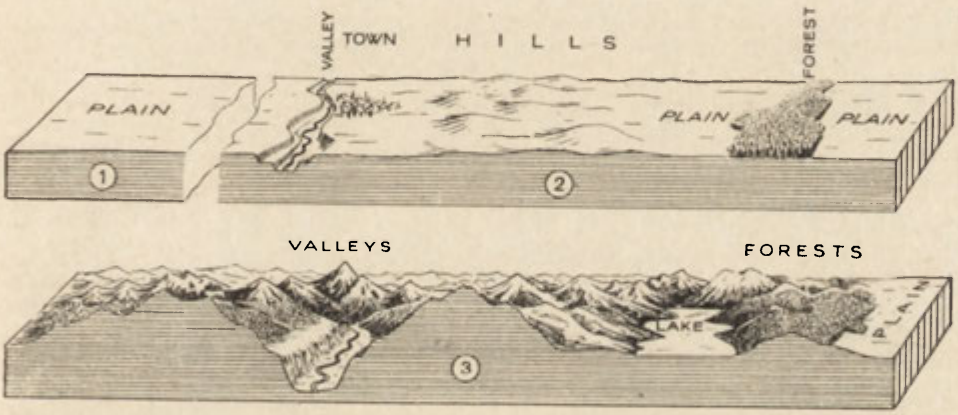

Fig. 1. Scheme of examples of regions chowing different structures corresponding to: *1* — homogeneous macroclimate, *2* — composed macroclimate, *3* — collective climates complex

an area of greatly differentiated landscape type, with a few flat fragments. numerous valleys, waters, woods etc., would have a climate composed of numerous mesoclimates of different type which — if it constitutes a defined regional whole — could be called *collective climates complex* (see fig. 1 and tab. 1).

As regard research methods, it may be stated again that in the field of microclimatic studies we have to use procedures and instruments which are not suitable for full standardization. According to the nomenclature of the Technical Regulations of the World Meteorological Organization (W.M.O.), the climatological stations "for specific purposes" may primarily be suited to this end (*10*). Macro- and mesoclimatic research will have to rely mainly an the observation stations defined in

international practice as "principal" and "ordinary climatological stations". For investigations into homogeneous macroclimate a net of a few widely scattered stations, all of them single principal ones, will prove sufficient. In the case of composed macroclimate, and even more so in that of a collective climates complex it will be necessary to investigate at least every type of mesoclimate (i.e. the local climate of every type of the units forming the components of the given region) by means of such a number of principal and ordinary stations (operated continuously or intermittently) which would allow determination of the properties of the main component mesoclimatic types and their mutual comparison, also their comparison with the properties of the macroclimate of the whole region.

From the above it would appear that a uniform distribution of the net of climatological stations can be considered as expedient only in the rare cases of uniform geographical character of extensive areas. The installation of the network of meteorological stations should therefore be carefully adapted to the character of the given geographical region — differently in areas with dissimilar macroclimatic structure. The proposed differentiation of this structure into homogeneous-, composed etc. macroclimates may facilitate this task.

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JANUSZ PASZYŃSKI

Transparence de l'atmosphère comme élément du climat local des régions industrielles

Les climats locaux des régions fortement urbanisées et industrialisées se caractérisent par une transparence relativement faible de l'atmosphère. Ceci est causé par une pollution de l'air (poussières et fumées) en général très prononcée, ce qui provoque l'accroissement du trouble atmosphérique sur ces terrains. Un tel état des choses engendre une série de conséquences et contribue surtout au changement des valeurs numeriques des composants du bilan radiatif. Cette influence s'exprime notamment par une sensible diminution du flux du rayonnement solaire direct sur la surface de la terre, par rapport aux terrains, où il n'existe pas de sources d'importante pollution de l'air.

D'autre part, cette diminution de la transparence de l'atmosphère causée par les fumées peut être considerée comme indice de pollution de l'air)*6, 8*).

Le degré de la transparence de l'atmosphère peut être déterminé par diverses méthodes. Se servant de mesures de visibilité, effectuées horizontalement, on peut caractériser la transparence de la couche d'air la plus basse, au niveau du sol. En utilisant les méthodes actinométriques (dans le sens de ce mot, employé en météorologie), nous pouvons déterminer la transparence de la couche entière de l'atmosphère, traversée par le rayonnement solaire.

Une telle méthode fut appliquée dans les recherches sur le climat local de la région industrielle de Haute-Silésie, effectuées déjà depuis quelques années par l'Institut de Géographie de l'Académie Polonaise des Sciences. Pendant les jours clairs, à ciel serein ou couvert en partie (les nuages étant éloignés au moins de 30° du disque solaire), on effectuait des mseures simultanées de l'intensité de la radiation solaire directe à incidence normale toujours dans deux points, dont l'un, variable, était situé dans la région industrielle, et l'autre, stable, au-delà de cette région.

Pour examiner la répartition géographique du trouble atmosphérique les recherches n'étaient pas limitées à un seul point de la région industrielle, mais étendues sur une série de points situés dans la partie centrale de la région. Afin de réduire au minimum le temps entre deux mesures consécutives, on utilisait une voiture. Chaque tournée était faite deux fois par jour: aller et retour. En ce qui concerne le

deuxième point, point-base, situé déjà au-delà de la région industrielle, il a été localisé à Pszczyna. Cette localité a été choisie à cause de sa position du côté au vent par rapport aux vents dominants dans cette partie de la Pologne (les vents du Sud-Ouest). Ainsi, on obtenait pour chaque point d'observation situé dans la région industrielle des valeurs de l'intensité de la radiation directe, comparables avec les valeurs simultanées de Pszczyna.

Les mesures ont été effectuées à l'aide d'actinomètres thérmo-électriques (solarimètres) du type Gorczyński (*1*), étalonnés dans la section d'actinométrie du Service Météorologique d'Etat. L'intensité de la radiation directe était evaluée pour le spectre solaire entier, ainsi que pour deux régions spectrales, déterminées à l'aide du filtre de verre standard RG-2. La limite de la transmission de ce filtre répond à une longeur d'onde $\lambda = 6300$ Å. Dans la région spectrale de courtes longueurs d'onde ("bleu"), c'est-à-dire pour $\lambda < 6300$ Å, il n'y a plus de bandes d'absorption de la vapeur d'eau, et la diminution du rayonnement solaire directe dans l'atmosphère (l'extinction atmosphérique) n'est pratiquement causée que par les particules en suspension, c'est-à-dire par l'aérosol et par la diffusion par les molecules de l'air même. L'étude de la transparence de l'atmosphère, limitée seulement à la région spectrale mentionée, permet d'éliminer l'influence éventuelle de la quantité variable de la vapeur d'eau dans l'air sur l'affaiblissement du rayonnement solaire.

Comme indice numérique de transparence de l'atmosphere dans la région spectrale analysée, on a adopté le „nouveau" facteur de trouble Θ d'après Linke (*4*). Il exprime le rapport entre la transparence dans les conditions existant réellement et une transparence qui aurait lieu dans le cas d'une atmosphère complètement pure et contenant la vapeur d'eau en quantité correspondant à 1 cm d'eau précipitable. Ce facteur de trouble se caractèrise par un manque presque complet de dépendance de la masse optique d'air, ce qui le rend utile pour comparer les résultats d'observations executées à différents moments de la journée, donc à différentes hauteurs du soleil (*5*).

Les valeurs du facteur de trouble ont été calculées pour tous les moments d'observation en fonction de l'intensité du rayonnement solaire direct, réduite préalablement à la distance moyenne terre-soleil, et de la masse optique de l'atmosphère (*7*).

Cependant la diminution de la transparence de l'atmosphère dépend aussi bien des poussières de caractère local — conséquence de la pollution de l'air par les fumées industrielles — que des poussières de caractère régional, dont le contenu dans l'atmosphère est à peu près le même sur de grandes étendues, mais change rapidement avec le temps (*3*). Le contenu des particules en suspension (aérosol) resulte donc non seulement des conditions locales, mais aussi du caractère des masses atmosphèriques, étant en général supérieur dans les masses d'origine continentale que dans celles d'origine maritime. Il fallait dons éliminer de nos recherches cet élément supplémentaire météorologique.

Dans ce but on a calculé les différences entre les valeurs du facteur de trouble, obtenues simultanément dans de différents points d'observation de la région industrielle et dans le point-base à Pszczyna, situé en

dehors de la région, en admettant qu'il se trouve déjà au-delà de la portée des fumées. Ensuite, on a calculé pour chaque point d'observation la moyenne des différences obtenues d'après toutes les mesures effectuées en 1958. Pour obtenir des resultats comparables le mieux, on a éliminé toutes les données provenant des jours où, à cause des conditions météorologiques, il était impossible d'effectuer des mesures dans tous les points.

Ces différences (écarts) comme valeurs relatives peuvent être considérées comme juste indice de pollution de l'air dans un endroit donnée, plutôt que les valeurs absolues du facteur de trouble.

Dans le tableau ci-dessous on a cité les valeurs moyennes des écarts obtenus pour quelques localités choisies de la région industrielle de Haute-Silésie. On a calculé séparement les moyennes pour les jours à vent d'Ouest et celles pour les jours à vents d'Est. Pratiquement, il s'agit ici uniquement de vents du Sud-Ouest et du Sud-Est, puisque les jours à vent des secteurs Nord, les conditions météorologiques n'étaient pas favorables aux mesures du rayonnement.

Les chiffres présentés au tableau 1 indiquent, que la diminution de la transparence de l'atmosphère dans la région industrielle de Haute-Silésie à la suite du trouble local est, en général, très considérable. Il faut remarquer, que la valeur absolue du facteur de trouble à Pszczyna ne depassait à l'époque étudiée 2,55 en moyenne, et que certains jours on observait des ecarts allant jusqu' à 10.

Tableau 1

Ecarts moyens du facteur de trouble Θ (pour $\lambda < 6300$Å) en 1958 par rapport au point-base de Pszczyna

Localité	Vent	
	Ouest	Est
Katowice	0,29	1,31
Chorzów	0,72	2,39
Bytom	1,03	2,10
Lipiny	1,27	2,20
Swiętochłowice	0,45	2,81

Il découle également du tableau que la diminution de la transparence de l'atmosphère les jours à vent d'Est, est plusieurs fois plus grande que les jours à vent d'Ouest. Ceci est causé par les vitesses peu élevées des vents du Sud-Est par rapport aux vents du Sud-Ouest. Parmi les vents soufflant à Katowice de la direction Sud-Est, 49% sont des vents faibles (vitesses inférieures à 2 m/sec) et seulement 13% — des vents forts (vitesses supérieures à 5 m/sec). Par contre pour la direction Sud-Ouest les vents faibles ne constituent que 34% à peine et la part des vents forts s'éleve à 26% (2). À cause de petites vitesses du vent et d'une faible turbulence, le processus de la purification spontanée de l'atmosphère se déroule très lentement et l'aérosol de provenance industrielle se maintient longtemps à proximité des sources de fumées.

Une pollution de l'air particulièrement forte peut avoir lieu durant les situations de l'inversion, liées souvent aux vents d'Est et du Sud-Est.

Les valeurs moyennes des écarts ont été également présentées sur cartes sous forme d'isolignes. Puisqu'il s'agit ici des écarts du facteur de trouble par rapport à sa valeur en dehors de la région industrielle, on peut nommer ces isolignes "isoanomalies de transparence de l'atmosphère". La carte jointe présente le parcours moyen de ces isoanomalies en 1958. Elle a été tracée en se basant sur les données de l'ensemble des jours des observations complètes, dans ce cas indépendamment de la direction du vent.

On voit nettement sur la carte l'influence des grands centres de l'industrie lourde, tels que Chorzów, Bytom, Ruda Śląska, sur la pollution de l'air. On y voit également des écarts sensiblement plus élevés dans la

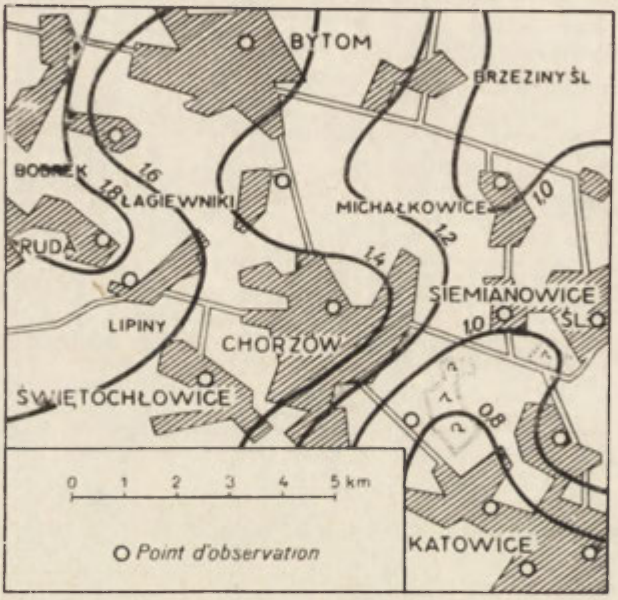

Fig. 1. Isoanomalies de transparence de l'atmosphère dans la partie centrale de la région industrielle de Haute-Silésie

partie occidentale du terrain en question par rapport à celles de la partie orientale. Ceci est lié non seulement avec localisation des sources de fumées mais reste également en rapport avec une plus grande pollution de l'atmosphère les jours à vent d'Est, que les jours à vent d'Ouest, ce qui a été déjà mentionné.

La carte presentée ci-haut devrait être traitée avant tout comme un essai de la méthode, parce qu'elle n'est basée que sur un nombre relativement restreint de données d'observation, provenant d'une seule année. Il se peut que les résultats des observations effectuées pendant une période prolongée, de plusieurs années, changent dans les détails le tableau obtenu. Cependant déjà maintenant les résultats des observations peuvent avoir une importance pratique, surtout pour la planifica-

tion urbaniste. Ils permettent de déceler les terrains particulièrement exposés à la pollution de l'air, où la construction de nouveaux cites d'habitation n'est pas indiquée pour des raisons climatiques, et où il faudrait appliquer en premier lieu des moyens techniques contre la pollution excessive de l'air.

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KAZIMIERZ DZIEWOŃSKI, STANISŁAW LESZCZYCKI

Geographical Studies of Economic Regions in Central-Eastern Europe

Problems and Methods

Problems of economic regions (and of economic regionalization) are a typical and common subject of interest and research carried on by economic geographers in the countries of Central-Eastern Europe.

It is perhaps interesting to know that those geographical researches on economic regionalization are generally based upon similar and even identical theoretical background which differs, however, from that generally applied in Western European countries or in the USA. The character and role which the economic region plays under the socialist planned economy, are — together with ideological reasons — the main source of those differences. This is so because the characteristic aim of those countries is to create a classless society by means of planned economy. Socialization of means of production involves handing of the management of productive enterprises over to the state and in the course of further progress in an increasing degree over to smaller territorial administrative units. In consequence basic administrative divisions become after a time administrative and economic divisions, and their economic role steadily increases. To fulfil functions and economic tasks set before the territorial administrative divisions requires, on the one hand, that they should be related to the existing regional structure of the country, and, on the other, to the processes of its improvement and modification. Present planning regions must be shaped also by taking into account regions planned for the further future.

Thus, in those countries which are building socialism, there is a vital need to learn about the present structure of national and regional spatial economy and to ascertain possibilities and suitability of social, economic and technical changes. Consequently the theme of economic regionalization, equally important both for the scientific knowledge of reality, and for practical needs of social and economic life — appeared in geographical research.

In 1957 the Czechoslovak geographers organized in Liblice their Second National Conference on Problems of Economic Regionalization to which they also invited representatives of other countries. An approved resolution of this conference called on the Institute of Geography of the Polish Academy of Sciences to create a centre of information

about studies carried on in various countries and to organize the next conference, this time on an international basis. This conference was held on 29 May — 1 June 1959 in Kazimierz Dolny [1].

All the reports, delivered or sent to it, can be divided into groups:

1. Reports on the scope of studies on economic regionalization carried out in the countries of Central-Eastern Europe.

2. Reports presenting examples of different methods used in research into the problems of regionalization.

3. Reports of a general character reviewing the present position and presenting programmes for future work.

Those materials give as a whole very interesting information about present state of opinions, studies and methods of research in the field of economic regionalization. Simultaneously they depict clearly the scope of interest and significance of those problems for socialist countries.

The problem of economic regionalization in the socialist ecoromy originated in the USSR, was undertaken in 1918 upon W. I. Lenin's initiative and developed later when work on the plan for the electrification of the Soviet Union (s.c. GOELRO-plan) was started in 1920. At the same time a separate committee directed by M. I. Kalinin began to work on the new administrative division of the State. The first project of main economic regions of the USSR was then prepared. Further studies, connected with some practical problems of economic planning, were worked out by the "GOSPLAN" and partly by the Academy of Sciences (specially in the Committee of Studies for the Development of Productive Forces).

The XX-th Congress of the Party during which a basic reform of the decentralization of economic organization of the Union was undertaken, intensified anew the interest and research of planning bodies, as well as of scientific institutions, in the problems or regionalization.

In other Central-Eastern European countries a broad interest for these problems developed after the Second World War in connection with organization of new administration and of economic planning.

All research and studies were carried on everywhere directly by the bodies concerned with economic planning as well as by scientific institutions, grouped mostly around academies of sciences. In all countries geographers were the main professional group dealing with economic regionalization.

The basic theoretical background upon which the above mentioned studies on regionalization were based is, in the first place, the recognition of the objective existence of economic regions. The term "economic

[1] The following scientists have taken part: from Bulgaria — Assistant Professor Ch. Marinow, from Czechoslovakia — Professor J. Korcak. Assistant Professor M. Blažek, and others, from German Democratic Republic — Assistant Professor G. Jacob and Dr. G. Schmidt-Renner, from Poland — Professors S. Leszczycki, M. Dobrowolska, K. Dziewoński, J. Kostrowicki, A. Wrzosek, and others, from Hungary—Professor A. Rado and others, from the USRR — Professors P. M. Ałampiew, A. K. Timaszew, N. Riazancew, and others; and as invited guests: Professor O. Tulippe (Belgium). Dr. S. Schneider (German Federal Republic), Professors Ch. D. Harris and H. L. Kostanick (USA). Moreover reports were sent by: Professor C. Stan (Roumania), Professor M. D. Popovic (Jougoslavia) and Dr. M. Laferrere (France).

region" signifies in those studies: a spatial socio-economic grouping which finds its lasting expression in the economy and investments of a given territory. Each economic region is a result of historical processes, born and changing in time, extending from past into future, and its development similarly to the whole socio-economic progress is due to quantitative and qualitative growth of productive forces.

There is no doubt that the evolution of economic regions is characterized by development of greater spatial units with stronger differentiation and closer internal ties of steadily growing economic significance. Geographers and economists of socialist countries share the common opinion that creation of economic regions is connected with and is an expression of the growth of territorial social division of labour. The geographers from the Soviet Union identify an economic region with the complex of territorial productive forces. The logical consequence of such an assumption would be to accept criteria of economic zones (or, to be more precise, of zones of the types of regional or local economy) as the basis for differentiation and delimitation of economic regions. In view, however, of the fact that the economic structure is always tied up, to a lesser or greater extent, to the administrative division, and that the organization and development of regional economy is, at the time being, the result of the decentralization of state (national) economy, the problem of nodal regions cannot be eliminated from the analysis. Those criteria are, however, quite different. As a result we are faced with a serious methodical problem of defining their mutual interdependence and hierarchy. The same problem occurs sometimes in a different shape, namely in a contradiction between criteria of specialization of regional production and of economic autarchy (balance of production and consupmtion) of the region. Various scientists, theoreticians and practical workers, attempted to solve those difficulties by different means. The existing differences in opinions can be even assumed as a basis for classification of several geographical schools and groups of thought in those countries. In spite of unanimous recognition of the basic elements of theoretical and methodical approach to the problems of regionalization, materials gathered and discussions held testify that there are also some problems omitted or discussed unsufficiently, as well as several preliminary or highly disputable statements of position.

So far as problems of interrelation between criteria of zonal and nodal structure or of specialization of production and autarchy of economy are concerned, a group of Polish geographers (K. Dziewoński, A. Wróbel) are of opinion that differences in existing types of economic regions and in the spatial economic structure of a given country are, in the first place, connected with the stage of socio-economic development, but also are related to the geographic environment, as well as to the historical way of socio-economic development of a given region. Thus in all studies on the present regional structure and in planning of future regional structure (regional division) of a given country it is necessary to include equally the problems of zonal and nodal structure and to determine their interrelation not upon *a priori* assumptions, but upon inductive reasoning. Thus the problem of typology of economic regions acquires a special significance.

Studies on forming and development of economic regions carried on presently can be classified according to the directly implied aims of research or applied methods of analysis.

Basing upon the criterion of aims it is possible to differentiate the following main types of present studies:

1. Analyses connected with the intended reform of the administrative and economical divisions; works of such a type were carried on in all Central-Eastern European countries.

2. Scientific research connected with the preparation of the regional plans which determine trends of the future development and economy of the country and its regions; works of such a type are fully developed in Czecho-Slovakia, Poland, Roumania and the USSR.

3. Current analyses carried on for the needs of operative economic planning; works of such a type were carried out in Bulgaria, Czecho-slovakia and the USSR, partly also in Poland.

4. Special studies aiming at the economic rehabilitation of under-developed areas or those with a less developed economy; very interesting studies on these problems were carried out in Czecho-Slovakia, also in Poland but only for small districts.

5. Purely scientific research on typology of regions and their historical genesis; works of such a type have been lately begun in Poland. Preliminary studies have dealt also with terms and their content.

The dominant element of analyses connected with changes of administrative division is, as a rule, localisation and accessibility to the main centre (thus the problem of regional nodal structure), although problems dealing with equalization of size (of the area or of the number of population, or both) of similar administrative units are also taken into consideration. In connection with the decentralisation of management a steadily increasing attention is paid to economic strength and balancing of regional income and expenses of a given district (administrative unit).

Scientific research carried out for the regional planning involves as a rule, preparation of complex analyses, and a tendency to use different methods simultaneously is therefore quite evident. Such studies often evolve into large regional monographies. The outstanding feature of latest analyses is the tendency to include economic or even econometric calculus based to a great extent upon global figures and universal economic indexes. This tendency is very typical for current analyses carried out for the operative current planning. A certain conflict, existing between economists and geographers, which is not so much of a scientific but rather of a professional character, is connected, on the one hand, with deficiencies in the economic theory which generally speaking does not include in its analyses spatial differentiation, and on the other with the unsufficient knowledge of this theory among the economic geographers.

In special studies aiming at economic rehabilitation of regions which often differ in size and significance, a slightly different method of regional analysis is developing. Rehabilitation of a region requires estimates of its reserves and ascertainment of its possibilities. Consequently the analyses and appraisal of basic characterstic features of geographical

environment of the region and of the forms of its present economic use play an important role in such studies.

Purely scientific research, i.e. theoretical studies dealing, among others, with the general typology of regions and with their historical genesis, is — as it appears now — of a great practical significance. Its development stipulates the improvement of all other types of studies and analyses, and is of a direct use for the economic planning. It also involves a tendency to introduce the comparative methods together with extensive economic analyses, based upon global data and statistical indexes, as well as upon economic calculus.

A new type of studies which are of great theoretical and practical significance for the analyses of economic regions and which deal with the international social division of labour, i.e. the economic specialization of various countries — has been initiated lately. Those are carried on for the sake of the Council of Economic Cooperation of which practically all above mentioned Central-Eastern European countries are members.

In our present remarks we have referred many times to the existence of different methods of studies and analyses. To provide a more systematic, although because of a rather limited space reserved for this report, only enumerative presentation, we have assigned those methods to the following main complexes:

1. Studies of the distribution of the main types of social economy, as defined by main global economic quantities, structure of production, services and consumption, as well as by forms of utilization of geogra-phical environment expressed, first of all, by the land utilization.
2. Studies of the territorial productive complexes.
3. Studies of the distribution, structure and zones of influence of settlements, complexes of settlements and of the settlement network (formation of nodal regions).
4. Analyses of the structure and character of boundaries and transit zones (borderlands).
5. Analyses of the dynamics of changes in time and space of specific regions, of their interrelations and hierarchy.
6. Analyses of the relations between the economic regions and the economic and administrative divisions, as well as between existing regions formed in the course of historical processes and postulated or planned regions.
7. Studies of the interregional relations, as expressed by the international or interregional social division of labour, economic cooperation and exchange (trade).

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Problems of Regional Structure of Poland

I. Theoretical background

The analysis of regional structure of Poland, carried on by the author in the Institute of Geography of the Polish Academy of Sciences, was based upon the assumption of the objective existence of economic regions. An economic region is — according to the author — a spatial grouping or a socio-economic complex, chiefly productive which develops in the course of time and finds its lasting expression in the character of development and land use of a given area. Consequently the economic region, its content and form, neither depend on the methodology and criteria applied for differentiation of regions by a given scientist, nor on the branch of science (economics, sociology, geography or history) which he represents.

This general definition of the economic region results directly from the fact that the existing economic regions differ in their content and form, in time and space. From the very nature of things the social and economic content, and first of all the nature of its economy (of production, services and consumption as well) characteristic in each case for the concrete stage of social and economic development, constitutes the main typological featurs of the economic regions. An additional typological element is provided by the form of economic region as expressed in the types of the development and use of land, the result of work carried on by the socio-economic grouping in its area.

To provide a complete typology is, however, a very difficult task because it happens very often in real life that a discord in time arise between the full development of the content of an economic region and the creation of a fully corresponding form. Consequently when the analysis is restricted only to the problems of regional forms, many serious mistakes cannot be avoided.

The relations between the economic regions and political and administrative regions or units are also difficult to deal with in practice. It is evident that — although the economic regions represent elements of social and geographical space, distinct and different from administrative units — the latter have a deep influence upon their beginnings, development and changes. This problem is specially evident in the socialist

countries in result of the socialization of means of production. It creates, on the one hand, the specific and distinctive character of the economic regions in these countries and, on the other hand, is the reason for the increased interest of those countries in the analyses of economic regions. Moreover, the fact that the basic data, especially statistical ones, concerning economic and social problems, are — as a rule — compiled for smaller or greater administrative units, makes it necessary to accept the administrative division as a starting point in the prevailing number of regional analyses. Thus, both from the point of view of the subject and of the method of research, a tendency develops to identify the administrative with the regional divisions. As a consequence, in research it is necessary to check constantly whether certain similarities of those two different in their natures divisions are real or casual or even imaginary.

There also exists another important factor which differentiates those two divisions and their typologies, namely a tendency, existing in all administrative divisions already introduced or proposed, to make of the same size all the units of the same rank, although in different divisions the criterion of that size (area, number of population, economic potential, etc.) may be different or combined. Economic regions however, expressing social and economic development, taking place in concrete geographical areas within the framework of specific geographical environments are — as a rule — strongly differentiated in their sizes. In consequence, all efforts to interpret the administrative divisions as a network of economic regions lead to the conclusions of extreme variability in the nature of regions which in turn is a fundamental obstacle to the establishment of an agreed typology of economic regions.

Turning to the problems of methods used in the analyses of regional divisions (regionalization), it may be stated that in practice there exist two different approaches. In the first one we look for the areas of uniformity in local economy (zonal regions), and in the second for the areas united by some internal ties (nodal regions). Those two approaches and criteria resulting from them are entirely different, and often contradictory. Without departing from reality, however, it is impossible to limit the geographical regional research to one of those approaches only, and it is always necessary to study from both points of view and to define their mutual position and relation. These may differ in various areas and in different periods (stages) of development; thus influencing the place of a region in the regional structure and hierarchy. This statement involves a wider assumption that contrary to the research carried on in special branches of economic geography (agricultural, industrial, settlement, etc.) studies of economic regions demand compound and complex methods of analysis.

To overcome all those typological and methodological difficulties the concept of the regional structure covering all economic regions of various sizes, character and theih interrelations, found in the given area, was introduced in the studies undertaken by the Section of Economic Regionalization in the Institute.

II. Zonal Regions of Poland

(Map No 1)

The zonal structure of the national economy (the territorial social division of labour) or the differentiation into various types of the regional and local economies, and their distribution is characterised in Poland by a wide fragmentation, result of historical conditions of development.

In fact, at present, there is only one really big region characterized by the dominance of industry, i.e. the region of Upper Silesia and Cracow. Remaining industrial areas form regions of rather small extention. They should better be called districts or even industrial centres.

The region of Upper Silesia and Cracow in its present form developed not earlier than by the end of the XIX century, i.e. in the period of the full development of capitalism. Since (and especially in the last years), it has spread quickly, and now is a large territorial unit which covers the greater part of three voivodeships; it is very densely populated (the average density, towns excluded, is from 100 to 300 persons per 1 km^2), and very strongly industrialized (25—40% of active population works in industry). It is, moreover, equipped with a transport network of great density (15 km or more of railways per 100 km^2 over 100 km of roads per 100 km^2.), and characterized by a considerably advanced disappearance of the division between agriculture and nonagricultural population and of boundaries between urban and rural settlement, as well as by a strongly developed internal functional spatial structure. It may be divided into:

a) the territory of the Central Coal Basin, completely urbanized, now in the full stage of a passive, and partly even of an active deglomeration,

b) the territories of other coal basins, both existing and potential, constituting reserve deglomeration areas for necessary urban settlements, secondary and tertiary industries and additional transport facilities,

c) the outskirt territories supplying the central areas with water, "podsadzka" sands (sands used for filling in the worked out seams of coal) and agricultural food products,

and d) several big industrial and urban centres, constituting proper places for the location of resource oriented industrial plants, not admitted for economic, social or technical reasons to the areas of valuable mineral deposits.

The boundaries of the region can be defined upon the basis of either the high index of non-agricultural population (more than 40%), or of the extent of commutation to work or of the increased number of worker-peasant families. In spite of the concentration around the black coal seams, its ties with the natural (physico-geographical) regions and its dependance on the geographical environment, are entirely indirect.

Processes of anthropic deformation of nature are, however, especially in the central part, well advanced. As far as its dynamic growth is concerned, the region seems to have achieved its maximum possibilities of territorial expansion. In future it will develop probably only by intensifying the economy of areas already included within the region (especially of underdeveloped enclaves).

Among districts of dominant industrial economy which do not extend over the territories of more than several counties, and which are deve-

loped in connection with extraction of some mineral resources (mining districts), or on a basis of some specialized branches of production (districts of wool or cotton industries) or on a basis of cooperation among establishments of various industries (centres of shipbuilding or other machine industries) — the district of Łódź should be mentioned in the first place. It is an example of a region, formed rather early, which reached the peak of its development before the First World War. Afterwards in the period between the two wars its industrial growth was impeded and the region itself was affected by a far going economic recession. It is characterised by a strong contrast and opposition between the country and the town, by a big vertical and horizontal concentration of industry and agglomeration of workers in towns, by the underdevelopment of services in the main centre, (characteristically the "City" is entirely missing) and in consequence by the lack of developed suburban zone. Its character and life has been changing again in the last decade, but as yet its traditional features have not been completely effaced.

The Sudeten District is also worth mentioning. It includes several, rather independent complexes (such as: coal mining in and around Wałbrzych, textile industry around Dzierżoniów, machine and chemical industries in Jelenia Góra, etc.) and has a typical structure of an old industrial region of dispersed industries and settlements.

A special problem for analysis was created by new districts and industrial centres which are built in part on a basis of freshly discovered deposits of important mineral resources and in accordance with economic plans. Their future extent and role have not yet been clearly defined and they constitute typical economic regions "in statu nascendi".

The regions of a dominant agricultural economy are in Poland both underdeveloped and greatly subdivided. This is the result of the political and economic partitions (the division of the Polish state territory among three agressive powers, and several revolutionary changes of the state boundaries both in the XIX and XX Centuries), which also led to the differentiation in the growth of commercial production in agriculture and in its economic structure (ownership and size of agricultural farms and homesteads). It was also caused by the lack (mountainous regions excluded) of sudden transitions and strong contrasts in the geographical environment and of the well established and defined natural, regional boundaries. Agricultural regions defined according to the differences in the development of commercial production, are, at the present moment, of a transitory character, as well as regions of the specialized production, although the latter, partly bound up with the conditions in the geographical environment, are of a more durable character.

Two important economic regions: coastal and metropolitan (Warsaw) are of a quite different and more complex character.

The Coastal Region (historic Pomerania), situated along the Baltic shore extends over 80—100 km. towards the interior (this region can be also defined as covering approximately the territory of the three coastal voivodeships). With the exception of big ports this region is not highly industrialized. It has, however, a rather different geographical environment with economic functions clearly outlined in relation to the whole country. In the course of further development specific elements of its

economy are likely to be increased. Its area is also functionally differentiated into:

a) districts of the main sea ports of Vistula (Gdańsk and Gdynia) and Odra (Szczecin) estuaries,

b) coastal zone with its small ports, fishing industry, tourism and (with the exception of coastal dunes) rather intensively developed agriculture,

c) lake districts with an extensive agriculture and forestry, and finally,

d) areas along the lower reaches of the main Polish rivers: Vistula and Odra, characterized by well-developed transport facilities, greater industrialization and intensive agriculture.

The Warsaw Region is a typical metropolitan region which arose in the course of the last few decades round the capital with its 1,000,000 inhabitants. Its inner spatial structure includes all classical elements of its type: "City", central districts, peripheral districts, suburban industrial area with its numerous satellite settlements and suburban zone of an intensive and highly specialized agricultural production. This region, a typical metropolitan area, is, however quite exceptional, as here the features of both a zonal and a nodal region partly coincide, i.e. we are faced here with the integration of regional structure.

From the geographical point of view it is quite interesting to observe that the mountains, an outstanding natural region, in the economic division do not play a role which would justify their classification as a separate region of a higher rank. This is clearly visible on the example of the biggest territorial unit in Poland, the West Carpathian Mountains. The differences in the type and intensity of the economy of their separate parts are so great that their area is split at least into two (if not three) parts which belong to completely different zonal regions.

III. Nodal regions of Poland
(Maps No 2 and 3)

In result of the typical for socialist countries direct connection between the local and regional economies and the activities of local authorities (local councils), due to the socialization of means of production, the structure of nodal regions in Polnad, although not identical, is largely based upon the fourfold system of social, economic and administrative organisation with its metropolitan, voivodeship, county (powiat) and parish (gromada) centres. The differences consist in the existence and development of urban centres, characterized by intermediary functions: submetropolitan (provincial), subregional and subdistrict, as well as of corresponding types of nodal regions.

In relation to Warsaw, as the capital, several towns: Cracow, Wrocław, Poznań and also Lublin, lately emerging as a large provincial capital, play the role of submetropolitan centres with numerous functions. This can be proved e.g. by the analysis of social origin of students from academical schools, or by other research. Their role is above all cultural and social. From the economic point of view they fulfil almost exclusi-

vely the functions of voivodeship centres, or of some greater but regional industrial agglomerations. Big industrial towns (Łódź, Katowice) if they fulfil some metropolitan function, they do it rather on a national although limited scale. In result their nodal regions are not clearly

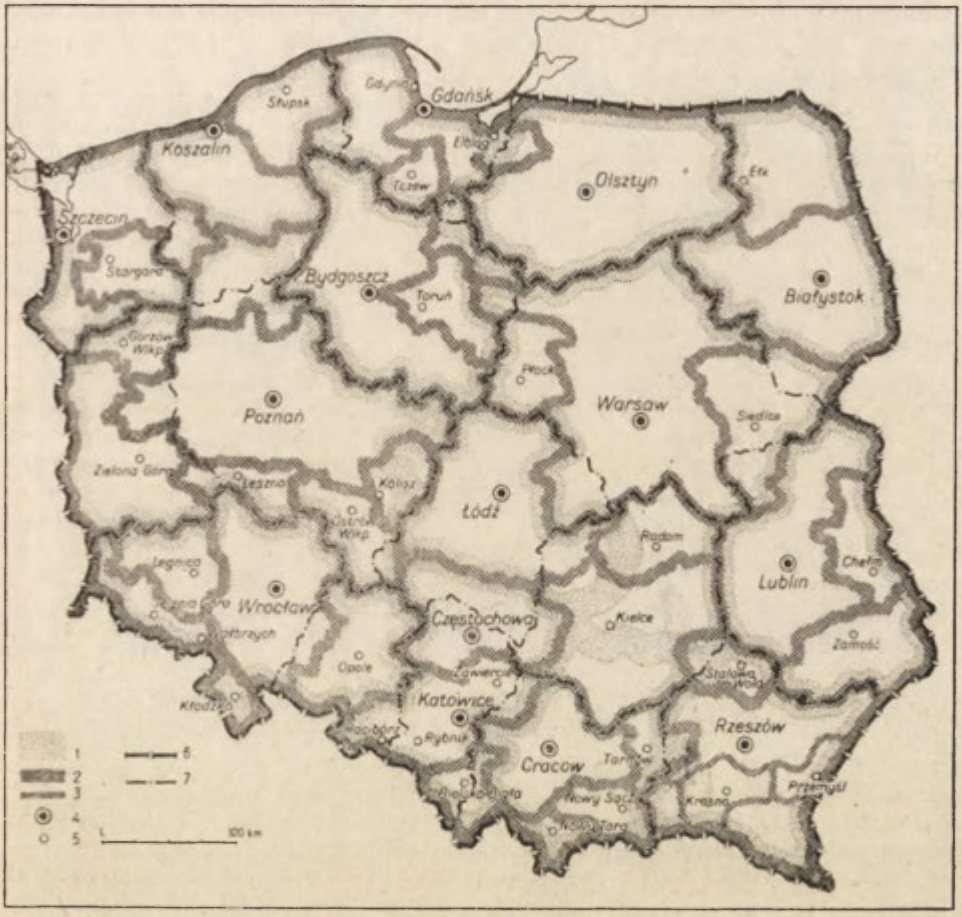
Map 2. Spheres of influence of major urban centre (as established on basis of the homes of the students at the universities and colleges): *1* — main educational centres, *2* — local educational centres, *3* — areas of dominance, *4* — areas of relative dominance, *5* — areas of balanced influences, *6* — supplementary areas of influences

This map is based on percentage of students living in the given county and studying in the given centre. Picture is somewhat simplified.

separated as distinctive spatial units. The same happens with the hinterlands of the sea ports Gdańsk, Gdynia and Szczecin which because of a clearly developed specialization of each port do not form distinct economic regions.

The analysis of passenger traffic (after eliminating commutation to

work), corried out by A. W r ó b e l, shows that services in trade and administration, as well as in the cultural field, of those voivodeship towns which are centres of the second rank of importance. are not standardized and often do not correspond with the administrative boundaries. The economic role of voivodeship town is, however, generally defined quite uniformly (incidentally those towns possesed the highest



Map 3. Spheres of influence of major towns according to A. W r ó b e l (as established on basis of passenger traffic, commuting excluded): *1* — spheres of influence for towns of the first order, *2* and *3* — spheres of influence for towns of the second order, *4* — towns of the first order, *5* — towns of the second order, *6* — state boundaries, *7* — boundaries of the voivodeships

index of growth in the last fifteen years), and in result of the institutional factors their spheres of influence are practically identical with the territory of the corresponding administrative units (voivodeships).

The analysis of regional structures of Warsaw voivodeship, carried out by A. W r ó b e l, established very distinctly the character, role and

extent of the influences of centres supplementing, or competing with the main centre of the voivodeship. They are usually based upon some concrete historical traditions, and in case of a very strong economic development the area under their influence may even achieve the rank of a separate nodal region on the voivodeship scale. This may lead in turn to the creation of a new unit, namely of the separate administrative region. It seems that Częstochowa (within the boundaries of the industrial region of Upper Silesia and Cracow), Kalisz and in a near future Tarnow, are at present growing up to the status of capitals of such administrative regions.

The detailed research carried out in the Institute of Geography into the structure of the settlement network and the spheres of influences of the local centres revealed the existence of the centres supplementing or competing with the county (powiat) towns. In Eastern territories in cases where such local urban centres are missing their functions are taken over by bigger villages. In the country as a whole the influence of a county town spreads in most cases, mainly for institutional reasons, over the administrative territory of the whole county.

Many towns, because of their industrial or other enterprises fulfil some special single functions for their neighbourhood. These however, only seldom develop into fully fledged, separate economic regions.

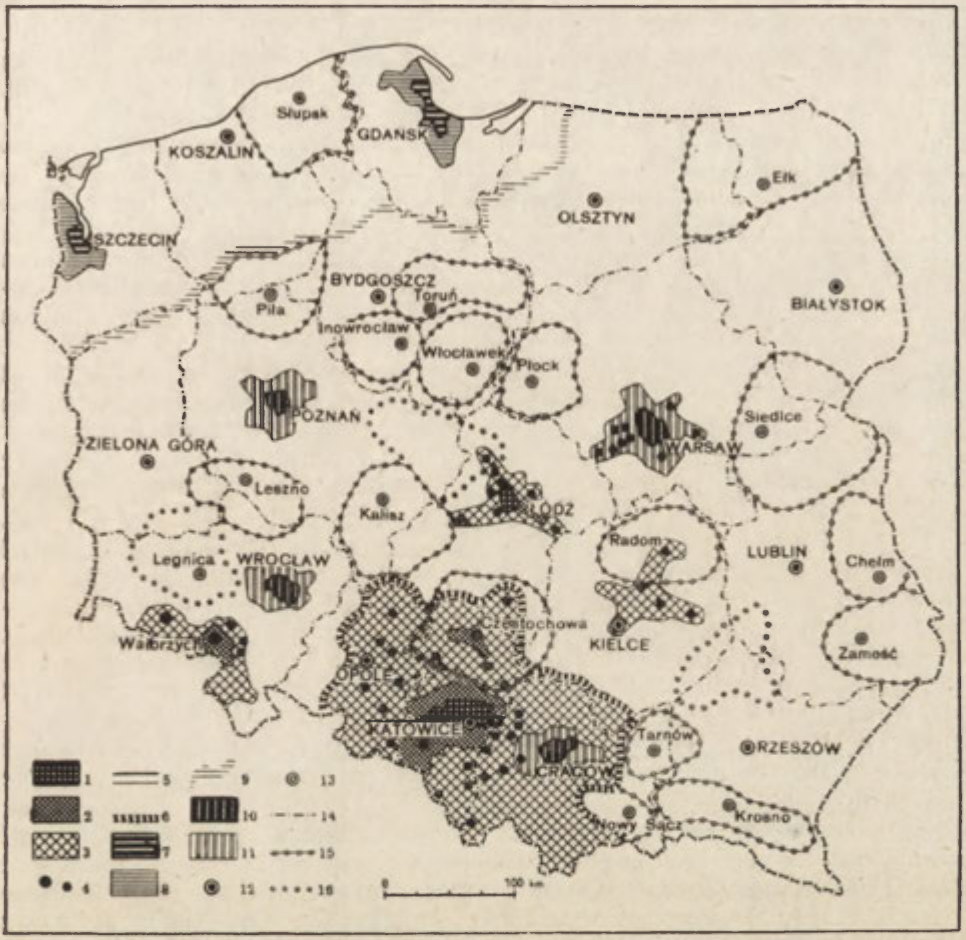
The structure of nodal regions in the smallest scale of separate complexes of villages, hamlets and individual farms so far has not been studied enough. In any case in result of historical changes, they are extremely differentiated, and at this moment on the verge of fundamental alterations, conditioned on the one hand by the process of socialization of agricultural production, and on the other by the steadily increasing scope of new houses constructed by rural populations from their own means (specially as their incomes from the work outside agriculture are continuously growing).

