NEW PERSPECTIVES IN HUNGARIAN GEOGRAPHY

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AKADÉMIAI KIADÓ • BUDAPEST

NEW PERSPECTIVES IN HUNGARIAN GEOGRAPHY

(Studies in Geography in Hungary, 27)

Edited by
ÁDÁM KERTÉSZ and ZOLTÁN KOVÁCS

Hungary has long been widely regarded as a pioneer of political and economic transformation in East Central Europe. With regard to this political attention the present volume may command great interest from broad disciplinary backgrounds. The idea to publish a set of papers on the latest achievements of geographical research in Hungary has long been conceived, yet, the opportunity was provided first by the 27th International Geographical Congress, held in Washington D.C., in 1992.

The papers in this special issue were assembled from diverse workshops of Hungarian professional geography – universities, colleges and research institutes – thus their contents reflect several features of recent geographic studies in the country. Nine papers on physical geography and eight on human geography provide the reader a comprehensive insight into the most important problems which are in the centre of contemporary Hungarian geography.

Papers on physical geography discuss soil erosion phenomena, landslides and karst processes, and several other questions, mostly related to the theoretical and empirical aspects of environmental studies.

Human geographical essays also cover a wide range of research topics, many of them representing entirely new research directions in the country.

The editors hope that this collection will contribute to a more informed understanding of the country's geography, and the papers of this volume represent the first step in the re-integration of Hungary to the international current of modern geography.

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NEW PERSPECTIVES IN HUNGARIAN GEOGRAPHY

STUDIES IN GEOGRAPHY IN HUNGARY, 27

Geographical Research Institute
Hungarian Academy of Sciences, Budapest

NEW PERSPECTIVES IN HUNGARIAN GEOGRAPHY

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PREFACE

This volume contains contributions of Hungarian physical and human geographers to the 27th International Geographical Conference Washington, August 1992. The editorial board selected the most significant papers informing the reader about major research trends in Hungary since the 26th International Geographical Conference.

Papers on Physical Geography reflect the results of contemporary research, mostly related to environmental problems.

Soil erosion, landslides, karst processes and phenomena are discussed by using traditional and up to date methods, i. e. measurements and experiments. Landscape ecology is treated both from theoretical and from practical aspects. Methodological aspects like mapping methods and interdisciplinary approaches are emphasized.

Human geographical essays cover also a wide-range of research topics. Among the current topical problems examined are East European urbanization, ethnic change, political conflicts and regionalism as well as the impacts of political transformation, like urban decline, changing international tourism, restructuring in telecommunication and agriculture.

Acknowledgements are due to all contributors (authors, translators, editors) and to the technical staff who promoted the publication of this volume.

Budapest, August 1992

Ádám Kertész and Zoltán Kovács
Editors

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AN ESTIMATION AND MAPPING METHOD FOR EROSION HAZARD IN THE CATCHMENT OF LAKE BALATON

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ABSTRACT

Relief evolution and geomorphological studies in the physico-geographically heterogeneous catchment area of Lake Balaton are of special importance for water quality in the lake. The amount and quality of pollutants reaching the lake are highly dependent on the erodibility of watershed. To determine it Marosi, S. (1984, 1985) elaborated the integration principle and method below on the basis of criteria of factors influencing erosion hazard in the region *(Table 1)*. It is to be emphasized that the grades of erosion hazard *(Table 2)* only indicate the general resistence capacity of the surface, its vulnerability and the potential dislocation of surface materials and point to differences between surfaces in this respect. The degree of actual erosion is also dependent on the following: amount, frequency and primarily intensity of precipitation of random spatial and temporal distribution and momentary surficial conditions. The redeposition-transportation route of the displaced material, its distance, site of accumulation is, in addition to the above, a function of slope length, configuration (arrangement of gentle segments), the nature and size of surface details functioning as base level, site of deposition. To measure sediment and chemicals reaching the lake from the watershed mechanically and in solution in a concrete case, an extremely complicated multivariate function would have to be solved. The final aim is to measure this load, differentiate it in space and time with the fundamental help of partial information from geomorphological mapping and with guidance of the above principles and methods.

INTRODUCTION

Erosion and erosion hazard can be approached from different viewpoints in the various disciplines.