IV. The general view of the regional structure of Poland and of its dynamics of development

(Map No 4)

Passing now to the confrontation of zonal structure of the national economy (and regional economies) with the structure of nodal regions — we ought to begin with the statement that the administrative and economic division into voivodeships and counties must be acknowledged — for institutional reasons — as the main element of this structure. Generally speaking the present administrative division of the country conforms to the social and economic reality, i.e. the boundaries of voivodeship do not divide — as a rule — the more important existing economic regions of the appropriate rank in such a way as to impede their development. This last statement is, however, not applicable to new units developed on the basis of the planned big investments and especially those connected with proposed industrialization of the country. Such units are often situated on the borders of two or more voivodeships. The following new basins; Kujawy (lignite), Sandomierz (sulphur) and Legnica—Głogów (copper) may serve as examples.

The voivodeship regions are generally nodal regions. On a bigger scale than a voivodeship it is now possible to prove the existence of two regions only, with dominant zonal problems. namely: the region of Upper



Map 4. Main regional structure of Poland: *1* — areas of industrial conurbations (with concentrated settlement), *2* — areas of mining conurbations (with dispersed settlements), *3* — areas strongly industrialized and /or main commuting areas, *4* — industrial centres (within industrial districts only), *5* — boundaries of industrial districts, *6* — boundaries of the industrial region of Upper Silesia and Cracow, *7* — areas of the main seaports, *8* — suburban zones of the main seaports, *9* — boundaries of the maritime region, *10* — areas of the main urban centres (over 350 thousands of inhabitants), *11* — suburban zones of the main urban centres. *12* — urban centres of voivodeships, *13* — urban centres of districts smaller than voivodeships but larger than single counties, *14* — administrative boundaries of voivodeships, *15* — boundaries of districts smaller than voivodeships, *16* — boundaries of districts in the process of development

Silesia and Cracow and the Coastal Region. Each of them spreads over three voivodeships (the first over the voivodeships of Katowice, Cracow and Opole, the second over the voivodeships of Gdynia, Koszalin and

Szczecin). The boundaries of those big regions do not correspond, however, with the boundaries of voivodeships. It is difficult to include such territories as e.g. the whole valley of the Middle and Lower Dunajec River, i.e. the districts of Tarnow nad Nowy Sącz, into the region of Upper Silesia and Cracow, or western counties of Opole voivodeship (districts of Nysa and Brzeg); similarly some Southern counties of the voivodeship of Koszalin should not be included into the Coastal Region but several Western counties of the Olsztyn voivodeship do belong to it. In this connection it is worth while drawing the reader's attention to a very interesting fact that the territorial units, situated accross or on the borders of regional divisions of a higher rank (perhaps just because of this fact) develop as small but highly individual regions with their own social and economic problems. The Opole region (situated within a big industrial region, but at the same time directly influenced by Wrocław, a big cultural and service centre), the Kielce region (situated on the borders of influences of such big economic and cultural centres as Warsaw, Cracow and Upper Silesia) and the Olsztyn region (situated on the borders of the coastal region, and at the same time influenced by and tied to the metropolitan region of Warsaw) — may serve as examples. The Częstochowa region, however, is of a quite different character because it is developing on a basis of its highly specialized production within a greater unit, namely the region of Upper Silesia and Cracow.

From the point of view of the dynamics of the development and of perspective plans there appears a possibility of unification of some voivodeships, e.g. the Kielce, Lublin and Rzeszów voivodeships, or Bydgoszcz, Łódź and Poznań voivodeships, into bigger regional units. It depends, however, upon the rate of growth and on the extent of penetration of influences of the newly created mining and industrial districts, and — in relation to other territories of those voivodeships — upon their role in the whole economy of the bigger region. These factors have not up to the present been satisfactorily analyzed and their role clarified.

All other divisions proposed by geographers and especially all endeavours to divide Poland into a certain number, defined in advance (5—7) of big regions (Secomski 1955, Dziewoński 1957, Timasheff 1953, Berezowski 1959, Rychłowski 1959, Ilinicz 1959, Janiszewski 1959) differ among themselves to a lesser or greater extent, and in my opinion as based upon subjective criteria are open to discussion.

Coming down the scale i.e. beneath the voivodeship level, we are faced, especially in more industrialized and urbanized areas, and in areas with a more intensive agricultural production, with the regional units of a zonal character, generally greater than counties. Similar, although smaller structures, can be found beneath the county level in the form of complexes of several parishes with a uniform type of economy.

Whereas the areas of biggest units are seldom confined within the regional division of the geographic environment, in minor units and especially those in which agriculture plays economically and socially a dominant role, the relation between the economic and regional structure and the natural (physicogeographical) structure is very important.

Coming now to the general and final statement which takes into account the dynamic and historical character of phenomena discussed, it can be stated that Poland is a country with a transitory regional structure. A great typological differentiation of economic regions occurs within its boundaries. In the East we are faced with a system of small agricultural regions, based upon local markets which constitute a typical for the feudal period, form of regions transformed later on in its own peculiar way, and in the West with bigger and more strongly developed regions of agricultural commercial production. We are faced too with smaller districts of dispersed industries, partly of home industries, and of handicrafts which developed already in the Middle Ages, with an industrial region formed at the beginning of capitalism, developed in its monopolistic stage, and finally checked in its further evolution and on the other hand with a big, strongly developed, mining and industrial region and with a metropolitan region with highly differentiated spatial structure formed in the period of imperialistic capitalism. All those forms are at present undergoing far-reaching changes under the influence of socialist planned economy. The antagonistic contradictions, characteristic for the capitalist economy, being eliminated, the process of development is accelerated, and newer, bigger, more complex and developed forms of regional structure are being developed. The advancing process of social and economic integration not only removes the biggest disproportions in its progress, but also enriches the regional structure of the land.

V. Final conclusions

As far as the methodology of studies of economic regions is concerned, the following provisory statement seems to be of significance:

1. In the regional structure of Poland small elements and regional units show a greater stability than their interrelations and than the greater regional structures which appear to be much more changeable than was accepted up to the present time, both in theoretical and in practical (applied) research. This statement facilitates the definition and order of problems which ought to be analyzed within the study of regional structure. The final element of analysis ought to be the evaluation of the achieved degree of integration of economic spatial elements in the given area (country).

2. In the course of studies of the regional structure it is necessary to define the historic genesis of separate units and to analyse the processes of their adjustment to the present stage of social and economic development.

3. The study of changes in the regional structure makes it possible to establish a general appreciation of the level of the development of the national economy in its spatial elements and from this point of view it is of a great practical value, especially for the countries of planned economy.

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Study of Economic Regional Structure
(on the example of the Warsaw voivodeship)

The aim of this report is to present the problems of the regional economic structure of the voivodeship of Warsaw as an example of application of underlying methodological principles.

The term "economic regional structure" instead of "division of the area into economic regions" has been introduced as a result of the multiplicity of meanings of the concept of an economic region.

This multiplicity of meanings and the accompanying terminological confusion stem from two main sources, both of which lay beyond purely terminological issues, but are inherent in the very nature of phenomena to which the concept has been applied.

The first one may be well presented by analyzing the two different ways of approach to the definition of the concept of region, which are characteristic for the modern Western and in particular for the American geography.

The prevailing opinion in contemporary American literature is that the concept of region as an objectively existing entity should be rejected; accordingly, the concept should be used only as an analytical device for selecting and studying of the complex phenomena found on earth-surface. This kind of approach is clearly evident in the following definition of D. Whittlesey: "the region... is an area in which the accordant areal relations produce some form of cohesion" [1].

We may call this an example of a formal definition, because "region" in this sense has an empirical content, which depends in every case on the particular problem studied, but expresses only a specific kind of mutual relationship among various elements of earth-surface [2]. According to this kind of definition of the region, the term „economic region" denotes simply an infinite variety of types of "regions" constructed by means of any economic criteria.

However, besides the strong suspicion of the author that Whittlesey's presentation of the system of nodal regions of various orders virtually implies the existence in actual reality of a system of regions

[1] *American Geography — Inventory and Prospect.* Syracuse 1954, p. 30.

[2] As a type of definition this formulated by Whittlesey is only a much more refined version of the often quoted definition given by a XIX centry Russian geographer Fortunatov: "region is an area that differs from other areas according to any criterion".

defined by concretely empirical content, it may be stated as a matter of fact that in the Western literature the concept of objectively existing economic region has existed for several decades — and it is used now, even if under different names.

The concept of economic region in this sense evolved from the observation of transformations occuring in the areal patterns of the total economic life under the conditions of advancing capitalist economy. Two fundamental aspects of this process of changes are: a) a progressing specialization of production within the individual areas and a tendency to concentrate population and production in certain areas, and b) the intensification, within and around these areas, of economic and social interconnections. In the analyses of this process one of these two aspects has been particularly accentuated. For a long time, the analysis of specialization of areas has been the object of research by economists, statisticians and geographers; as a scientific concept aiming at determining the laws of development of this process, this analysis has, for the first time, found its expression in the well known work of Lenin[3]. However, the main trend of development of the concept of economic region exposed the problem of interconnections of human activities, especially in the domain of production (territorial division of labour) and significance of regional focal places (nodality). Two important lines of thought may be here particularly mentioned: 1) the concept of metropolitan region as conceived by the Chicago school of sociology (Gras, MacKenzie, Bogue), 2) the theoretical concept of systems of regions based on the theory of central place (Christaller, Loesch).

Recently, we may observe the tendency to dismiss the term, but not the concept of economic region, especially in attempts to formulate a more general theory of economic regionalization (e.g. Philbrick's "areal functional organization" [4]).

There is, of course, some reason for the search of more adequate statements of position than defining an objectively existing economic region only by a number of its characteristics.

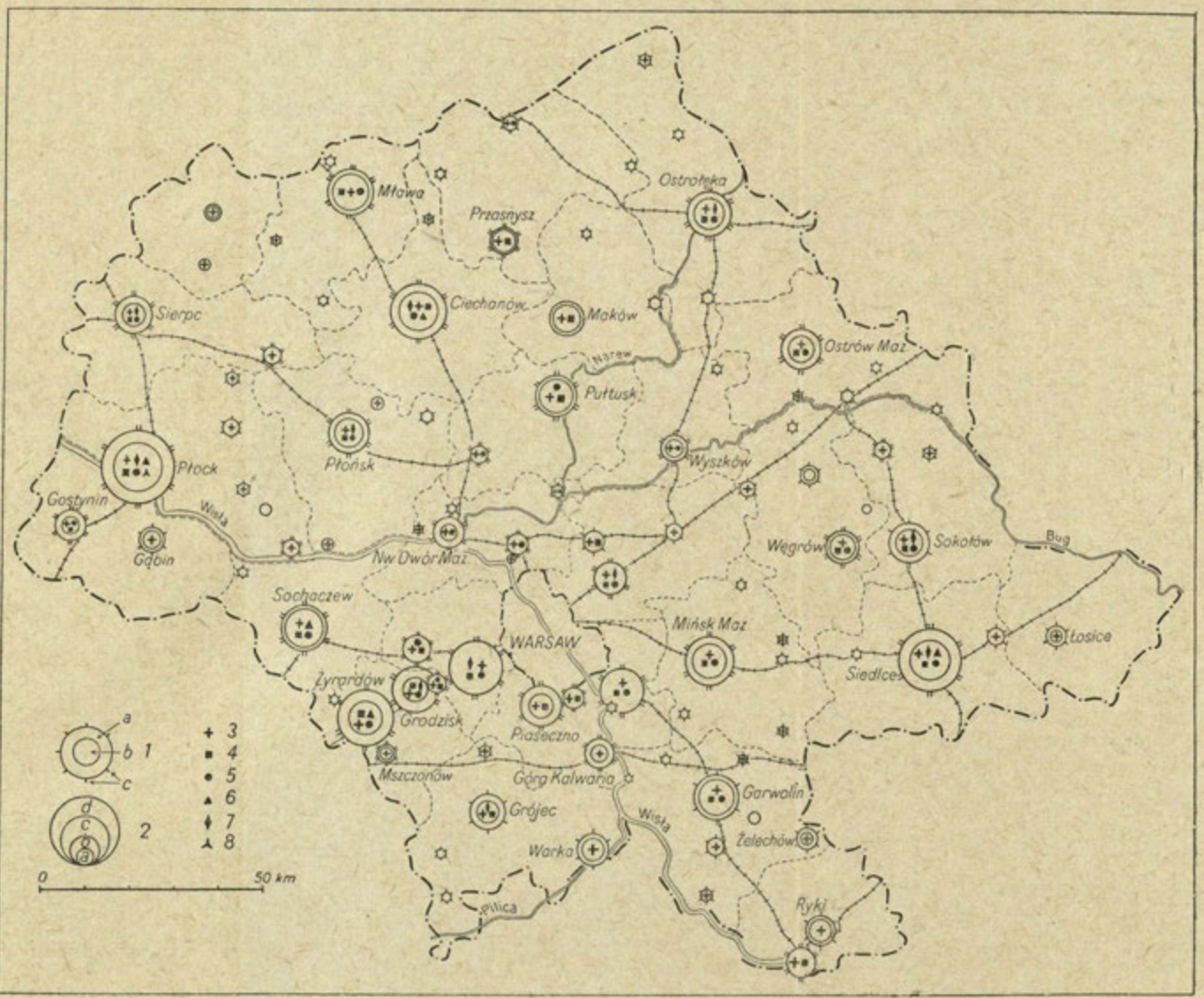
Let us examine such "material" definition of economic region as given by Dickinson (it is a fair example of usage of the term by many economic geographers):

"(An economic region) is an area of interrelatated activities and kindred interest and organization. It is an entity of human space relationships, which are affected through the medium of route pattern and the urban centres. Such a region therefore embraces the complex and closely woven fabric of intercourse by which are effeceted the transfer of goods, and the distribution of services, news, and ideas... (Its) unity is due to a set of conditions: first, the predominance of a group of activities... that are the same or complementary and interdependent..., second, the dominance of both movements and activities by one or more great cities...; third, by common bonds of historical development... [5].

[3] *The development of Capitalism in Russia* (in Russ), St. Petersburg 1898.

[4] *Principles of Areal Functional Organization in Regional Human Geography.* "Economic Geography", 33 (1957), pp. 299—336.

[5] *The Regions of Germany.* London 1945, p. 23.



Map 1. Commerce 1956: *1* — commercial centres: *a* — annual value of retail turnover in industrial goods, *b* — annual value of retail turnover in industrial goods, *b* — annualover estimated needs of local urban population, *c* — number of market-days in the week; *2* — scale of circles *1a* and *1b*: *a* — 5 mill. zlotys, *b* — 10 mill. zlotys, *c* — 50 mill. zlotys, *d* — 100 mill. zlotys; *3* — drug stores; *4* — bookshops; *5* — shops selling furniture; *6* — shops selling optical and other goods; *7* — shops selling electric goods; *8* — jewellers

This kind of approach, by linking the concept of economic region with the concept of market and that of a productive complex, as well as pointing out the dynamic character of such areal unit, suggested wide perspectives for research; however, it also implied new and considerable theoretical difficulties. Particular attention must be called here to the essential fact that such a concept of economic region has been, in principle, based on the analysis of the so-called "metropolitan regions" (thus, regions of defined, high order) found in countries economically highly developed. It is indeed such a metropolitan region which represents a fully developed economic region possessing all the attributes enumerated in the above quoted definition. The universal application of this definition led to a number of difficulties which undermined the significance of this concept as an objective basis for regional economico-geographical studies.

These difficulties are connected with (most generally speaking) double meaning of such a concept of economic region: a) its economic productive content covered by the concept of a territorial productive complex, b) the territorial organization of the life of the inhabitants of the area and of the servicing of their needs. The latter refers to the hierarchically developed system of service centres and of travel to work (which by the way, may also be taken into consideration as a kind of productive link), the former — to the interconnections between productive units which do not necessarily form a system corresponding to the system of central places [6].

The development of industry during the period of developing capitalism which led to the collapse of the relatively well balanced regional organization of the feudal era, disrupted the connection between both of these and the regional structure. As a consequence not only of the spontaneous development of capitalist economy and concrete historical facts, but also of the marked differentiation in economic and technical condition of marketing of various goods, and — last but not least — of differentiation of natural environment in actual present day conditions we do not often encounter instances of full correspondence of these various aspects of economic regionalization which would permit us to call an area unequivocally an economic region and in particular it is an exceptional instance where this coincidence would apply to the entire hierarchical system of regions of different rank.

It seems to be indeed the fate of every "material" definition of economic region that — however carefully formulated — it does not enable us to establish complete division of a country into economic regions just because of overlapping in actual reality of various areal patterns treated by such definition as correspondent.

That is why we propose not to eliminate from economic geography the concept of an economic region as an objectively existing entity, but introduce as a related more general and elastic concept of "economic regional structure", which will allow both for discordance of these two kinds of interconnections, and — in each of its component elements, but

[6] To be more exact we may of course reformulate the above statement by referring to Christaller's distinction of dispersed and regional goods.

also for taking into account the differentiations of uniform areas distinguished on the basis of kind and degree of economic development and conceived as a background of the evolution of systems of interconnections.

The second basic problem underlying the present terminological confusion in discussion about economic regions, particularly vital in reference to economic regions in planned socialist economies, is the role of institutional factors. The importance of this problem may be well seen by analizing the Soviet concept of an economic region, that evolved in the early after-revolutionary period as a necessary planning device for handling the administration and development of centralized socialist economy. This concept of economic region has been expressed in the now "classical" and videly quoted definition of the Commission of the All-Union Executive Committee working under chairmanship of M. Kalinin.

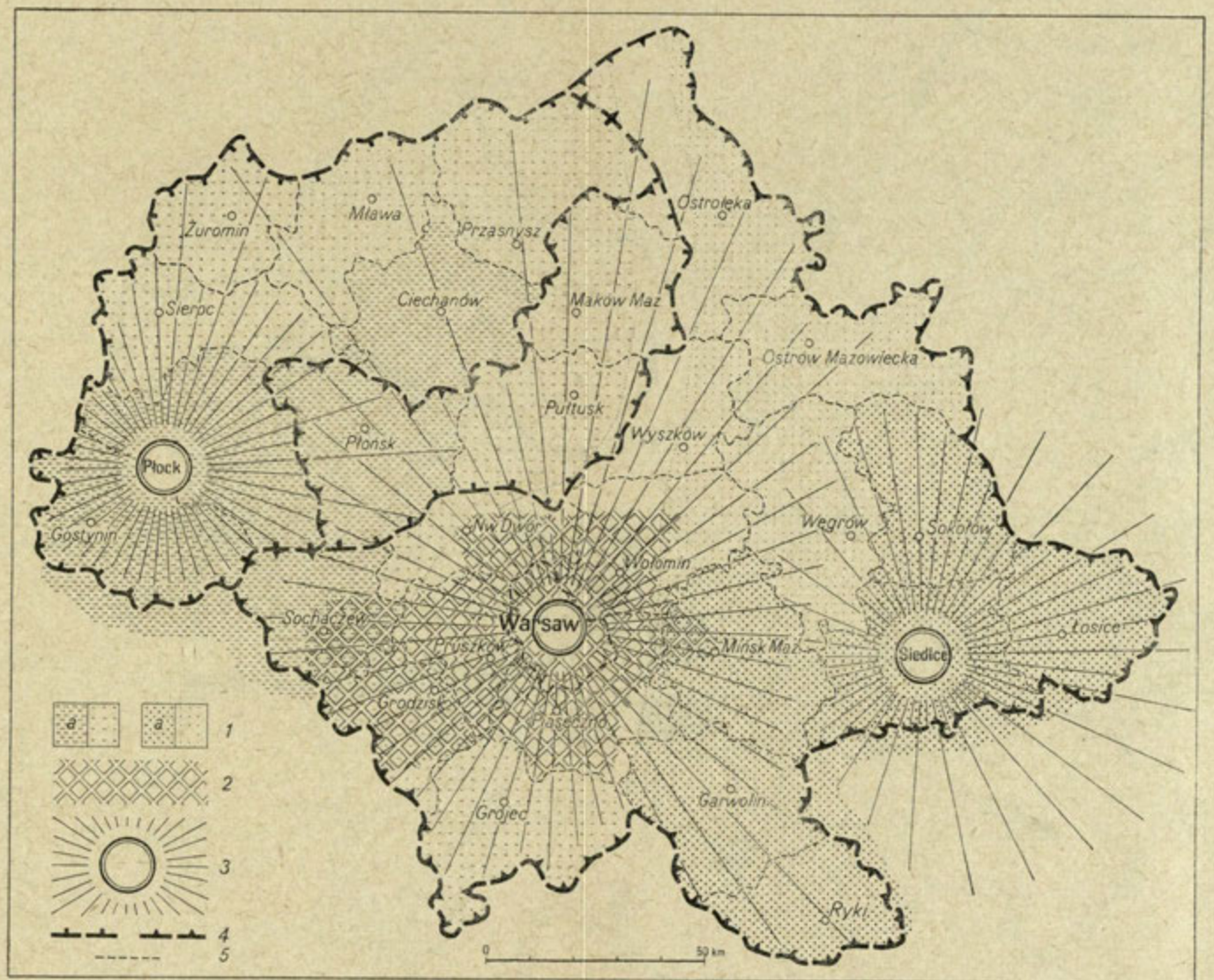
"As an economic region should be distinguished a specific, as far as possible economically complete area which, owing to the combination of natural features, cultural accumulations of the past as well as population with its productive abilities, would constitute a well defined unit of national economy".

The practical character of this concept is here evident in the way of defining the aim of the economic regionalization not as the scientific description, but as the establishment of the economic control and management. This planning concept of economic region has been later introduced into Soviet economic geography as its basic theoretical concept.

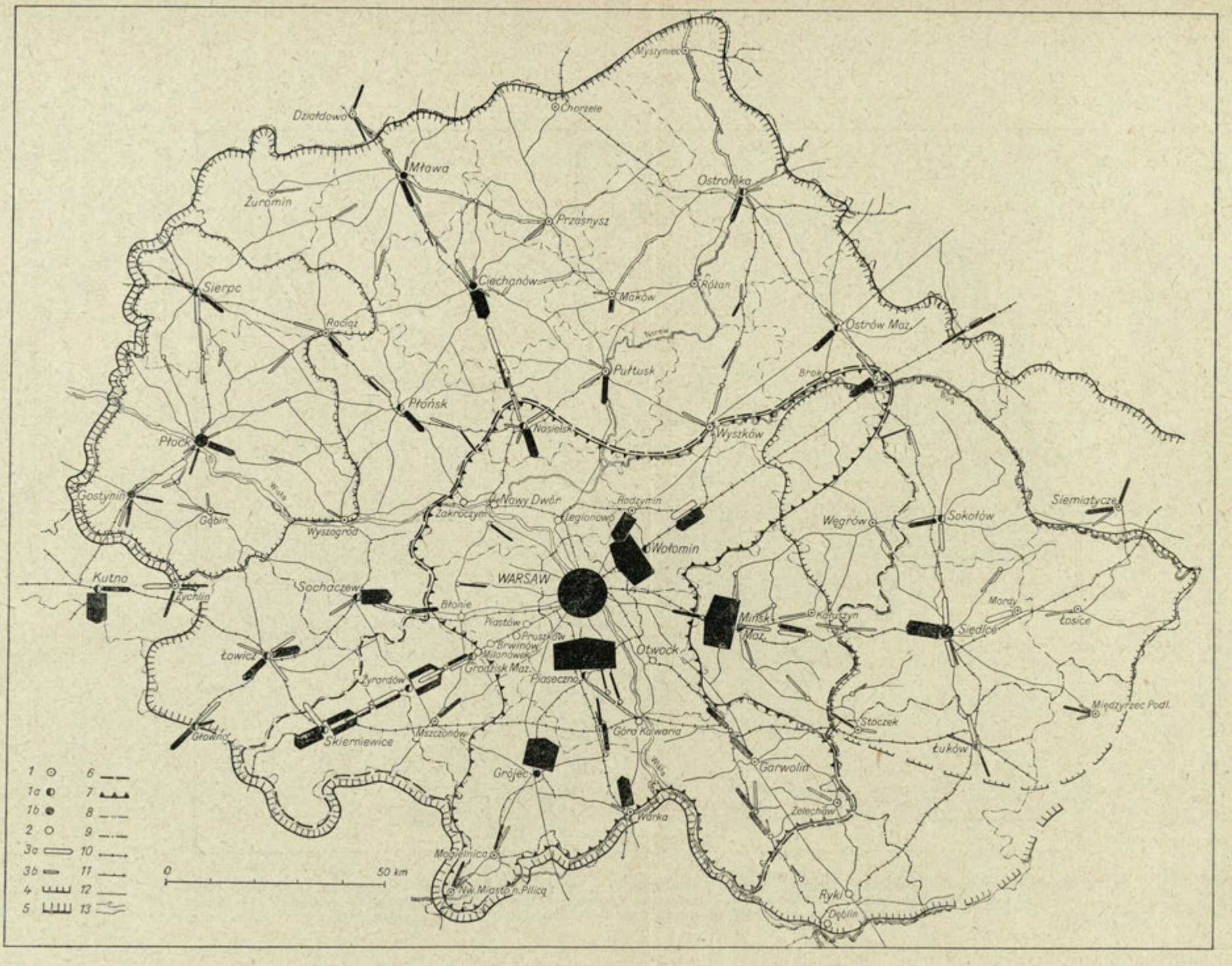
However some difficulties arise as to the meaning of the "objective existence of economic region" another definition generally supported by Soviet geographers.

The nature of these difficulties is the following: if we assume -- as the Soviet geographers usually do — that an economic region is necessarily an area of economic planning (i.e. if this feature is included implicitly or explicitly in the definition of economic region) and at the same time, maintain that an area of the country is actually divided into economic regions conceived as objectively existing entities, then there arises a strong, and natural, tendency to identify economic regions with regions of economic planning and administration in which case the problem of differentiating economic regions cease to exist as a problem of economic geography.

On the other hand, however, if we define economic region purely in terms of distributions and flows — subject without doubt to be studied and mapped by economic geographers — the fact remains that these distributions and flows in the conditions of planned economy are strongly influenced and sometimes even directly determined by the institutional factor of existing administrative division. Therefore it is indeed improbable that even so defined economic regions will cross-cut the boundaries of administrative regions (although there is a possibility of the existence of economic regions of "intermediate order" as compared with the hierarchy of administrative regions). Some discordances of areal patterns of various elements of so defined economic region and of the pattern of administrative divisions may be rather expected in many cases. In such



Map 3. Voivodeship of Warsaw. Regional economic structure: *1* — zones of agricultural development and their cores (*a*), *2* — areas (industrial region of Warsaw), *3* — secondary regional centres and their spheres of influence, *4* — limits of territorial complexes of production, *5* — boundaries of poviats (counties)



Map 2. Nodal regions of average daily passenger traffic (commuting excluded): *1* — places covered in research, particularly places considered to be end points of traffic: *1a* — by rail, *1b* — by rail and bus services; *2* — places bypassed in research; *3* — arrows denote intensity and direction of traffic (black arrows denote traffic to urban centres of the voivodeship): *3a* — 1 mm — 2700 journeys, *3b* — 1 mm — 1350; *4* — limits of traffic for secondary regions; *5* — limits of traffic for primary regions; *6* — limits of particularly dense passenger traffic to Warsaw (over one journey per inhabitant daily); *7* — limits of direct influence of Warsaw; *8* — boundaries of powiats (counties); *9* — boundaries of voivodeship; *10* — railroads (normal gauge); *11* — railoroads (narrow gauge); *12* — roads with bus services; *13* — main rivers

a case the really significant problem of economico-geographical study would be to analyse the economic regional structure of the area (instead of "to divide the area into economic regions"). This means, obviously, that not all regions of administration and planning are objectively existing economic regions as defined by economic geography.

The present boundaries of the Warsaw voivodeship coincide largely with these of ancient province of Mazowsze. Originally its economic unity and internal structure were formed mainly by physical factors (especially centripetal river network). Since these physical factors declined later on in importance, the basic economic conditions for the development of the regional unit corresponding to the Warsaw voivodeship evolved at the end of the XIX-th century and gained full importance during the years between the two world wars. They were, on the one hand

1) the powerful development of Warsaw, including its suburban area and its industrial district,

2) the establishment of the concentric system of railroad, and on the other hand:

3) the growth, on the periphery of the area, of new regional units (Łódź, Włocławek).

The analysis of the present economic regional structure has been divided into two parts:

1) the Warsaw voivodeship as an area of production,

2) the regional links of non-productive character.

From the analysis of the problem of production it may be concluded:

1. In the area of the voivodeship two principal zones of agricultural development differing considerably as to the type and volume of agricultural production, as well as to the degree of development of agricultural industries — are quite evident.

2. The Warsaw industrial district contains the only important agglomeration of industries other than those transforming the agricultural products; this district shows the features of a typical industrial complex developed not on the basis of the local raw materials, but on the basis of the facilities offered by an already existing large city (profiting i.a. by economies of common location and local market).

3. In the domain of industry based on the agricultural products which is the dominant branch of economic activity of the remaining part of the area, two regions connected by the flow of raw materials may be observed.

To establish other connections beyond those of industrial importance the author undertook, i.a., the following investigations:

1. A study aiming at the classification of central places on basis of:

a) the functional analysis of occupational structure in urban settlements,

b) the analysis of the volume of retail sales of industrial goods at various localities (map No. 1),

2. A study of the areas of services rendered by the various centers by means of:

a) the investigation of the passenger traffic (map No. 2),

b) the analysis of the spheres of influence of the centers of secondary education,

c) in reference to Warsaw — the analysis of travel to work.

As a result of all these investigations it became evident that three service centers of second rank: Warsaw, Płock, and Siedlce, each with its corresponding service region, could be distinguished within the voivodeship; this system does not fully correspond to the regionalization based on the productive relations.

In result the author concludes that:

The Warsaw voivodeship is a distinct economic region (within the investigated area — one of the first order) whose boundaries, although defined institutionally, are — on the whole — based on the historical development of economic processes, on the extent of the present range of services rendered by Warsaw, and on its geographical position in relation to other regional centers. This region represents an entity strongly connected with its focal center by means of its communication network. Its economic importance is established by the nucleus, i.e., the city of Warsaw, with its industrial district; compared with this core area, the function of remaining part of the region is limited to the supplying with agricultural products of the densely populated centre.

Within the range of the Warsaw voivodeship, recognized as an economic region of the first order, there are three regions of second order, each consisting of several lesser administrative units (Map No. 3):

1) the region of Płock —

(A) comprising the counties of Płock, Gostynin and Sierpc.

2) the region of Siedlce —

(B) comprising the counties of Siedlce, Sokołów, Węgrów, and Łosice, also relatively strong influence is exerted by Siedlce as a service centre on the counties of Łuków and — to a lesser degree — of Siemiatycze, although these two are situated beyond the boundaries of the voivodeship,

3) the region of Warsaw composed of separate areas:

(C) the metropolitan area of Warsaw, comprising the city of Warsaw, and 11 neighbouring counties (Pruszków, Grodzisk, Sochaczew, Piaseczno, Grójec, Otwock, Garwolin, Ryki, Mińsk, Wołomin, and Nowy Dwór). This entire area should be described as a specific economic region of third order;

(D) the area of the counties of Ciechanów, Maków, Mława, Płońsk, Przasnysz, Pułtusk, and Żuromin. This area is marked by homogeneous and high levelled commercial agricultural production and by strong development of various agricultural industries, it is linked in production both internally and with the neighbouring Płock region:

(E) the area of several undeveloped counties (Ostrołęka, Ostrow, and Wyszków) which form a group of small distinct regions of the third order;

It should be noted that only areas (A) and (C) constitute economic regions in terms of both service and productive regions; whereas area (D) is the clear example of discordance between these two types.

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Functions of Industries in Shaping Socio-Economic Regional Structure

This work belongs to a serie of studies carried out by the authoress on shaping and typology of regional structures [1]. The common feature of those studies is a tendency to reproduce forces shaping regional structures and dynamics of their changes.

In view of her other works [2] dealing with changes in the socio-economic structure in Southern Poland caused by industry during the capitalist economy, the authoress in her present article discusses solely the interrelations between the development of industry and localization of industrial centres and changes in demographic and social structure during the fifteen years of People's Poland. The voivodeship of Cracow was chosen by her as the basis for analysis.

During the fifteen years of socialist economy industrial investments constituted the basic incentive for changes in the regional economy. Creation of many new industrial centres and plants (as e.g. Nowa Huta, Aluminium Plant in Skawina, Shoe Factory in Nowy Targ, Integrated Chemical Plants in Oświęcim, development of industrial plants in Tarnów, Siersza, Jaworzno and others) was closely connected with the problem of labour. An outstanding feature of this period, especially during the fulfilment of the Six-Year Plan, was the increase of production by means of increasing labour. The rapid growth of industrialization of the country during the period 1950—1955 caused radical changes of the territorial labour division in the industrial centres and also in their agricultural hinterland.

The period from 1947 up to the last year of the Six-Year Plan was marked by the absorption of real or seeming surpluses of labour in Małopolska villages by industry and other related branches of national economy.

These facts decided the direction of research. Radical qualitative and quantitative changes occurring in the postwar period in the demographic

[1] M. Dobrowolska: *The Dynamics of Cultural Landscape.* „Geographical Review", XXI, 1948.
M. Dobrowolska, R. Mochnacki: *Economic Map of the World.* Cracow 1949.
M. Dobrowolska: *Changes in the Geographical Environment in Poland from Ancient Times up to the End of XV c.* PWN, Warszawa 1960.
[2] M. Dobrowolska: Report for the International Regional Conference *in Kazimierz 1959* (Series: Geographical Studies — in printing).

and social structure of the rural population of Cracow voivodeship due to industrialization and increasing demand for labour, growth of the number of mixed peasant-workers families or those including workers only in certain agricultural territories, and decrease of inhabitants in others — created the possibility of reproducing the dynamism of changes, the role of planned economy and of spontaneous processes, unsufficiently mastered. They contributed to a better knowledge of factors shaping the new regional territorial division of labour.

Researches carried on in cooperation with the planning institutions included some practical tasks as well. Rational handling of manpower and full employment which is the principle of socialist economy, necessitate a thorough knowledge of the labour market.

Complex studies on structural changes caused by industrialization of the country and aiming — in the first place — at the description of territorial division of labour involved successively:

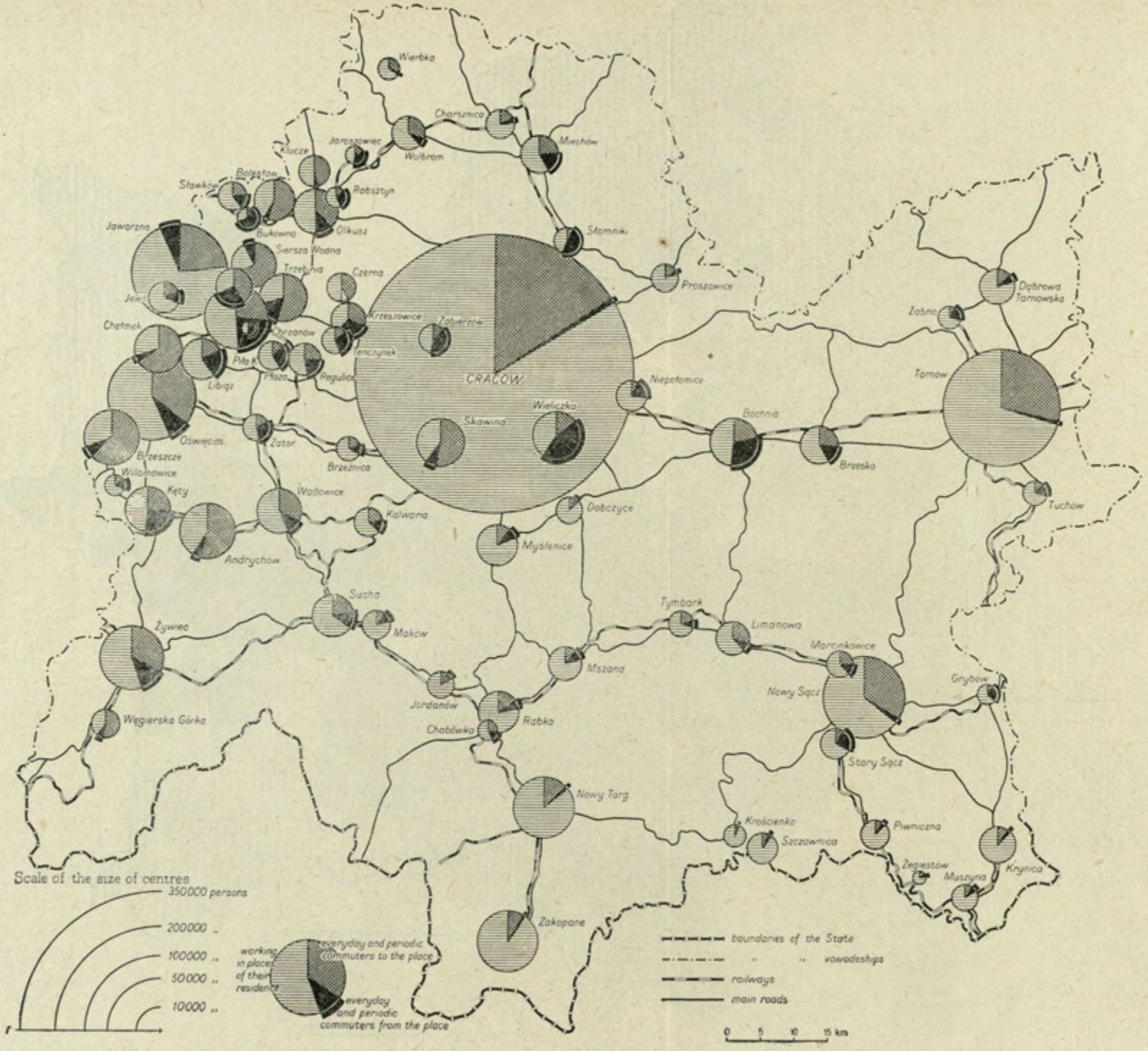
1. Analysis of development, structure and spatial distribution of work centres (agricultural excluded), with a special stress on industrial units.
2. Studies of commutation to work and zones of influences of separate centres.
3. Studies of typology of settlements according to the social division of labour including the average size of farms and density of population per 100 hectares of cultivated land.
4. Balance of surpluses and deficits of manpower.
5. Analysis of the economic structure of separate villages caused by the shift of the rural population to work in industry and in branches of national economy other than agriculture.

1. First studies included the analyses of separate industrial centres in the territory of Cracow voivodeship. Their aim was to establish the functional types of those centres and their influence on their agricultural hinterland, based upon the development of those centres and upon typical structural features which stipulate the labour demand (qualification — and age — groups included). The criteria of classification were chosen as follows; a) number of workers employed and demand for local and non-local labour, b) supply of labour by means of migration of agricultural population or commutation to work, c) individual, structural features of a given centre as expressed in the number of workers employed in separate branches of national economy with a special stress on industry, d) balance of commutation to and from the place and changes in the employment typical for the analyzed period.

Statistical results of this analysis were presented in another article[3]. The map No. 1 drawn by J. Herma, annexed to this article, shows main commutation centres on the territory of Cracow voivodeship. It reveals correlations (in percentages) of the number of local workers and commuters to the whole active population living in this centre (i.e. working in the centre or commuting from it to work in another place). It also makes possible the estimation of the role played by separate centres as labour markets for their agricultural hinterland. Centres with a high percentage of commuters (40—70 per cent of all employed) very

[3] M. Dobrowolska: *Report...*, op. cit.

Map No. 2. Surpluses and deficits of employed in agriculture in Cracow voivodeship: *1* — areas without surplus of males employed in gariculture, and where employed outised agriculture (and forestry) comprise 10% or over 10% out of the total population, *2* — areas without surplus of males employed in agriculture, and where employed outside agriculture comprise under 10% of the total population, *3* — areas with surplus of males employed in agriculture amounting to 20% of all males employed in agriculture, *4* — areas with surplus of males employed in agriculture amounting to 20—30% of all males employed in agriculture, *5* — areas with surplus of males employed in agriculture amounting to over 30% of all males employed in agriculture



Map No. 1. Main centres of work outside agriculture

often predominate in the industrialized Western part of the voivodeship (i.e. in the counties of Chrzanów, Olkusz, Oświęcim and Wadowice), in its middle part (Cracow, Tarnów) and mountain valleys (Żywiec, Nowy Sącz, Nowy Targ etc.). At the same time it shows the demand for labour and balance of commutation to and from the place.

Another map [4], by L. Pakuła, showing the structure and distribution of industry according to the number employed in different branches of economy throws light upon the role of industrial groupings on the territory of Cracow voivodeship. Both prove a big disproportion existing in the distribution of industry caused by the distribution of raw materials and sources of energy, as well as by the process of historical development. Structural disproportions are intensified by the irregular railway network, result of the period of political partition of the Polish state when this region was divided into two separate organisms, each annexed by another state (this network was later corrected by a new railway line Cracow—Tunel—Warsaw), by the lack of an efficient railway network on the vast territories of the Southern mountainous part of the voivodeship, insufficient bus connections, especially scarce in the poorly industrialized counties.

The analysis of employment structure in separate towns and industrial centres according to various branches of national economy shows that so far the greater per cent of commuters finds employment in industry. Its number amounts from 50 to 95 per cent of all travelling to work to a given locality. The coal industry in Siersza is based in 80 per cent, in Brzeszcze in 75 per cent, the textile and shoe manufacturing industries in Andrychów, Chełmek and Nowy Targ in 65—75 per cent of commuters to work. An important part takes the demand for outside labour in building and transport dependent on the foundation of new industrial establishments.