One of the approaches is the measurement or estimation of the amount of soil eroded ie. soil loss. The methods of this approach are the recording of soil thinning, the spreading and growing dimensions of rills, gullies, streams, gorges and valleys.

Another way is to start from the local rate of erosion, to measure the amount of the load transported mechanically and in solution and then accumulated in waters, and to draw conclusions concerning the quantitative and qualitative processes.

The farmer and the soil scientist recognize first of all the lack of eroded soil especially on cultivated slopes. Hydrologists, however, deal with the transported and deposited sediments and with the unwanted accumulation of dissolved material. Nevertheless, the concept of *erosion* lies behind both experiences.

Where has the eroded material gone? From where is the accumulated matter coming? These questions have to be answered using both approaches. An identification of the major reasons and factors of erosion is needed in order to draw conclusions for the degree of erosion hazard.

DISCUSSION

1. A geographical approach to erosion

The increased agricultural, industrial, technical etc. use of the surface calls for a prediction of relief evolution modified by human impacts.

It is obvious that geomorphic evolution is manifested most marked in the uppermost horizon of the surface, ie. in the soils. Therefore, since more than three decades the researchers of the Geographical Research Institute have studied the geomorphology, complex physical geography and ecology of different regions, among others the environs of Lake Balaton, by means of thematic mapping at scales of 1:100,000, 1:25,000, 1:10,000, 1:5,000 and 1:2,000, based on evaluating erosion catenas from densely recorded soil profiles.

In the course of this activity it has become clear that the mapping and analysis of soil formation and erosion, carried out with exact methods allows the recognition of new regularities in geomorphic, and more particularly in slope evolution (Juhász, Á. et al. 1974; Marosi, S. and Szilárd, J. 1967, 1969; Marosi, S. 1972). Slopes react to soil formation and erosion with changes in angle, exposure, structure, cover deposits and dynamic state, water and thermal budget. The functional investigation as well as the analysis of interrelations between these factors have become necessary.

2. Interdisciplinary complex investigations

An interdisciplinary cooperation of many decades has been extremely fruitful especially in the complex ecological investigation of different regions on the Balaton catchment. In addition to the geographers (e.g. Góczán, L. and Szilárd, J., 1954, 1969, 1971), names of geologists, pedologists, geobotanists, among others Erdélyi, M. (1963), Stefanovits, P. (1964), Kazó, B. (1967) and Jakucs, P. (1969) have to be mentioned here.

This cooperation had began before the deterioration of water quality and environmental state of Lake Balaton became fully recognised.

Since the mid-sixties the lack of the filtering function of Little Balaton as well as the increased siltation of the Keszthely Bay have been emphasized (Marosi, S. 1965, 1975), confirming the concept of reconstruction by Cholnoky, J. (1942). In the early seventies these ideas were repeated by the competent experts before the Council for Coordination of Research on Lake Balaton. Finally, the increased deterioration of water quality called for a rehabilitation plan, which is now being implemented.

A series of detailed agroecological maps on several key regions were prepared, partly as soil conservation plans, and the maps of soil erosion also constructed *(Fig. 1)*. Our researchers took part in the detailed engineering geological mapping of the Balaton environs and geomorphological maps for various purposes and at different scales were also prepared. As a synthesis a geomorphological map of 1:300,000 scale was compiled under the guidance of Pécsi, M. (1969), based on geomorphological mapping at 1:25,000 scale.

The mapping of 1:10,000 scale and the investigations by Góczán, L. elaborating a new method with the aid of B. Kazó's rainfall simulator can also be mentioned. The water management parameters that can be measured for soils of different genesis were determined as a function of slope angle, rainfall intensity, infiltration and runoff. A "natural hydraulic conductivity of soils" was defined and the role of slope in soil formation underlined (Góczán, L. and Kazó, B., 1969; Góczán, L. and Szász, A.F., 1970).

Investigating soil water budgets by means of rainfall simulation in complex studies on the southern shore of Lake Balaton, Kazó, B. demonstrated the fundamentally different water budgets of surfaces with the same ecological features but with different vegetation cover (Kazó, B., Marosi, S., Stefanovits, P., Szilárd, J. 1967). Beside the vegetation cover the water retention capacity proved to be an important factor of soil erodibility (Kazó, B. 1967).

3. Mapping soil loss and the factors controlling soil erosion

Our mapping of soil erosion is based on the degree of erosion compared to complete profiles of genetic soils *(Fig. 1)*.

When mapping the vertical (relative relief) and horizontal (valley density) dissections, we are aware of the fact that with their increase potential erosion hazard also grows.

The rate of erosion is essentially controlled by the erodibility of the su 'e and by the erosivity of rainfall. The formula by Wischmeier, W.H. and Smith, D. for esti 'ting general loss of soil (1978), known and applied also in Hungary, have been debate 'y many researchers; its general validity has been also questioned by Richter, G. (19ℓ who carried out detailed investigations in Germany and emphasized that the parameter from which soil loss is estimated should be chosen as a function of the local ecologica

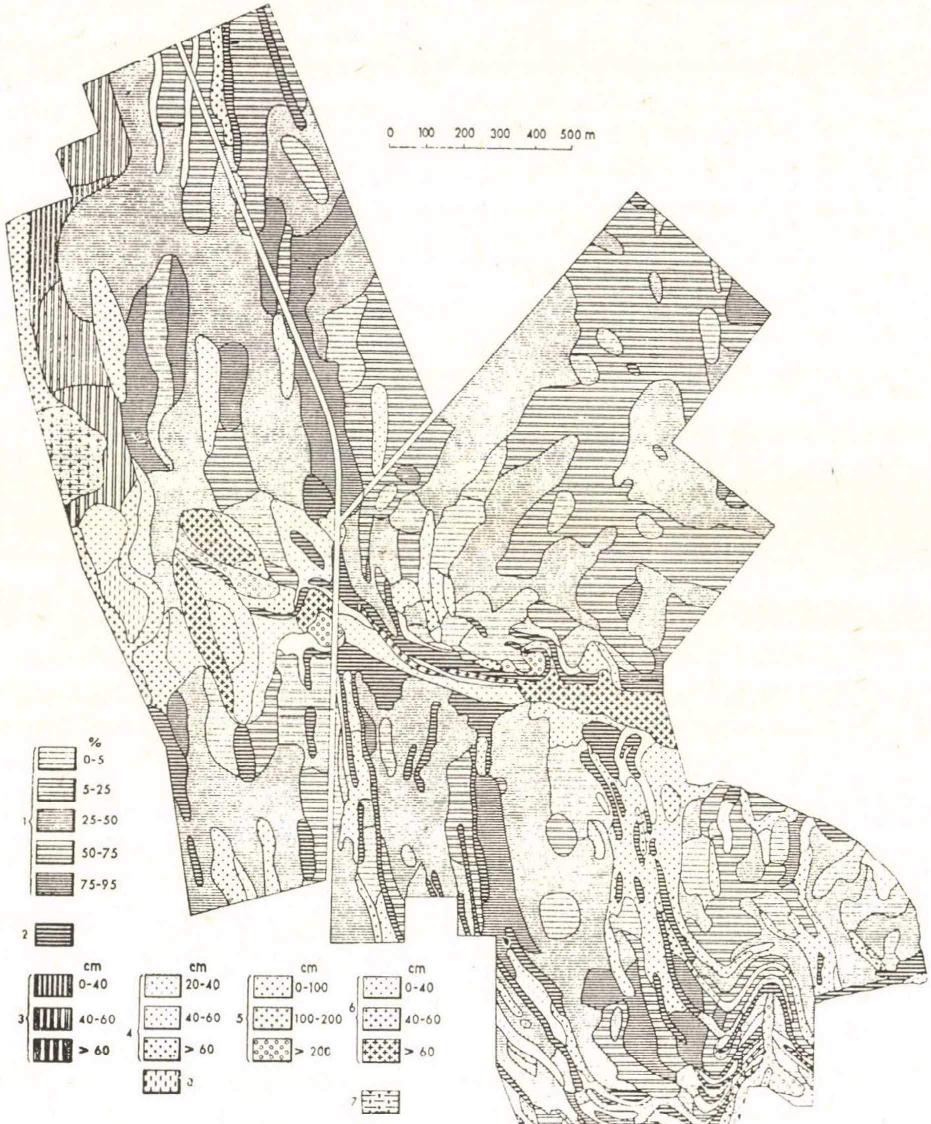

Fig. 1. Soil erosion map of the northern part of the Karádi-ridge (Rádpuszta) (Mapped and edited by Marosi, S. and Szilárd, J.). 1 = degree of soil erosion in %; 2 = earthy barren; 3 = thickness of meadow chernozem soil in cm; 4 = thickness of humus-carbonate soil in cm; a = hydromorphic effect; 5 = thickness of slope deposit in cm; 6 = thickness of accumulation in cm on the original soil; 7 = waterlogged area