It is quite evident that indices and maps cannot present the whole complex economic structure of separate centres of Cracow voivodeship. Those problems were dealt with in analytical monographs on the development of industry [5].

The analysis of type of production, of work and wage conditions provided necessary elements for understanding of functions of industrial centres as labour markets for their hinterland.

2. Changes in the agricultural hinterland, commutation to work and growth of the class of workers and mixed peasant-workers families in villages are closely bound with the distribution of industrial centres and with the existing transport network. This problem was presented in detail in other works which include maps and tables illustrating: a) percentage of commuters to the whole active population in separate communities, b) zone of influences of several centres and degree of commutation, c) relations between zone of the first degree of influence and the maximum scope of influence, d) relations between place of

[4] Already published in the above mentioned report.

[5] The index of those studies was included in the article of M. Dobrowolska *Changes of the Socio-Economical Structure of the Village in Lesser Poland.* „Przegląd Geograficzny" XXXI, 1, 1959.

work and place of residence of workers commuting to their work in different industries.

These maps and statistics, together with field studies carried out in the hinterland of the centres, faciliated an understanding of their role in shaping the regional structure connected with separate industries. They also provided some elements for delimitation of zones of gravitation, of criss-crossing commutation and those without commutation [6].

3. The socio-economic structure of Małopolska villages creates favourable conditions for a big supply of labour for developing industries.

A village in this region is a classical example of „agrarian overpopulation". This is a quite typical element in the regional structure of Southern Poland with its manifold remains of the feudal formation: undersized agricultural farms, often not bigger than 1—2 hectares with fields forming a patchwork, small number of mechanized agricultural equipment and low standard of agriculture. Growth of population resulting from the high index of natural increase (especially in the mountainous villages) found only a temporary solution in the distribution of land after the agricultural reform and as a source of a big supply of labour for developing industries.

The socio-economic analysis of some dozens of typical villages carried out in monographic studies and local surveys was aimed at discovering structural changes and typological differentiation under the socialist economy. Those studies led us to the conclusion that the main factor in shaping the socio-economic structure of villages and new regions are changes in occupational structure and shift of many peasants to work outside agriculture. Analyses of typical farms carried out in some dozen of villages, showed that income from work outside agriculture exceeds income from a small farm of 1—2 hectares, and even of 3 hectares, although they are in a privileged situation having small compulsory deliveries.

A radical increase of work outside agriculture among peasant-owners of undersized farms influences, to a great extent, the socio-economic structure of villages and becomes a decisive factor in its changes [7].

Those facts justify the choice of method under which the typology of villages and communities is based upon percentages of population working in and outside agriculture [8].

The classification and differentiation of types were based upon the criteria established previously by M. Dobrowolska upon the different types of employment of the permanent population in a given settlement.

Because of the character of data the statistics were based upon the general number of inhabitants. This made the classification of types of communities rather difficult. Those difficulties result primarily from the differentiated structure of age groups in the territory of the voivodeship,

[6] M. Dobrowolska: Report for the International Regional Conference in Kazimierz, including maps and statistical tables.

[7] M. Dobrowolska: *Studies on the Geography of Settlements in Southern Małopolska.* Rocznik Naukowy WSP, No 8 — Geografia, Kraków 1958.

[8] M. Dobrowolska: *Changes of the Socio-Economical Structure of the Village in Lesser Poland.* Ibidem discussion of the working methods. „Przegląd Geograficzny" XXXI, 1, 1959.

which influence the index of the general occupational activity in separate settlements. Another reason for this fact is the character of the census data which were taken as the basis of the analysis. (In this census the number of women employed in agriculture was estimated rather too high). Those circumstances have their effect upon the indexes of agricultural and non-agricultural employment, and necessitated the elimination of two categories of settlements namely inhabited by peasant or by mixed peasant-workers families (cf. notes to map).

Because of the great importance of the work outside agriculture which limits the amount of work in agriculture, population employed outside agriculture was marked on the map with special signs. The type of work undertaken outside their places of residence only indirectly reveals the socio-economic character of the settlement. Those marks provide a special base for differentiation of the settlements inhabited by workers commuting to work and settlements in which the population, to a lesser or greater extent, finds employment in their locality outside agriculture.

The statistical analysis based upon previous local surveys resulted in giving a picture of spatial differentiation of types of settlements according to the social division of labour by the end of the first fifteen years of People's Poland.

Map drawn by T. Jarowiecka, — shows the differentiation and disproportions in the socio-economic structure of the voivodeship, resulting from the delayed development in the period of political partitions and from the intensive rate of industrialization during the socialist economy.

Disproportions in the distribution of industry and in the regional structure were only partially amended in the short period of the planned economy. They found their expression in the percentage of peasants working outside agriculture which number indicates changes in the socio-economic structure of villages. The district of Chrzanów with its prevailing number of villages inhabited by workers or mixed peasant-workers families and with its counties of Olkusz, Żywiec and Wadowice which are characterized by a differentiated socio-economic structure and a prevailing number of mixed peasant-workers families may be contrasted with the communities of Miechów, Proszowice, Dąbrowa counties with their typical agricultural villages. Workers and mixed peasant-workers communities in the hinterland around industrial centres of Cracow, Tarnów, Nowy Sącz and others, as well as changes occurring in villages neighbouring with new industrial centres and plants in Nowy Targ, Skawina, etc. prove the regularity of development in the regional structures of suburban zones.

Spatial correlations of the types of the structure of employment together with the average area of farms and density of agricultural population per 100 hectares of cultivated land, analysed on a basis of a geographical environment, made it possible to differentiate some typical regional structures. Their differentiating feature is the spatial structure of age groups, compiled by communities. Demographic structure of industrialized territories is characterised by a high index of population of the age of 20—34 years which in the county of Chrzanów amounts to 25 per cent, in the Oświęcim county up to 26 per cent, whereas the average index for rural community in the whole voivodeship amounts to

23 per cent. The number of agricultural population of the age of 20—34 years is decreasing in the agricultural territories which are characterized by a strong migration to towns. In the counties of Miechów, Proszowice and Dąbrowa this index amounts to 20 per cent, whereas the group of people older than 55 years is steadily increasing.

All those researches, including preparation of maps and compiling of indexes of typological and spatial relations, permit of a better understanding of the differentiation of the territorial division of labour, which is an important element in the process of changes of the socio-economic structure in regional and settlement structures [9].

At the same time they constitute valuable material for the institutions dealing with economic planning. The estimation of the balance of labour per community, based upon the statistical indices of the territorial division of labour, was also begun, and is presented in the map drawn up by W. Czarkowska in the course of the above mentioned complex studies. It was based upon yearly average norms of employment per 100 hectares for community, and clearly shows the surpluses of labour on the mountainous territories industrially underdeveloped, with a high index of natural increase of population and few possibilities of commutation to work.

Those studies revealed the marked differentiation of the spatial structure in the voivodeship of Cracow, connected with the distribution of industrial centres and the transport network. The process of industrialization causes rapid changes in the spatial structure of a region, resulting from a long historical evolution and physiographic contrasts. It has not, however, wiped out the basic structural features connected with the unequal distribution of raw materials and sources of energy, with the physiographic differentiation, and especially with the differences in the orography of the land. So characteristic for the first fifteen years of People's Poland planned processes occurring together with spontaneous, rapid rate of changes, creation of a new industrial centres, changes in the demand for skilled and unskilled labour — make difficult the stabilization of processes. Functional structure of several centres together with new regional structures is now in process of crystallization.

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[9] This problem was discussed in the above work dealing with socio-economic changes of the village in Lesser Poland.

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Spatial Structure of Polish Industry in 1956

This paper presents an attempt to use the statistical and cartographical analysis in order to establish the level of industrialization in different parts of Poland, and especially the distribution of areas in which industry is an important branch of economic activity.

The data on the employment in industry and handicrafts according to the census of December 31, 1956 were used as a starting point.

At present, the employment data are relatively the best (although not wholly satisfactory) comparative measure of distribution of the different branches of industry.

According to the "point distribution" of industry in space, the accompanying maps present the distribution of industrial centres, towns and settlements which employed in industry and handicrafts more than 4,000 persons.

The importance of these centres is presented in Table 1. Out of 2,918 thousand persons employed in industry and handicrafts — 1,968 or 67.5 per cent are concentrated in 114 centres which meet the definition set forth above. The largest share of centres, namely 83.8 per cent, we find in the voivodeship of Katowice and in the voivodeships of Łódź and Warsaw. In both last cases the most important are the two large centres in Łódź (195,000 persons employed in industry) and Warsaw (153,000 employees in industry).

Through the analysis of the map, the most salient items can be indicated. The biggest agglomeration of centres exists in the Upper Silesian Industrial District, technologically and economically interconnected with such centres as Częstochowa and Zawiercie (to the north), Cracow with Nowa Huta to the east and Bielsko-Biała to the south. Second in importance is Lower Silesia with the districts of Wałbrzych, Świdnica, Dzierżoniów and Jelenia Góra. In Central Poland, the Districts of Warsaw and Łódź are the main centres in the spatial pattern of economic activity. Among relatively important centres we can mention Poznań and Wrocław.

In the distribution of the smaller industrial centres four areas represent some peculiar features. The first is the group of centres in the area of the Lower Vistula, viz.: Bydgoszcz, Toruń, Grudziądz, Elbląg, Gdańsk, Gdynia. The second group are the following centres in Central Poland being the continuation of the historical "Old Polish Industrial District":

Table 1

Industrial Centres in Poland — in 1956

Voivodeship	Employment in industry and handicrafts total	Employment in industrial & handicraft centers		%	Industry and handicraft employment by the size of industrial centres					
					thousands of persons					
	persons in thousands	number of places	persons in thousands		4 — 6	6 — 10	10 — 20	20—40	40 — 60	more than 60
Warsaw	246.1	5	180.2	73.2	5.7	21.8	—	—	—	152.7
Bydgoszcz	140.2	5	91.5	65.2	—	6.6	39.9	—	45.0	—
Poznań	203.3	5	113.9	56.1	—	10.6	26.7	—	—	76.6
Łódź	321.0	8	274.7	82.5	4.9	14.3	38.3	22.0	—	195.2
Kielce	127.6	6	82.7	64.8	4.0	—	50.9	27.8	—	—
Lublin	68.9	3	31.0	45.0	9.0	—	—	22.0	—	—
Białystok	38.6	1	14.0	36.3	—	—	14.0	—	—	—
Olsztyn	36.2	1	4.8	13.3	4.8	—	—	—	—	—
Gdańsk	107.3	3	71.1	66.3	—	—	11.4	59.7	—	—
Koszalin	30.2	1	5.8	19.2	5.8	—	—	—	—	—
Szczecin	58.8	1	29.5	50.2	—	—	—	29.5	—	—
Zielona Góra	61.0	3	24.7	40.5	—	14.7	10.0	—	—	—
Wrocław	300.3	11	163.5	54.5	13.0	51.7	—	35.9	—	62.9
Opole	111.1	7	45.2	40.7	20.6	24.6	—	—	—	—
Katowice	747.0	37	626.5	83.8	50.6	93.2	92.4	231.1	231.1	63.5
Cracow	238.1	13	171.9	72.3	27.7	25.5	36.7	—	—	82.0
Rzeszów	91.9	4	36.7	39.9	4.1	8.5	24.1	—	—	—
Total:	2917.6	114	1967.7	67.5	150.2	271.5	344.7	292.3	276.1	632.9

Table 2

Spatial structure of Polish Industry in 1956

Areal unit	Area in thousand sq km.	Population in thousands	Employment in industry & handicrafts in thousands	Employment in industry & handicrafts — share by particular branches								Employment in industry & handicrafts — per:		Employment in industrial centers (percentage of total employment)
				power & fuel mining	metal melting & metal manufact.	chemical	mineral	timber & paper	light industry	food	others	1 sq. km.	100 inhabitants	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Silesian-Cracow Industrial District	13.1	4203	931.7	35.5	32.8	3.9	6.5	3.4	10.7	4.9	2.3	71.3	22.2	83.2
1a. Sub-district of the Upper Silesia	3.6	2187	578.5	50.9	31.3	3.3	4.5	1.7	3.2	3.7	1.4	158.6	26.5	88.2
1b. Sub-district of Cracow	3.8	1090	172.2	18.3	31.0	8.9	12.4	4.1	11.8	8.8	4.7	45.8	15.8	80.4
1c. Sub-district of Bilsko	2.4	443	92.4	3.3	35.9	0.3	4.7	8.3	38.0	6.7	2.8	38.4	20.9	74.4
1d. Sub-district of Częstochowa	3.3	483	88.6	1.3	42.5	1.6	9.3	8.6	27.5	3.7	3.5	29.2	18.3	65.6
2. Industrial district of Łódź	5.9	1358	288.4	1.0	11.3	6.9	3.1	3.7	66.4	4.9	2.7	48.8	21.2	92.8
3. Industrial district of Warsaw	4.6	1680	204.3	1.8	44.4	8.2	6.6	4.8	15.0	9.7	9.5	44.7	12.2	85.4
4. Sudeten-piedmont Industrial district	5.2	754	153.4	20.9	15.5	3.7	12.8	7.9	30.5	6.4	2.3	29.4	20.3	57.6
4a. Sub-district of Wałbrzych	0.8	220	55.4	54.9	5.2	0.9	11.5	3.5	19.0	3.4	1.6	70.9	25.2	76.0
4b. Sub-district of Świdnica & Dzierżoniów	1.15	199	46.8	0.9	28.5	2.0	11.1	4.8	43.3	7.5	1.9	39.8	23.5	69.2
4c. Sub-district of Jelenia Góra	1.15	162	30.7	2.2	14.8	11.3	13.2	13.2	36,9	4.2	4.2	26.1	18.9	45.0
4d. Sub-district of Kłodzko	2.1	173	20.5	2.0	14.9	3.8	19.6	18.8	22.9	15.5	2.5	9.9	11.8	0.0
5. Industrial Area of Gdańsk	5.8	866	96.8	2.5	41.8	3.3	4.5	9.9	12.7	22.2	3.1	16.8	11.2	73.5
6. Industrial Area of Wrocław	7.4	914	117.2	2.6	41.4	5.8	9.0	4.8	16.5	15.1	4.8	15.9	12.8	67.8
6a. Sub-area of Wrocław	3.6	636	89.0	3.1	47.3	4.4	6.8	4.4	13.9	15.8	4.3	25.2	14.0	80.2
6b. Sub-area of Legnica	3.8	278	28.2	0.7	22.6	10.3	15.9	6.1	24.6	13.1	6.7	7.4	10.1	28.7
7. Industrial area of Opole	6.3	701	97.1	2.8	25.4	6.4	18.0	10.7	24.1	10.7	1.9	15.5	13.8	42.1
8. Industrial area of Bydgoszcz	7.1	783	102.1	1.5	34.1	13.1	7.4	7.6	13.1	17.9	5.3	14.4	13.0	78.5
9. Old-Polish industrial area	7.5	894	101.9	0.8	53.9	6.6	12.6	5.4	10.5	8.9	1.3	13.5	11.4	77.2
10. Industrialized area of Tarnów & Rzeszów	6.8	843	75.9	2.5	54.0	7.5	7.6	6.1	8.1	12.8	1.4	11.2	9.0	65.5
10a. Sub-area of Tarnów & Mielec	2.4	312	35.1	3.8	45.4	14.9	8.7	8.6	6.7	10.8	1.1	14.6	11.2	73.0
10b. Sub-area of Tarnobrzeg	2.6	237	24.1	2.3	67.3	0.7	4.7	3.9	7.6	12.9	0.6	9.5	10.2	58.0
10c. Sub-area of Rzeszów	1.8	294	16.7	0.3	52.9	1.8	9.4	3.9	11.7	17.2	2.8	9.2	5.7	60.6
11. Industrialized area of Greater Poland	20.2	1826	188.1	1.6	33.9	4.4	8.6	10.3	17.7	18.2	5.3	9.3	10.3	60.5
12. Industrialized area of Zgorzelec & Zielona Góra	7.5	486	64.1	6.9	17.8	3.4	18.1.	9.4	34.0	7.5	2.9	8.5	13.2	26.5
12a. Sub-area of Zgorzelec	3.3	211	28.5	10.2	7.8	6.7	22.5	12.2	33.1	5.9	1.6	8.6	13.5	0.0
12b. Sub-area of Zielona Góra	4.2	275	35.6	4.3	25.7	0.8	14.5	7.3	34.7	8.7	4.0	8.4	12.9	47.8
13. Carpathian-Piedmont industrialized area	6.4	395	23.6	28.4	21.7	5.0	10.8	8.3	15.7	8.7	1.4	3.7	6.0	17.3
13 industrial areal units— total	103.8	15703	2444.6	16.2	31.8	5.4	7.8	5.5	21.0	8.9	3.4	23.6	15.6	75.3
POLAND — total	311.7	28070	2917.6	13.9	29.8	5.2	8.3	7.1	20.5	11.8	3.4	9.4	10.4	67.4

Radom, Skarżysko-Kamienna, Starachowice, Ostrowiec Świętokrzyski, Kielce. The third are the areas of Tarnów and Rzeszów with the centres of Tarnów, Rzeszów, Stalowa Wola, Mielec, Nowy Sącz. The fourth is the Opole area with the centres of Opole, Kędzierzyn, Raciborz, Otmęt, Ozimek and Prudnik.

There are also several isolated centres with more than 10 thousand people employed in industry and handicrafts. These are: Lublin, Szczecin, Zielona Góra with Nowa Sól, Białystok, Włocławek, Kalisz, Ostrów Wielkopolski.

The most significant remark concerns the difference between the relatively high level of industrialization of the southern and central parts of Poland and the non-industrialized areas in the north and east in which we do not find any important industrial centres.

The next step in the analysis was an attempt to delineate the areas of higher level of industrialization in Poland. Two indices for each county have been used.

Index I — the number of persons employed in industry and handicrafts per one sq. km. of a given areal unit. This index is a measure of areal concentration of industry.

Index II — the number of persons employed in industry and handicrafts per 100 inhabitants of a given areal unit. This index is a measure of the social and economic importance of industry in a given area.

After the necessary computations two maps have been drawn.

Map No. 1 presents the distribution of industrial centres and the level of industrialization of different areas outside those centres. The centres were distinguished by sings divided into seven classes according to the number of persons employed.

The level of industrialization of each county is distinguished by a proper set of lines — the perpendicular lines expressing the values of index I, the horizontal ones the values of index II. All centres are omitted in which the values of indices are below the average for Poland: 3.1 persons per 1 sq. km. and 4.5 persons per 100 inhabitants [1].

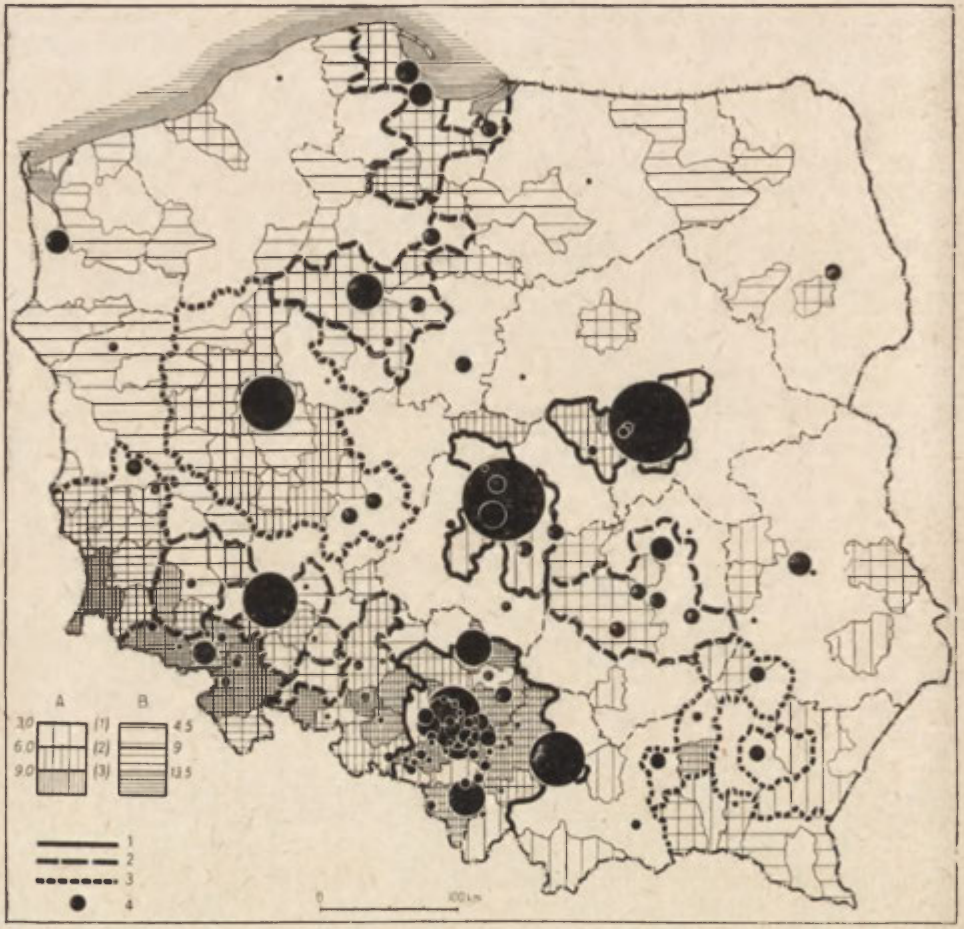
To distinguish the different levels of industrialization 3 classes have been used: first class — above the national average, second — more than twice above the national average, third — more than three times above the national average.

The important aspect of Map No. 1 is that it does not conceal the difference between the industrial centres and the industrialization of surrounding counties. It is, however, not showing the deviations caused by commuting which in some areas is an important phenomenon. Another map has been, therefore, designed in which all industrial centres were included in the proper counties.

This approach presents indirectly the power of influence of a given industrial centre upon a surrounding area and also indicates the way to minimize the deformation of the real picture as the number of commuting persons is frequently balanced within each county.

[1] The values computed using the numbers of persons employed in industry and handicrafts in a given country after substraction of numbers of persons employed in industrial centres.

In Map No. 2 all the counties which have values of both indices lower than 50 per cent of the national average have been omitted. Here the counties are also divided into 3 classes but *principium divisionis* is

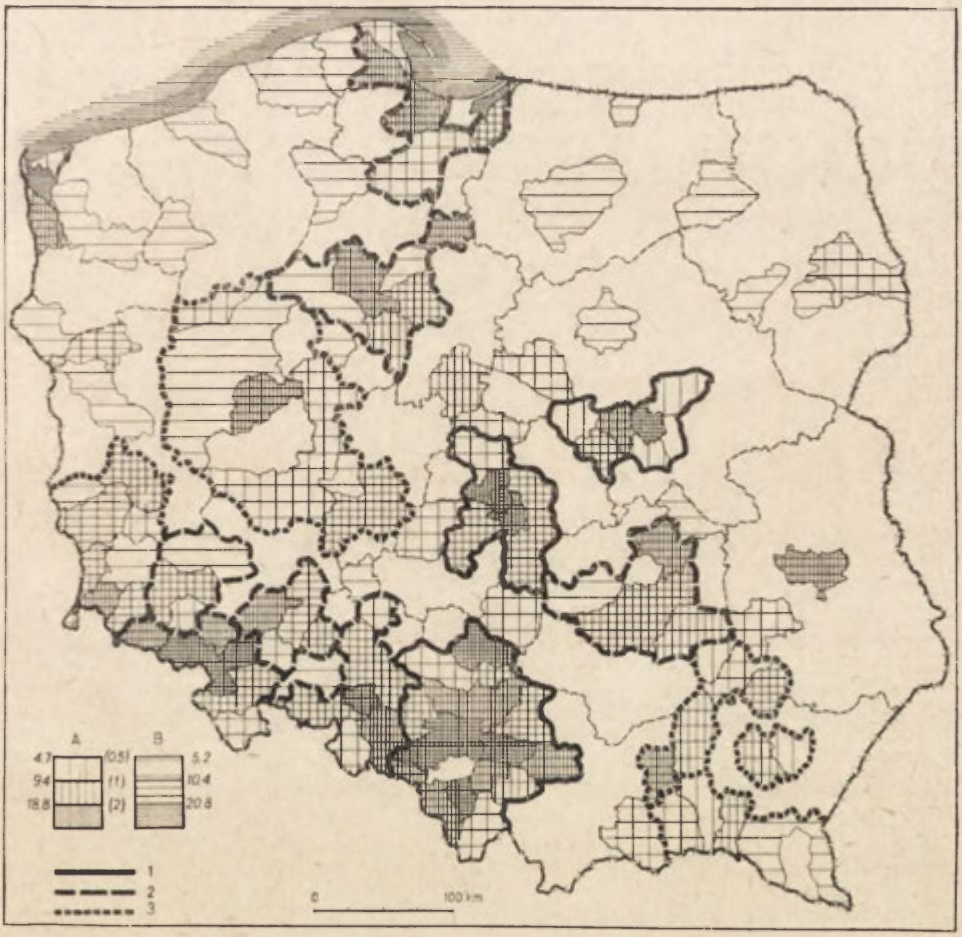


Map. 1. Industrial centres and the degree of industrialization of the areas outside those centres: *A* — The employment in industry and handicrafts per areal unit (persons per 1 sq km) *B* — The employment in industry and handicrafts per 100 inhabitants; *1* — the limits of industrial districts, *2* — the limits of industrial areas, *3* — the limits of industrialised areas, *4* — industrial centres with more than 4000 persons employed in industry and handicrafts (the circles are proportional to the volume of employment)

slightly different. The first class — 0.5—1.0 of national average, the second class 1.1—2.0 of the national average, the third class — over 2 times the national average.

The counties distinguished on both maps were used as the basis for delineation of areas with higher level of industrialization. Only those

counties were taken into account in which values of both indices were higher than 50 per cent of the national average (see Map No. 1) or 100 per cent of the national average (see Map No. 2). In delineation of the groups of areal units only those centres were included in which one of the indices was above the necessary minimum, but only in case there



Map 2. The degree of industrialisation of Poland (the industrial centres were included in the county statistical data): *A* — The employment in industry and handicrafts per areal unit (persons per 1 sq. km); *B* — The employment in industry and handicrafts per 100 inhabitants; *1* — the limits of industrial districts, *2* — the limits of industrial areas, *3* — the limits of industrialised areas

were areal ties with areas of a higher level of industrialization. At the same time a number of isolated counties were omitted which had respectively high values of both indices.

As the result of this analysis we can present the following industrial areal units in Poland (see Table 2 and Map No. 3):

Industrial Districts

1. The Silesian-Cracovian Industrial District with a division into 4 subdistricts:
   a. the Upper Silesia,
   b. the subdistrict of Cracow,
   c. the subdistrict of Bielsko,
   d. the subdistrict of Częstochowa.
2. The Industrial District of Łódź.
3. The Industrial District of Warsaw.
4. The Sudeten-Piedmont District with the division into four subdistricts:
   a. the subdistrict of Wałbrzych,
   b. the subdistrict of Świdnica and Dzierżoniów,
   c. the subdistrict of Jelenia Góra,
   d. the subdistrict of Kłodzko.

The Industrial Areas

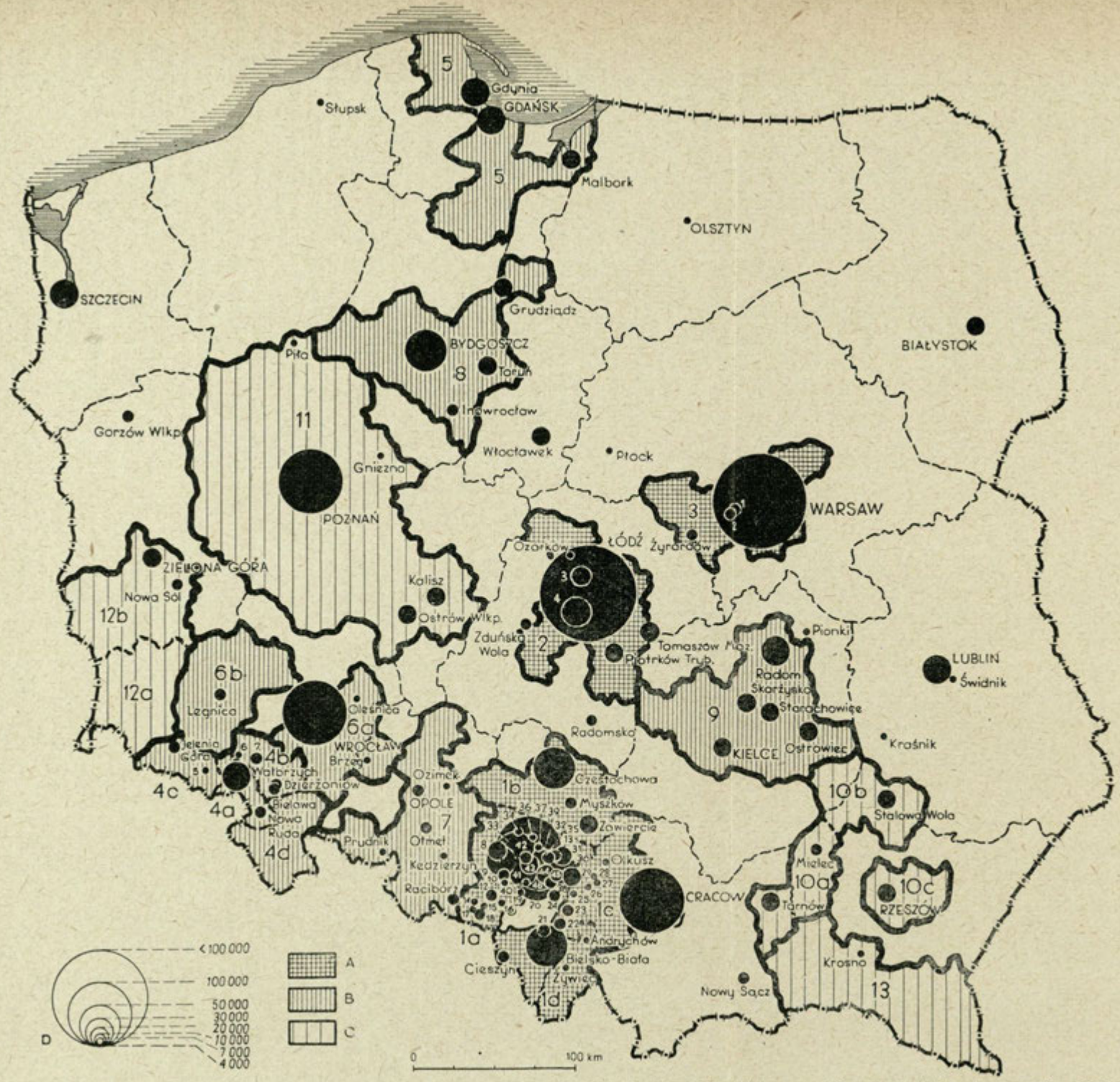
5. The Industrial Area of Gdańsk.
6. The Industrial Area of Wrocław with the division into two subareas:
   a. the subarea of Wrocław,
   b. the subarea of Legnica.
7. The Industrial Area of Opole.
8. The Industrial Area of Bydgoszcz.
9. The Old Polish Industrial Area.

The Industrialized Areas

10. The industrialized area of Tarnów and Rzeszów with the division into three subareas:
    a. the subarea of Tarnów and Mielec,
    b. the subarea of Tarnobrzeg,
    c. the subarea of Rzeszów.
11. The industrialized area of Greater Poland.
12. The industrialized area of Zgorzelec and Zielona Góra with the division into two subareas:
    a. the subarea of Zgorzelec,
    b. the subarea of Zielona Góra.
13. The industrialized area of Carpathian Piedmont.

The industrial areal units do not include isolated industrial centres which have a considerable number of persons employed in industry and handicrafts. Their influence, however, does not reach, in most cases, beyond the limits of the counties in which they are located. Included within such centres are Szczecin, Lublin, Białystok, Włocławek and Gorzów Wielkopolski.

As industrial districts we recognise those territories which have a relatively high concentration of industry, and a well developed central place or large urban agglomeration. The value of index I for those districts is much higher than 300 per cent of the national average. The value of index II is on the average about 20 with the exception of the District of Warsaw.



Map 3. The industrial districts and areas in Poland: *A* — Industrial districts; *B* — Industrial areas; *C* — Industrialised areas; *D* — Industrial centres with more than 4000 persons employed in industry and handicrafts (the circles are proportional to the volume of employment); *1* — Ursus,, *2* — Pruszków, *3* — Zgierz, *4* — Pabianice, *5* — Kamienna Góra, *6* — Świebodzice, *7* — Świdnica, *8* — Łabędy, *9* — Gliwice, *10* — Knurów, *11* — Czerwionka, *12* — Rybnik, *13* — Będzin, *14* — Rydułtowy, *15* — Niedobczyce, *16* — Boguszowice, *17* — Pszów, *18* — Radlin, *19* — Łaziska, *20* — Kostuchna, *21* — Czechowice, *22* — Brzeszcze, *23* — Oświęcim, *24* — Lędziny, 25 — Chełmek, *26* — Chrzanów, *27* — Trzebinia, *28* — Siersza, *29* — Jaworzno, *30* — Sosnowiec, *31* — Dąbrowa Górnicza, *32* — Chorzów, *33* — Bytom, *34* — Tarnowskie Góry, *35* — Czeladź, *36* — Piekary Śl., *37* — Brzeziny Śl., *38* — Wesoła, *39* — Siemianowice, *40* — Mikołów, *41* — Nowy Bytom, *42* — Ruda Śl., *43* — Świętochłowice, *44* — Szopienice, *45* — Mysłowice, *46* — Katowice

The analysis of the values for index II indicates that the high percentages of industrial employment are (in some cases) at the same time a measure of an insufficient supply of services or an unduly high share of women in total employment as for example in Łódź where the non-balanced structure of industry (the domination of textile industry) has such consequences.

Describing the level of industrial employment in the urban agglomeration and especially in Upper Silesia and in Warsaw we must not forget the thousands of persons commuting daily from places outside the given town. The areas described as industrial districts cover 9.3 per cent of the territory of Poland, 28.5 per cent of the population and 56.1 per cent of the employment in industry and handicrafts. The following data indicate the national share of industrial districts by numbers of employment of the most characteristic branches: 91.0 per cent — in power industry and in the fuel mining industry; 52.0 per cent — in iron, steel and other smelting industries and also in metal manufacturing industry; 51.5 per cent — in chemical industry; 42.5 per cent — in building materials and other mineral industries; 31.1 per cent — in textile and paper industries; 61.5 per cent — in light industry (textile, garments, shoe and leather industries); 26.6 per cent — in food industry.

In the different industrial districts, those branches of industry which are most characteristic are expressed by the percentage in total industrial employment. Thus the metal smelting and metal manufacturing industries dominate in the District of Warsaw (44.4 per cent) and in the Silesian-Cracow District (32.8 per cent); the light industry — in the District of Lodz (66.4 per cent) and in the Sudeten-Piedmont District (30.5 per cent); the power and fuel mining industries and especially the coal industry — in the Silesian-Cracow District (35.5 per cent) and in the Sudeten-Piedmont District (20.9 per cent). The total percentages of those three basic (from the point of view of the development of industrial districts branches of industry are represented by the following numbers: 79 per cent in the Silesian-Cracow District, 79 per cent — in the District of Łódź, 61 per cent in the Sudeten-Piedmont District.

The main differences between the industrial districts and *industrial areas* are that the latter show a lower level of concentration of industrial employment. In these areas there are some bigger industrial centres but the surrounding territory is less industrialized. We can mention here the examples of Gdańsk and Elbląg in the Gdańsk Industrial Area, and also Wrocław and Legnica industrial subareas. Some industrial areas do not include a well developed central place (for example the Opole Industrial Area). The values of index I for industrial areas fall within the limits between 13.5 and 16.8 and is on the average about 150 per cent of the national value. The deviations of index II are smaller (11.4—13.8) but the values are always above the national averages.

The share of industrial areas in the total national employment is much smaller than the share of industrial districts. The industrial areas cover 11.0 per cent Poland's territory, 14.9 per cent of total population and 18.4 per cent of total industrial employment. The shares in national totals for different branches are as follows: 2.7 per cent — in power

and fuel mining industry; 23,4 per cent — in metal smelting and metal manufacturing industry; 23.9 per cent — in chemical industry; 21.8 per cent — in mineral industry; 18.7 per cent — in timber and paper industry; 13,1 per cent in light industry; 22.4 per cent in food industry.

The data presented above indicate the growing share of such industries as chemical, mineral, and food industry. However the metal smelting and manufacturing industries are still the most important branches and their share does not fall below 25 per cent.

The industrialized areas are recognised as the third type of industrial territorial units. In those areas industry is quite important but not a leading branch of economic activity.

Each of the four industrialized areas is distinguished by some characteristic features.

The industrialized area of Tarnów and Rzeszów includes the territory with few but relatively recent industrial investments. In this area such industrial centres as Stalowa Wola, Mielec, Dębica, Tarnów and Rzeszów are situated in an underdeveloped rural territories. The rate of growth in this area is, however, particularly high and its economy will in a short time be changed into an industrial type. Especially important are the big investments connected with the construction of a new integrated chemical plant in Tarnobrzeg using the lately discovered deposits of sulphur.

The Greater Poland Industrial Area is the biggest one. Small industrial plants, mostly of food and timber industries dispersed in small towns are most characteristic for this area. The only exception are the three medium sized industrial centres: Poznań, Kalisz and Ostrów Wielkopolski. The leading branches are the metal industry (Poznań, Ostrów) and the light industry (Kalisz).

The dispersion in industry is also characteristic for the industrialized area of Zgorzelec and Zielona Góra. The most important industrial centres of this area are Zielona Góra, Nowa Sól and quickly growing Turoszów which is a place of large investments in brown coal mining and in power industry. This area is notable for old traditions in industrial activity. The light industry is a leading branch.

The Carpathian-Piedmont Area is the last of the industrialized areas to be distinguished. There are some difficulties to classify correctly this area. The level of industrial development is rather low. The oil mining industry dispersed over the whole territory is characteristic for this area. Only in a few rather small industrial centres (Krosno, Sanok, Gorlice) we find some plants representing other branches of industry.

Outside those 13 areal units with different levels of industrial development we find some isolated centres which can in future be starting points of industrialization of the surrounding areas. There are some doubts connected with the delimitation and classification of those 13 areas. The first weakness lies in taking into account only the three indices — index I, index II and the branch structure. Because of the lack of the data for the same year the relation between industrial and non-industrial employment (especially agricultural employment) is not exactly described. An index which would establish the role of persons employed in industry and handicrafts in the rural economy would in

turn be a good measure of the influence of industrial centres in agricultural areas. The second weak point of the analysis is the size of the basic areal units for which statistical data are published. The boundaries of the 13 areas are schematic; they would be much more exact if we get data for the units smaller than counties. The third weak point is the consequence of having used only one measure of industrial distribution — the employment data. The analysis would be much better if we had used other data as, for example, data on commuting, transportation of commodities and the economic structure of agriculture (e.g. the share of farms possessed by peasants who are at the same time idustrial workers).

Therefore the presented picture of Poland's industrialization is but approximated and will be changed and supplemented through more detailed research.

This picture, too, consists of only one cross-section in time — the indices for 1956. However, each industrial unit has characteristic feature of historical development and possibilities of future expansion. The dynamic approach, therefore, would have been much better than presented static one. It is especially important in the countries with high rate of industrial growth. In the relatively near future the indices of industrialization could change and would therefore present quite a different areal picture in some parts of Poland.

In this article we have only twice mentioned the problem of the future growth when describing the industrialized areas of Tarnów and Rzeszów and also of Zgorzelec and Zielona Góra.

We have perhaps incorrectly omitted the area of Konin where in the post 1956 period the promotion of industrial activities is proceeding quickly due to large-scale investments. There is also emerging the possibility that a new industrial district will develop in the area of the Lower Vistula. The newly discovered copper-ore deposits in Lower Silesia and the exploatation of the deposits of natural gas in Lubaczów will probably influence the future delimitation of industrial units. The above examples, a few of the many possible, stress the role of newly discovered mineral deposits, newly projected or planned large-scale industrial investments that will change the spatial structure of industrial activity, especially in areas without bigger industrial centres.

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The 13 industrial units discussed above include 87 · per cent of Poland's total employment in industry and handicrafts, therefore our analysis has included a decisive majority of areas in which the industry is an important branch of economic activity (see Table 2).

A more detailed analysis will be presented in a next article when we shall have investigated the several special problems mentioned above.

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Problème de répartition des industries en Pologne

Un des faits économiques les plus importants en Europe c'est l'industrialisation actuellement fort rapide des pays de l'Europe orientale. Une partie de ce fait c'est l'industrialisation de la Pologne qui progresse vite. L'emploi de la main d'oeuvre dans l'industrie en 1937 se chiffrent en Pologne dans ses frontières d'alors, au total, par 828.000 personnes; en 1949 dans ses nouvelles frontières il a augmenté jusqu'à 1.736.000 et en 1956 comptait déjà 2.800.000 c'est-à-dire a accru, par rapport à la période d'avant guerre presque trois fois et demie. Le pourcentage des personnes vivant d'industrie et d'artisanat s'est élevé de 12,8% en 1931 jusqu'à 20,9% en 1950 et accuse, ce temps dernier, la tendance à un accroissement considérable.

En comparaison avec les années d'avant guerre, le rôle que jouaient, dans ce temps, l'artisanat et la petite industrie a aujourd'hui diminué; par contre, l'industrie accuse une sérieuse concentration. Si, dans les premières années d'après la guerre, l'accroissement de l'emploi de la main d'oeuvre dans l'industrie était causé par la reconstruction et la mise en marche de nombreux établissements industriels occupés par la Pologne sur les Terres occidentales, et surtout en Silésie — après 1949 l'accroissement successif de l'emploi de la main d'oeuvre dans l'industrie est dû à la construction de nouvelles usines, à la reconstruction des usines existantes et cela dans le pays tout entier. Cet accroissement est particulièrement remarquable dans les voïévodies qui jusqu'alors étaient le plus faiblement industrialisés. L'augmentation de la part que prend l'emploi de la main d'oeuvre dans l'industrie par rapport à l'emploi de la main d'oeuvre dans toute la Pologne se fait remarquer notamment dans les voïévodies de Varsovie, de Lublin, de Białystok, d'Olsztyn, de Koszalin, de Szczecin, de Cracovie et de Rzeszów, c'est-à-dire dans les régions du Sud-Est, de l'Est et du Nord de la Pologne.

Il résulte pourtant assez clairement de ce qui vient d'être constaté que le processus d'industrialisation progressive de la Pologne nivelle graduellement, bien que lentement, les contrastes qui existent encore aux dégrés différents dans l'industrialisation de différentes parties de la Pologne.

A côté du fait de développement de l'industrie en Pologne il y a celui de changement de sa structure d'après ses branches. Pour voir dans quel sens ce changement se produit, il suffit de comparer la participation des branches les plus importantes de l'industrie à l'emploi général de la main

d'oeuvre dans l'industrie polonaise avant la guerre (1937) et ce temps dernier (1957). Ce changement se présente comme voici dans le tableau 1.

Comme on en voit, les plus grands changements dans la structure. que forment différentes branches de l'industrie, vont dans la direction marquée par l'accroissement de l'importance de l'industrie lourde, avant tout de celle des machines, des métaux et de l'électrotechnique ainsi que de la sidérurgie et de la métallurgie et de l'industrie combustible et chimicokière. Les branches de l'industrie qui en pourcentage ont le plus perdu de leur importance ce sont celles du textile et du bois. Une certaine diminution de la participation en pourcentage à l'emploi de la main d'oeuvre fut également marquée dans les industries chimique, minérale et céramique, mais cette diminution résulte, avant tout, de la transformation de la structure intérieure de ces branches de l'industrie, dans lesquelles les établissements menus et primitifs sont remplacés par des établissements grands, aménagés d'une façon moderne et par conséquent n'ayant pas besoin de tant de main d'oeuvre. L'accroissement de la participation en pourcentage des industries alimentaire et du cuir à l'emploi général de la main d'oeuvre s'explique en somme par le fait que dans la période d'avant guerre en Pologne la production des produits alimentaires et des articles en cuir (surtout des chaussures) se fasait dans les cadres de l'artisanat dont les travailleurs ne comptaient pas parmi la main d'oeuvre employée dans l'industrie. Actuellement ces branches de la production se sont pour la plupart transformées en fabriques et de là l'accroissement de l'emploi de la main d'oeuvre.

Tableau 1

Branche de l'industrie	Participation en pourcentage à l'emploi géneral de la main d'oeuvre dans l'industrie	
	années	
	1937	1957
Industrie combustible et chimicokière	10,5	12,8
Sidérurgie et métallurgie	4,6	5,9
Industrie des machines et électrotechnique	16,3	24,1
,, chimique et du caoutchouc	6,2	5,2
,, minérale et céramique	9,7	8,0
,, du bois	8,2	5,5
,, textile	18,9	12,5
,, du cuir	1,5	3,5
,, alimentaire	10,4	11,8

Le problème de répartition géographique et de caractère de l'industrialisation de la Pologne Contemporaine, j'ai l'intention d'en parler en me basant sur les 4 cartes géographiques illustrant l'état de cette question à la fin de 1956. Les cartes en considération ont été faites d'après les districts et d'après les villes constituant à elles mêmes chacune un district c'est-à-dire d'après les unités administratives correspondant aux

arrondissements français. La superficie moyenne d'un district (sans y compter les districts-villes) est en Pologne d'environ 1000 km².

Le degré d'industrialisation c'est-à-dire la participation de l'industrie à l'économie des régions respectives du pays peut le mieux être illustré

Carte 1. Le nombre des employés dans l'industrie et l'artisanat pour chaque mille d'habitants selon les districts (1956)

par la participation de la main d'oeuvre employée dans l'industrie et dans l'artisanat au chiffre global de la population. Ce problème a été présenté sur la carte géographique ci-jointe No. 1. Elle démontre que l'unique partie de la Pologne, grande et fortement industrialisée — d'une façon serrée — c'est celle qui s'étend de Cracovie situé à l'Est vers Nysa Łużycka et Zielona Góra situés au ord-Ouest, c'est-à-dire la Silésie historique y compris la partie Ouest de la voïévodie de Cracovie et les environs de Częstochowa. C'est cette région de la Pologne qui par sa structure économique se rapproche des autres pays du centre européen tels que Tchécoslovaquie et l'Allemagne où l'industrialisation ne se limite pas

aux grandes villes, mais comprend toute une étendue où elle se manifeste même dans plusieurs villages et quelques cités menues.

D'autres centres industriels de Pologne tels que par exemple région de Łódé et de Varsovie occupent une relativement petite superficie, l'industrie s'y agglomère presque uniquement dans un petit nombre des villes. Quant à d'autres étendues fortement industrialisées elles se bornent à des villes isolées à part quoi seulement quelques arrondissements de la voïévodie de Gdańsk, de Szczecin et de Rzeszów qui accusent une grande participation des employés à l'industrie. Sur des vastes étendues, mais avec une faible intensité se manifeste le fait d'industrialisation dans les voïévodies de Poznań et de Bydgoszcz, mais sans les parties autrefois appartenant à la Russie tzariste.

La plus grande étendue compacte très faiblement industrialisée c'est la partie Nord-Est de la voïévodie de Varsovie et presque toute la voïévodie de Białystok. Le district le moins industrialisé en Pologne est celui de Dąbrowa, dans la voïévodie de Białystok, où sur 1.000 habitants il y a 3 personnes employées à l'industrie et à l'artisanat et en ce qui concerne l'industrie seule à peine 0,7 personnes.

A l'autre extrémité il y a les villes Stalowa Wola et Bielsko-Biała où la proportion équivalente est 667 éventuellement 644 personnes par 1.000 habitants. Cela témoigne non seulement d'une très grande industrialisation, mais aussi d'une grande intensité du phénomène que constituent les voyages quotidiens au travail, car le nombre des places au travail dépasse de beaucoup la possibilité de loger toutes ces gens en ville.

L'aspect de la participation des employés de l'industrie au nombre des habitants du pays ne dit pourtant pas tout de l'intensité absolue de l'industrie dans les régions respectives, car cet aspect est déformé par les différences qui existent dans la densité de la population dans différentes régions du pays. De cette façon les étendues ayant un petit nombre des employés dans l'industrie mais peu peuplées se présentent plus avantageusement que celles qui ont plus d'industries mais sont plus densement peuplées. De cette façon la voïévodie de Koszalin, par exemple dénote, en moyenne, des valeurs supérieures que celles de Lublin ou de Varsovie bien que ces dernières accusent des chiffres plus élevés des gens employés dans l'industrie et participent au pourcentage également plus élevé de la valeur globale de la production industrielle. Pour mettre à jour ces différences il faut l'aspect de la première carte comparer à celui de la carte No. 2 qui illustre le nombre des employés dans l'industrie par rapport à l'unité de la superficie (1 km²). Malgré quelques ressemblances générales on y observe aussi des différences assez importantes. Tout d'abord on y voit nettement une industrialisation relativement forte des régions centrales de la Pologne (voïévodies de Łódź, de Kielce, de Poznań et d'une partie de celle de Varsovie), lesquelles sur la première carte paraissent faibles. De même les voïévodies de Cracovie et de Rzeszów s'y présentent plus avantageusement. Par contre de beaucoup plus nettement se manifeste la faiblesse de l'industrialisation, par rapport à la superficie, de la partie Nord-Ouest de la Pologne où, à part quelques villes importantes, l'industrie est toujours encore faiblement développée. Il est aussi évident que plus fortement

que sur la première carte ressort pour la Pologne le grand rôle des grandes villes dans la répartition des industries.

Le plus grand centre industriel de la Pologne c'est évidemment la region industrielle de la Haute Silésie qui comprend le basin houiller de Haute Silésie. Sur une petite superficie il y a là environ 500.000 personnes travaillant dans l'industrie. Y prédominent les industries des combustibles, des sidérurgies, l'industrie lourde des machines, mais l'importance des industries alimentaires et chimiques, celle du zinc, du plomb et des matériaux de construction n'est guère moindre.

Carte 2. Le nombre des employés dans l'industrie et l'artisanat par 1 km²

C'est Bytom qui a le plus grand nombre absolu des employés dans l'industrie parmi les villes de cette région, puis viennent: Zabrze, Katowice, Chorzów, Sosnowiec et Gliwice. C'est l'industrie houillère qui occupe dans la plupart des villes, le plus grand nombre des personnes, seule dans la ville de Chorzów la sidérurgie a plus d'importance et dans la ville de Gliwice l'industrie des machines. Quant à Sosnowiec il y a là

une part importante d'industrie textile. Bytom est le plus grand centre d'extraction de minerais de zinc et de plomb. Parmi les villes de moindre importance dans Dąbrowa Górnicza domine la sidérurgie et Szopienice constitue un centre important métallurgique de zinc et de plomb.

Le second centre industriel c'est Łódź avec les petites villes de ses environs où l'emploi de la main d'oeuvre atteint le chiffre de 300.000 personnes. C'est l'industrie textile qui y prédomine. Dans la ville même de Łódź il y a à part cela l'industrie des machines, de la confection, alimentaire et du caoutchouc. À Zgierz et à Pabianice on observe une importante doze d'industrie chimique. Parmi d'autres grandes villes de Pologne, le plus éminent centre industriel après Łódź c'est Varsovie où prédomine nettement l'industrie des machines, après laquelle il faut citer les industries: alimentaire, polygraphique, chimique et des confections. De même la région suburbaine de Varsovie est caractérisée par une grande intensité de l'industrie des machines.

On observe également la primauté de l'industrie des machines dans l'emploi de la main d'oeuvre dans d'autres grandes villes de Pologne telles que Cracovie, Poznań, Wrocław, Bydgoszcz et Gdańsk. Cette prépondérance est très importante à Poznań, à Wrocław, à Gdańsk — plus faible à Cracovie où peu à peu la sidérotechnique commence à occuper le premier rang, suivie — tout de suite après par l'industrie alimentaire et puis par l'industrie chimique, polygraphique, et celle du cuir. A Poznań un rôle important est joué par l'industrie alimentaire, vestimentaire, polygraphique et du caoutchouc; à Wrocław par l'industrie alimentaire, vestimentaire et chimique. A Bydgoszcz, à part l'industrie des machines ont une même importance les industries alimentaire, chimique, du cuir et du bois. A Gdańsk un rôle assez important est joué par l'industrie alimentaire et celle du bois. A Szczecin la production industrielle est très variée. L'industrie des machines est aussitôt suivie — sans grands intervalles — par les industries: alimentaire, chimique, vestimentaire, sidérurgique et papetière.

Quant à d'autres grandes villes de Pologne, Częstochowa se distingue par la prépondérance de l'industrie textile suivie aussitôt par la sidérurgie et par l'industrie des machines. Wałbrzych est une ville typique d'industrie minière et de cokefaction à côté de laquelle il y a l'industrie de la verrerie, de la porcelaine et des machines.

A Radom c'est l'industrie des machines qui prédomine ayant à ses côtés celle du cuir, ainsi que l'industrie alimentaire. Par contre Lublin et Gdynia sont les seules grandes villes de Pologne où prédomine l'industrie alimentaire; l'industrie des machines se place au deuxième rang.

Parmi les villes moyennes le plus grand centre industriel c'est Bielsko-Biała, qui, au point de vue du nombre des personnes employées à l'industrie, occupe le onzième rang parmi les villes de Pologne et de par ce fait dépasse toute une série de grandes villes (par exemple: Częstochowa, Gdańsk, Sosnowiec, Gliwice, Lublin, Szczecin). Cette importance la ville de Bielsko la doit à l'industrie textile et à celle des machines. Quant à d'autres villes moyennes, il mérite d'être signalées les villes telles que Kalisz, Białystok ainsi qu'un ensemble de villes Bielawa et Dzierżoniów, où l'industrie textile prédomine, ainsi que les villes Stalowa

Wola, Ostrowiec et Zawiercie en tant que centres sidérurgiques; Skarżysko-Kamienna, Starachowice, Elbląg et Ostrów Wielkopolski en tant que centres importants d'industrie des machines ainsi que Piotrków, centre de verrerie le plus important de Pologne. La production variée des industries est marquée surtout par Jelenia Góra, mais aussi par Toruń, Tarnów, Włocławek, Grudziądz et Zielona Góra. La partie Sud de la voïévodie de Wrocław, constitue à elle seule une grande région industrielle à un profile de production très variée.

Une lumière additionnelle est projetée sur le problème d'industrialisation par le rapport existant entre les employés à l'artisanat et les employés à l'industrie et à l'artisant ce qui est présenté sur la carte No. 3.

Carte 3. L'emploi dans l'industrie par rapport au nombre global des employés dans l'industrie et l'artisanat. Le pourcentage des employés dans l'artisanat

Or, le premier trait caractéristique aperçu sur la carte c'est le fait que sous le rapport de la participation de l'artisanat, les territoires récupérés après la guerre cèdent sensiblement aux territoires anciens.

A l'Ouest de la Pologne, aussi bien dans les villes qu'à la campagne, l'artisanat est plutôt insuffisamment développé et cela se comprend puisque c'est une forme ancienne de production et en tant qu'une forme ancienne elle n'est pas attractive pour la jeunesse et c'est elle qui, en premier lieu, a colonisé les terres occidentales. D'autre part les artisans forment un élement peu remuant, peu actif et c'est pourquoi ils n'ont pas cherché à s'y installer. L'autre trait caractéristique important c'est la liaison manifeste avec le degré d'industrialisation des districts ou des villes. Les districts et les villes qui accusent le pourcentage le plus bas de la participation de l'artisanat à l'emploi général de la main d'oeuvre et à l'industrie et à l'artisanat (moins de 5%) sont ceux qui, sans aucune exception présentent des centres bien industrialisés se trouvant surtout dans la partie Sud-Ouest de la Pologne et en particulier dans la région d'industrialisation intensive mais éparpillée. Il faut y placer aussi bien Łódź que d'autres villes du centre de Pologne (Tomaszów Mazowiecki, Ostrowiec, Starachowice, Stalowa Wola). Cependant le pourcentage allant de 5 à 10% des employés à l'artisanat est observé non sulement dans les districts fortement industrialisés mais parfois aussi sur les terrains faiblement industrialisés mais aussi faiblement peuplés ou faiblement organisés. Cela concerne surtout certains districts situés au Nord-Ouest et au Nord-Est ainsi que les régions fortement épreuvées du fait de la guerre et à peine organisées il n'y a pas longtemps telles que région de Bieszczady (Coin Sud-Est de la Pologne).

Mais y font partie également les villes plus fortement industrialisées du centre de la Pologne (par exemple: Gdańsk, Bydgoszcz, Toruń, Kalisz, Radom etc.) ainsi que plusieurs villes de la Pologne de l'Ouest, lesquelles, si même elles constituent aujourd'hui des centres bien développés de services, tels que Wrocław, Szczecin, Zielona Góra, Koszalin, Legnica etc., ils se caractérisent par un faible développement de l'artisanat parce qu'ils ont été après la guerre, à nouveau colonisés. Dans les grandes villes polonaises normalement développées, telles que Varsovie, Poznań, Cracovie, Lublin, l'artisanat constitue de 10 à 20% du chiffre global des employés à l'industrie et à l'artisanat. Ce pourcentage est caractéristique pour une grande partie des régions faiblement industrialisées. Le pourcentage des employés à l'artisanat se chiffrant par 20 à 50% du chiffre total des employés à l'industrie et à l'artisant est caractéristique pour la majorité de régions de Pologne typiquement agricoles et il est le plus élevé dans les voïévodies de Varsovie, de Białystok, de Poznań, de Bydgoszcz et de Lublin. La prépondérance des employés à l'artisanat sur ceux employés à l'industrie ne se manifeste que dans quelques districts des voïévodies de Białystok, de Lublin, de Varsovie et de Kielce. Ce sont là les endroits de Pologne économiquement les plus arriérés où l'industrie manque presque totalement.

La carte No. 4 présente la participation en pourcentage des employés à l'industrie — soit le groupe *A* par rapport au chiffre global des employés à l'industrie sans artisanat, c'est-à-dire qu'elle illustre la relation existant entre l'emploi de la main d'oeuvre dans l'industrie des biens de production et celui dans l'industrie des biens de consommation.

Le groupe *A* comprend: l'industrie énergetique, celle des combustibles, sidérurgie, industrie des machines, métallurgique, chimique, celle

du caoutchouc et des matériaux de construction — le groupe *B* comprend toutes autres branches de l'industrie.

Il faut souligner que cette carte n'indique pas le degré de l'industrialisation, mais démontre uniquement la relation existant entre les deux groupes d'industries, voilà pourquoi la même couleur peut com-

Carte 4. Le rapport entre l'emploi dans l'industrie du groupe *A* et le nombre global des employés dans l'industrie (1956)

prendre aussi bien les districts fortement industrialisés que ceux qui ne le sont que faiblement. Voilà porquoi cette carte ne peut être étudiée qu'en comparaison avec celles marquées No. 1 et 2, dont elle sert de complément. Les dégrés de l'échelle sont posés de façon à mettre en relief les valeurs extrêmes soit les étendues de la prépondérance tantôt de l'un tantôt de l'autre de deux groupes d'industrie.

Cette carte nous permet de tirer des constatations suivantes:

1. L'étendue de la prépondérance du groupe *A* est, par rapport à la

quantité des industries, considérablement réduite s'il s'agit de l'espace occupé, car la prédominance de ce groupe se manifeste surtout dans les villes et dans les districts densement peuplés.

2. Plus de 3/4 des grandes villes de Pologne (16 du chiffre global de 21) ainsi que les 3/5 des autres villes moyennes, constituant des districts libres, démontrent, en ce qui concerne l'emploi de la main d'oeuvre la prépondérance des industries du groupe *A*.

3. Les districts ayant la prépondérance de l'emploi de la main d'oeuvre du groupe *B* (plus de 95%), presque exclusivement font partie des régions faiblement industrialisées alors que les districts ayant la plus forte prédominance de l'emploi de la main d'oeuvre du groupe *A* (plus de 90%) font partie — à l'exception du district de Pińczów — des régions le plus fortement industrialisées. D'autres catégories des relations numériques des deux groupes ne sont en aucune liaison valable avec le degré de l'industrialisation.

4. Aux régions où prédominent les industries du groupe *A* appartiennent avant tout les voïévodies: de Katowice, de Kielce et de Rzeszów; le triangle dont les sommets sont marqués par Varsovie, Wałbrzych et le coin Sud-Est de l'État polonais comprend dans son territoire les terrains caractérisés par la prédominance des industries du groupe *A*. Le plus

Tableau 2

Villes	Pourcentage des employés dans l'industrie	Voïévodies	Pourcentage des employés dans l'industrie
Łódź	29,6	Katowice	24,7
Poznań	21,4	Wrocław	15,0
Cracovie	18,9	Opole	12,8
Wrocław	16,8	Gdańsk	9,9
Varsovie	15,6	Zielona Góra	9,1
Bydgoszcz	9,0	Cracovie	8,2
		Łódź	8,2
		Kielce	7,5
		Szczecin	7,4
		Poznań	6,8
		Rzeszów	6,1
		Koszalin	4,9
		Olsztyn	4,4
		Varsovie	4,3
		Lublin	4,1
		Białystok	3,8

Pourcentage moyen dans toutes les voïévodies de Pologne 10,8

grande prédominance de groupe *B* se manifeste dans les voïévodies de Koszalin et d'Olsztyn, où aucun district ne marque la prépondérance du groupe *A*; une forte prépondérance du groupe *B* est à remarquer aussi dans les voïévodies de Lublin, de Białystok, de Łódź et de Szczecin.

Pour finir j'y joins le tableau 2 qui marque le pourcentage du nombre global de la population constituée par les employés dans l'industrie et dans l'artisanat en 1956, dans différentes voïévodies de Pologne selon l'ordre établi par le degré de leur industrialisation.

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(*7*) Karpiński A., Rakowski M.: *L'Économie de la Pologne comparée à l'économie mondiale.* Książka i Wiedza, Warszawa 1957.
(*8*) *Notre économie et ses perspectives.* Książka i Wiedza, Warszawa 1958.
(*9*) „Petit Annuaire de Statistiques 1939", Warszawa 1939.
(*10*) „Statistique Industrielle 1945—1955". GUS, Warszawa 1956.
(*11*) Wełpa B.: *État et répartition de l'emploi de la main d'oeuvre dans l'industrie et l'artisanat en Pologne* (en polonais avec un résumé en anglais). „Przegląd Geograficzny" („Revue Géographique") XXXI, 1, 1959.
(*12*) Wrzosek A.: *Géographie économique de la Pologne — Industrie.* PWN: éd. I-1956, éd. II-1957, éd. III-1959, Warszawa.

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ANTONI KUKLIŃSKI

Problems in the Location of Brickmaking Industry in Poland

The paper presents some problems and results of studies carried on under guidance of Professor S. Leszczycki in the Department of Industrial Geography in the Institute of Geography of the Polish Academy of Sciences. These studies involved 3 main approaches to the problem, namely: historical, economic and physiographic.

Studies based upon the first (historical) approach included the analysis of historical changes in the relative significance of different locational factors.

Studies so far published indicate that the most essential characteristics of spatial structure of the brickmaking industry may be defined as follows:

1. The typical producting unit of the brickmaking industry is a small plant [1].

2. The determining spatial structure factor in the brickmaking industry is the pattern of local markets.

3. Raw materials (clays) for the production of bricks and building ceramics are ubiquitous and as such have no influence on the spatial structure of the brickmaking industry [2].

The aim of the first study was to verify the above theses on the basis of an analysis of changes in spatial structure of the brickmaking industry in Western Poland from 1861 to 1939 [3].

The relatively good German statistical data [4], covering the territories

[1] In defining the most characteristic size of a plant in the brick and fireclay industry S. Florence uses the term "smallish" to denote a class intermediate between "small" and "medium". In his opinion, "Bricks cannot for physical reasons be produced in a few places on the scale that would be most efficient" (P.S. Florence: *The Logic of British and American Industry. A Realistic Analysis of Economic Structure and Government.* London 1957, pp. 24, 93, 94).

[2] In his classic work, A. Weber distinguishes raw materials available practically everywhere and localised ones. Among ubiquitous raw materials the author differentiates those of the general type, such as e.g. air, and those of the regional type, such as e.g. clays, wood or grain. This division has given rise to opinions which considered brickmaking raw materials as ubiquitous (A. Weber: *Über den Standort der Industrien.* Tübingen 1909, pp. 51—52).

[3] A. Kukliński: *Spatial Structure of the Brickmaking Industry in Western Poland from 1861 until 1939.* Series of the Institute of Geography of the Polish Academy of Sciences: Geographical Studies No. 18 (Polish with an abstract in English). Warszawa 1959.

[4] The investigated territory was a part of Germany in those times.

discussed, enabled the author to draw up a complex of indices, necessary for comparisons both in space and in time to reveal the factors and trends in the locational processes (Table 1).

In result the author came to the following conclusions:

1. Although it revealed itself later than in other industries, a definite tendency for larger plants to squeeze out the smaller ones, undoubtedly exists in the brickmaking industry. This development studied over the period in question can be presented in the following form:

	1861	1907	1939
Number of brickmaking plants	2830	2225	920
Average number of persons employed per 1 plant	5,5	17,0	29,5

2. In the course of historic development, local markets lost the position of the sole factor determining the spatial structure of the brickmaking industry. The growth of the size of plants was connected not only with the increasing quantities of bricks absorbed by local markets, but also with the extension of the range of areas supplied by some plants. In the course of these studies evidence was found that brickmaking plants producing primarily for non-local markets were no exception in the territory investigated. In 1939, 15 of the 112 counties of Western Poland were characterised by well developed brickmaking centres producing for non-local markets. Those counties accounted for 13,4% of the area investigated and 35% of the number of persons employed in the brickmaking industry. According to our estimates in 1939, not more than 30% of the output in the counties referred to, were absorbed by the local markets. Analogically, in 1907, the group of counties in question embraced 5,4% of the respective area and 18,6% of the number of persons employed in the said industry (Table 2).

3. Large brickmaking plants manufacturing high quality products (e.g. hollow bricks and tiles) and producing for nonlocal markets, developed usually in areas with particularly advantageous deposits of raw materials. Resources of this type were not ubiquitous in the territory investigated and for this reason, contrary to the traditional opinion, they have a far reaching influence on the spatial structure of the brickmaking idustry. In general balances of employment and output, the importance of brickmaking plants producing for non-local markets increased simultaneously with the rise in the utilisation of high quality raw materials (of the localised type) and with the diminishing importance of those utilising low quality raw materials (of the ubiquitous type).

In result the following conclussions were drawn:

1. The spatial structure of the pre-capitalistic brickmaking industry in the territories investigated, was governed by a sole factor determining the localisation of a brickmaking plant — the pattern of local markets.

2. The spatial structure of the capitalist brickmaking industry, in the territories referred to, was differentiated so far as the location of plants

Table 1

List of indices for the spatial structure of the brickmaking industry in Western Poland

Group	Class	Relation of the local market to brickmaking industry output in a given county	Index values					
			employment per 10 000 inhabitants	employment per 100 sq. km.	population density persone per 1 sq. km.	employment per 10 000 inhabitants	employment per 100 sq. km.	population density persons per 1 sq. km.
			1907			1939		
A. Counties with the brickmaking industry producing prirnaily for local markess	1. supplies to local markets on areas population density* exceedings 200 persons per 1 sq. km.	a. deficit counties[1]	<35	>80	<200	<19	>20	>200
		b. self-sufficient counties[2]	35—60	>80		19—32	>40	
	2. supplies to local markets on areas with population density* of 80 — 200 persons per 1 sq. km.	a. deficit counties	<35	<80	80—200	<19	<40	80—200[5]
		b. self-sufficient counties	35—60	40—80		19—32	20—40[6]	
	3. supplies to local markets on areas with population density* below 80 persons per 1 sq. km.	a. deficit counties	<35	<40	<80	<19	<20	<80
		b. self-sufficient counties	35—60	<40		19—32	<20	
B. Counties with the brickmaking industry producing for local and non-local markets	1. counties with employment amounting to: 20—40 persons per 100 sq. km.	surplus counties[3] with local demand amounting to 50—75% of output	60—90	20—40	30—60			
	10—20 persons per 100 sq. km.					32—40	10—20	30—60
	2. dtto, 40—80 persons per 100 sq. km.	dtto, 40—75% of output	60—110	40—80	40—120			
	20—40 persons per 100 sq. km.					32—60	20—40	40—120
	3. dtto, over 80 persons per 100 sq. km.	dtt, 40—60% of output	90—110	>80	100—160			
	over 40 persons per 100 sq. km.					48—60	>40	160—200
C. Counties with the brickmaking industry producing primarily for non local markets		specialised counties[4] with local demand amounting below 40% of output	>110	>80	50—150	>60	>40[7]	35—225

1 As deficit counties are classified counties in which local demand exceeds 25% of the local brickmaking industry output.
2 As self-sufficient counties are classified counties in which local demand varies from +25% to —25% of the local brickmaking industry output.
3 As surplus counties are classified counties in which local demand varies from 75% to 40% of the local brickmanging industry output.
4 As specialised counties are classified counties in which local demand does not exceed 40% of the local brickmaking industry output.
5 Excepting the counties: Olsztyn (79,4) and Głogów (76,3).
6 Excepting the counties: Złotoryja (17,2), Kłodzko (45,4) and Nysa (48,3).
7 Excepting the county Drawsko (35,0).
* And with the corresponding intensity of building activities.

is concerned, and governed by two fundamental factors: 1) the pattern and volume of demand of the local markets, especially those of bigger towns and 2) the distribution of larger deposits of raw material, especially of high quality clays providing the basis for the development of large centres producing for non-local markets.

Table 2

Changes in the spatial structure of the brickmaking industry in Western Poland in the years 1907 and 1939

Counties	Area		Population		Number of plants		Employed in the brickmaking industry	
	1907	1939	1907	1939	1907	1939	1907	1939
Group A	76,5[1]	57,5[1]	78,5	65,6	72,0	48,5	59,2	38,4
Classes B_1 and B_2	18,1	29,1	14,9	20,9	19,5	30,6	22,2	26,6
Class B_3 and group C	5,4	13,4	6,6	13,5	8,5	20,9	18,6	35,0
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

[1] In percents.

The presented approach is well established among the studies dealing with the industrial location. The publications of Edgar M. Hoover[5] and of Norman J. G. Pounds[6] can be mentioned as the two most outstanding examples.

The second approach to the problem — the economic one — consists of a detailed analysis of the areal differentiation of a given economic activity. In the presented case this activity embraced the Polish brickmaking industry in 1955. To get all necessary statistical data, the Institute prepared a special questionnaire in which suggestions of the Central Statistical Office, the Planning Commission and other governmental agencies responsible for the management of brickmaking industry in Poland were taken into account.

The Institute received 830 filled out questionnaires which covered 91 per cent of Polish brick plants producing 98 per cent of total output.

The data presented in the questionnaires contributed to a far more detailed and interesting analysis than one could find in such studies which use one measure of industrial distribution only[7].

The analysis of these materials is the subject of a Ph. D. study which will be completed this year by M. Najgrakowski.

[5] E. M. Hoover: *Location Theory and the Shoe and Leather Industries.* Harvard University Press 1937.

[6] Norman J. G. Pounds: *The Upper Silesian Industrial Region.* Indiana University Publications. 1958. Cf. the review in "Geographical Review", October 1959.

[7] Cf. P.S. Florence, W. G. Fritz, R. C. Giles: *Measures of Industrial Distribution.* Chapter 5. *Industrial Location and National Resources.* Washington D.C. 1943.

The author distinguishes three kinds of areal differentiation of Polish brick industry [8]:

1) the areal differentiation of capital equipment,
2) the areal differentiation of employment and labour efficiency,
3) the areal differentiation of the volume and costs of production.

These economic phenomena change not only in space but also in correlation with the size of the plant (Table 3).

As one can see in Table 3 the sole exception consists of two bigger plants which have higher cost than "normal" for this size. There are two causes of this irregularity. The first one — the economic consequences of a wrong choice of the site of plants in relation to proper raw material deposits, the second — general difficulties which can be seen in many plants shortly after the start of production.

In 1960, both plants although perhaps not the most efficient, however greatly decreased their costs of production.

The study of M. Najgrakowski is a pioneer project in Poland, whereas in other countries excellent examples of studies with this approach can be found [9].

The third approach — the physiographic one — deals in a new way with the old problems of the relation between the human activity and natural environment.

One of the difficulties in the present development of geography is the growing gap dividing the research projects in economic and in physical geography [10]. The theoretical and practical necessity led to the establishment of a new field of research — industrial physiography. An experimental Ph. D. study by J. Grzeszczak entitled: "The problems in the physiography of brickmaking industry in Poland" has already been started.

There are two groups of problems to be dealt with in this study.

The first is the question to what extent the efficiency of the brickmaking industry is affected by differences in natural environment. The second is the question of changes introduced into the natural environment by the brickmaking industry [11].

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[8] Cf. *Clay Brickmaking in Great Britain. A Survey of Methods Used.* Ministry of Works. National Brick Advisory Council. Paper Six. London 1950.
Clay Building. Bricks of the United Kingdom. Op. cit. Paper Five. London 1950.

[9] R. S. Liwszic: *Distribution of Iron and Steel Industry in the Soviet Union.* Moskva 1958 (In Russian only).
C. H. Cotterill: *Industrial Plant Location. Its Application to Zinc Smelting.* Saint Louis 1950.
H. J. Kunze: *Die Lagerungsordnung der westeuropäischen Eisen und Stahlindustrie im Lichte ihrer Kostenstruktur.* Kiel 1954.

[10] Cf. Maurice B. Ballabon: *Putting the "Economic" into Economic Geography.* "Economic Geography" 1957, No. 3.

[11] Cf. S. H. Beaver: *Land Reclamation after Surface Mineral Workings.* "Journal of the Town Planning Institute" May 1955.
S. W. Wooldridge, S. H. Beaver: *The Working of Sand and Gravel — A Problem in Land Use.* "The Geographical Journal" January—March 1950.
H. Hessberger: *Die Industrielandschaft des Beckumer Zementreviers.* Westfalische Geographische Studien 1957.
G. Grundtke: *Die Bedeutung des Klimas für den industriellen Standort.* Gotha 1955.

Different criteria of evaluation, in the first case — the efficiency of the industry itself, in the second — the interests of the local community or the efficiency of other economic activities (e.g. agriculture) constitute a division between those two groups of problems.

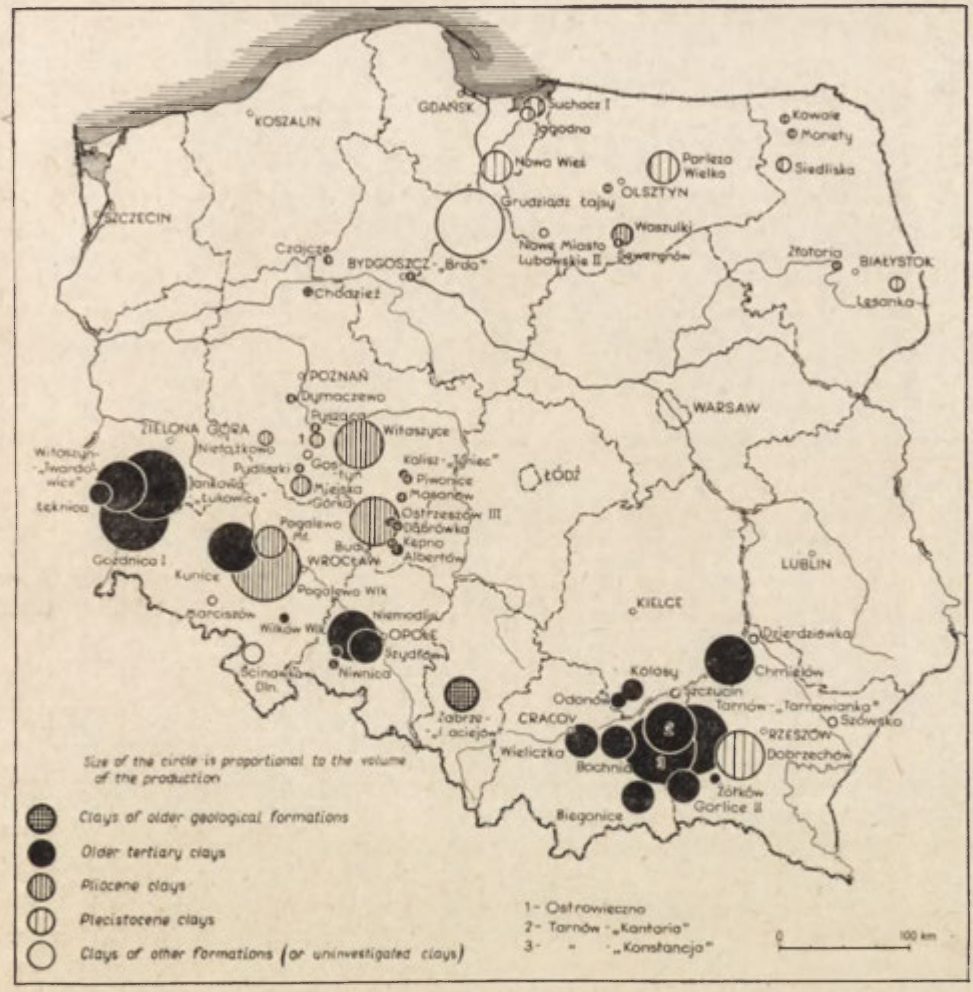

Fig. 1. Raw materials used in the production of tiles in Poland

Raw materials used by the brick industry are — quite naturally — the most important problem of the first group. The key questions in this field are: the size of the deposits in comparison with the size of the plant, the influence of geological conditions on the quarry operations, the influence of the physical and chemical qualities of the raw material on the production processes and on the type of the commodities produced.

Table 3

The cost of production and size of plant in Polish brickmaking industry 1955

Output in 1955 in mill. of ceramic units	Number of plants	Cost of production per 1000 cer. units /in Polish złoty/											Average cost of production
		100—200	200—300	300—400	400—500	500—600	600—700	700—809	800—900	900—1000	1000—1200	1200—1500	
0— 1	114			5	13	26	21	23	9	8	7	2	680
1— 2	150		1	21	67	35	18	5	2			1	504
2— 3	194		3	63	81	35	7	3	1	1			451
3— 4	122		5	47	49	15	4	1	1				424
4— 5	102		7	49	29	13	4						404
5— 6	50		10	27	10	3							362
6— 7	38	1	6	17	7	5	2						388
7— 8	15		6	2	5	1	1						398
8—10	17		4	8	3	2							361
10—12	12		2	6	3		1						385
12—15	8	1		2	3			2					463
15—20	7		2	2		2							374
20—30	6		1	4	1								365
Number of brickmaking plants	834	2	47	253	271	137	58	34	13	9	7	3	470
Average output per plant	3,5	10.2	6.7	4.5	3.2	2.7	2.1	1.7	1.0	0.6	0.3	0.6	

Computed by M. Najgrakowski

The investigations by J. Grzeszczak[12] confirmed the existing relations between the type of commodities produced by the brickyard and raw material used. For example in 1955 more than 80 per cent of

Table 4

Raw Materiales Used in the Production of Tiles in Poland in 1955

Type of raw material	Number of brickmaking plants		Production of tiles	
		%	mill. of ceramic units	%
Clays of older geological formations	2	3,2	5,2	2,9
Older tertiary clays (mainly miocene)	21	33,3	115,9	63,6
Pliocene clays	19	30,2	30,6	16,8
Pleistocene clays	13	20,6	16,2	8,9
Clays of other formations and uninvestigated clays	8	12,7	14,2	7,8
Total	63	100,0	182,1	100,0

Computed by J. Grzeszczak

tiles produced in Poland were manufactured in plants using pre-quaternary high quality clays. (Table 4, Fig. 1).

*
* *

The presented studies aimed at preparation of an example of a modern detailed analysis of a given branch of industry and resulted in creation of an interconnected project. The distinction among the historical, economic and physiographic approaches may seem slightly artificial, but is necessary from the point of view of a rather efficient division of labour in research activities.

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[12] J. Grzeszczak. *The Production of Tiles in Poland in 1955.* "Building Materials" 1958, No. 8 (In Polish only).

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JERZY KOSTROWICKI

Land Utilization Survey as a Basis for Geographical Typology of Agriculture

As has been the experience in other systematic disciplines of the social side of geography, contemporary agricultural geography has developed from studies formerly part of economic and human geography. The following basic directions can be distinguished in its development [1].

The first, connected with what is termed commercial geography, has primarily provided information on the appearance and distribution, and also the amount of production of certain raw materials on the earth. These include the agricultural, with emphasis on those which have been or might have been the object of international commerce. Emphasis has been placed more on the results of production than on the conditions under which it developed. The purpose was more to explain where the given raw material might be bought at the lowest price, than in what way it was produced. The physical, social and economic conditions under which the agriculture producing these raw materials developed as well as how agriculture utilized the advantages and overcame the disadvantages of its geographical environment, were not a subject of direct interest.

This approach has been characteristic of nearly all classical textbooks of commercial and later economic geography. Many studies have been published treating the geography of agriculture in this way.

Besides the exposition of what is called general geography some early textbooks of economic geography also contained a regional part dealing with problems of production and the exchange of products between certain countries. The latter approach was sometimes the only one used and in a number of countries it dominated economic geography. In studies on the geography of agriculture this direction was maked, to a lesser or greater extent, by a detailed description of the agriculture in the region in question. Many studies of this kind were also made by agricultural economists. If the individual elements of the agricultural economy are not treated as isolated from each other, this method yields important results.

Although they differ in their methods, there is a great similarity in character in the works which treat the economy as a whole, or more

[1] Cf. J. Kostrowicki: *Trends in the Development of Agricultural Geography and its Tasks in Poland.* „Przegląd Geograficzny" 29 (1957) No. 1, pp. 3—19 (in Polish, English summary).

often only agriculture, in frame of physical, mainly climatic, units. In such works man and his economy are often treated as subordinate to their physical conditions.

In contradistinction to these trends which originated in economic geography, the third direction which in France is called *géographie agraire* (as opposed to *géographie agricole)* is derived from human geography. This trend is less informative, being more qualitative than quantitative, more genetic than descriptive in character. Although various authors interpret *géographie agraire* in different ways, most of the studies deal more with the effects of human activities as visible in the landscape, than with the economy itself, looking for the genesis of the existing forms (shape of fields and villages, enclosures, fences etc.).

In the Thirties of the present century, works more problematic and synthetic in character (derived from all the three trends discussed above) began to appear, mainly in France and the USA. They presented the geography of agriculture as the geography of systems or types of farming. I would suggest that we call this trend "typological". In recent years a number of works of this kind have also been published in other countries such as Germany and the USSR [2].

The most interesting papers submitted to the section on the geography of agriculture of the 18th International Geographical Congress [3]

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[2] Cf. primarily a long series of articles on agricultural regions of the world published in *Economic Geography*, in the yars 1925—1943 and prepared by: O. E. Baker, O. Jonassson, C. F. Jones, G. Taylor, S. Van Valkenburg, H. K. Schantz; and also the following studies: *A Classification of the Agricultural Regions of Europe and North America on Uniform Statistical Data.* By R. Hartshorne, S. N. Dicken. "Annals of the Association of American Geographers" 25(1935), pp. 99—120; *Major Agricultural Regions of the Earth.* By D. S. Whittlesey. Annals... 26(1936), pp. 199—240.

Numerous studies by American and British geographers representing this trend have been mentioned in the article of J. Kostrowicki entitled: *Remarks on the Geography of Agriculture in English-Speaking Countries.* „Przegląd Geograficzny 29(1957), No. 1, pp. 47—65 (in Polish, English summary).

Among French studies the work by D. Faucher: *Géographie agraire. Types de cultures.* Paris 1949 — should be mentioned first. Then: P. George: *La campagne: Le fait rural à travers le monde.* Paris 1956; and also numerous studies of partial character dealing with particular types (systems) or regions.

Among German publications, the works of L. Waibel are representative of the typological trend. As regards the Soviet writers, the subject is discussed by J. G. Saoushkeene in: *Geograficheskiye Ocherki Prirody i selskokhozyaystvienoy dieyatielnosti naselenya v rozlichnykh rayonakh Sovetskogo Soyuza.* Moskva 1947 (in Russian).