conditions by geographical units and the formula by Wischmeier should be corrected accordingly. Ten years of measurement on water budgets and runoff by Góczán, L. and his team also point to the need of a more differentiated interpretation.

Based on our own geographical-geomorphological results and relying upon the sediment load measurements carried out by he Institute of Hydraulic Planning as well as upon soil loss data (Kamarás, M. 1965), a novel study on the erosion hazard was carried out by Dezsény, Z. (1980, 1982), Hungarian Geological Survey, in two subcatchments of Lake Balaton. The case study published on the catchments of some tributaries of Balaton as well as the map of 1:100,000 scale naturally provide only restricted information and general results. Although the scale does not allow to establish the validity of the method applied, the results of the study are by all means remarkable.

Both the soil erosion mapping from agricultural and soil conservational viewpoint and the prediction of potential non-point pollution of agricultural origin induced by soil erosion require more detailed investigations. In the extremely heterogeneous Balaton catchment mapping in a scale of 1:25,000 and, if possible, either by subcatchments or by landscape types of homogeneous ecology would be necessary. Further, the mapping based on parameters calculated to a square grid (independent of natural areal units) is also feasible. Our landscape typological map *(Fig. 2)* demonstrates this heterogeneity in the 96 subcatchments.

Numerous instances could be cited for the applicability of information as a function of mapping scale, of the soil erosion ranging from 1:500,000 to 1:2,000.

The human factors of soil erosion are changeable and can be modified while the natural ones (the bedrock, soil, relief conditions and partly the vegetation cover) are mostly relatively constant. Certain uses of land (e.g. vineyards, orchards, built-up areas) are partly constant. Among the natural factors of erosion hazard the meteorological ones are extremely variable and cannot be modified, their effects, however, can be reduced by different soil conservation measures (e.g. terracing, ditches, drain-pipes,agrotechnological, plant protection and technical methods).

To approach the surface erodibility in the Balaton catchment of extremely heterogeneous physiographic features, Marosi, S. (1984, 1985) elaborated a special set of criteria of the erosion hazard for the region *(Table 1)*. Weighing some of the factors, he attributed a decisive role to the slope angle and land utilisation making distinction between surface coverage and the closely related land utilisation. He claimed that the forms of the latter are partly constant, the vegetation cover, however, is changeable as a function of seasons, phenophases and areas in crop cultivation *(Tables 1 and 2)*. It is to be emphasized that the grades of erosion hazard *(Table 2)* only indicate the general resistance or erodibility and the potential dislocation of materials on various surfaces. The degree of actual erosion also depends on the following factors: the amount, frequency and primary intensity of precipitation of random spatial and temporal distribution, the momentary surface conditions, the redeposition-transportation route of the dislocated