This trend is more or less dealt with in the following textbooks of economic geography:

C. F. Jones, G. G. Darkenwald: *Economic Geography.* New York 1941 and further editions.

D. H. Davis: *The Earth and Man. A Human Geography.* New York 1942.

N. J. G. Pounds: *An Introduction to Economic Geography.* London 1952.

[3] e.g. H. Boesch, M. Brunhofer: *The Decline of the Drei-Zelgen System in Northeastern Switzerland.*

D. Gribaudi, P. L. Ghisleni: *La distribution géographique des types d'aménagement des surfaces cultivées en Italie.*

O. Ribeiro: *Utilisation du sol, systèmes agraires et habitât: quelques remarques comparatives.*

J. Tricart: *Types de systèmes agricoles et niveaux de vie en Afrique Occidentale Française.*

belong to this trend. Agricultural economists and agriculturalists [4] have also contributed much in this respect. Up to the present time. however, we still observe studies carried on with different methods based on sample investigations, frequently non-comparative, due to the fact that various types and systems are differently understood. It seems that the geography of agriculture, as a separate geographical discipline, is still in the stage of describing and distinguishing various types, and it is only after this period is over that the systematization and scientific classification of these types, based on uniform criteria, will come. The first syntheses in the geographical typology of agriculture, which have already appeared, although they are not based on uniform objective criteria, seem to promise this further period of development. The process may be hastened and the uniform objective criteria for division established when we take advantage of land use surveys, provided they are properly set up.

Apart from the above trends in studies, in the Thirties of this century, research also began to develop on land utilization which, although closely connected with the geography of agriculture, surpassed it in its scope. The greatest contribution has been made by L. D. Stamp who guided the work on the land utilization survey of Great Britain [5]. To him, too, mainly, belongs the credit for the creation and direction of the work of the Commission on Land Utilization of the IGU, which has made research on land utilization popular all over the globe [6]. Numerous maps and studies of various approaches, scales and scopes have been elaborated. Thanks to the Commission's activity, differences in method are not significant but the scale of the studies and their depth continue to differ. Together with maps and investigations which distinguish only the main uses. there is more and more frequent research in order to analyse the technical, economic and even social aspects of agriculture and to differentiate its various systems and types [7]. The first approach is less appreciated nowadays since — as is commonly stressed — similar

O. Tulippe: *Une révolution agraire au milieu tropicale: les paysannats indigènes au Congo Belge.*

J. Vila Valenti: *Un concept complexe: le système de culture.*

Cf. *Abstracts of Papers.* XVIIIth International Geographical Congress. Rio de Janeiro 1956.

[4] Compare for example the following studies:

E. Laur: *Einführung in die Wirtschaftslehre des Landbaues.* Berlin 1920.

A. Chevalier: *Essai d'une classification biogéographique des principaux systèmes de cultures pratiqués sur la surface du globe.* Revue Int. Renseignement Agricole 1925.

H. Hitier: *Systèmes des cultures et assolements.* 1925.

O. S. Morgan: *Agricultural Systems of Middle Europe. A Symposium.* New York 1935.

A. Howard: *Agricultural Testament.* 1943.

Generalized Types of Farming in the US. US Department of Agriculture. Washington 1950.

R. Dumont: *Economie agricole dans le monde.* Paris 1954.

[5] The work as a whole is summed up by L. D. Stamp in: *The Land of Britain, its Use and Misuse.* London 1948.

[6] Cf. Reports of the Commission on Inventory of World Land Use at the International Geographical Congresses in Washington in 1952 and in Rio de Janeiro in 1956.

[7] To them belong British, Pakistani, Italian, Japanese, Canadian and other studies.

results might be obtained almost mechanically from the topographical map or aerial photograph, whereas the second type of research is presently being more and more developed and deepened for both scientific and practical purposes. Here the typological trend in agricultural geography has been related to the land utilization survey — a contact which may prove very fruitful.

Investigations on agricultural typology, thanks to the fairly uniform methods exercised in research on land utilization, may themselves obtain more uniform methodical bases, whereas research on land utilization, being already of practical significance, will acquire a deeper scientific purpose. Studies on land utilization in Poland follow this pattern.

The origins of studies on land utilization in Poland date from the pre-war period when several studies of that type were carried out. However, they did not go beyond differentiation of the major forms of land use [8]. After the war, on the initiative of the Central Office of Physical Planning, Polish geographers following the pattern of their British colleagues, started discussion on a land utilization map of the whole country. Methods were then worked out, but the project of covering all of Poland with a detailed land survey had to be rejected as unrealistic, due to the lack of scientific personnel and means. The scope of work limited to the preparation of a general land utilization map of Poland on the scale of 1 : 300,000 based on pre-war 1 : 100,000 topographical maps. The work was completed in 1956 and a general land utilization map of Poland on the scale of 1 : 1,000,000, a photographic reduction of the 1 : 300,000 maps, was published [9].

However, the idea of a detailed land utilization survey was taken up again and again, particularly in connection with regional planning. In 1953 and 1954, on the initiative of Professor K. Dziewoński [10], other attempts at a detailed land utilization survey were undertaken, and work was continued in the following years. Samples of these maps were presented to the Agricultural Geography Section at the 18th International Geographical Congress in Rio de Janeiro in 1956 (J. Kostrowicki) [11]. In the following years, due to the newly established Section of Agricultural Geography within the Institute of Geography of the Polish Academy of Sciences, these studies were considerably extended and they resulted in a final definition of the aims, concept, scope,

[8] Cf. J. Kostrowicki: *Research Studies on Land Utilization in Poland.* „Przegląd Geograficzny" 31(1959), No. 3—4, pp. 517—533 (in Polish, English summary).

[9] Poland. General Land utilization Map 1 : 1,000,000. Director and Editor: Professor F. Uhorczak. Warsaw 1957. 22 maps of elements and their combinations (Legend in Polish, English and Russian).

[10] K. Dziewoński, J. Kostrowicki and others: *Temporary Instructions on Drawing Detailed Land Utilization Maps* (Project). „Dokumentacja Geograficzna" (1956), No. 1, 39 pp. (in Polish).

[11] K. Dziewoński: *The Detailed Land Use Map in Poland.* XVIIIth International Geographical Congress. Abstracts of Papers. Rio de Janeiro pp. 150—151 (in English).

K. Dziewoński: *Detailed Survey of Land Utilization in Poland.* „Przegląd Geograficzny" 28(1956), Supplement, pp. 26—31 (in English).

J. Kostrowicki: *Polskiye issledovaniya ispolzovaniya zemel.* „Izvestija Akademii Nauk SSSR". Seria geograficheskaya (1958). No. 4, pp. 131—134 (in Russian).

methods and techniques of the survey [12]. A number of studies based on the survey were published [13]. Others are in print or are being prepared.

The aim of the land utilization survey in Poland is twofold: scientific and practical. The scientific object is the study of the forms and ways in which man's economy utilizes its natural environment (i.e., the land). The practical aim is the definition of the degree of rationality in land utilization and the drawing of conclusions in regard to a more rational utilization of his natural environment by man.

Deeply penetrating the natural, social, technical and economic aspects of agricultural economy, the Polish land utilization survey also may provide a good foundation for a geographical typology of agriculture; the elaboration of this typology is, in turn, of remarkable significance, both scientific and practical.

The following categories are included in the Polish land utilization survey:

1. The object of land utilization, i.e. natural environment evaluated from the point of view of human economy (mainly agriculture and forestry).
2. The subject of land utilization, i.e. social and ownership relations connected with land utilization.
3. The form of land utilization, i.e. the actual use of the land by particular branches of the human economy.
4. The way or manner of land utilization, i.e. the organizational and technical methods and systems and the intensity of this utilization.
5. The direction or orientation of land utilization, i.e. the qualitative economic purposes of the utilization, or, in other words, the kinds of products already obtained or to be obtained as a result of the land utilization.
6. The result or effect of land utilization, i.e. the quantitative effects of production, i.e. the volume of production obtained as a result of a land utilization that has been determined.

These six categories are obviously closely inter-related. Natural conditions exert their influence on both the method and direction of land utilization as well as on the results obtained. The subject of land utilization, i.e. the social relations or, in other words, who is the user or the owner of the land — this factor exerts its influence on the way, directions and effects obtained in land utilization. And, finally, the ways

[12] Cf. *Polish Land Utilization Survey.* Instructions for the Detailed Land Utilization Survey. Editor J. Kostrowicki. „Dokumentacja Geograficzna" (1959) No. 2, 129 pp. And also: J. Kostrowicki: *Research Studies...*, op. cit.

[13] W. Biegajło, J. Tobjasz: *Three Field Crop Rotation with Fallow System. The Village of Grabowiec.* „Przegląd Geograficzny" 29(1957), Nr. 1, pp. 111—142 (in Polish, English summary).

W. Biegajło: *Agriculture in the Suburban Zone. The Commune of Horodniany.* „Przegląd Geograficzny" 29 (1957), No. 1, pp. 143—158 (in Polish, English summary).

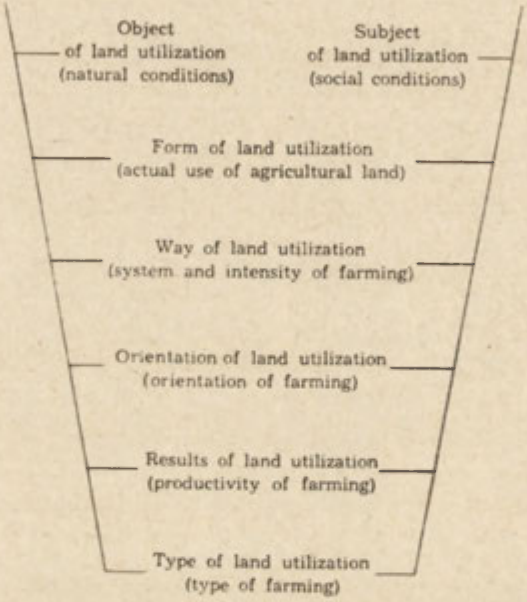
R. Szczęsny, H. Piskorz, J. Rakowicz: *Studies on Land Utilization in Mrągowo County (Materials from Research Work in 1955—1956).* „Dokumentacja Geograficzna" (1958), No. 1, 103 pp. (in Polish).

W. Biegajło: *Farming in Gdańsk Żuławy; Radunica Village.* „Przegląd Geograficzny" 31(1959), No. 2, pp. 345—350.

R. Szczęsny: *Farming in Lower Beskid — the Commune of Cergowa.* „Przegląd Geograficzny" 31 (1959), No. 3—4, pp. 629—644.

of land utilization are bound up with the direction of land utilization and exercise an influence on the effects, etc.

The relations among these categories are varied. Being interrelated, they are in some way connected with the natural environment, which is a separate category. A somewhat distinct category is the subject of land utilization. All the categories combined are the basis for determining the type of land utilization (= type of man's economy in nature, = type of farming) understood as the shaped by the determined social and economic processes, combination (ensemble) of forms, ways, orientations and effects of land utilization.



These relations are schematically presented in the diagram 1.

The particular categories of land utilization find their expression in the various stages of the elaboration of the survey material and only some of them can be found on the land utilization map. Nevertheless, the map and especially all the survey materials, give sufficient basis for distinguishing systems, directions and types of the agricultural economy, understood as stated above.

Thus far in Poland a detailed land utilization survey (on the scale of 1 : 10,000 and 1 : 25,000) has covered about 10 thousand sq. km. (about 3,850 square miles), which equals 1/30 of the whole area of the country. It is not our intention to cover the whole country with so detailed a survey, since we have neither the personnel nor the means to do so. To involve greater areas in the survey would obviously be still less possible. However, this survey which penetrates deeply into the mechanism of the agricultural economy, if a proper territorial representation is considered, can give sufficient material for distinguishing the characteristic features of particular types of the agricultural

economy. The elaboration on this basis of proper indices and their cartographic analysis on a larger scale will permit a study of the extent of the types of farming.

The appropriate geographical typology of agriculture should obviously distinguish types of various ranks: a whole hierarchy of types, from those on a world scale to local types dealing with the basic local units, which are individual farms. The types of farming in the world are subject to constant changes and transformations which occur simultaneously with the alteration in their particular elements. Thus on areas having old agricultural traditions there have been a superposition of newer forms, systems and directions in agriculture upon the old and this has given rise to highly complex types. Areas which have been farmed only recently and undeveloped lands present less complicated types.

All the various types of farming may be firmly and objectively distinguished for any area, if indices are provided which properly represent the most important social, technical and economic aspects of agricultural economy.

However, the elaboration of a full system of such indices and the elaboration of world typology of farming surpasses the capacity of a single researcher and even of one country; it requires world-wide co-operation.

Thus far, the Polish land utilization survey permits us to distinguish a number of agricultural types differing in systems, intensity, direction and productivity of the rural economy. The number of studies is not large enough to enable us to state with certainty that some type of smaller extent has not been omitted. Also the other part of the work, namely the determination of the exact extent of the types distinguished, has not yet been done.

According to various studies, Polish agriculture as a whole and those of some other neighbouring countries are now in a transitional stage from the old, special, underdeveloped form of mixed West European capitalistic agriculture which has been characteristic of east-central European countries — to the new socialistic agriculture whose elements are only germinating in Poland. The latter will obviously in the future create on this area some individual types of agriculture, different from those of the socialist agriculture of the podsolic areas of Central Russia, or that of the chernozems of the Ukraine or, in particular the socialist agriculture of China.

Within the general type thus defined, the following subtypes can be distinguished in Poland:

1. Technically the most primitive and at the same time the least intensive and productive is the agriculture of north-eastern Poland. Here there can still be found strong remnants of the three-field system of farming (three-field crop rotation with a fallow field or, more frequently, three field crop rotation with one crop of lupine or seradella (sown into the fallow); fields and holdings are greatly fragmentated and are orientated to cereal or cereal and root crops, with rye or rye and potatoes prevailing. There is a large ratio of dairy cattle raising, the cattle grazing on uncultivated meadows, pastures and on fallow land. The productivity

of this type of farming is small, as is marketability mainly based on cereals, milk, dairy products and pigs.

2. On the whole, the economy of the central part of the country is similar, although it is somewhat more intensive and has a higher technical level. Here, on the heavy soils, there is four-field crop rotation based on the Norfolk system, whereas three-field crop rotation is practised on the lighter soils. Cereal and root crops orientation is prevailing here, most frequently rye and potatoes, and, on the best soils, wheat and potatoes or wheat and sugar-beet with a big share of livestock raising — mainly pigs. The productivity of this type of agriculture is low or average, its marketability depending primarily on the size of the holding or on the labour power, is mainly based on the sale of pigs, and — to a smaller extent — of milk or other dairy products, or of grains and, rarely, of industrial plants (sugar-beets, flax, tobacco).

3. The farming system of southern Poland is highly intensive but technically primitive being based on the highly fragmentated small farms. Its main stress is on dairy farming as well as cereal and root crops; root and cereal crops orientation, with rye and potato or wheat and potato prevailing. In spite of the great intensity of this system of farming, its productivity per unit area is barely average, and per labour unit it is very small. The marketability, mainly based on animal husbandry, is quite low due to the small size of the holdings and the relative over-population of the agricultural land.

4. Greater Poland (Wielkopolska) and the Opole Region have a system of farming with a direction, intensity and productivity which, although less mechanized, come closer to West-European agriculture. Here more rational methods of farming are in use, especially on arable lands, with a greatly mixed orientation which may be rye and potatoes, rye and sugar-beet or wheat and sugar-beet with an established share for animal husbandry and a large one for industrial plants. The productivity is relatively high both per unit area and per labour unit. The commercial return in these not highly populated areas comes from the sale of pigs, cereals, dairy products and industrial plants (sugar-beet, rape and others).

5. In the Western Territories a mixture of all the types discussed above appears in various proportions because these areas are now inhabited by new-comers who have brought with them various traditional methods of farming. Compared with the pre-war period, as a result of the war devastation and migration of people, there is an increase in the share of plant production, especially cereals, in relation to animal husbandry, and a decrease of productivity in the rural economy, with its commercial character preserved. These areas show remarkable regional differences resulting from the differences in natural conditions and in the origins of the inhabitants. The former Polish population who are concentrated in Opole Silesia and several counties (powiats) of the former East Prussia continue to maintain an intensive, highly productive and commercial type of rural economy, with animal husbandry predominant. The future will undoubtedly bring to this area new types of farming more related to local conditions and less to traditions brought in from outside. This process has already begun but the final formation of these types requires time.

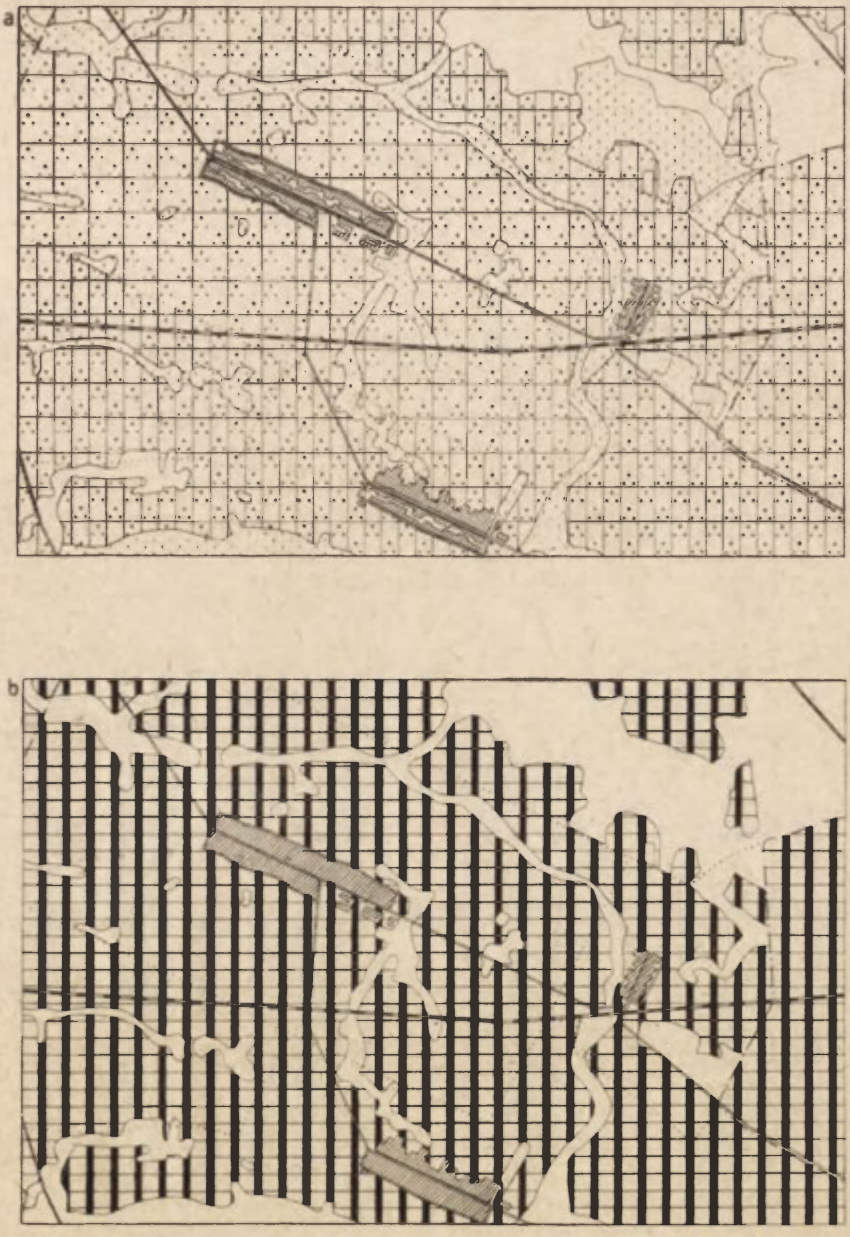


Fig. 1. Type of farming from north-eastern part of Poland. Podlasie Plain Example from Bielsk Podlaski County, Parcewo commune: *a* — sandy or sandy-clayey podsolised soils. Great proportion of small farms, concentrated settlement fragmentation of lands, three-field system with fallow; *b* — cereal-rect-crops orientation (61,3% cereals with rye prevailing, 15,4% root-crops with potatoes prevailing, 19,8% fodder crops with annual plants: lupine or seradella prevailing) with dayrying (52,3 animal units per 100 ha of agricultural land with dairy cattle prevailing). From the Land Use Survey 1956—57

Fig. 2 — Type of farming from north eastern Poland, Suwałki Lake District. Example from Suwałki county, Prudziszki commune. Clayey or sandy clayey podsolides soils: *a* — farms of medium size, disperced settlement, three-year crop rotation without fallow; *b* — cereal-root-folder or cereal-root-crops orientation (cereals 53,3 — 61,2% with rye prevailing, root crops 14,7 — 19,5% with potatoes prevailing, fodder crops 19,2 — 23,1% with annuals: lupine or seradella prevailing) with dayrying (45,8 animal units per 100 ha of agricultural land with dairy cattle prevailing). From the Land Use Survey 1959

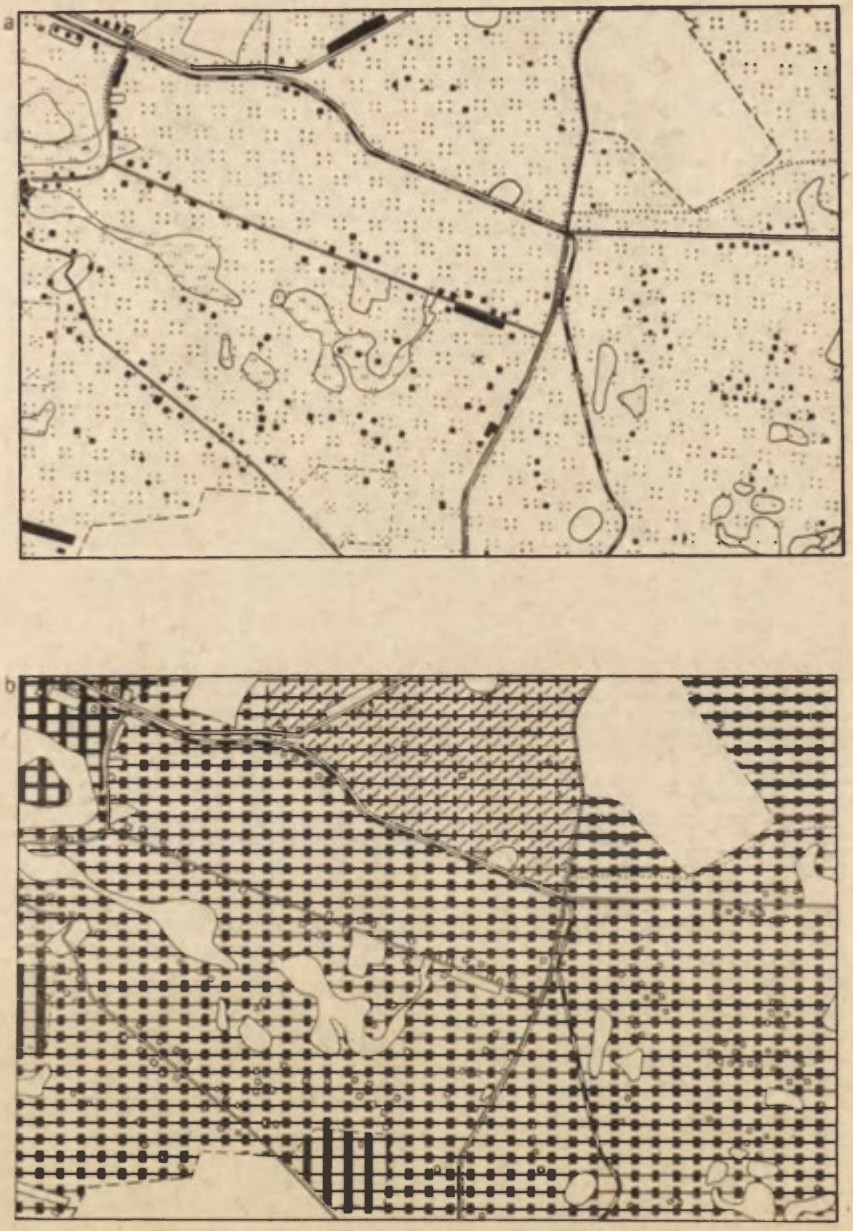


Fig. 3. Type of farming from central Poland, Lublin Upland. Example from Hrubieszów county, Terebiniec commune. Chornozems or brown forest soils on loess: *a* — farm of medium size prevailing, dispersed settlement fouryear crop rotation system, exceptionally five-year; *b* — cereal-root or cereal-fodder or cereal-root-fodder orientation (cereal 56,8 — 64,2% with wheat prevailing, exceptionally rye prevailing, root crops 17,4 — 22,6% with potatoes prevailing — fodder crops 12,3% with multiannual plants as clover lucerne prevailing) with livestock raising, pigs breeding prevailing. From the Land Use Survey 1958

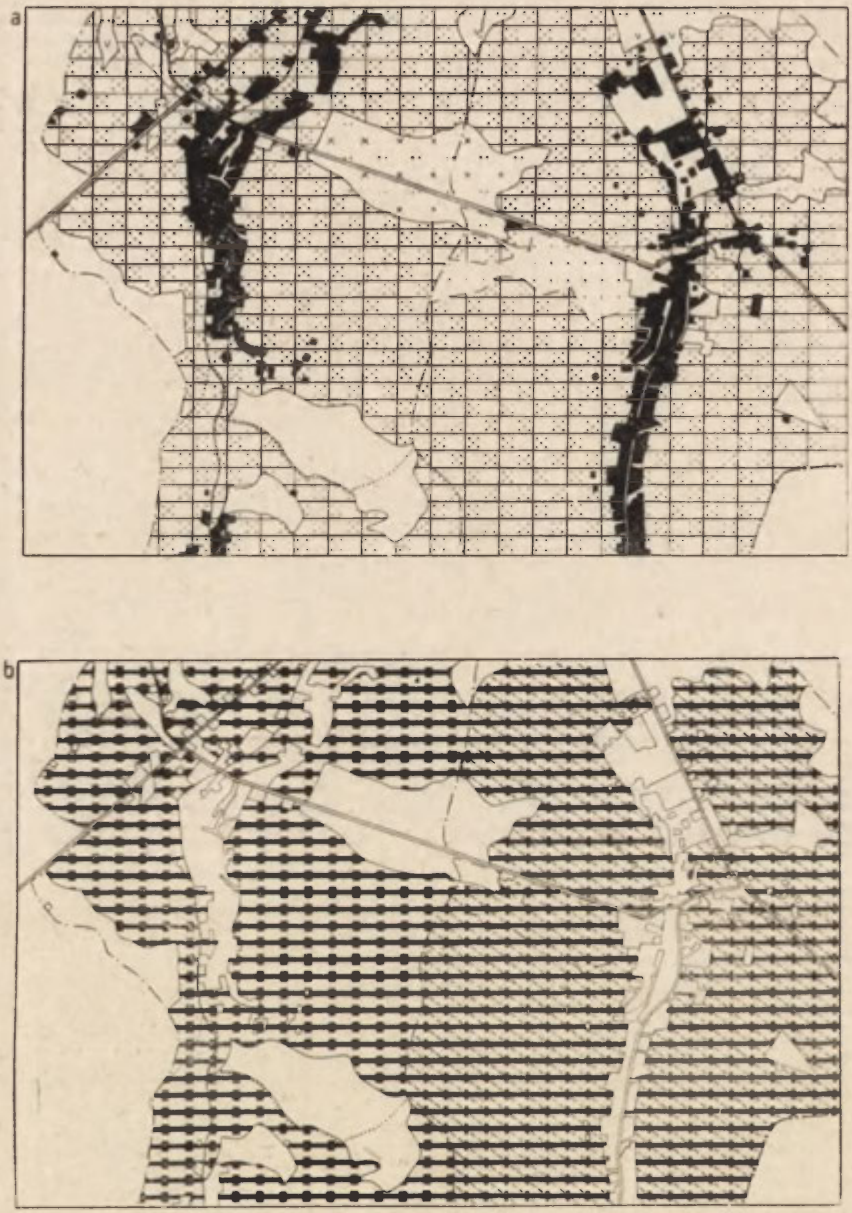


Fig. 4. The type of farming from southern Poland, Carpathian Mountains, Jasło — Sanok Basin. Example — Krosno county, Iwonicz and Rogi communes Clayey mountain brown or podsolised soils: *a* — settlement concentrated in river valleys, big, long villages, high proportion of small (— 5 ha) farms, highly fragmentated land, five-year rotation; *b* — cereal-root or cereal-root-fodder crops orientation (cereals 55,4 — 61,3% with wheat prevailing, roots 22,5% with potatoes prevailing fodder crops 15,2 — 23,6% with multiannual plants mostly clover prevailing) with dayring (79,2 animal units per 100 ha of agricultural land with dairy cattle prevailing). From the Land Use Survey 1958

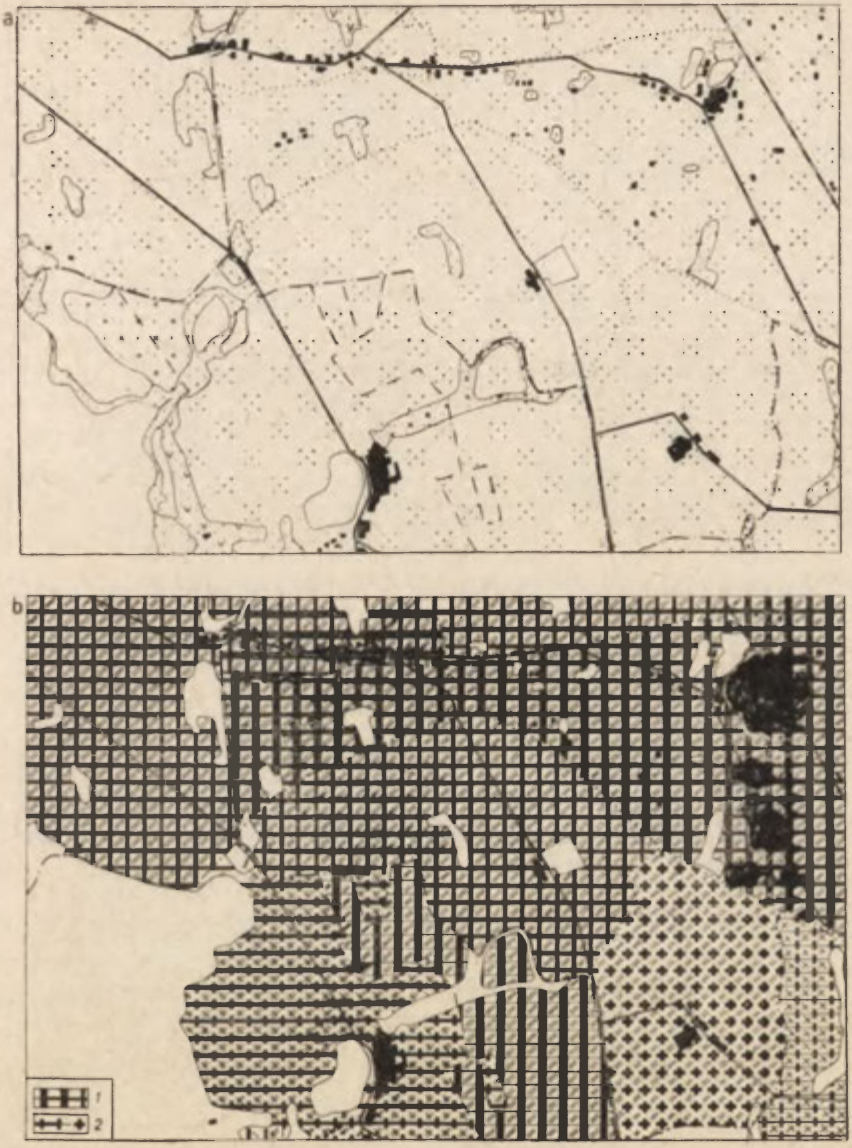


Fig. 5. The type of farming from Greater Poland — Kujawy Plain. Example from Inowrocław Country, Chełmce and Bachorce communes. Black earths with patterns of sandy soils: *a* — dispersed settlement, partly former manor estates (actually state farms), partly isolated individual farms. Five-year rotation; *b* — 1) individual farms: cereal-root crops orientation with highly differentiated proportion of particular crops (cereals 53,8 — 61,2% with rye or wheat prevailing or with similar proportion of rye and wheat; root-crops 24,2% with potatoes or sugar-beet prevailing; fodder crops 15,2% with many-year plants as lucerne or clover prevailing; industrial crops 5,1%) with livestock raising 64,2% animal units per 100 ha agricultural land with pig-raising prevailing), 2) state farms (south west and south east of the area). Cereal-root-fodder crops orientation (cereals 47,2% with wheat prevailing, roots 21,7 — 25,3% with sugar-beet prevailing, fodder crops 21,7% with multiannuals prevailing, high proportion of industrial crops 10,7—15,8%) with feebly developed stock-raising (48,2 animal units with cattle prevailing). From the Land Use Survey 1957

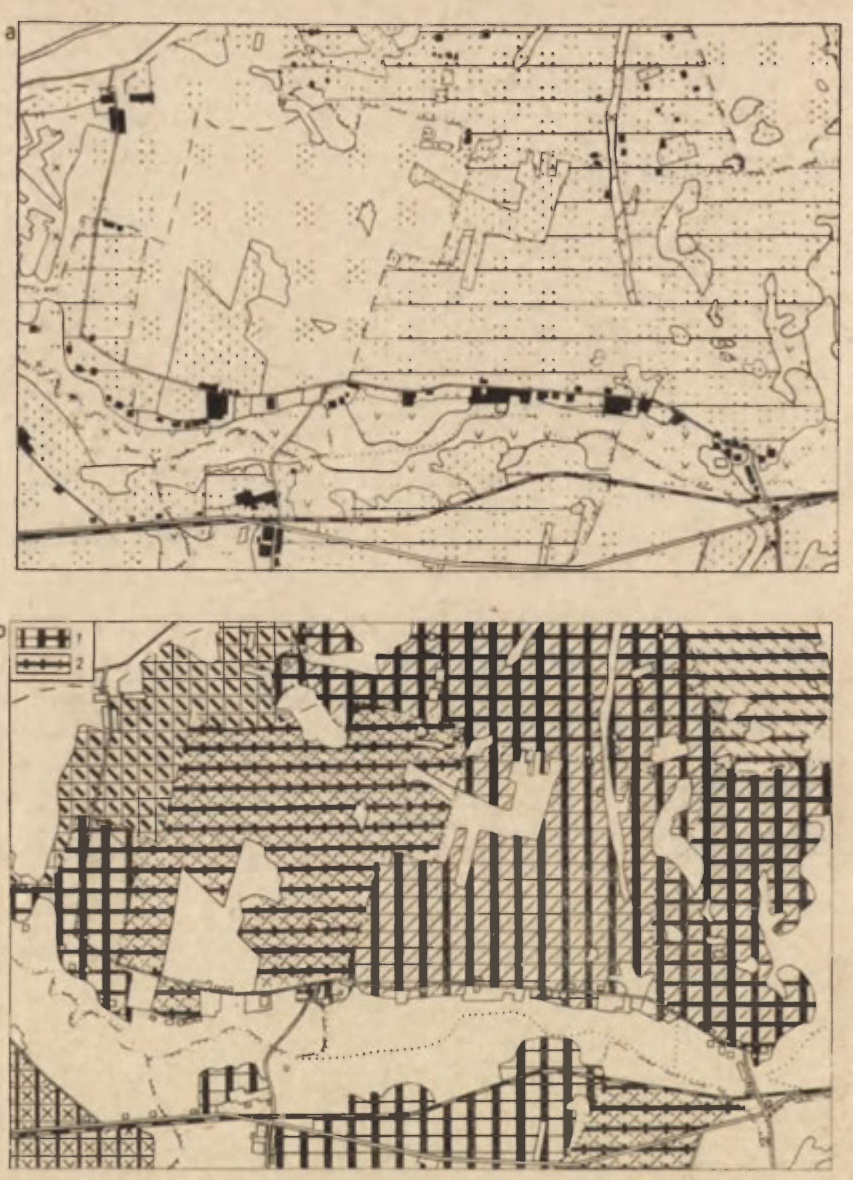


Fig. 6. Type of farming from North Western Territories, Baltic Coast Region, Koszalin county, Miłogoszcz commune. Heavy clayey brown or podsolised soils prevailing. *a* — 1) individual farms mostly dispersed settlement, isolated farms, four-year rotation, 2) state farms — concentrated settlement, former manor estates, six, seven or eight year rotation; *b)* — 1) individual farms: cereal-root or cereal-root-fodder crop rotation (cereals 61,2% with rye prevailing, roots 18,7 — 22,3% with potatoes prevailing, fodders 16,6% with clover prevailing, industrial 5,7%) with dairying (55,5% animal units with dairy cattle prevailing), 2) state farms — cereal-root, cereal-root-fodder, root-cereal-fodder or even fodder-cereal-root crop orientations (cereals 38,2 — 45,3% with wheat or rye prevailing: root 11,7 — 20,3% with potatoes prevailing; fodders 23,7 — 40,1% with multiannual crops as clover and lucerne, prevailing; large share of industrial crops 8,9 — 15,7% with smaller role of livestock raising (42,1 animal units with dairy cattle prevailing). From the Land Use Survey 1958

gromada (commune) boundaries

village or farm boundaries

state farm boundaries

collective farm boundaries

limits of main uses

railways

roads

settlements

PERMANENT GRASSLAND

improved

partly improved

cut twice yearly

cut and grazed

cut once yearly

grazed

ARABLE LANDS
Crop rotation

three field without fallow

three field with fallow

four year

five year

six year

seven year

eight year

LAND FRAGMENTATION

under 5 lots of arable land per 1 farm

5—10 lots of arable land per 1 farm

more than 10 lots of arable land per 1 farm

SIZE OF FARMS

farms under 5 ha more than 50% of total agricultural land

farms under 5 ha 25—50% of total agricultural land

ORIENTATION IN LAND UTILIZATION

CEREALS >60% >40% >20%

Rye

Wheat

ROOTS

>30% >20% >10%

Potatoes

Sugar beet

FODDERS

Annuals

Multiannuals

INDUSTRIAL CROPS

>10% >5%

6. In the environs of the larger towns and industrial centres a cosmopolitan type of suburban agriculture has originated, characterized by high intensity but little mechanical aid. Intensive manuring has pushed the role of crop rotation to second place. Predominant are root vegetables or root and cereal crops, mainly with vegetables, vegetables and potatoes or potatoes and rye prevailing, with a quite remarkable proportion of pig and dairy cattle raising. Locally, orchards play a considerable role. The economy is highly productive, its marketability being primarily based on the sale of vegetables and potatoes, more rarely fruits and flowers, and also pigs and milk.

The typology presented above relates to the individual farming economy which in Poland occupies 85,4 per cent of the agricultural land, and partly to cooperative farms, especially smaller ones. State Farms (involving 12,3 per cent of the agricultural land) and some cooperative farms have developed a different type of farming. Apart from regional differences, a common feature of this group of farms is a considerable degree of mechanization. The emphasis is on cereals or cereals and fodder with a large share to industrial plants; the proportion of livestock raising is smaller than it is in individual farming. Up to 1956, this group of farms had practically not applied a rational crop rotation; they are now in a transitional phase leading to the introduction into their farming system of a crop rotation covering many years. Although the productivity of these farms is lower than average, their marketability is high and is based primarily on cereals and industrial plants, and — to a smaller degree — on animal products. The fact that most state farms are situated in the northern part of the country which suffered great war devastation and now lacks man-power in agriculture, has had its influence on the intensity, direction and productivity of the farming. Much better results are obtained by the state farms of Greater Poland and Silesia. The regional differentiation of the rural economy of the state farms requires detailed study.

Research on the geographical typology of Polish agriculture will be continued through further detailed land utilization surveys. Their tensity should be increased so that final conclusions can be drawn, also by means of simplified surveying probably on the scale 1 : 300,000, based on the method of detailed land use survey covering the whole country. The latter by means of proper indices, will make it possible to determine the territorial extent of the types previously distinguished. We also are going to start comparative studies in other countries.

Studies on the geographical typology of agriculture are of great scientific significance since they allow us to classify phenomena and facts in a scientific way, and to generalise them. Also their practical importance is great because they help us to learn of phenomena which have great practical significance; they allow us to draw conclusions regarding the rationality or irrationality of the present farming systems and possible necessary changes in the future. It would be highly desiderable to base such a typology on uniform, objective criteria valid for larger areas. For this purpose the land utilization survey, which enjoys great popularity in many countries, would be of assistance.

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STANISŁAW BEREZOWSKI

Recherches géographiques sur l'évolution des migrations pastorales en Europe

L'auteur du présent rapport a mené au cours des dernières années des études sur les problèmes de l'élevage saisonnier et celui des migrations pastorales, basées sur une ample littérature ainsi que ses propres recherches pratiques et les enquêtes effectuées en Pologne et dans certains pays des Balkans. Les résultats de la première étape de ces études ont déjà été publiés dans le premier volume de l'ouvrage collectif intitule: *Vie pastorale dans les Tatra polonaises et la région subtatrique*, paru en 1959 sous la rédaction du professeur W. Antoniewicz

A cette étape des études, l'auteur avait surtout pour but d'établir une typologie des formes des migrations pastorales la mieux adaptée aux études géographiques, et ensuite d'analyser les traits essentiels de cette tellement intéressante, bien que souvent primitive, forme d'exploitation économique du milieu géographique, appliquée surtout dans les régions montagneuses de nombreux pays d'Europe.

Plusieurs auteurs ont déjà pris la parole au sujet de la typologie des formes de migrations. Cependant, nous y rencontrons encore toujours une confusion de termes, qu'il conviendrait de déterminer et de ranger définitivement. H. Boesch (*Die Alpen* 1956, No 6) conçoit de la manière la plus juste les types de migrations, en distinguant le nomadisme, la transhumance et l'économie alpine (*Alpenwirtschaft* ou la vie pastorale). Il s'avère cependant que, compte tenu du grand développement technique de l'économie alpine et de l'existence de formes nettement différentes des montagnes en Europe Orientale, il faudrait élargir cette typologie. C'est pourquoi, l'auteur propose, en se basant sur ses propres études, d'établir les suivantes formes principales de migrations pastorales:

Nomadisme

Le trait caractéristique des migrations de ce type est l'émigration saisonnière ou périodique de toute la population avec ses troupeaux. Cette forme primitive de migrations est caractéristique pour les pays d'Asie et d'Afrique. En Europe, on la rencontre encore chez les Valaques dans les pays balkaniques, mais ce sont là des vestiges du passé en voie de disparition.

Transhumance

Dans ce type de migration, la population reste sur place dans les villages et seuls les bergers surveillent les troupeaux sur les pâturages d'été (dans la plupart des cas dans les montagnes) pour les emmener

ensuite vers les pâturages d'hiver) — (régions submontagneuses ou au bord de la mer). Ils se déplacent ainsi avec eux dans les deux sens. D'après la localisation des pâturages par rapport au domicile des propriétaires de troupeaux, on peut diviser la transhumance en trois catégories:

1. *Transhumance normale soit ascendante.* Dans ce cas-là les troupeaux séjournent en hiver sur les terrains situés au bas des montagnes, aux environs du domicile de leurs propriétaires. Les troupeaux passent cependant en groupe et durant toute la saison on ne les rentre pas pour la nuit au village. En été les troupeaux émigrent dans les montagnes, où on organise également un estivage collectif.

2. *Transhumance inverse ou descendante.* Les troupeaux appartenant aux montagnards pâturent en été dans les alpages et en hiver émigrent vers les pâturages de plaine ou situés ou bord de la mer, ou ailleurs.

3. *Transhumance alternée.* Durant deux saisons de l'année (été-hiver), les troupeaux passent en dehors de la région d'habitation de leurs propriétaires, c'est-à-dire en été dans les alpages, et en hiver dans les régions de plaine. Seulement deux fois par an, sur le chemin de passage du pâturage d'été au pâturage d'hiver, les propriétaires accueillent chez eux leur bétail.

Estivage

Cette forme de migrations pastorales ne connaît pas le pâturage d'hiver collectif ni souvent individuel à ciel ouvert. Les troupeaux passent l'hiver dans les bergeries et ceci constitue une différence entre ce système et la transhumance ascendante (normale). Il est facile de deviner que cette forme des migrations pastorales est appliquée partout là, où, pour de raisons climatiques ou autres, le séjour dans le pâturages d'hiver est impossible et où les pâturages de montagne ne permettent que l'estivage des troupeaux. Une autre différence entre la transhumance et l'estivage est que ce dernier est souvent appliqué sur le terrain d'une chaîne régulière de montagnes et le chemin fait par les troupeaux est plutôt court.

Type helvétique

Il porte également le nom du „type complexe d'économie alpine". Etant donné qu'il s'est développé très tôt en Suisse et que c'est là-bas qu'il a connu le plus grand essor, on l'appelle souvent le type „helvétique". Il diffère, de l'estivage décrit ci-dessus, par sa forme plus parfaite, bien que plus compliquée. Les migrations des troupeaux sont suivies ici par la migration saisonnière de leurs propriétaires qui habitent dans deux villages: dans l'un en hiver, situé le plus souvent dans la vallée, et dans l'autre en été, situé plus haut dans les montagnes. Durant les mois d'été, les troupeaux émigrent avec les bergers encore plus haut, sur les alpages. Cela permet de lier encore plus étroitement l'élevage avec la culture des plantes, où la culture des plantes fourragères joue un grand rôle.

Il existe également une série de types des migrations pastorales qui ne peuvent être classées sans réserves à ces types fondamentaux. On rencontre également des formes peu répandues ainsi que des formes de transition qui ne peuvent non plus être classées dans les 4 types en question. La portée territoriale est également sujette à certaines variations ainsi que la méthode d'organiser le pâturage (à plusieurs étages) et l'exploitation de l'élevage. Néanmoins — mutatis mutandis — les

4 types cités ci-dessus constituent les formes principales des migrations pastorales.

Les types susdits sont liés aussi bien aux conditions du milieu géographique qu'au niveau du développement sociale et économique du groupe donnée de la population. Une adaptation meilleure, et plus rationnelle aux conditions géographiques engendre aussi des changements dans le domaine de l'activité économique générale ainsi que des changements dans la méthode d'organiser les migrations pastorales. Ainsi donc le développement du peuplement stabilisé et l'abandon de la forme caractéristique de vie de la société vivant dans les cadres de la communauté primitive passant à des formes supérieures de vie, engendre la diminution du nomadisme au profit soit d'une des formes de la transhumance, soit de l'estivage. L'estivage d'été évolue vers l'estivage du type helvétique, soit vers l'élevage intensif sur place, sans migration ni pâturage collectif. Le développement social et économique engendre en règle des changements dans les méthodes d'organisation des migrations pastorales, mais il n'existe aucune règle quant à l'ordre du passage d'un type de migration à l'autre. Ce phénomène est lié à de nombreux facteurs aussi bien de nature géographique que sociale. Au fur et à mesure du développment des régions montagneuses en Pologne, ont permis à l'auteur d'établir la méthodes de production, on observe très souvent la réduction de la portée des migrations pastorales. Est-ce que la tendance va vers leur disparition complète? Dans certaines régions de l'Europe évidemment oui, mais pas partout.

Les études sur les importants problèmes géographiques des migrations pastorales dans les pays européens, en tenant particulièrement compte des régions montagneuses en Pologne, ont permis à l'auteur d'établir la direction de leur transformations. Dans les régions des hautes montagnes, cette vieille et traditionelle forme d'élevage connaît presque partout une plus ou moins sensible diminution quantitative et subit de changements assez considérables dans les méthodes d'organisation de la production. Dans de nombreuses régions de plateux et des montagnes moyennes les migrations pastorales ont disparu complétement. Cependant dans les pays au caractère de haute-montagne prononcé, ces migrations se maintiennent jusqu'aujourd'hui, bien que leur forme ait subie des transformations et que leur étendue territoriale et le nombre de bêtes englobées par ces migrations soient réduits.

Ce qui plus est, de nombreux faits semblent indiquer que les migrations pastorales sont une forme adaptée dans une grande mesure à l'économie d'élevage des terrains montagneux et des hautes montagnes. Qu'ils constituent non seulement la meilleure méthode de l'adaptation passive au caractère géographique de ces terrains, mais même de l'exploitation active de leurs conditions naturelles. Approfondissant la connaissance de l'essence du complexe des phénomènes de la nature qui forment dans la montagne le milieu géographique et en appliquant les méthodes techniques de production rationnelle scientifiquement élaborées, la communauté qui dirige l'économie peut, en organisant les migrations pastorales avec l'estivage, utiliser plus rationnellement ces terrains à ses besoins. C'est pourquoi, l'opinion exprimée par certains auteurs, que les migrations pastorales saisonnières et en particulier l'estivage deviennent pre-

tendument un anachronisme, ne semble pas être justifiée. Le développement de l'économie et les progrès de la zootechnique ne provoquent pas obligatoirement une décadence de la vie pastorale. Ils ne font que limiter cette vie aux proportions indispensables, classées sous formes rationelles dans les cadres des deux grands systèmes mondiaux économiques et sociaux.

Deux pays de montanges: les Alpes et le Caucase en sont le meilleur exemple. Les Alpes, en tant que région de puissant développement des forces productives d'effectuant dans le cadre des relations de production capitalistes. Les Caucase, en tant que région où règnent des relations socialistes de production permettant d'atteindre — malgré le niveau des forces productives inférieur à celui des Alpes — un développement de l'économie plus rapide pour ce qui est de l'adaptation aux conditions du milieu géographique.

Au cours du dernier siècle on a vu se développer dans la région des Alpes un élevage de montagne hautement intensif avec application du système compliqué et differencié des migrations englobant hommes et troupeaux, migrations correspondant dans les diverses régions des montagnes au niveau de la mise en valeur de la région et à leurs conditions géographiques. Dans le Caucase, des conditions pour l'accélération de la mise en valeur ont été créées pendant une période relativement courte de vingt et quelques années, sur la base du progrès dans le développement des rapports de production. Le caractère des migrations s'est transformé. La forme primitive — le nomadisme — a disparu et le système de transhumance, appelée là-bas l'élevage de pâturage et de migration, y a été largement popularisée. En même temps, partout là où les conditions le permettent, s'est développé dans la région de Caucase l'élevage du type estivage ainsi que l'élevage sur place.

Des formes plus arriérées de migrations pastorales sont appliquées aux Balkans et également, en partie, dans les Karpates. Ceci est causé par le niveau général de développement toujours trop bas des pays de cette partie de l'Europe, résultat du rythme lent, à travers les siècles, du développement économique. La disaprition partielle et la limitation territoriale des migrations pastorales étaient causées soit par de raisons politiques, telles que déplacement de frontières ou conflits entre Etats, soit par des difficultés économiques, et non pas par l'intensité croissante de l'agriculture, augmentation de la superficie des terres arables, la protection des forêts ou une économie sylvicole plus rationnelle. Mais quand même la Slovaquie et la Bulgarie sont les pays de cette partie de l'Europe qui ont pris le chemin d'une forme d'élevage plus moderne, plus rationnelle, tout en gradant un cheptel important de bétail participant aux migrations pastorales.

En Pologne on observe récemment une augmentation du nombre des têtes du bétail, surtout des ovins. Cependant cet accroissement n'est pas accompagné, dans une mesure suffisante, de travaux tendant à l'augmentation de l'intensivité de l'élevage par une exploitation plus rationnelle des pâturages. En 1956, environ 104 mille ovins ont participé à l'estivage dans les montagnes polonaises, dont 13,5% dans les montagnes des Sudètes. Les migrations pastorales saisonnières groupaient à cette époque là 2,5% à peine du nombre total d'ovins en Pologne. Cependant,

en 1957, les estivages englobaient 39% d'ovins élevés dans les Karpates. Ensuite, il faut constater que parmi les ovins vivant dans les alpages des Karpates, 60% appartiennent aux montagnards du district subtatrique de Nowy Targ, appelé Podhale.

Les Karpates polonaises ressemblent quant à l'élevage aux Karpates slovaques. Bien que dans ces deux régions karpatiques le nombre de têtes de gros bétail est superieur au cheptel ovin, dans ces deux régions les moutons restent jusqu'à présent les plus caractéristiques pour l'estivage. L'estivage de deux côtés des Karpates Occidentales a gardé jusqu'aujourd'hui des formes et des coutumes traditionnelles plus ou moins anciennes. En Pologne, tout comme en Slovaquie, on a observé un grand développement quantitatif dans les régions montagneuses, avec cette différence que dans la partie polonaise ce développement intéressait le nombre des ovins et en Slovaquie celui des bovins.

Dans les années d'après guerre, on a observé dans les régions montagneuses de ces deux pays que le développement quantitatif du cheptel en stabulation fut plus intense que l'accroissement des troupeaux participant aux estivages et aux migrations pastorales saisonnières. Ceci apparaissait avec une netteté particulière en Slovaquie, où l'élevage sur place du bétail à cornes a connu un grand essor. Par contre dans la partie polonaise des Karpates, aussi bien dans les Beskides que dans les Tatra, le grand accroissement de l'élevage des ovins, allait, dans de nombreuses régions, de pair avec une exploitation extensive des alpages.

Dans les Sudètes, on observe un accroissement du nombre des têtes de bétail et aussi dans une certaine mesure des ovins. Il est nécessaire d'accroître ici les soins rationnels et l'entretien des pâturages. Dans les Karpates on augmente le nombre et on améliore la qualité du gros bétail à cornes, en particulier dans le domaine d'une exploitation moderne des près et des pâturages. Dans de nombreuses parties des Beskides il existe encore d'importantes réserves de terrains pouvant être utilisés comme pâturages.

Un problème à part est celui de l'avenir de la vie pastorale dans les Tatra et la région de Podhale. Il faut toujours réduire le nombre des ovins sur les pâturages montagneux. Les données de la Direction du Parc National des Tatra, sur le nombre maxima des ovins, à savoir jusqu'à. 5.000 (dans les Tatra polonaises) sont justes. Cela répond à peu près aux possibilités rationnelles des pâturages dans les Tatra et est conforme aux postulats de la protection du milieu géographique de cette région. Dans les années 1952—1956, encore 8.000 ovins et plus de 1.000 de bovins ont profité des pâturages dans les Tatra polonaises.

L'autre région des Karpates polonaises, où un grand progrès s'est effectué dans les années dernières dans le domaine de l'utilisation des terrains de pâturages montagneux, sont les Beskides de Sącz, et surtout leur partie orientale. Les autorités de cette région ont créé une quinzaine de nouveaux centres de pâturage. De nouveaux principes d'organisation et de nouvelles installations comme par exemple des bâtiments en bois servant l'abri aux ovins dans le période de froids et des pluies, la fumure, l'irrigation, l'ensemencement des près, ont permis d'organiser en 1959 un estivage plus rationnel englobant environ 8.000 ovins et 500 bovins. Dans la partie orientale des Karpates polonaises, cela veut dire dans

la voïévodie de Rzeszow, on mène à l'estivage environ 30 mille de moutons provenant surtout de l'Ouest. En plus à Jaworki (partie orientale du district de Nowy Targ) se concentre l'estivage de quelques milliers d'ovins. Il en découle que dans les Karpates polonaises l'estivage d'été se développe depuis la fin de la guerre.

Au fur et à mesure que s'élevera le niveau économique de Podhale et des Karpates polonaises, l'agriculture polonaise pourra se développer dans la direction que lui implique le caractère géographique et sociale de cette région. Dans l'agriculture, cette direction c'est l'élevage du gros bétail à cornes, étant plus rentable que l'élevage des ovins. En outre on pourra développer la sylviculture et le développement des services liés au tourisme, centres de vacances et stations climatiques, et enfin une industrialisation rationnelle et bien repartie (une juste localisation). C'est seulement de cette façon que le développement planifié d'une manière complexe de l'économie des Karpates polonaises pourra donner à l'élevage une juste direction et un rôle adéquat. Pour ce qui est de cet élevage, les migrations des troupeaux préparées et dirigées selon un plan rationnel trouveront surement à l'avenir leur place convenable.

Comme il découle des exemples susdits des transformations dans le domaine des migrations pastorales et surtout de l'exemple des migrations en Pologne, cette forme d'élevage est souvent dans les montagnes de l'Europe une forme permanente de l'exploitation des conditions spécifiques du milieu géographique, bien que changeante d'après le niveau du développement social-économique. Donc, les études dans ce domaine servent non seulement à fixer les formes du passé en voie de disparition, attirantes souvent par leur charme ethnographique. Elles ont également une importance pour la recherche des orientations du développement de l'économie et de nouvelles formes qui seront employées dans l'avenir.

C'est pourquoi, au fur et à mesure du resserrement à l'époque actuelle de la coopération scientifique à l'échelle internationale, il serait peut-être utile pour de nombreux pays de coordonner d'une manière plus étroite les recherches dans ce domaine. Tenant compte de ce fait, l'auteur de l'élaboration présente voudrait non seulement présenter à la discussion la typologie citée ci-dessus des formes de migrations pastorales, mais proposer une discussion à ce sujet et éventuellement déterminer une méthode commune de recherches. L'auteur propose d'effectuer les études à l'aide d'une méthode d'enquête, tendant à recueillir des matériaux analytiques détaillés concernant les centres d'estivage.

Le manque des données comparatives constitue la difficulté principale des recherches en question, recherches d'une grande envergure et englobant le territoire de quelques pays. Ceci résulte du fait que presque chaque auteur, et en principe chaque pays, mènent ces recherches à partir de différents points de vue. C'est pourquoi il est très difficile d'établir des rapports statistiques (quantitatifs, qualificatifs et de développement) concernant la superficie des estivages, le nombre des animaux, les produits obtenus, etc. ainsi que de préparer une typologie géographique comparative qui engloberait quelques pays des Karpates ou bien des Balkans. Cependant un tel rapport aurait une grande importance permettant d'obtenir une ample image des problèmes examinés des migrations pastorales. Il serait une continuation des travaux déjà

effectués et abandonnés par la commission des recherches créée dans la période d'entre-les-deux-guerres pendant le Congrès des Géographes et des Etnographes Slaves.

Ces migrations renferment évidemment une série de problèmes divers et compliqués. Donc une seule série des recherches d'enquêtes ne saurait pas englober tout. Il faut aborder autrement les études sur le nomadisme, autrement celles sur la transhumance, différemment encore celles sur l'estivage ou encore l'estivage du type helvétique. Il parait cependant que la coordination des recherches sur l'estivage aura la plus grande importance pour une série considérable de pays européens. C'est une forme répandue depuis longtemps déjà dans les régions karpatiques. Aux Balkans, elle se développe récemment assez fort, occupant la place de l'ancien rythme de la transhumance.

C'est pourquoi l'auteur voudrait présenter un projet d'enquête concernant les recherches sur l'estivage. Cette enquête a pour but de recueillir de matériaux analytiques détaillés, concernant les lieux de production que sont dans ce cas-là les centres des régions données de l'estivage d'été appelés en polonais les „hala" et dans une série d'autres langues les "alpes" ou alpages. L'enquête est conçue en principe de manière à fournir l' image la plus exacte possible de la période des recherches. Seules de rares questions ont pour but d'éclairer le problème du développement et des transformations. Un tel principe de l'enquête est cependant juste. Il faut tout d'abord obtenir une image exacte pour une époque determinée et ce n'est seulement qu'à l'avenir, ou bien par une autre méthode que l'on pourra obtenir un élargissement de cet image dans le temps.

En présentant le projet susdit des recherches homogènes dans cette sphère, peut-être un peu étroite bien que détaillée, l'auteur se rend compte du fait que ce projet n'assurera pas l'examen de tous les problèmes. Cependant on obtiendra un matériel de base solide et exact qui permettra facilement à l'avenir d'élargir les recherches et d'obtenir des résultats englobant déjà l'ensemble des problèmes intéressant les migrations des troupeaux.

L'auteur du rapport propose que l'enquête sur l'estivage en tant que forme des migrations pastorales, englobe les problèmes suivants: 1) Nom et situation des alpages (alpes). 2) Caractère du terrain de l'estivage du point de vue physico-géographique et économique. 3) Types d'habitations et des bâtiments auxiliaires ainsi que des installations existantes. 4) Personnel sejournant à l'estivage. 5) Nombre et qualité des ovins, des bovins et d'autres animaux. 6) Formes de propriétés et principes de mise en valeur (individuels et collectifs). 7) Durée du séjour en montagnes ainsi que les dates des migrations. 8) Passé et avenir, c'est-à-dire une caractéristique de l'orientation des transformations des migrations et les méthodes d'élevage liées à ces migrations. 9) Présentation cartographique des régions des estivages examinées et des migrations.

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Problems of Settling the Polish Western and Northern Territories

Introduction

Poland's regaining of the Western and Northern Territories is a fact which basically influenced the economic and demographic development of our country. These territories belonged to Poland at the beginning of the 11th century during the period when statehood was being forged but afterwards they were gradually lost as a result of the steady German expansion. At present, the Polish boundaries correspond to the former ones.

In the reconstitution of the Polish state after 1918, the eastern regions, ethnically non-Polish, were included within it (in 1939 national minorities made up 31.1 per cent of the total population). On the other hand, regions populated by Poles (Opole, Silesia) remained outside its boundaries. Only after the boundary changes after the last world war were the conditions for a uninational state created. The territorial changes were accompanied by a mass transfer of the population, which totalled about 11,000,000 — 13,000,000 people. An exact establishment of these figures is impossible because of the difficulties in estimating the number who settled here during the war (evacuation from bombed areas, forced labour) and the war casualties among the German population. The development which was effected in this area is the largest of all the many national migrations in Central-Eastern Europe in the present century with regard to its extent.

This characteristic includes the settlement of the Western and Northern Territories. This area embraces territories which belonged to Germany in 1939 and were united with Poland in 1945. The former Free City of Gdańsk which legally was joined to the Polish State before the war (customs union) does not strictly belong to the Regained Territories. It is considered here, nevertheless, because of the population processes which ensued there, rendering this area similar to the rest of the Western and Northern Territories.

Territories, with an area of 103,000 square kilometres, or 33 per cent of the country's area, is not a separate administrative unit. They have been divided among 10 different voivodeships of which only 5 comprise solely recovered territory. Administrative changes which ensued especially in 1954 and 1956 hinder a direct comparison of the data.

The General State of Settlement

There were in 1958 in the Northern and Western Territories about 2,400,000 people more than in 1946. The different amount of settlement in various parts are connected with: 1) the structure of population according to origin, 2) the extent of war destruction, 3) the economic character of the area.

Fig. 1. Administrative division of Western and Northern Territories of Poland

The capacity of the Western and Northern Territories, restricted by war destruction, could be estimated in 1946 at about 4,400,000 of which 2,000,000 in the cities (average destruction — 54 per cent; Wrocław —

Table 1

Population of the Northern and Western Territories 1946—1958
(Numbers and indices)

	1946*	1950**	1958***
Total			
in thousands	5022.2	5936.2	7411.0
index	100	118	148
Białystok voivodeship (part)			
in thousands	36.5	70.6	102.0
index	100	193	279
Gdańsk voivodeship (part)			
in thousands	327.3	500.8	666.0
index	100	153	203
Katowice voivodeship (part)			
in thousands	469.2	588.6	621.0
index	100	125	132
Koszalin voivodeship			
in thousands	585.1	518.4	675.0
index	100	89	115
Olsztyn voivodeship (part)			
in thousands	351.8	610.2	772.0
index	100	173	219
Opole voivodeship			
in thousands	792.2	809.5	903.0
index	100	102	114
Poznań voivodeship (part)			
in thousands	36.9	49.3	66.0
index	100	134	179
Szczecin voivodeship			
in thousands	307.5	529.3	724.0
index	100	172	235
Wroclaw voivodeship			
in thousands	1768.8	1698.9	2130.0
index	100	96	120
Zielona Góra voivodeship			
in thousands	346.9	560.6	752.0
index	100	162	217

* Statistical Yearbook of Poland 1947.
** National Census of Poland 1950.
*** Statistical Yearbook of Poland 1959.

74 per cent, Gdańsk — 50 per cent, Szczecin — 40 per cent) and about 3,400,000 in the rural areas (average destruction about 27.5 per cent). The actual figures — 1,970,000 in the cities and 3,100,000 in the rural areas were then approximated according to the possibilities created by the supply of housing. It should be noted that 2,000,000 Germans were in the Western and Northern Territories in 1946. An especially marked number of the German population was concentrated in the southern part of Lower Silesia where in some areas the number of the population was higher than pre-war. In 1946—1948 the Germans were moved (almost totally) to the area of the former Soviet and British occupation zones. The actual increase in population in 1946—1950 was, therefore higher than what the indices in Table 1 indicate. The general population is at present lower than in 1939 (8,855,300) with the index as compared with 1939 about 85 per cent. Considering the rapid tempo of the increase, it is anticipated that the pre-war state will be surpassed between 1965—1967.

The decline in the percentage of the urban population between 1939 and 1946 reflects the lesser destruction in the countryside. The evacuation of the German population in the following years caused a drop in the population of the Wrocław and Koszalin voivodeships. However, after 1950, w note a significant increase in the number of inhabitants everywhere and especially, a rise in the share of urban population.

Table 2

The proportion of the urban population in the Western and Northern Territories (in percentage)

Voivodeship	1939	1946	1950	1958
Total	47.6	39.0	47.2	54.3
Białystok (part)	29.0	22.2	30.5	34.3
Gdańsk (part)	66.5	63.7	69.0	72.3
Katowice (part)	65.1	65.2	80.5	82.3
Koszalin	38.9	27.0	34.3	42.9
Olsztyn (part)	35.1	29.0	30.1	35.8
Opole	31.4	21.8	27.3	35.3
Poznań (part)	70.6	50.1	62.1	83.3
Szczecin	55.3	48.8	55.9	60.3
Wrocław	50.9	40.4	49.6	58.9
Zielona Góra	45.1	34.0	37.1	46.0

B. Wełpa *Changes in the Status and Distribution of Towns and Urban Population in the Western Territories between 1956—1959.* Problems of Economic and Demographic Development of Western Territories, Poznań 1960, p. 53 and the Statistical Yearbook 1959 issued by the Central Bureau of Statistics.

The percentage of the urban population is everywhere higher than pre-war. By 1958, the number of towns with a population over that of 1939 surpassed 70. The largest include: Gdańsk (250,000 in 1939, 118,000 in 1946, 272,000 in 1958), Zabrze (126,000, 104,000, 181,000), By-

tom (101,000, 93,000, 181,000), Gliwice (117,000, 96,000, 125,000), Olsztyn (50,000, 29,000, 63,000). This growth in population was only rarely related to the changes in the adminitsrative boundaries. These changes were connected with the relatively rapid reconstruction of industry, whose production now surpasses that of 1939 despite the great war destruction. The primacy of industrial development was moreover maintained not only in the Western and Northern Territories but throughout Poland. Herein the specific character of the new social system was expressed.

Three periods stand out in analyzing the demographic development of the Western and Northern Territories.

First Period, 1945—1948

The dominating feature of the first period was the powerful migration movements. It began with the forced evacuation and the flight of the German population as the war front came closer [1]. Part of this population returned later to their homes, but the total number of inhabitants was then much lower than at the end of 1944. The exodus of Germans lasted throughout 1945 [2] and led to a drop in the total number of Germans to 2,300,000 in February 1946 in the whole country. The planned transfer of Germans undertaken subsequently lasted to 1948 and embraced about 2,200,000 people. As a result the number of Germans remaining in the Western and Northern Territories was estimated at 50,000 — 100,000 and the Polish indigenous population who were verified numbered about 1,000,000 [3].

[1] The total number of people who left their residence before the end of the war was estimated by German sources at 5,000,000 (Bundesrepublik Deutschland, Bundesministerium für Vertriebene, Dokumentation der Vertreibung der Deutschen aus Ostmitteleuropa, Bonn 1953, Bd I — after E. Wiskemann: *Germany's Eastern Neighbours. Problems Relating to the Oder — Neisse Line and the Czech Frontier Regions.* Issued under the auspices of the Royal Institute of International Affairs, Oxford University Press. London — N. York — Toronto 1956).

According to S. Waszak these figures can be raised to about 7,000,000 *(The Number of Germans in Poland 1931—1959.* „Przegląd Zachodni" (Western Revue), 15, 1959, No. 6., p. 323.

[2] According to German sources (G. Rhode: editor *Die Ostgebiete des Deutschen Reiches.* Würzburg 1957) 400,000 Germans were transferred in 1945.

[3] Official German statistics gave the number of Poles (those who spoke Polish or its dialects) in the Western and Northern Territories (without the Free City of Gdańsk) as 1,020,500 in 1910, 663,000 in 1925; 438,000 in 1933 and between 100,000—130,000 in 1939 (quoted from J. Ziółkowski: *Demographic and Social Changes in the Polish Recovered Territories,* the Review of the Polish Academy of Sciences, 3, 1958, No. 3—4). However, these data are not authentic, as attested to by the separate statistics for internal use. For example, the official figure quoted for Upper and Lower Silesia in 1933 was 99,000 Poles whereas confidential German estimates give a figure of 550,000 (H. Rogmann: *Der Sprachgebrauch bei den Gottesdiensten in Oberschlesien. Ergebnisse einer von der Landesgruppe des Bundes Deutsches Osten durchgeführten statistichen Erhebung,* Breslau 1935. Streng vertraulich). This work, found after the war, was published in 1957 by the Western Press Agency. Polish sources estimated the number of Poles at that time in Opole Silesia at 800,000 (S. Waszak, ib.). The total number of Poles in the Western and Northern Territories in 1939 is estimated at 1,260,000 of which 60,000 were in the former Free City of Gdańsk.

The influx of the Polish population from the territories ceded to the Soviet Union (repatriates) and from the overpopulated Central Poland (resettlers) began in 1945. The third, and smallest group were remigrants returning often after dozens of years abroad — mainly from France, Germany and Yugoslavia. Many Poles returning from concentration camps in Germany also stayed in the Western Territories as many of

Table 3

The structure of the population in 1950 according to the major groups of Territorial Origin (in percentage)

Voivodeship	Total	Indigenous population	Settlers from Polish land with the present boundaries	Repatriates and remigrants	Others and unknown
Total					
in thousands	5936.2	1165.0	2916.5	1749.7*	105.0
in percentage	100.0	19.6	49.1	29.5	1.8
Białystok (part)	100.0	6.8	80.4	11.7	1.1
Gdańsk (part)	100.0	11.6	66.8	19.5	2.1
Katowice (part)	100.0	62.7	19.5	15.9	1.9
Koszalin	100.0	9.5	64.4	24.3	1.8
Olsztyn (part)	100.0	18.2	57.7	22.5	1.6
Opole	100.0	54.1	19.5	23.3	3.1
Poznań (part)	100.0	5.8	61.6	31.5	1.1
Szczecin	100.0	3.2	65.0	30.3	1.5
Wrocław	100.0	5.7	53.1	39.9	1.3
Zielona Góra	100.0	3.2	51.8	43.7	1.3

Source: Central Bureau of Statistics.

* Of This 1,596,000 repatriates and 153,000 remigrants.

them had neither homes nor families [4]. According to estimates, there were 3,680,000 new arrivals in the Western and Northern Territories at the beginning of 1947 of which 1,700,000 were repatriates [5]; during

[4] The best example of this are the former inhabitants of Warsaw, scattered throughout the Western Territories. This is related to the fate of Poland's capital. After the crushing of the Uprising in 1944, the entire population was expelled from the city (the number of people living in the main part of the capital, the left bank, which was till January 1945 in the hands of the Nazis and involved in the Uprising, numbered 1,048,000 in 1939 and at the beginning of 1945 — only 22,000 in the outlying districts), a large part beeing taken to concentration camps inside Germany. The city continued to be destroyed and the general degree of destruction was estimated at 81 per cent in 1945 and in mid-town at 95 per cent.

[5] According to M. Olechnowicz (*The Campaign of Populating the Western Territories.* „Przegląd Zachodni" (Western Revue No. 3, 1947) this number was composed of 1,240,000 of those repatriated in an organized manner, 190,000 former prisoners and slave labourers returning from Germany and other occupied countries and originating from countries beyond the Bug River, 70,000 demobilized soldiers

1947, an additional 800,000 arrived. The mass migrations of the population ended in the Western and Northern Territories in 1948. The process of settlement which toward the end proceeded in more planned manner was basically completed. At the beginning of 1948 the Northern and

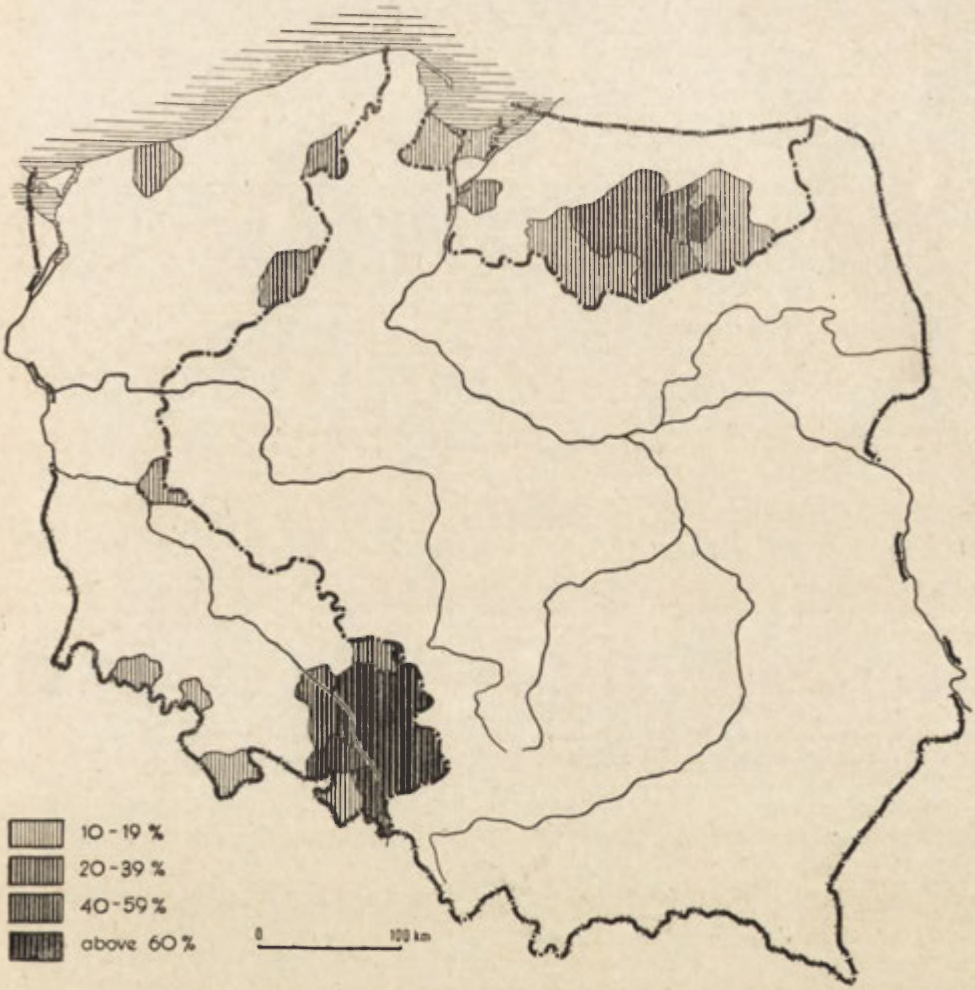

Fig. 2. Native population of Western and Northern Territories of Poland in 1950 (percentage of total population)

Western Territories were inhabited by about 5,500,000 people. This has been achieved in spite of heavy war losses, estimated at about 6,000,000 Poles (about 20 per cent of pre-war population of the country).

and 200,000 refugees who fled from beyond the Bug before official repatriation had begun due to the terroristic activities unleashed by the nationalistic Ukrainian Gangs.

The population status may be evaluated on the basis of the 1950 census which also gives information on the population structure shortly after completing the process of settling the Western and Northern Territories. It supplies also detailed data on the territorial origin of the population (Table 3)[6].

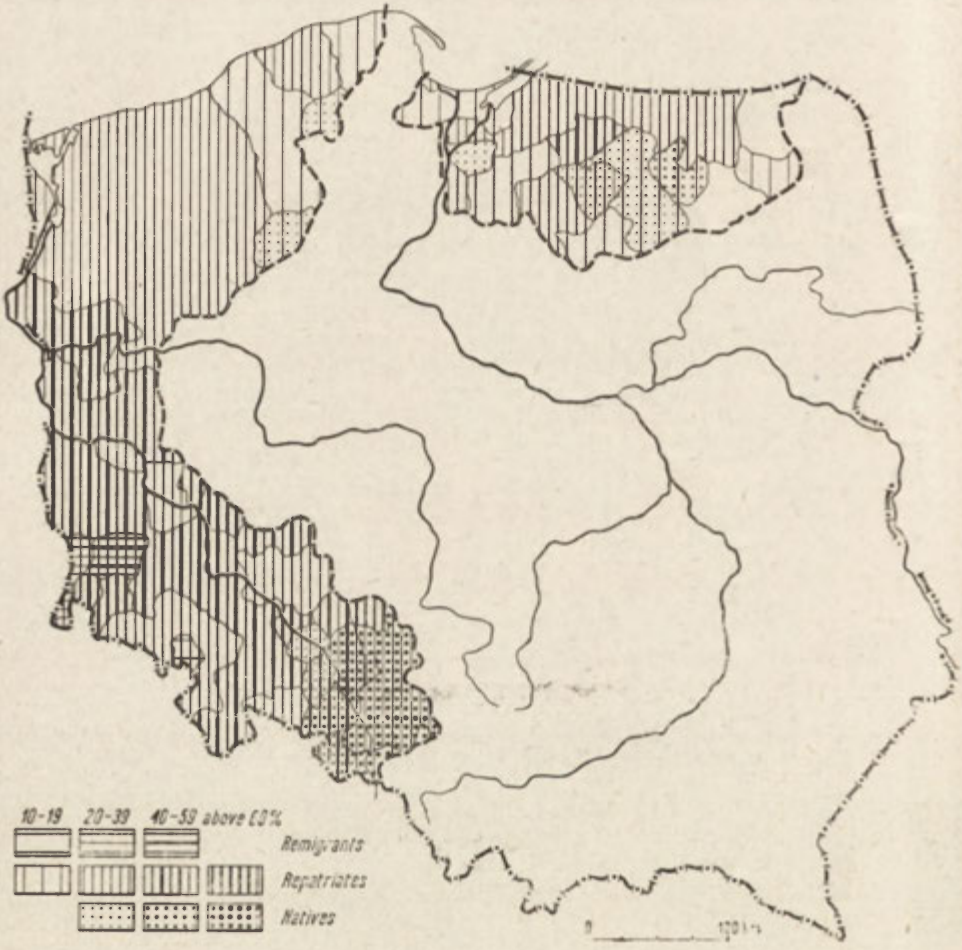

Fig. 3. Repatriates and remigrants in Western and Northern Territories in 1950 (percentage of the new arrivals; natives — percentage of total population)

The major group of residents were the resettlers from the central provinces of Poland (about one-half, dominating in almost all the voivodeships except for the two Silesian ones where the leading group was

[6] The origin was established according to the place of residence on August 31, 1939. Children born later are counted together with their mothers. The group of indigenous population includes all who resided in the Western and Northern Territories before the outbreak of war.

the indigenous population). On the average the share of the indigenous population was the lowest — about one-fifth of the residents of the Western and Northern Territories. Repatriates were about one-third and were most numerous in the Zielona Góra voivodeship.

The indigenous population was most prominent in two regions — in Upper Silesia (in some counties this group surpassed 75 per cent of the

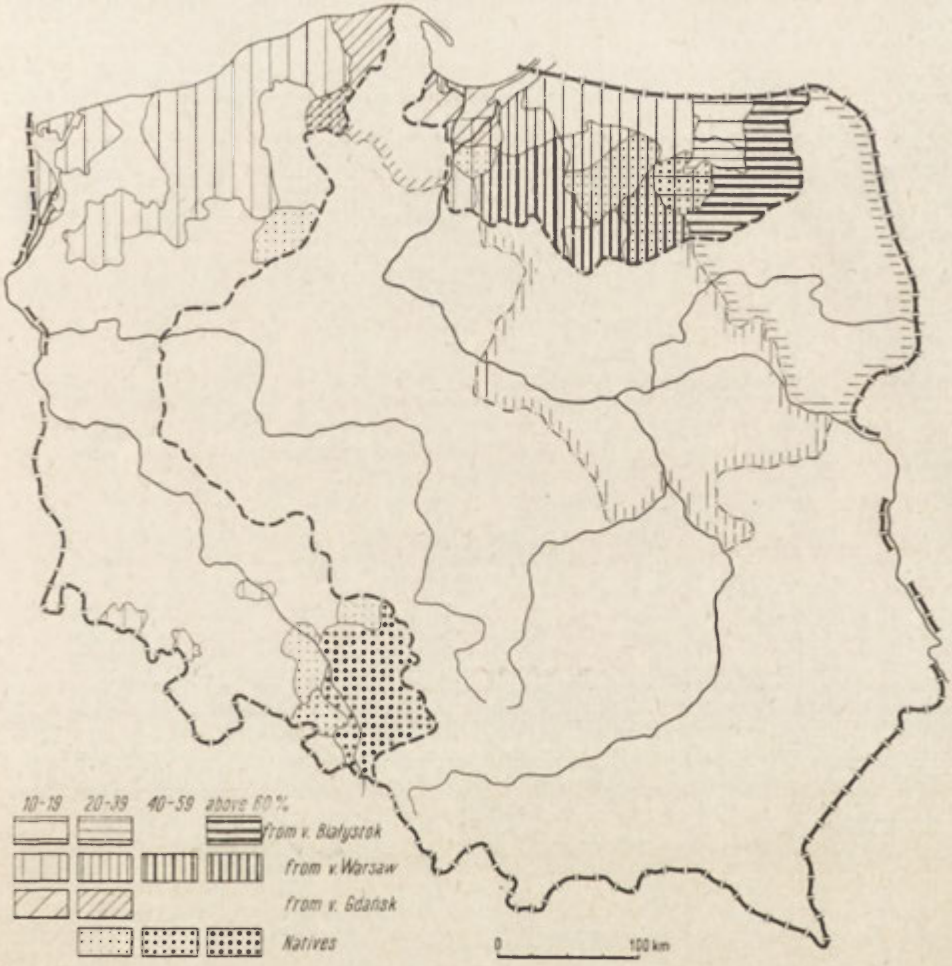

Fig. 4a. Resetlers from the neighbouring voivodeships (percentage of the new arrivals, natives — percentage of total population)

total population) and in the southern part of former East Prussia. In addition, near the former borders, three counties stood out with old Polish traditions. The Germans, however, still lived in Lower Silesia.

Seventy-five per cent of the repatriates from the Soviet Union and 73 per cent of the remigrants were concentrated in the Western and

Northern Territories. The proportion of repatriates was the highest in the voivodeships of Zielona Góra, Wrocław and the western parts of the Opole voivodeship (in some counties, over 60 per cent of the new arrivals). The proportion of remigrants was more marked only in a few Lower Silesian counties.

Resettlers from various voivodeships drifted in many directions. One can speak here of two types of migrations. The first type consisted of

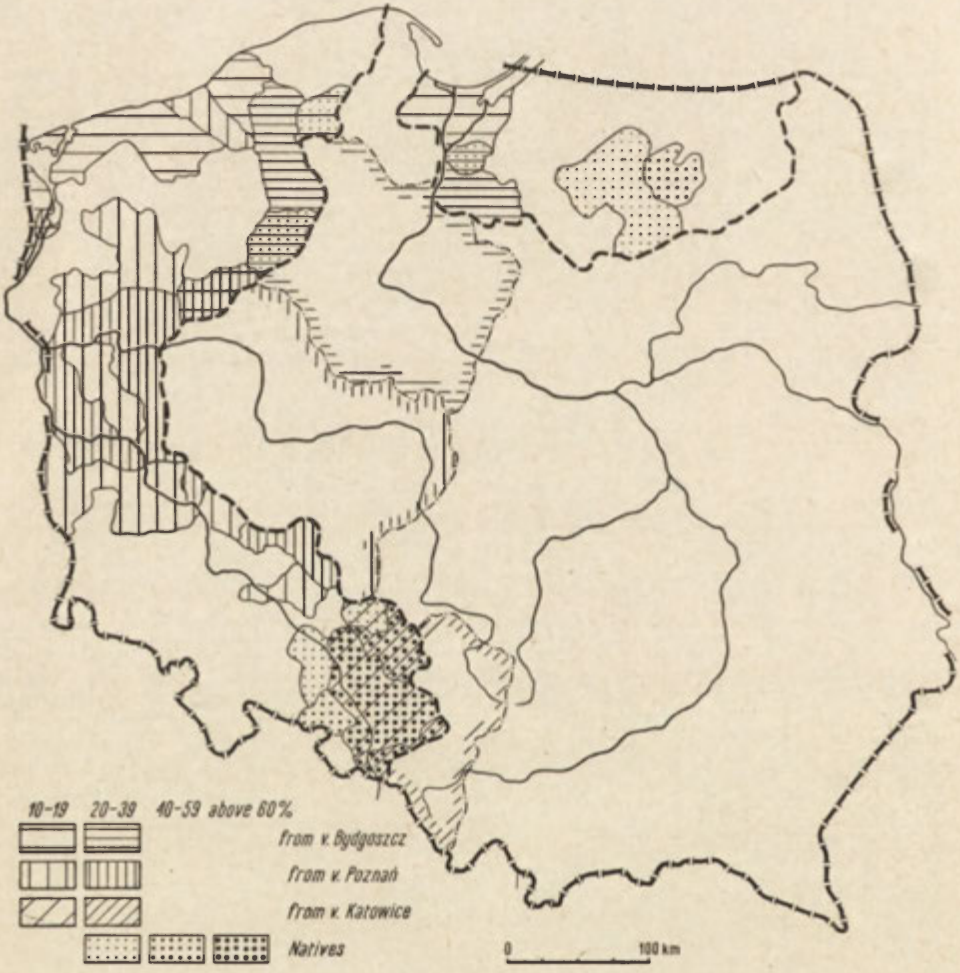

Fig. 4b. Resettlers from the neighbouring voivodeships (percentage of the new arrivals, natives — percentage of total population)

adjacent migrations and the second, of very distant ones. As has been mentioned, the resettlement of the Polish population was directed, especially in the final period.

A good example of adjacent settlement is the immigration from Białystok voivodeship which supplied up to 80 per cent of the new arrivals in the old border counties. The proportion of the resettlers from Warsaw voivodeship was also very high in the neighbouring counties and

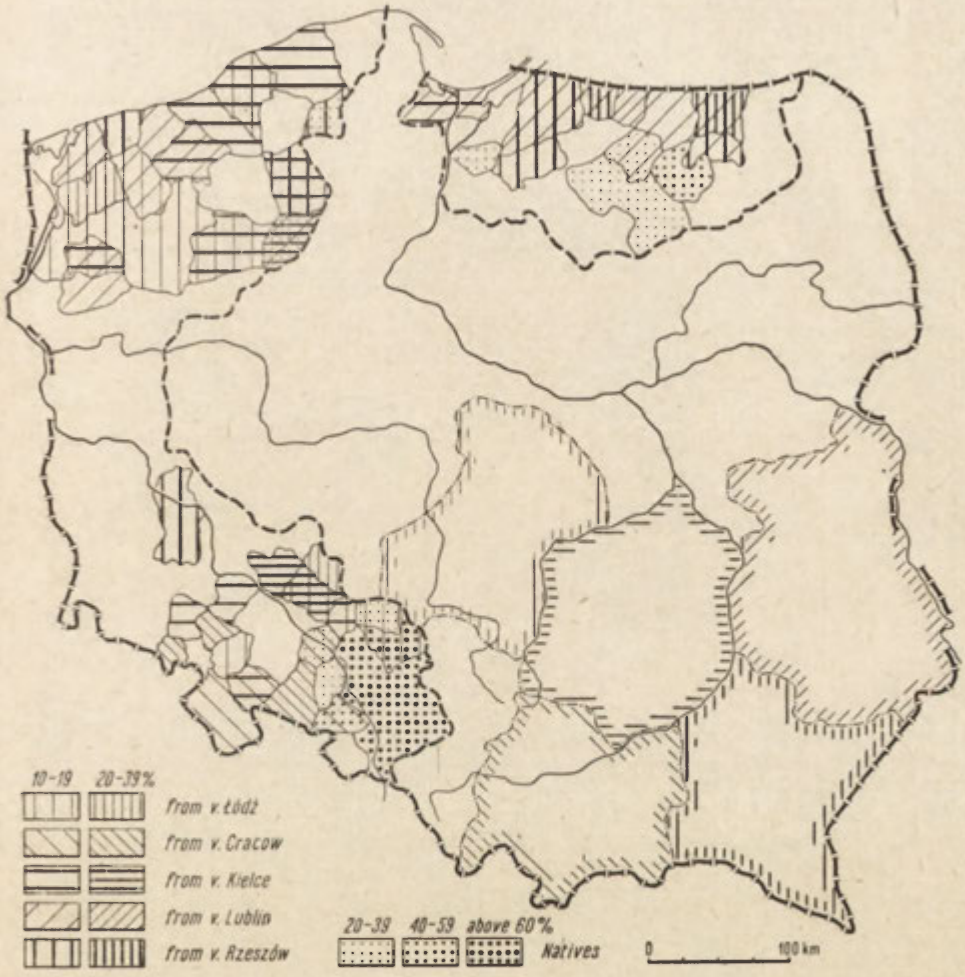

Fig. 5. Resettlers from distant voivodeships (percentage of the new arrivals, natives — percentage of total population)

decreased in further ones. The situation was similar with regard to the resettlement from the other voivodeships presented in Fig. 4, i.e., the voivodeship of Gdańsk (part) Bydgoszcz, Poznań and Katowice (part). The intensity of adjacent resettlement attests to the high demographic pressures existing before the war and revealed at the propitious moment. The emigration included primarily the agricultural population which did not find room in the overpopulated countryside with extremely

small farms. An improvement in the situation on the countryside clearly appeared in the southern and eastern voivodeships, becoming a classical reservoir of the surplus agricultural population [7].

Resettlers from the voivodeships of Łódź, Kielce, Cracow, Rzeszów and Lublin did not concentrate together as did tne resettlers from the previously-named voivodeships. Emigrating to greater distances, they were dispersed and did not become such a significant proportion of the new arrivals (40 per cent, at the most).

A consequence of the resettlement trends is the various degree of mixture of the new arrivals — less in the former border areas, greater

Table 4

Age and sex structure of population in 1950
(in percentage)

Age	Poland Total	Western and Northern Territories Counties with marked participation of				
		indigenous population	repatriates	resettlers from Central Poland		
		agricultural County (Mrągowo)	agricultural County (Lidzbark Warmia)	agricultural County (Gryfice)	industrial County (Kamienna Góra)	large City Wroclaw
Total	100.0	100.0	100.0	100.0	100.0	100.0
0— 2	7.8	6.7	10.4	11.6	12.3	9.2
3— 6	7.8	6.2	8.5	9.3	8.8	7.3
7—14	14.1	18.0	16.5	14.0	10,6	7.8
15—18	7.6	9.9	8.5	8.0	7.0	6.8
19—29	18.8	15.3	18.4	20.0	27.6	29.7
30—59	35.5	30.2	31.3	32.1	29.9	34.8
60 and more	8.4	13.7	6.4	5.0	3.8	4.4

Source: B. Wełpa: *Age Structure of the Population of People's Poland*. „Prace Georgaficzne" (Geographical Studies) Geographical Institute Polish Academy of Sciences, No. 16, Warszawa 1955, pp. 60—113.

on the heart of the Western Territories, especially in Pomerania. The greater mixture was a positive factor, on the one hand, causing an exchange of experiences and the inception of inter-group competition, on the other hand, it hindered social integration especially during the first period.

[7] The overpopulation in pre-war Poland was a very serious problem connected with the high natural increase which did not find room in the countryside and found no outlet in industry. The southern part of the country was especially overpopulated.

The differences in the structure of the origin of the population were also expressed in differences of the age and sex structure.

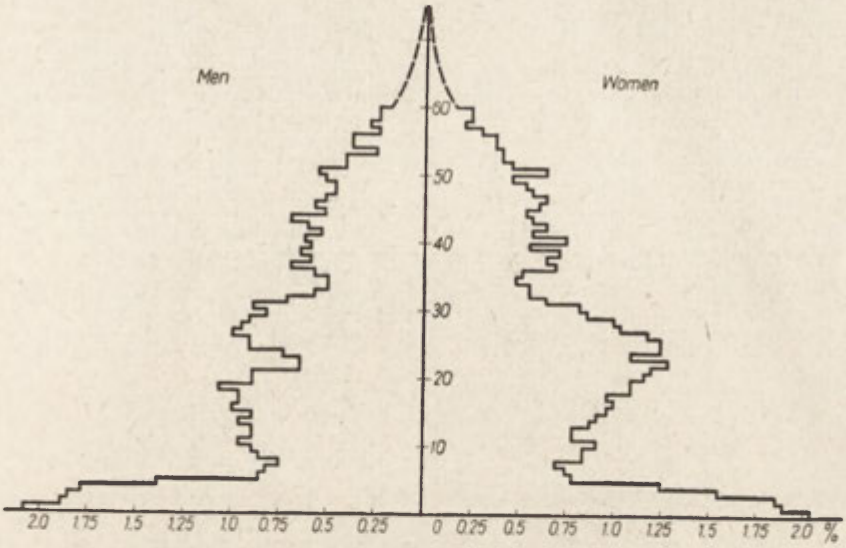

Fig. 6a. Types of sex and age structure of the population of Western and Northern Territories in 1950. Poviat Gryfice — agricultural region.

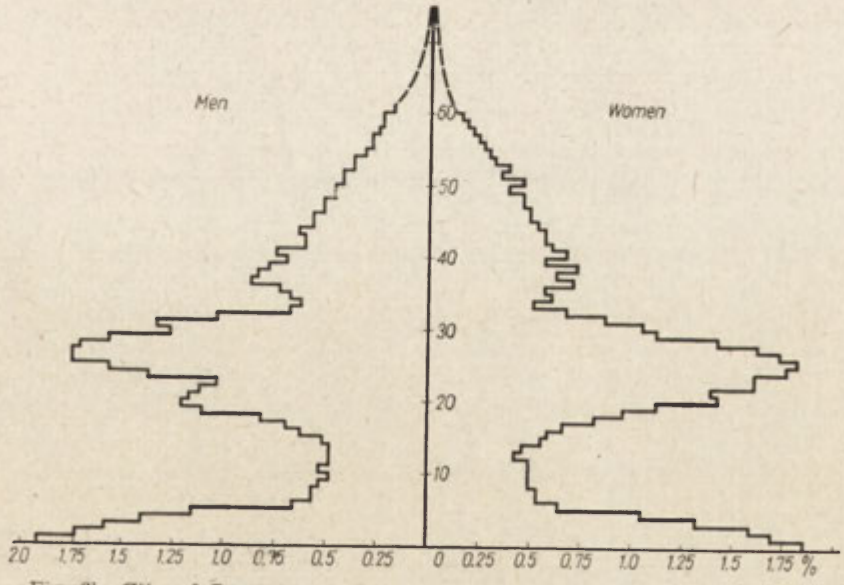

Fig. 6b. City of Szczecin — great city with strong influx of population

The areas with a notable share of indigenous population showed a particularly significant disturbance in the sex and age structure con-

nected with 1) war casualties among the men incorporated into the German army, 2) remaining abroad of some of the population, forcibly evacuated — especially in Germany, 3) the different dynamics of the

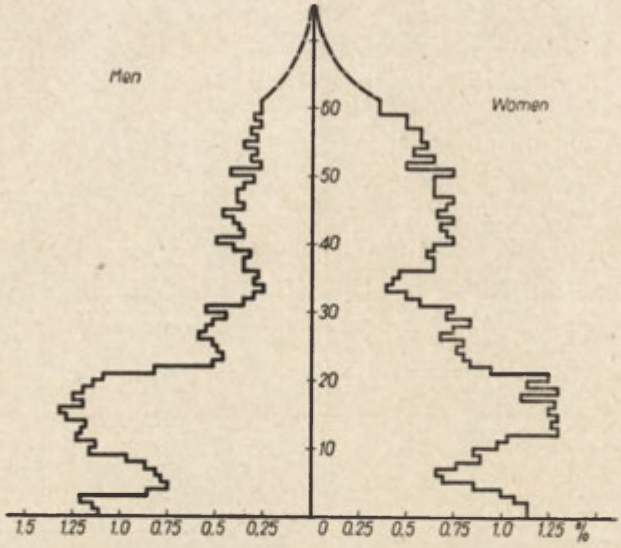

Fig. 6c. Poviat Mrągowo — agricultural region with great share of natives

natural increase during and after the war. The repatriates arrived with their entire families, hence the age and sex structure was very balanced, whereas in the territorial structure of the areas settled from Central Poland, the portion of youth age groups is extremely high.

Second Period, 1949—1955

Characteristic of this period was the fact that the natural increase moved to the fore as the major factor in population growth of the areas under discussion. The specific age and sex structure of the population resulted in the first place in changing the dynamics of the natural movement. The Western and Northern Territories and within them bordering voivodeships with a high proportion of new arrivals stood out for their high natural increase. Especially the voivodeship of Szczecin, should be mentioned where a record index of births and natural increase was noted in 1950.

Despite the declining tendency, the Western and Northern Territories stand out in their dynamics as compared with the remaining parts of Poland. The case of Opole voivodeship should be especially mentioned. In the earlier years the index for this voivodeship was the lowest. However, Opole voivodeship was the only one that showed a rising trend and the marriage index here in 1958 was the highest in Poland This attests to an approaching wave of higher increase.

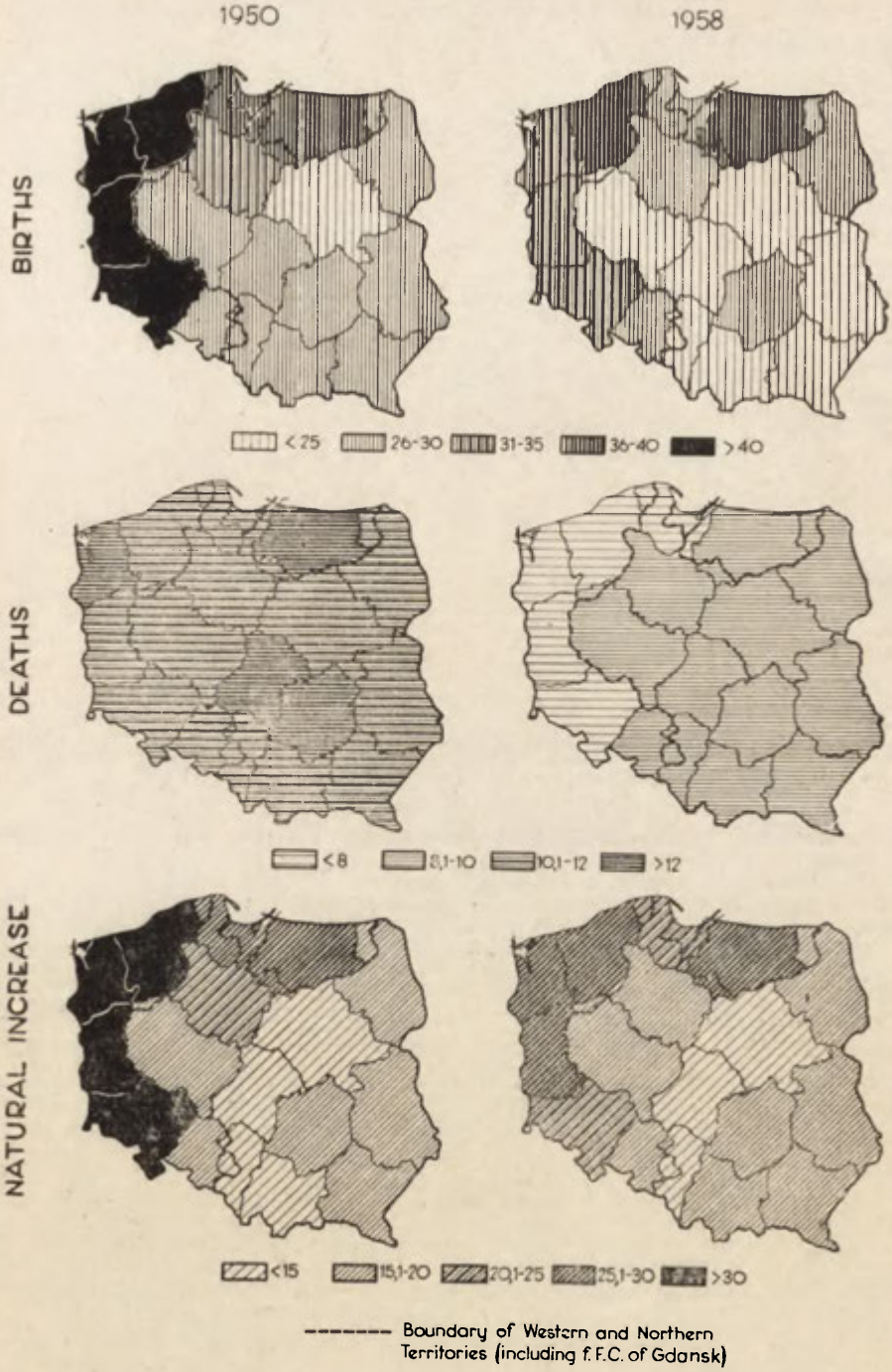

Fig. 7. Natural movement of Poland's population in 1950 and 1958 (per 1000)

A limit to a further migration growth of the population in the Western and Northern Territories occurred between 1950—1957. This does not mean that the migratory movement stopped. However the influx and exodus were equalized to a marked degree. Moreover instead of interregional migration — a very normal movement from the countryside to the cities took place. This was bound up with the changes in the social structure of agriculture and the emphasis placed on extending industry. Certain unfavourable phenomena appeared transitionally, connected with the misunderstanding of the specific character of these territories in economic and population policies. Nevertheless a further intensive population increase occurred as a consequence, in the first place, of the marked natural increase.

Table 5

Natural population movement in some voivodeships
(per 1,000 inhabitants)

Voivodeship	1950			1955			1958		
	M	B	N	M	B	N	M	B	N
Poland Total	10.8	30.7	19.1	9.5	29.1	19.5	9.2	26.3	17.9
Gdańsk	12.4	37.8	26.8	10.9	34.9	26.3	9.9	29.4	22.7
Koszalin	11.1	44.2	33.0	11.3	40.6	31.3	9.8	35.9	28.3
Olsztyn	10.8	39.3	26.6	11.3	39.2	29.0	9.8	35.8	27.2
Opole	10.5	28.4	17.1	9.3	28.8	18.7	11.1	29.3	19.9
Szczecin	15.0	48.9	36.5	12.9	41.2	32.1	10.5	34.2	27.0
Wrocław*	15.7	44.4	32.7	11.3	46.6	28.1	11.0	30.8	23.9
Zielona Góra	12.1	44.4	32.8	10.5	39.1	30.2	8.8	32.9	25.3

* In 1958 the city of Wroclaw became a separate voivodeship. The joint index is calculated in the table.

M — Marriages, B — Births, N — Natural increase.

Note: The table only presents those voivodeships in which the regained territories from the majority. Source: A. Jelonek — *Natural Population Movement in Poland between 1947—1955*. „Geographic Documentation", IG PAN, No. 6/1957, p. 31 and the Statistical Yearbook 1955.

The total population growth between 1951—1957 was 1,245,000 (17,2 per cent) of which the natural increase was 1,233,000 (17,0 per cent). The highest migratory increase appeared during this period in the voivodeship of Białystok (9,1 per cent), Szczecin (5,1 per cent), and Zielona Gora (4.3 per cent).

Third Period — After 1956

This period does not differ as markedly as the second does from the first. The specific features were 1) a heightened settlement activity which included about 80.000 people [8] between 1957—1959, 2) allowing the

[8] This settlement of agricultural families and the selling of land to private owners from the State Land Reserves is bound up with the new agricultural policy carried on since 1957. About 20,000 hectares of land were sold between March 1958 to September 1959 in the Western and Northern Territories.

departure of people whose relatives were abroad separated from their families (so-called Link Campaign), 3) the admission of repatriates returning from the Soviet Union under a new agreement, to the Western and Northern Territories.

As a result of the external migratory movements to both German states between 1956—1959, 264,000 people of which 250,000 were from the Western and Northern Territories left the country. As a result, almost all the Germans left and also that part of the Polish population whose families lived abroad. The emigration was also partly of an economic character as proven by the investigations on the motives for leaving [9]. The influx of repatriates did not completely compensate for the exodus. In 1956, the unfavourable balance stood at 5,000 (0.1 per cent) and in 1957, — 54,600 people (0.7 per cent). This balance was insignificant to the total population. Simultaneously, the steady influx of the population from the heart of the country more than made up for the decrease from the emigration. The general balance of migration for 1951 to 1957 was favourable.

The natural increase continued at a high level. As a result of this, a new community structure arose in which side by side with the old indigenous population, there appeared a new group of people born after the war in the Western and Northern Territories. Their number is estimated at about 2,800,000 people [10], or 36 per cent. In this situation, the division of the population into indigenous and now arrivals loses its meaning.

A separate question which I cannot deal with here is the processes of social adaptation and integration consolidating the community in the regained territories. Many factors enter into these processes, and as a result, their advance is very varied. It should be emphasized that the relationships of the young generation plays an important role in this regard. The high proportion of the young people is also a favourable factor from the sociological point of view.

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[9] F. Miedziński: *Repatriation to the Federal German Republic as part of the Link Campaign.* „Przegląd Zachodni" (Western Revue), 14 1958. No. 2 pp. 311—329.

[10] This estimate is based on the number of children born after 1945 and living in these territories in 1950 (census) and on the number born after 1950 independent of their present place of residence. Considering the natural losses — the number of post-war indigenous population was estimated at about 2,400,000 at the end of 1957. In 1959 and 1959 the increase from the natural increase (minus losses) was about 400,000.

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MARIA KIEŁCZEWSKA-ZALESKA

Problème des transformations économiques des petites villes en Pologne

La Pologne possède de nombreuses petites villes [1], surgies dans des périodes historiques passées, qui s'adaptaient aux nouveaux systèmes sociaux et économiques. Il y a surtout beaucoup de petites villes d'origine féodale qui ont été des centres locaux pour des régions agricoles [2]. Souvent un district de 500 à 1000 kilomètres carrés, avec la ville principale d'environ 10 mille habitants, posséde encore un ou deux petits centres urbains comptant moins de 5 et même moins de 3 mille habitants. Ce réseau de petites villes féodales était trop dense déjà à la fin du XIX-e et au début du XX-e siècle. Beaucoup de petites villes ont succombé car leurs bases économiques étaient mal développées.

Les terribles destructions de la dernière guerre ont aggravé la situation des petites villes. Les pertes dans les bâtiments et dans les installations permanentes allaient de pair avec les pertes humaines Dans les petites villes de la Pologne Centrale, les Allemands ont exterminé une grande partie de la population, surtout des Juifs.

Les petites villes de l'ouest et du nord ont perdu la population au cours de l'action de guerre et par la migration. Il y a très peu de petites villes qui aient survécu le cataclisme de guerre sans pertes humaines et matérielles et qui auraient évité la migration.

Après la guerre la structure économique du pays a été transformée. La transformation de la base d'existence des villes a créé des nouvelles conditions de vie pour la population, qui était en train de s'établir dans des villes. La fonction de médiation commerciale de l'initiative privée fut très limitée, tandis qu'avant la guerre elle avait dominé dans les petites villes. Le modèle du service commercial a changé. Le nombre de postes commerciaux tout d'abord très réduit après la guerre n'augmente que très lentement. La nouvelle forme du commerce nationalisé n'a pas beaucoup animé la vie des petites villes. La reconstruction de la vie économique des petites villes s'est beaucoup plus liée avec leur fonction de production, avec le développement des ateliers d'artisans et des petites fabriques. Ces dernières allaient être réorganisées et leur activité même arrêtée pour un certain temps.

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[1] W. Rewieńska: *La densité urbaine en Pologne*. „Comptes Rendus du Congrès International de Géographie". Warszawa 1931, edit. 1937, pp. 241—249.

[2] J. Kostrowicki: *Problème des petites villes en Pologne* (en polonais avec résumé en anglais). „Przegląd Geograficzny" 25, 1953, pp. 12—52.

De nombreuses monographies des petites villes, faites par les géographes, ont noté cet état et ont attiré l'attention des autorités et de la société sur le besoin de créer des conditions pour animer les petites villes [3]. Les petites villes forment le groupe le plus nombreux dans le nombre total de villes en Pologne. Presque 20% de la population urbaine habitent les petites villes, ce qui est à voir sur le tableau 1 [4].

Tableau 1

	Villes		Population	
	1950	1955	1950	1955
Nombre total	706	729	9.772.000	11.850.000
Nombre de villes de moins de 5 mille habitants	393	339	1.070.000	955.00
Nombre de villes de 5 a 10 mille habitants	154	184	1.085.000	1.286.000

La crise de la vie économique a laissé une empreinte dans la réduction du nombre de la population des petites villes au cours de quelques années après la guerre. La transformation de la population des petites villes est, pour ainsi dire, un coefficient de l'intensité de ce procès. Au cours du grand développement de l'industrialisation de la Pologne, du développement des nouvelles villes, de l'accroissement des grandes villes et du peuplement des nouveaux territoires après la guerre, les migrations sont devenues communes et il y avait de grandes probabilités de trouver le travail dans le pays. Les habitants des petites villes n'ayant pas trouvé de bases d'existence suffisantes sur place pouvaient chercher le travail ailleurs. Les changements dans le nombre de la population au cours des huit dernières années permettent approfondir le sens de ce problème pour toute la Pologne.

La population des petites villes en Pologne (1950—1958)

On a pris en considération 500 petites villes, qui en 1950 avaient moins de 10 mille habitants. Pour comprendre le sens des changements de la population on a pris comme base le nombre de la population selon le recensement du 1950 et pour 1958 le chiffre estimatif de la fin de 1958 de l'Office Central de Statistique (GUS). En plus on a compté le chiffre de la population, qui aurait pu être atteint dans chacune de ces petites villes au cours des 8 années, grâce à l'accroissement naturel. Pour calculer ce dernier chiffre on se servait des indices moyens de l'accroissement naturel pour chaque voïévodie et pour chaque année. C'est une

[3] *Etudes géographiques sur l'activisation des petites villes.* „Prace Geograficzne" IG PAN 9. Warszawa 1957 (en polonais).

Ce volume contient 3 articles généraux et 21 monographies détaillées des petites villes. Rédacteurs: K. Dziewoński, M. Kiełczewska-Zaleska, J. Kostrowicki, L. Kosiński, S. Leszczycki).

[4] „Annuaire Statistique 1956" GUS, Warszawa 1956, p. 56.

certaine simplification, mais elle est nécessaire en vue du manque des indices pour chaque ville particulière.

Considérant cependant que l'accroissement naturel dans la période mentionnée avait été presque le même à la campagne, dans les petites et dans les grandes villes, l'erreur d'approximation causée par cette simplification est relativement pas grande. Grâce aux calculations effectuées on est parvenu à contrôler les procès d'accroissement et du déclin des petites villes pendant la période de 8 ans. Ces huit années sont assez éloignées de la première étape de reconstruction et des transformations causées par la migration directement après la guerre pour qu'on puisse comprendre le rôle de la petite ville dans la construction du système économique et dans l'adaptation de cette forme d'habitat à se système.

Du point de vue des transformations dans le peuplement, qui ont eu lieu au cours des 8 années (1950—1958), on peut diviser les petites villes polonaises en 3 groupes:

1. Petites villes ayant subi des pertes en chiffres absolus.
2. Petites villes ayant subi des pertes relatives de la population en conséquence des migrations.
3. Petites villes, dont l'accroissement est dû à la migration (acroissement total dépasse l'accroissement naturel).

Au premier groupe appartiennent ces villes dont la population a diminué, qui comptaient moins d'habitants en 1958 qu'en 1950. C'est à peine 26 d'entre les 500 petites villes étudiées, qui font parti de ce groupe.

Le socond groupe des petites villes, qui ont perdu une part de leur population par suite de la migration, est beaucoup plus nombreux. Le chiffre de leur population n'a pas atteint le chiffre qui aurait pu être atteint en 1958 par l'addition du chiffre d'accroissement naturel au chiffre de la population de 1950. Il y a 178 petites villes dans ce groupe.

Tout de même, le groupe le plus nombreux est formé par ces petites villes dont l'accroissement général surpasse l'accroissement naturel. Il y en a 297, ce qui fait environ 3/5 du nombre total des petites villes étudiées. C'est un fait qui donne à réfléchir et qui, il faut l'avouer, semble inattendu.

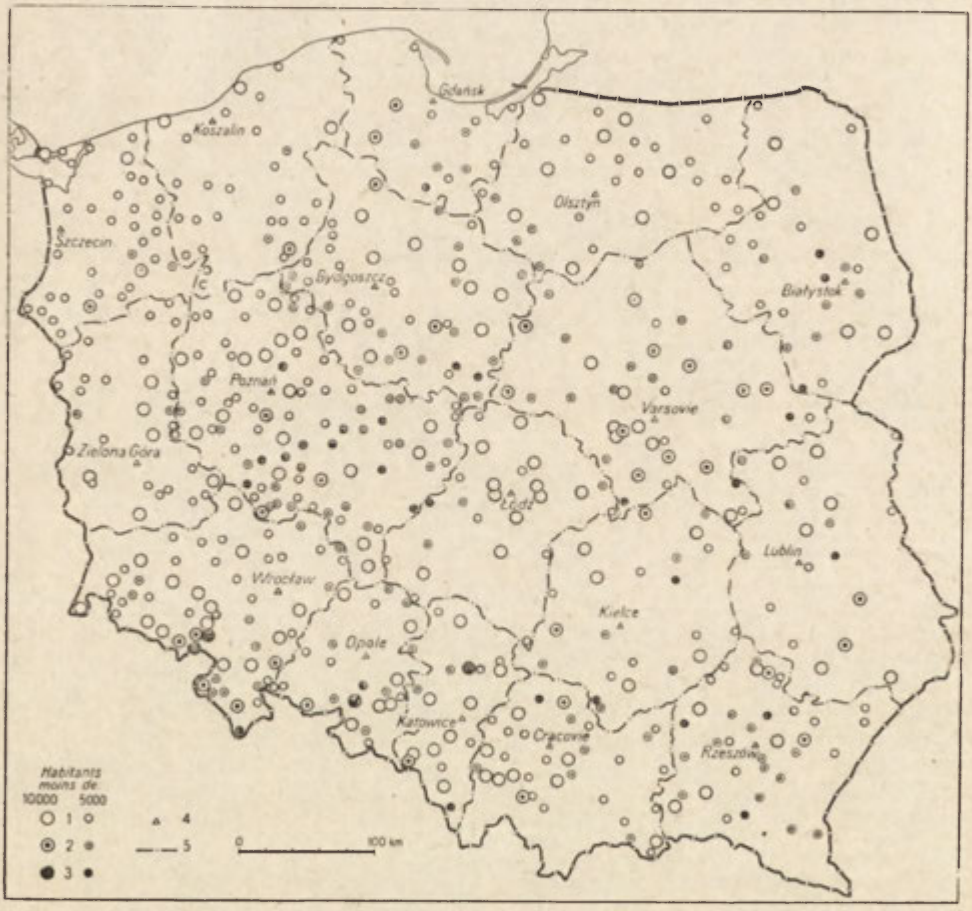
Le groupe des petites villes où le nombre des habitants a diminué forme à peine 5% du nombre total des petites villes de moins de 10 mille habitants. La réduction de la population n'y est pas grande et ne représente que quelques dizaines, ou quelques centaines de personnes, tout au plus. Dans ces petites villes les symptômes de la crise économique ont été les plus prononcées, et un nombre considérable d'habitants les a quittées. Ce sont des villes différentes au point de vue du caractère économique et de leur grandeur: il y a entre elles 14 comptant moins de 3 mille habitants; 7 qui comptent 3 à 5 mille et 5 de 5 à 10 mille. Ces villes, étant un exemple d'une regression démographique, appartiennent en premier lieu aux petites villes rurales avec un pourcentage élevé de la population agricole [5]. On les rencontre surtout dans la voïévodie de Poznań, où le réseau des villes d'origine féodale est le plus dense [6], mais aussi

[5] I. F. Tłoczek: *Petites villes agricoles dans la Grande Pologne.* Instytut Urbanistyki i Architektury, Warszawa 1955 (en polonais).

[6] Z. Kulejewska: *Des études du problème de locations urbaines dans la Grande-Pologne au XVI—XVIII siècle.* „Przegląd Zachodni" 9/10, 1953, Poznań 1953, pp. 181—194 (en polonais).

dans les voïévodies les moins économiquement développées, à l'est de la Pologne, dans les voïévodies de Białystok et de Rzeszów. Plusieurs plus grandes stations thermales, qui n'avaient pas encore trouvé de chances de développement (Szczawno, Wisła Zdrój, Rymanów) font parti de ce groupe des villes. Il y a aussi quelques plus grands centres locaux d'une importance historique, comme Brześć Kujawski et Wolbrom, qui méritent d'être étudiés en détail.

A l'ouest et au nord de la Pologne il y a très peu de villes de ce genre. Il y a quelques localités limitrophes dans les Sudètes, telles que



Carte 1. Le changement de la population des petites villes en 1950—1958: *1* — villes où l'accroissement général dépasse l'accroissement naturel, *2* — villes où l'accroissement naturel dépasse l'accroissement général (pertes relatives), *3* — villes montrant un décroissement (pertes absolues), *4* — capitales de voïévodie, *5* — frontières des voïévodies

Międzylesie, Mieroszów, Głogówek. La réduction de la population dans ces dernières est causée par le fait que dans les premières années après la guerre, elles avaient plus d'habitants, car elles avaient été peu détruites.

Le second groupe des petites villes montrant un décroissement relatif causé par la migration embrasse des petites villes de grandeur différente, comme le premier groupe. On y estime que dans ce nombre un quart ce sont des villes comptant plus de 5 mille, et plus que la moitié des petites villes de moins de 3 mille habitants. Elles sont les plus nombreuses dans les voïévodies de Poznań, de Białystok, de Bydgoszcz. Il y en a beaucoup dans la voïévodie de Varsovie. Ces dernières sont presque toutes situées assez loin de Varsovie, aux confins de la voïévodie. Leur décroissement est dû à la migration, tandis que les petites villes dans le voisinage de Varsovie sont d'un caractère démographique différent. Ils ont augmenté rapidement et dans la banlieue de Varsovie ils ont atteint une grandeur de plus de 10 mille. Dans la banlieu de Varsovie il n'y a plus de petites villes décroissantes. Ceci est une preuve de la force attractive de Varsovie et de ses environs.

Il n'y a pas beaucoup de ces petites villes à l'ouest et au nord du pays. Dans la région des Sudètes les petites villes de ce genre sont concentrées d'une manière distincte. Ceci peut être expliqué par le fait que ces villes n'ayant pas été très détruites pendant la guerre ont attiré beaucoup de refugiés de Wrocław et des autres villes situées sur l'Odra. C'est là aussi que venaient s'établir de nouveaux habitants directement après la guerre.

Les procès engageant la population pendant les 8 années considérées prouvent que la crise qui a affecté les petites villes après la guerre [7] et qui s'est manifestée dans le chômage et dans de nombreuses migrations, n'était pas très profonde et qu'elle a été en général surmontée au cours des années suivantes dans ce pays. C'est vrai qu'on ne peut pas juger que les symptômes de la crise ont disparu, car des surplus de la population existent dans les petites villes. Au contraire, on peut tirer la conclusion que les petites villes se sont adaptées aux nouvelles conditions. S'il était autrement la réduction de la population des petites villes en Pologne serait beaucoup plus forte dans la situation économique actuelle.

Les transformations structurales de réseau d'habitat

Les transformations qui ont eu lieu dans les petites villes au cours des dernières 8 années n'ont pas changé les principes de structure du réseau. Les petites villes de tous les types, des plus petits centres ainsi que les plus importantes villes du district se sont conservés et il n'y a pas beaucoup de différence si on compare l'état d'avant la guerre. Il y a tout de même une tendance générale du développement structural du réseau d'habitat, qui à la longue peut beaucoup transformer le réseau des villes. A savoir, les capitales du district et des petites villes de plus de 5 mille habitants se développent plus rapidement, tandis que le développement des toutes petites villes de moins de 3 mille habitants est beaucoup plus lent. D'entre les 159 petites villes comptant 5 à 10 mille habitants, 60 ont atteint 10 mille, tendis que parmi les 210 des plus

[7] M. Kiełczewska-Zaleska: *Problèmes géographiques et économiques des petites villes* (en polonais) dans l'ouvrage collectif *Etudes géographiques et économiques des petites villes*, voir No. 3.

petites villes la population a dépassé 3 mille habitants dans 44 petites villes seulement, malgré que ce groupe des petites villes est le plus nombreux. Les centres du district deviennent plus forts et plus grands, pendant que les petites villes restent sur le même niveau qu'avant. Dans certaines régions cette tendance est plus forte, dans d'autres, elle en est moins. Dans la voïévodie de Poznań d'entre les 20 villes comptant plus de 5 mille habitants, 8 ont atteint 10 mille, et d'entre 47 petites villes de moins de 3 mille, 5 seulement comptent 3 mille à présent. Les mêmes tendances sont à observer dans les voïévodies de Wrocław, Bydgoszcz, Łódź et Lublin. Ce sont des terrains où l'agriculture domine jusqu'à présent. Les différences entre les centres du district et les plus petits centres du sous-district s'approfondissent dans ces terrains, tandis que la région économique formée par la ville du district avec son „hinterland" se transforme. Les centres du district dans le système présent deviennent des centres de transactions commerciales bien liés avec l'hinterland. Les services de culture et d'éducation sont mieux organisés dans des villes plus grandes, qui malgré, que leurs fonctions de production ne soient pas toujours bien développées, ont pourtant des bases d'existence assez bonnes.

Les villes les plus petites, centres du second ou troisième ordre, sont liées avec un plus petit hinterland et ne sont engagées ni dans l'administration territoriale ni dans les relations commerciales. Leur rôle de médiateur entre la ville et la campagne est limité. Elles sont devenues semblables dans leurs droits à beaucoup de plus grands villages. Ces villages, sièges des Conseils Nationaux des communes, se sont transformés en centres de service. C'est là qu'il y a des centres d'achat des produits agricoles, des magasins nationalisés, des institutions du service de la santé, qui ressemblent à celles qui se trouvent dans les petites villes. Aussi le nombre des personnes employées en dehors de l'agriculture a beaucoup augmenté dans des grands villages. C'est surtout les anciens grands villages, sièges traditionneles des autorités rurales, de l'école, de la paroisse, ont élargi leurs fonctions de service.

La construction des installations liées avec le service technique de l'agriculture, des stations des machines et des tracteurs font ressortir le caractère de service de nombreux centres ruraux. Ce procès de transformation de la campagne a contribué à affaiblir le rôle et l'importance des petites villes. Il a aidé à briser la microrégion formée jusqu'ici par la petite ville et son hinterland. Les services concentrés autrefois dans la petite ville, se sont répandus dans un plus grand nombre de localités, qui gravitent directement vers la ville, centre du district et s'y unissent plus étroitement. Ceci assure à la population rurale un contact élargi avec „le monde" tandis que les moyens modernes du transport facilitent l'accès au centre du district, même s'il est assez éloigné. Les transformations présentées ci-dessus n'ont pas encore embrassé tout le territoire de la Pologne, mais ont peut observer de tels procès dans de différentes parties du pays [8]. Ils témoignent de la dynamique de la structure du

[8] M. Dobrowolska: *Transformations sociales et économiques des villages en Pologne du Sud.* „Przegląd Geograficzny" 1, 2959, pp. 3—32 (en polonais, résumé en anglais).

réseau d'habitat, où cependant la situation de la plus petite ville n'est pas très favorable.

Le procès du développement du réseau d'habitat est tout à fait différent dans des régions industrialisées de la Pologne du sud-ouest, dans les voïévodies de Katowice et Kraków [9], dans une partie des voïévodies d'Opole et de Gdańsk. Dans ces terrains toutes les petites villes montrent une tendance d'accroissement rapide. De plus des nombreuses habitations urbaines dont la grandeur varie entre 3 et 10 mille, y surgissent. Ce sont les habitats des travailleurs de l'industrie et des mines, bâtis sur le terrain des anciens villages ou nouvellement fondés auprès des établissements industriels. Dans ces régions le réseau d'habitats change absolument sa structure et l'ancien système féodal du réseau urbain ainsi que la hierarchie des villes disparaissent [10].

Ces nouveaux habitats n'ont pas développé encore toutes les fonctions de ville et seulement récemment, grâce à l'accroissement considérable de la population non-agricole, ils ont obtenu le status urbain. Les habitats de ce genre sont plus nombreux que les anciennes petites villes de ces régions, ce qu'on voit dans le tableau 2.

Tableau 2

Petites villes et habitants urbains en 1958*

Voïévodie	10 — 5 mille habitans		5 — 3 mille habitants		3 — 1 mille habitants	
	petites villes	habitats urbains	petites villes	habitats urbains	petites villes	habitats urbains
Katowice	8	19	7	14	3	6
Kraków	15	13	15	14	5	2

* *Annuaire Statistique 1957*. GUS, Warszawa 1958.

Ces deux voïévodies, les plus industrialisées, se distinguent par un petit nombre des plus petites villes et habitats comptant moins de 3 mille habitants. On peut dire que le problème des petites villes en déclin n'y existe plus. Des exemples particuliers des petites villes appauvries, trop éloignées de la région industrielle peuvent se présenter, mais en général les petites villes sur ce terrain ont de bonnes approches au travail et elles se développent en centres, plus importants, c'est pourquoi le type d'une petite ville n'a pas de chances d'y exister.

La structure du réseau des petites villes de la Pologne occidentale, dans les voïévodies de Wrocław, Zielona Góra et Szczecin se distingue par une dynamique de développement tout à fait différente. La structure du réseau urbain a un caractère féodale en principe, mais il y a quelques régions transformées par les habitats industriels, par exemple dans les Sudètes. Il y a donc un grand nombre de petites villes, y compris celles

[9] M. Dobrowolska: *Etudes de la géographie de l'habitat de la Petite-Pologne du Sud*. „Rocznik Nauk. WSP", Kraków 1958, pp. 93—124 (en polonais, résumé en anglais).

[10] R. Pieńkowski: *Nouvelles villes sur le terrain du bassin houiller*. „Miasto" 1, 1953 (en polonais).

qui comptent moins de 3 mille habitants. Ces dernières montraient une plus vive tendance d'accroissement au cours des années 1950—1958 que dans l'ancien territoire de la Pologne. Le procès du repeuplement et de la reconstruction des petites villes n'était pas fini encore au cours de ces 8 années et c'est pourquoi la dynamique des transformations du réseau était encore plus forte [11]. Dans la voïévodie de Wrocław par exemple 13 villes ont dépassé le nombre de 10 mille habitants et 9 d'entre les plus petites villes le nombre de 3 mille. D'autre part il y a encore dans ces terrains qui ont le plus souffert pendant la guerre des toutes petites villes pas encore reconstruites en plein. Leur activisation exige des investissements spéciaux ainsi qu'une adaptation aux nouvelles tendances du développement du réseau des habitats.

Les tendances des transformations économiques

Les petites villes du „sous-district" c'est-à-dire la catégorie la plus basse des petites villes, celles qui n'exercent pas de la fonction administrative, s'adaptent au nouveaux système économique et social par voies diverses. De nombreuses observations permettent de fixer quelques tendances de transformations [12].

Les petites villes, ayant abandonné le rôle du médiateur commercial, retiennent tout de même une partie de leurs anciennes fonctions du service pour l'hinterland, y compris les fonctions culturelles, religieuses, du service de santé, du service des artisans etc. Les fonctions du service ne suffisent pas en général à donner l'accupation à toute la population. Ici la meilleure solution c'est l'accroissement de la fonction de production qui anime la ville [13]. Une petite ville ouvrant un nouveau établissement productif gagne un nouveau facteur de développement assurant l'occupation sur place aux habitants. La localisation des établissements industriels dans de très petites villes est rare, à moins ces petites villes soient situées à la proximité de la source des matières premières, comme dans le cas des petites villes de Kujawy, ou bien à la proximité des grandes villes, par exemple près de „Tri-ville" (Gdańsk—Sopot—Gdynia) ou autour de Łódź.

Par contre les petites villes situées dans les régions remarquablement agricoles gagnent des bases d'existence élargies si des établissements industriels, des ateliers mécaniques pour le service d'agriculture y sont organisés. Les centres d'Etat des Machines et des ateliers liés avec eux possèdent deux ou trois postes dans le district. Possédant un nombre de machines, ils emploient des dizaines et souvent des centaines de travailleurs pour assurer le service et la conservation des machines. La petite ville dans laquelle un tel poste se trouve gagne non seulement l'occupa-

[11] L. Kosiński: Ouvrage collectif: *Etudes des fonctions et de la population des petites villes des Territoires de l'Ouest* (en polonais) (à l'imprimerie).

[12] S. Gwiaździński: *Analyse du développement économique des villes de la voïévodie d'Olsztyn et des possibilités de leur activisation.* „Przegląd Zachodni" 3, 1957, Poznań 1957, pp. 86—115 (en polonais).

[13] L. Kosiński: *Structure de la population des petites villes polonaises.* „Prace Instytutu Urbanistyki i Architektury" II, 1. Warszawa 1952, pp. 35—43 (en polonais).

tion pour ses habitants, mais aussi une liaison plus étroite avec l'hinterland, grâce à quoi aussi les autres fonctions du service de la petite ville sont bien basées [14]. La localisation d'un Centre de Machines dans une petite ville est favorable pour l'hinterland, car la ville a, en général, un système concentrique des routes menant aux villages des environs, ce qui leur assure un accès facile. En 1957 des 420 Centres des Machines 100 étaient placés justement dans les petites villes.

Le placement d'un grand Centre des Machines ou d'un autre établissement industriel dans une petite ville est beaucoup plus avantegeux que sa fondation sur une place nouvelle. L'expérience a prouvé, que les usines construites loin des localités et les Centres des Machines à la campagne ne possèdent pas les installations nécessaires pour l'existence et le service du personnel. C'est pourquoi les petites villes bien munies des installations permanentes et investissements communaux, ayant les services bien organisés, se prêtent le mieux au placement des établissements industriels et l'organisation de l'existence de la population ne cause dans ce cas de dépenses additionelles [15].

Pour des raisons sus-dites, on devrait prendre beaucoup plus en considération les petites villes, quand on organise les établissements servant l'agriculture.

Chercher l'occupation hors de la petite ville est une autre forme d'adaptation aux nouvelles conditions. Les habitants de la petite ville ne pouvant trouver d'occupation sur place, possédant des logements commodes dans cette petite ville, partent pour travailler ailleurs. Ces voyages quotidiens sont devenus très communs dans de nombreuses petites villes situées autour d'une grande ville ou auprès des grands établissements industriels.

Pas toutes les petites villes ont une situation si favorable tant qu'il s'agit des départs pour le travail. C'est pourquoi on remarque une troisième tendance du développement de la petite ville, à savoir le développement de sa fonction agricole. Dans les petites villes il y avait toujours un certain pourcent de population agricole, car l'agriculture était l'occupation supplémentaire d'une grande partie de la population. Dans les petites villes il y avait autrefois des domaines et des sièges des propriétaires ainsi que des petites exploitations privées donnant de l'occupation à une partie de la population [16]. A présent le pourcentage de la population agricole a augmenté dans beaucoup de petites villes. L'organisation de la production agricole subit certaines transformations adaptées aux nouvelles conditions économiques et sociales. Voici un exemple: la population de Biała Rawska [17] s'est chargée de l'ancien domaine et elle y a organisé une coopérative agricole sur une partie considérable des terrains attenant à cette petite ville. Elle a entrepris aussi l'initiative du développement de l'industrie d'alimentation basée

[14] M. Kiełczewska-Zaleska: *Rôle des Centres de Machines dans la formation des villes*. „Życie Gospodarcze" 1958, Warszawa 1958 (en polonais).

[15] M. Kiełczewska-Zaleska, J. Kostrowicki: *Problème d'activisation des petites villes en Pologne*. „Nowe Drogi" 7/8, Warszawa 1956, pp. 31—47 (en polonais).

[16] L. Kosiński: *Trzcianka-Zdrój*. „Dokumentacja Geograficzna" IG PAN 2, Warszawa 1958 (en polonais).

[17] J. Saloni: *Biała Rawska* (en polonais).

sur des matières premières locales. Dans d'autres petites villes l'économie agricole se développe dans des exploitations privées et les habitants des petites villes tiennent en ferme les terrains situés plus près des petites villes pour pouvoir les exploiter d'une manière plus intensifiée. La culture des semences, des certains légumes donne de bons revenus à la population. En conséquence les petites villes deviennent plus agricoles, ce qui, en général, ne cause pas de baisse du niveau de vie des habitants, mais ne donne pas de chances d'occupation pour le surplus de la population.

Toutes les tendances de transformation peuvent se manifester dans une petite ville ensemble, on bien, selon les conditions, une de ces tendances domine. Ces transformations répondent à la question pourquoi les petites villes, même si elles ne remplissent plus leur ancien rôle, ont retenu un si grand nombre de population.

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Role of Lakes in the Localization of Settlements in Western Poland

Investigation of the landscape of lake districts as a physiographical background for settlement processes embraces in Western Poland the territories situated between the valleys of the lower Odra and the lower Vistula. Its northern frontier is the Baltic coast. The author of this communication drew the southern frontier on the map: *Les lacs en Pologne au nord de la parallele 50° (The Lakes in Poland North of the 50° Latitude),* published in 1934. This line runs along the area where the last glacier reached, where the percentage of the lake area drops suddenly from 10 ha. out of a total area of 10,000 ha. to 2 ha. out of the 10,000 ha. of the entire surface of the county.

A considerable number of geographers, historians and prehistorians drew attention to the fact that settlements as a rule were located at the shores of lakes. The observations, which signalized these facts did not give a quantitative analysis, except the works of F. Bianchi and F. A. Forel.

Polish lowlands are characterised by small differences in height, therefore the term of "distance" used in this paper above all refers to the two dimensional measurements of the space relation. The hypsometrical differentiation of the monutainous relief especially in the alpine landscape — bring in the third dimensional measurement — the height, and on account of this it is difficult to make a comparison between the notion of the distance referring to the alpine lakes and the term "distance" as presented in this paper.

That ist why this work tries to supply the proper data explaining the phenomenon of the location of settlements at the shores of lakes. For this purpose the author examines the territory and cartographical material of the areas of 2,918 lakes in Western Poland. The considerable quantity of statistical data thus obtained permits the drawing of general conclusions.

The author surrounded each one of the 2,918 lakes with three zones, depending on the distance from the lake: 0—500, 500—1,000, 1,000—1,500 metres. He decided about the size of these zones, examining on the spot the existing conditions and measuring the average distance of border lines of fields and settlements in 1802. These border lines as a rule were at a distance of 1,5 to 2 km. He also utilized statements made

by experts in stock breeding, to the effect that the above mentioned distances normally corresponded to the lenght of the way to the pasture and to the watering-place.

The conception of "localization of lakes" was replaced by that of "localization of zones" influenced by the neighbourhood of the lakes and it is, because the investigation embraces an increased number of 3,037 settlements situated within the limtis of these three zones. The investigations revealed that between the settlements situated in the zone closest to the shore of the lakes, namely at a distance of 0—500 metres from the lake only 25 per cent were situated just at the board of the lake.

There can be noted considerable differences in the percentage of lake area as compared with the total area. (From 900 ha. per 10,000 ha., to 2 ha. per 10,000 ha. of the total area of the given county). That is why the author, in order to come closer to the truth,used smaller territorial units in order to establish the localization of settlements at lakes. For this purpose he utilized Pietkiewicz's physiographical division into regions [1], since it is comprehensible and provides the proper generalizations. The differences noted as regards the geomorphological aspect, the forested area and density of population made it necessary to divide the region up into two sub-regions: the territories of the northern wooded hills of the baltic moraines, situated north of the Toruń-Eberswalde preglacial valleys and the southern region, embracing part of Wielkopolska (Poznań region) and the Lubusz region which have a denser population and considerably less wooded areas. In nine northern landscapes were 1,806 lakes and 1,471 settlements and in the eight southern ones — 1,112 lakes and 1,566 settlements.

The term "settlement" is used without its specific qualitative, demographic, functional, physiognomic and situation features. We approach it here as a geometrical point, thought it was precisely the plan of the settlement which was the factor that decided to which region it should belong. Settlements approached from this point of view were placed, irrespective of their size, in each of regions. The table 1 presents the total results within the northern and southern sub-regions.

Table [1]

Concentration of settlements at shores of lakes in Western Poland

Region	Number of lakes	Number settlements	Number of settlements in the various		
			0—500 m.	500—1000m.	1000—1.500
Northern	1.806	1.471	813	357	301
Southern	1.112	1.566	764	430	372
Total	2.918	3.037	1.577	787	673

This table clearly indicates the predominance (50 per cent) of settlements in the zones closed to the lake 0—500 m., a violent drop as soon as the distance reaches one km. and a less striking quantitative decrease in the furthest removed zone of 1,000—1,500 m.

[1] S. Pietkiewicz: *Morphological Division of Northern and Middle Poland.* „Czasopismo Geograficzne" 1947, Wrocław.

In connection with some of the lakes there can be noted some cases where the relationship of figures differs from the rule. These differences only confirm the value of the established rule. If there is no predominance of settlements in the region closest to the lake, then the only reason for this is that lowering of the water level made the waters of the lake retreat from its shores and thus a settlement which originally had been in the first zone had to be added to those in the second zone. Galon's [2] research showed the considerable number of lakes which dis-

Table 2

The relations between the number of settlements situated at various distances from lakes as compared with the total number of settlements in the various zones

Region	Settlements in the various zones			Total
	0—500 m.	500—1.000	1,000—1.500 m	
	in percent			
Northern	55.4	24.3	20.3	100
Southern	48.7	27.5	23.5	100

appeared in the regions of the latest glaciation. Another type of differences was the quantitative increase of settlements in the third zone in such areas which were densely populated and functionally connected with the existence of a network of main routes.

Table 2 gives you the indices for this phenomenon in percentages.

What is striking in this table is the regularity in the composition of the figures, despite the physiographic and demographic differences of the two regions. There can also be noted a phenomenon observed in the case of some of the lakes: a disappearance of the differences between the various zones (particularly of the more distant ones) in regions of different demographic conditions.

If, in place of a criterion of the distance we take a criterion of surface, then another index could be set up: the relation between the number of settlements and the surface of each of the zones, i.e., the number of settlements par 100 square kilometres defines the density of settlement. In this way we would obtain the data included in table 3.

These indices are more convincing than those in table 2; what is particularly striking is the regularity of the gradation law: from the highest figures close to the lake to the lowest in the third zone, furthest away [3].

The overwhelming majority of today's settlements is functionally not at all connected with the lake; despite this fact there remains the above mentioned gradation law. To explain this phenomenon it is necessary to refer to the historical law of permanent settlements. Synthetic comparisons of settlements at the shores of lakes in the environs of Biskupin

[2] R. Galon: *A Preliminary Communication on a Paper Concerning the Disappearance of Lakes in Poland.* „Przegląd Geograficzny" XXVI, 2, 1954, Warszawa.

[3] I am addebted to Mrs. M. Jasiewicz and to Mr. W. Szorski for their help to the cartometrical work.

(Lake Weneckie, Lake Skrzynka, Lake Biskupińskie, Lake Godawskie, Lake Gąsawskie), prepared by Rajewski[4] in 1956, revealed: a) permanent settlements from the epipaleolithic age to the period of the migration of nations, inclusively, and b) "concentration of settlements along the line of lakes". A study of these maps permits the statement that the established gradation law had made its appearance already at that time.

Table 3

Name of the Region according to Pietkiewicz	Number of settlements per 100 sq. km. of the surface of the zone		
	0—500	500—1.000	1.000—1.500
Casubian Lake District	28.5	9.6	7.7
Drawa ,, ,,	21.9	7.7	6.8
Myślibórz ,, ,,	51.1	6.2	4.8
Wałk ,, ,,	14.4	2.7	3.0
Wysoczyzna Krajeńska	28.8	10.0	8.2
Równina Tucholska	36.6	8.0	6.5
Cassubian coastal area	16.4	9.0	8.0
Coastal area of Sławno	15.6	7.1	7.4
Coastal area of Szczecin	27.9	12.1	8.0

The author is not of the opinion that only physiographical factors are responsible for the law determining the localization of settlements at the shores of lakes, but comes forward with the hypothesis about the important role played by stock breeding as a foundation for settlement in this localization. The main factor prompting settlement was the need in the remote past for a watering place and meadows situated close to river beds and lakes shores.

Research conducted by prehistorians (Kostrzewski[5], Rajewski[6] and Henzel[7]) pointed to the important role fishing and stock breeding was bound to play in the Neolithic and Bronze Age. Even later when the change of climate encouraged people to develop agriculture and large settlements sprang up, stock breeding continued to be important. Thus the regions situated near lakes have for centuries during pre-historic times been centres with a concentration of settlements.

[4] Z. Rajewski: *The Primary Settlement of Biskupin and its Environs.* „Bulletin Archéologique Polonais", Warszawa 1957.

[5] J. Kostrzewski: *Les origines de la civilisation polonaise. Préhistoire-protohistoire.* p. 54 sq *(Elevage).* Paris 1949. Presse Universitaire.

[6] Z. Rajewski, op. cit. In the Bronze Age the fortified settlement of Sobiejuchy (Hallstatt time) consisted probably of about 200 houses with about 2.000 inhabitants but the half settled economy based on pastoralism and stock breeding give the small, half permanent settlement.

[7] W. Henzel: *Poznań in Ancient Times and the Early Middle Ages.* „Przegląd Zachodni" (Western Review) November 1953, Poznań.

During historical times when the art to drill wells was already universally known, stock breeding was no longer dependent on lakes as watering palces, however the value of the meadows situated near lakes continued to exert its influence on the localization of settlements. Thus, for instance, there was a stud farm for 100 horses at the lake in Znin, in 1548 and new ones were later added (Topolski)[8].

The author tries to explain that, within the framework of the law about permanent settlements, it is possible to accept the hypothesis that the localization law of settlements at the shores of lakes in a quantitative gradation, signifies the beginnings of localization based on elements of stock breeding, side by side with other values determining' settlement in the environs of lakes.

One should try to find out whether the law that existed for the past did not lose its value for our times. For this purpose the term "settlement" was imbued with a demographic value. Surveys were made in five regions taken, each 600 sq. km. in size. Thus sheets of maps were drawn up in a scale of 1:100,000.

Table

Number of inhabitants of settlements

Distance from the lake:	0—500	500—1.000	1.000—1.500
Sheet Środa			
Number of settlements	18	8	6
Number of inhabitants 1931	6.199	1.936	2.247
Sheet Buk			
Number of settlements	15	10	6
Number of inhabitants 1931	4.990	2.486	1.782
Sheet Szamotuły			
Number of settlements	8	3	6
Number of inhabitants	2.080	1.469	988
Sheet Inowrocław			
Number of settlements	23	4	6
Number of inhabitants	6.490	475	1.641
Sheet Wągrowiec			
Number of settlements	19	4	6
Number of inhabitants	5.373	1.205	2.298

The selected examples demonstrate various forms of the overlapping of old localizations in the vicinity of lakes and new localizations remaining under the influence of the network of roads. This brought about a violation of the gradation in the third zone.

The sheet of Buk shows the normal course of this phenomenon: the gradation of the number of settlements is retained, which is in accordance

[8] J. Topolski: *L'économie rurale dans les domaines de l'Archêveche de Gniezno du XVI au XVIII.* Poznań 1958. Poznańskie Towarzystwo Przyjaciół Nauk (Société des Amis des Sciences).

with the quantitative gradation of the number of the inhabitants. The Szamotuły sheet reveals the violation of gradations of settlements, but it retains the demographic gradation. The sheets of Września, Inowrocław, Wągrowiec reveal various degrees of oscillations as regards gradation, involving the number of settlements as well as that of the inhabitants.

The rapid demographic development of our times, the more and more decisive role played by planned economy, will bring about a development of settlements as the result of economic reasons. Nevertheless, the typical phenomena for lake regions which have been discovered, can be found not only in the localization of the settlement network, but also in demographic phenomena, typical of our present times.

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Développement de l'habitat en Posnanie

La plaine de Posnanie (Wielkopolska) et de Cujavie est un prolongement de la grandde plaine du Nord et s'étend depuis l'Odra à l'Ouest jusqu'a la Vistule au Nord-Est et le plateau de Łódź à l'Est. Sa formation géologique et morphologique est assez homogène. Son paysage se caractérise par des 1) vallées glaciaires, 2) élévations des moraines frontales et 3) terrains plats ou ondulés des moraines de fond, qui occupent environ 70% de tout le territoire. Toutes ces formations sont disposées en bandes latitudinales et alternes. Ce paysage c'est formé dans la deuxième phase de la dernière période glaciaire et on y voit l'influence des eaux provenant de la fonte des glaciers. Les vallées glaciaires latitudinales: de Toruń—Kostrzyń, Varsovie—Berlin et de Barycz-Głogów sont liées entre elles par des vallées longitudinales. Ce sont: la vallée de Warta, de Śrem à Oborniki, de l'Obra, suivant la ligne des lacs d'Obra et la vallée de l'Odra sur la frontière occidentale de la Pologne. Les fleuves principaux de la region qui empruntent ces vallées, ainsi que leurs affluents forment un réseau hydrographique assez régulier, divisant toute la plaine de Posnanie et de Cujavie en une série de plateaux. Le réseau dense de rivières et le relief du terrain relativement moderé constituaient depuis les temps les plus éloignés des voies excellentes de transport.

La Posnanie historique *(Polonia Maior)* étant le berceau de l'Etat polonais aux IX/X-èmes siècles est issue du territoire occupé par un peuple composé de tribus primitives qui englobait presque tout le bassin de la Warta et du Noteć jusqu'à Santok, Drezdenko et Międzyrzecz à l'Ouest. Se basant sur un développement naturel de nombreux siècles, économique, politique et territorial, liée à l'intérieur par le réseau des voies fluviales et des anciennes lignes commeriacles, la Posnanie (Wielkopolska) dura dans ses frontières, exception faite de changements peu importants, jusqu'à 1815, l'année du Congrès de Vienne. A partir de cette date, les terrains limitrophes de la Posnanie ont été maintes fois occupés et l'actuelle voïévodie de Poznań est, par rapport à la Posnanie historique, un peu rétrécie, surtout dans sa partie du Nord et de l'Ouest.

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La Posnanie est un des plus anciens terrains où la population se soit établie en Pologne. Au Moyen-Age, au moins au début du X-e siècle, il existait ici un Etat polonais organisé avec sa capitale Gniezno, ce qui restait

sûrement en rapport avec l'habitat hatif de cette région. De nombreux vestiges archéologiques permettent de constater que de cités agricoles existaient ici bien auparavant, déjà au moins depuis le VI-ème au VII-ème siècles et les enceintes fortifiés (*castrum*) portant les germes de la vie urbaine, à partir du IX-ième siècle. L'apparition sur l'arène de l'historie en 965 d'un grand Etat polonais avec des frontières du Bug à l'Odra, a été précédée de l'existence d'une vie économique organisée prolongée, dont témoignait un réseau de cités agricoles non protegées et enceintes fortifiées — berceaux de villes. On evalue qu'en l'an 1000, la densité moyenne de population de Pologne fut de 4—5 habitants au km² et sur les territoires peuplés d'une manière particulièrement intense et auxquels appartenaient la Posnanie Centrale et la Cujavie, la densité de population pouvait s'élever de 16 à 18 habitants au km² [1]. Sur le territoire de la Posnanie il existait environ 500 enceintes fortifiées, vestiges d'anciennes cités fortifiées plus ou moins grandes, dont une partie date de VI-ème et du VII-ème siècles. Environ 80 de ces enceintes étaient des enceintes historiques, dont l'existence a été notée dans les sources historiques et qui étaient liées à l'Etat organisé [2]. Les villes principales de la Pologne d'alors furent Gniezno et Poznań et une série d'autres telles que Kalisz, Ląd, Giecz, Krzywiń et Międzyrzecz — centres administratifs ainsi que le siège de couvents et d'églises. L'habitat principal de la Posnanie aux X—XIII-ème siècles suivait les lignes des sols fertiles mais pas lourds. Il s'étendait sur un territoire assez dense sur les plateaux de Poznań et de Gniezno, à partir du Buk à l'Ouest, en tant que base économique de la rive gauche de Poznań, à travers Gniezno, Kruszwica, jusqu'à la Cujavie et la Vistule. C'était ensemble principal de l'habitat de la Posnanie et de la Cujavie, auquel étaient liées des régions au l'habitat moins important, situées entre les forêts à l'Ouest et à l'Est. Le second ensemble d'habitat dense se trouve aux environs de Kalisz et s'etend en longueur vers le Nord-Est par Turek, Spicymierz jusqu'à Sieradz. Le troisième ensemble d'habitat, mais déjà moins dense, sans centre plus important, est constitué par cités de la Posnanie du Sud, de la Śrem près la Warta, par Lubiń, Krzywiń, Przemęt, Wschowa, qui s'unissait aux environs de Głogów et de Milicz aux groupes d'habitat de Silésie [3].

Déjà depuis le X-ème ou XII-ème siècles, les cités de type d'enceinte-fortifiée possèdent des enclos *(suburbia)* souvent fortifiés. Une riche vie artisanale et commerciale existait dans nombreuses d'elles. Les fouilles ont mis à jour dans la majorité des centres comme à Poznań, Giecz, Gniezno, Kruszwica, Międzyrzecz et Kłeck, non seulement de beaux produits de l'artisanat local (par exemple: orfèvrerie, articles en os et à Kruszwica industrie de verre), mais également des objets de luxe,

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[1] H. Łowmiański: *Bases économiques de la création des états slaves.* Varsovie 1953, p. 244.

[2] W. Kowalenko: *Les bourgs de Posnanie et la colonisation à l'époque du haut moyen-âge (VII—XII siècles).* Poznań 1938.
J. Kamińska: *Enceintes fortifiés médievales des territoires de la Pologne centrale et le problème de l'habitat.* Łódź 1953.

[3] A. Wędzki: *Matériaux cartographiques pour l'atlas du début de l'histoire.* 1959.

provenant d'importations ainsi que des trésors en monnaies sous forme de dirhens des pays arabes de l'Asie Centrale qui témoignaient des relations commerciales animées entre la Pologne et les pays lointains (Scandinavie, Russie de Kiev). Ces objets témoignaient également de la haute culture des féodaux polonais. Un trait caractéristique de cette période est que les habitats étaient liés à l'existence de bons sols argileux. Parmi les cités rurales, des cités de prisonniers (Poméraniens, Hongrois, Prussiens, Tchèques, etc.) jouaient un rôle spécifique, de même que des cités d'artisans de prince, dont la population, specialisée dans une fonction économique donnée, se groupait autor des sièges princières (Żerniki, Korabniki. Świniary, Piekary, Sokolniki, Świątniki, etc.). A côté des cités princières qui formaient le plus grand groupe (environ 45%), la propriété des églises et des couvents qui menaient sur les terrains que le prince leur a donnés la campagne de l'habitat, était également importante. Les cités de chevaliers constituaient un groupe moins important.

La moitié du XIII-ème siècle est une date importante dans l'histoire de l'habitat de la Posnanie. A cette époque de grandes transformations sociales et économiques interviennent en Pologne à la suite de l'introduction de plus en plus générale des baux dans les relations rurales. On se servit à la campagne de l'économie de loyers, qui dura à peu près jusqu'à la moitié du XV-ème siècle. Ceci est lié au développement de l'économie marchande et monétaire qui a influé éminement sur l'animation de l'économie des villes et sur le peuplement rural. C'est une période dite de peuplement basé sur le droit allemand. De nombreuses nouvelles villes ont été créées à cette période, et plus nombreuses encore furent les anciennes cités urbaines qui se sont réorganisées sur la base du droit allemand. Les sources historiques mentionnent jusqu'à la fin de cette période environ 2620 cités rurales et 153 villes en Posnanie. La densité des cités rurales fut, pour l'époque, assez grande. Dans la Posnanie Centrale on comptait une cité par 8—10 km², aux peripheries une cité par 17—20 km². Le réseau de villes était plus dense que dans d'autres parties de Pologne [4]. Au XIV-ème siècle on comptait une ville par 351,50 km² et au XV-ème siécle, seulement une par 213,65 km². En 1253, Poznań obtient les droits urbains et s'établit dans les frontières d'une ville nouvellement planifiée et fortifiée sur la rive gauche de la Warta, et l'ancienne cité urbaine sur l'île du fleuve se transforme avec le temps en un centre ecclésiastique. De nombreuses cités marchandes, anciennes enceintes fortifiées ou „suburbia" ont obtenu à cette époque les droits urbains. Elles quittent alors les terrains marécageux pour s'installer sur des terrains plus secs (par exemple Poznań). En principe les villes sont construites au bord des rivières [5]. L'habitat rural de cette période continue à se développer sur des sols fertiles, à proximité d'importants centres administratifs, économiques et ecclésiastiques. Les voies de communication constituaient également un facteur attractif. Jusqu'à la fin de cette période, le réseau d'habitat en Posnanie est déjà

[4] J. Hładyłowicz: *Changements du paysage et le développement de la colonisation en Posnanie du XIV-ème siècle.* Lwów 1932.

[5] H. Münch: *Genèse de la planification des villes de la Posnanie au XIII-ème et XIV-ème siècles.* Kraków 1946.

formé dans ses grandes lignes (environ 70% de villages et 80% de villes).

La période suivante de la moitié du XV-ème siècle jusqu'à la fin du XVI-ème siècle apporte des changements dans le système agraire, ce qui trouve un net reflet dans l'habitat et en particulier l'habitat rural. L'économie de servage s'intensifie, pour devenir au XVI-ème siècle une méthode dominante. La production agricole et d'élevage était destinée surtout à couvrir les besoins nationaux et à l'écoulement à l'étranger. Ceci influait sur le développement des villes déjà existantes et sur la fondation de nouvelles qui se situent parfois à proximité de l'ancienne ville (par exemple Trzciel). Sont nées alors 17 nouvelles villes et 2 villes situées à proximité des villes déjà existantes, dont la majeure partie en Posnanie Centrale. Des cités rurales continuent à apparaître bien qu'en nombre moins important que dans la période précedente. Au XVI-ème siécle existant dans cette région 3573 cités ceci veut dire qu'au cours des siècles XV-ème et XVI-ème seulement 952 villages ont été créés. Leur densité ne s'est accrue que très peu, et on compte à l'époque une cité par 6—8 km² et aux péripheries une par 14—15 km².

La période suivante, le XVII-ème et le XVIII-ème siècles, période ou on réadopte de nouveau le système des baux, cette fois payés en espèces, se caractérise par une nouvelle vague d'habitat qui, dans la situation ou tous les sols fertiles ont été occupés par les villages, se retourne vers des régions de forêts. On commence le déboisement et la superficie des forêts diminue fortement à cette époque. On commence également l'assèchement des marécages et terrains marécageux et les colons qu'on faisait venir en partie de l'Ouest, surtout d'Allemagne, obtiennent de conditions particulièrement favorables. Plus tard, les colons se recrutent parmi la population polonaise. Au XVIII-ème siécle, on compte en Posnanie 4206 villages, ce qui veut dire que durant deux siècles, malgré une forte colonisation on n'a fondé que 633 villages. Le terrain de l'habitat le plus dense, reste toujours le district de Gniezno, où on compte un village par 5 km², aux périphéries un par 11—13 km². Au XVII-ème siècle 11 nouvelles villes sont crées ainsi que 18 villes "nouvelles" à côté des "anciennes". Elles apparaissent en plus grand nombre dans les propriétés des nobles (83%) en Posnanie du Sud, ou dans la région frontalière sont crées des villes des tisserands, des emigrés religieux de l'Allemagne, de Bohême, d'Ecosse et d'autres pays. Au XVII-ème siècle on compte une ville par 162,63 km² et au XVIII-ème, une par 149,25 km². La naissance de nouvelles villes reste en rapport au développement des tissages, surtout des tissages du drap [6].

La période du capitalisme apporte des changements importants au système social et économique. A la suite de la campagne tendant à rendre les paysans propriétaires de la terre, réaparaissent jusqu'à la moitié du XIX-ème siècle des rapports capitalistes et dans la II-ème moitié de ce siècle on voit régner ici la formation capitaliste. Les rapports politiques et avant tout la perte de l'indépendance nationale et une politique

[6] Z. Kulejewska: *Etudes du problème des locations urbaines en Posnanie du XVI-ème au XVIII-ème siècles.* „Przegląd Zachodni" (Revue Occidentale) 1953, cahier 9—10.

économique différente de chacun des occupants, ont pesé également sur ce siècle. Seules de rares cités ont été fondées à cette époque; on observe uniquement l'accroissement de la population des villages et des villes. L'occupant prussien colonise également la campagne. Aucune ville nou-

Carte 1. Densité du réseau d'habitat rural dans la voïévodie de Poznań en 1959: *1* — nombre des villages par 100 km², *2* — limites des voïévodies, *3* — limites des districts, *4* — limites des régions d'habitat, *5* — *I* — région est, *II* — région sud, *III* — région centrale, *IV* — région ouest-centrale, *V* — région nord

velle n'est fondée, et le réseau trop dense de villes provoque de declin de nombreuses cités urbaines qui deviennent des villages. Au cours des deux derniers siècles, 58 petites villes ont suivi ce destin. La population

d'autres villes s'accroît, surtout là, où des voies de chemin de fer ont été amenagées et où a été construite une certaine usine. Le rôle de l'industrie croît de plus en plus, la population rurale émigre vers les villes, de manière qu'à la moitié du XIX-ème siècle la population citadine constitue déjà 34% de toute la population. Dans les années 1861—1910 la densité de la population passe de 53 par 1 km². Cet essor concerne surtout des grandes villes qui absorbent les villages avoisinants. Jusqu'à 1939, Poznań a absorbé 58 villages [7].

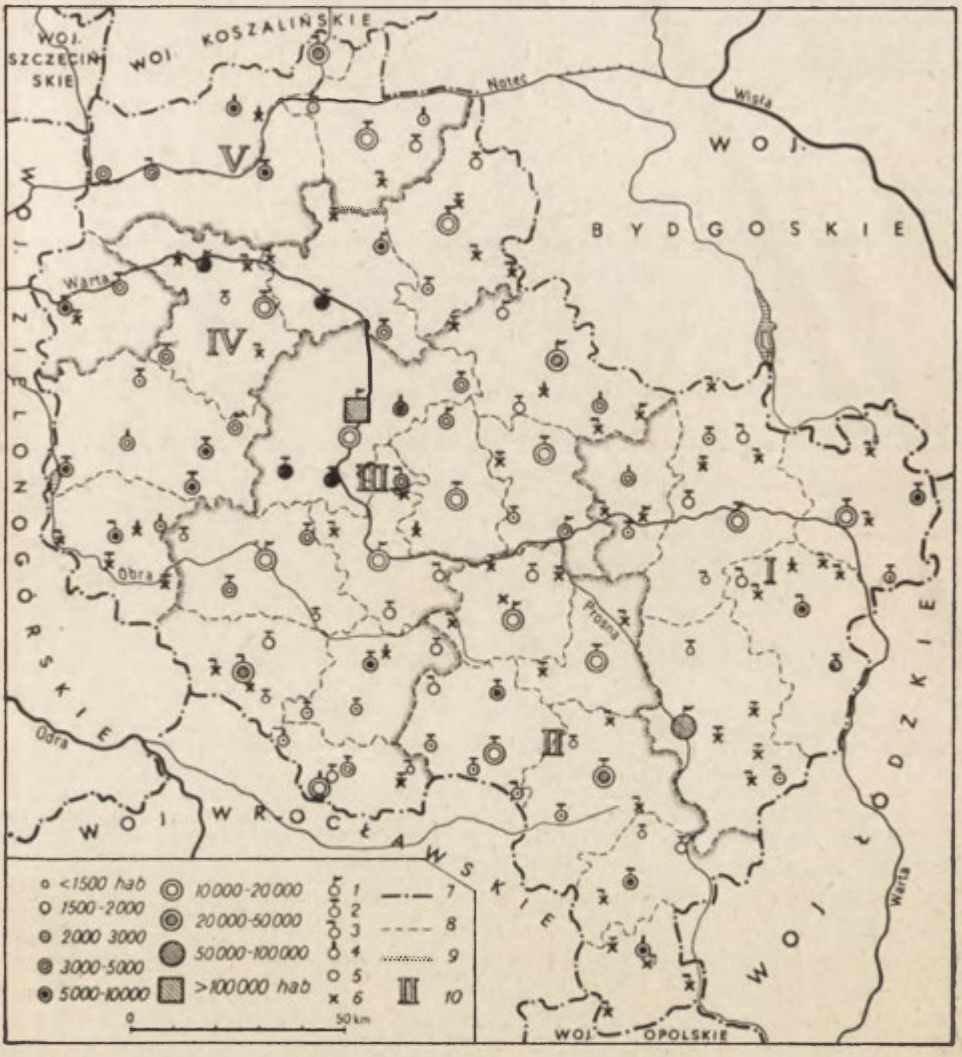
Le réseau de l'habitat rural et urbain de l'actuelle voïévodie de Poznań est dense. On peut distinguer ici 5 régions d'habitat marquées de certains traits caractéristiques. Ce sont les régions: I — de l'Est, II — du Sud, III — Centrale, IV — Centrale de l'Ouest et V — du Nord. Sur le territoire de la voïévodie de Poznań, d'une superficie de 26.925 km², il existe 3673 villages administrés par des maires de villages. Chacun d'eux possède dans son rayon d'administration un ou quelques hameaux. La première région, de l'Est se compose des districts: de Konin, de Koło de Słupca, de Turek et de Kalisz. Ils n'appartiennent à la voïévodie de Poznań qu'à partir de 1945. Ayant appartenu pendant un siècle et demi au territoire de l'occupation russe, ils ont subi de processus économiques et sociaux différents à ceux que le reste de la Posnanie, gerée par l'occupant prussien. Ceci a eu des conséquences dans la genre de l'économie et d'habitats. C'est là le cas du territoire historique de Kalisz, dont la densité du réseau des cités découlait notamment du retard et des différences dans le systeme économique rural ayant en vue de rendre la terre aux paysans. On compte ici plus de 20 villages par 100 km². Le réseaux dense de villages ne correspond pas du tout à la densité de population, parce que seulement le districts de Konin et de Koło possèdent 75—100 habitants par km² et autres districts 50—75 par km². Le réseau dense de cités est lié dans une certaine mesure avec la prépondérance du type de l'économie agricole. Le pourcentage des terres arables y est le plus grand dans toute la voïévodie, (70—80%) et le pourcentage des forêts le plus petit (district de Koło 8%, de Słupca 5,6%). En conséquence, 80—90% de toute la population de la région de l'Est travaillent dans l'agriculture, et seulement dans le district de Konin ce chiffre diminue jusqu'à 75% en raison du développement rapide du bassin de lignite et du développement de l'industrie qui en découle. Par contre le nombre de travailleurs dans l'industrie est, dans tous de district, peu élevé (au-dessous de 10%). La ville de Kalisz — grand centre industriel — constitue ici la seule exception (62,1%).

La région II — du Sud, se compose des districts: de Kępno, d'Ostrzeszów, d'Ostrów, de Krotoszyn, de Pleszew, de Jarocin. Le réseau d'habitat est ici très rare; on compte 10—14 villages par km² et dans le district d'Ostrzeszów 9 villages — sièges de municipalité de village. La densité de la population oscille autour de 50 à 75 par km² jusqu'à 75—100. La région du Sud est plutôt agricole (60—80% des travailleurs sont occu-

[7] St. Zajchowska: *Développement du réseau de l'habitat des environs de Poznań du XI-ème au XX-ème siècles.* „Przegląd Zachodni" (Revue Occidentale) 1953, cahier 6—8. Poznań.

[8] Annuaire 1959 pour la voïévodie de Poznań ((Annuaire du Conseil Scientifique et Economique près le Conseil de la Voïévodie).

pés dans l'agriculture), mais elle manifeste une tendance vers l'industrialisation (10—20% des travailleurs employés dans l'industie) et surtout le district de Jarocin. Dans cette région se trouve également un grand



Carte 2. Villes de la voïévodie de Poznań: Date de la fondation des villes: *1* — avant 1260, *2* — 1260—1450, *3* — 1450—1600, *4* — 1500—1800, *5* — après 1800, *6* — villes en déclin, *7* — limites des voïévodies, *8* — limites des districts, *9* — limites des régions d'habitat, *10* — *I* — région est, *II* — région sud, *III* — région centrale, *IV* — région ouest-centrale, *V* — région nord

centre industriel — Ostrów, avec 47,3% de travailleurs industriels. La part des terres arables dans la supercifie totale de la région est encore grande (60—80%) excepté le district d'Ostrzeszów où, à cause du grand nombre de forêts, elle diminue jusq'à 56%. La région III — Centrale

(districts: Poznań, Gniezno, Września, Środa, Śrem, Kościan, Gostyń, Leszno, Rawicz) constitue un vrai noyau de la Posnanie et englobe presque toute la région la plus ancienne d'habitat. Elle se caractérise par un réseau de villages assez dense, 14—20 villages — sièges de municipalités par 100 km². Le pourcentage des terres arables s'éleve à 70—80%, des forêts — au dessous de 20%. Les grandes villes, Leszno, Gniezno et Poznań, qui groupent la majeure partie des objectifs industriels de la voïévodie, augmentent le degré de l'industrialisation de la région. La région IV — Centrale de l'Ouest, avec les districts: Wągrowiec, Oborniki, Szamotuły, Nowy Tomyśl, Wolsztyn, possède un habitat de date moins ancienne, surtout à l'Ouest, où les terrains sablonneux et boisés ont arrêté le développement de l'habitat vers les limites periphériques occidentales de la Posnanie. L'actuelle densité des villages est partout moyenne et s'élève à un peu plus que 10 villages par 100 km². Par contre le nombre d'habitants par km² est relativement bas et oscille dans toute la région entre 52 et 66 par km². Ceci decoule des grandes forêts surtout dans les districts d'Oborniki (32%) et de Wolsztyn (31,3%). La région porte un caractère agricole, sauf sa partie centrale où l'industrie est relativement importante à cause de la proximité de la ville de Poznań et des voies de communication importantes auprès desquelles sont situées les plus importantes villes de ces districts. Ainsi, dans le district de Szamotuły, le pourcentage des travailleurs employés dans l'industrie s'élève à 31%, dans le district d'Oborniki. à 21%, tandis que dans le district de Wolsztyn à peine à 12,9%. Le caractère agricole de la région s'exprime dans le pourcentage des travailleurs de l'agriculture qui est de 50 à 70% et dans le district de Wolsztyn de 71% même. La région V — du Nord, avec les districts: Chodzież, Trzcianka, Czarnków et Międzychód est la région limitrophe de la Posnanie (Wielkopolska), terrain de merécages et d'anciennes forêts. C'est pourquoi le réseau de l'habitat y est jusqu'aujord'hui moins dense que dans l'autres parties de la Posnanie. Le nombre de villages par 100 km² dans toute la région est de 10, et dans le district de Trzcianka de 6. La densité de population y est également la plus basse dans cette région, à savoir elle ne depasse pas 50 par km². Ceci découle dans une certaine mesure du plus grand boisement de la région (30—40—50%) ainsi que du pourcentage le plus bas des terres arables (40—50%). La région est peu industrialisée, parce que, outre les villes de Piła et de Chodzież, ou les travailleurs de l'industrie prédominent, toute la région possède plutôt une structure agricole. Le district de Czarnków porte le caractère agricole le plus prononcé (71,4%).

Les régions de l'habitat de la Posnanie montrent des différences plus ou moins importantes en ce qui concerne la densité du réseau de l'habitat rural et urbain, leur grandeur, et leur caractère économique. Cette différenciation est le résultat du développement de l'habitat pendant des siècles, depuis le début de l'existence de l'Etat polonais jusqu'aujourd'hui et depend d'une évolution différente des processus économiques, sociaux et politiques et dans un certain sens des conditions différentes du milieu géographique des diverses parties de la Posnanie.

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*

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Errata

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Supplement 1960

Article of A. Wróbel

Page	Para.	Line	For	Read
127	6	2	... has an empirical content	... has no empirical content
129	3	3	... both of these and the regional structure	... both of these aspects of the regional structure
130	4	2	... another definition	... — another thesis
Map 1	(legend)	2		value of retail turnover in industrial goods overestimated needs of local urban population
Map 2	„	1	... average daily passenger traffic	... average monthly passenger traffic
Map 2	„	4	... (over one journey per inhabitant daily)	... (over one journey per inhabitant monthly)
Map 3	„	2	... areas	... industrial areas

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