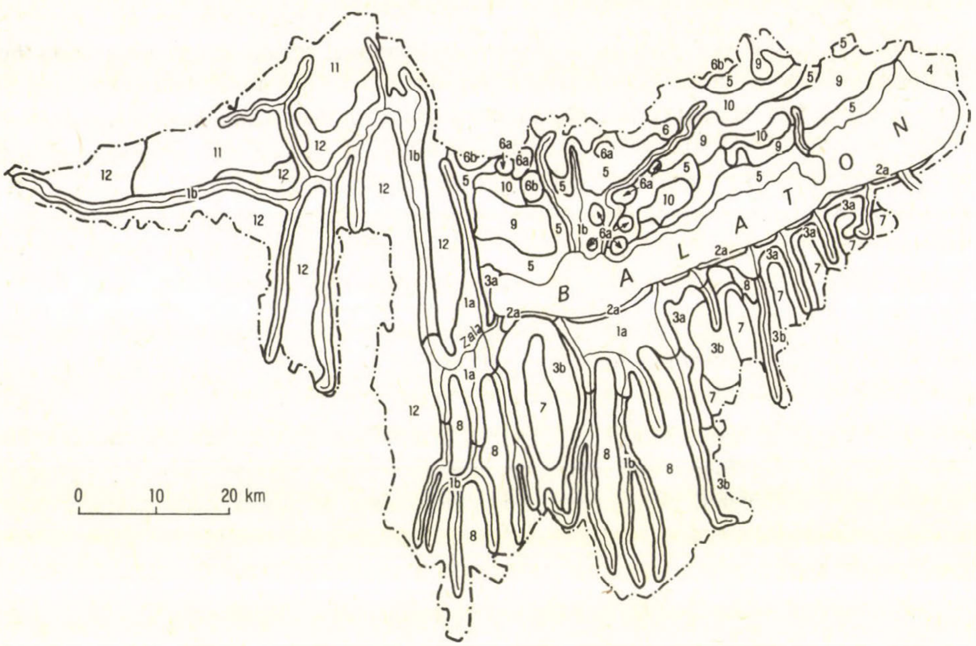

Fig. 2. Landscape types in the catchment of Lake Balaton (sketch after Pécsi, M., Juhász, Á., Marosi, S., Somogyi, S., Szilárd, J.)

1a = alluvial surfaces of azonal, hydromorphic and semi-hydromorphic soils with flood plain of poor runoff with peaty, fen, occasionally meadow soil; 1b = flood plain with meadow soils, locally with fen, mostly free of floods; 2a = recent lacustrine offshore bars; 3a = loessic, mostly agriculturally utilized, slightly dissected low hills, covered by different (from chernozem to brown forest) soils; 3b = moderately undulating, loessic, lowland cropland under sub-Atlantic and continental climatic effects; 4 = loessic lowland with deep-seated groundwater and covered by lime-coated chernozem, mostly under cultivation; 5 = moderately dissected piedmont surface with deep-seated groundwater and mostly with rendzina and other soils of different zonation in lithomorphic spots; 6 = isolated basaltic and basalt-tuffic monadnocks (a) and plateaus (b) covered by lithomorphic, locally by brown forest and meadow soils and characterized by mosaic-like forestry, agriculture and horticulture, and with quarrying in spots; 7 = loessic, medium-dissected hilly landscape under sub-Atlantic and moderately continental climatic effects, mostly of lessivated brown forest soil, with hornbeam-oak, partly with beeches, and partly under cultivation; 8 = sand plain under sub-Atlantic to sub-Mediterrenean climatic effects, and of predominantly rust brown forest soil with peduncular-hornbeam-oak and linden vegetation, used for the most part to field growing of plants; 9 = low horsts of carbonate rocks and of deep karst water table, covered by Turkey-oak, hornbeam-oak, mosaic-like beeches and karst shrubs on rendzina and lessivated brown forest soils; 10 = intramontane basinal hills with hornbeam-oak forest remains; 11 = partly gravelly alluvial fan plain of medium and deep ground water table, with dense water network and with lessivated brown forest soil covered mosaic-likely by loess alluvium; 12 = erosion hills reflecting moderately cool and humid sub-Atlantic and sub-Alpine climatic effects, covered by pine and mixed oak forest mosaics on pseudogleyic soil with brown loess, partly under cultivation

Table 1. Grades and criteria by factors of erosion hazard in the vicinity of Lake Balaton

Grade of surface resistence	Lithology	Slope angle	Soil	Surface cover	Land use
1. no erosion hazard	limestone, dolomite, phyllite, basalt, gravel,	< 3%	lessivated brown forest soil	> 90%	closed forest, meadow, pasture, urban area
2. slight erosion hazard	clay, marl basalt tuff, peat	3–12%	brown forest soil, chernozem brown forest soil on loess and solid rock	60–90%	vineyard with contour plantation, sparsely built-up area
3. medium erosion hazard	red sandstone, Pannonian sandstone, conglomerate, silt	12–17%	chernozem rendzina	30–60%	vineyard with lines traversing contours, arable with cereals
4. heavy erosion hazard	sand (Pannonian, fluvial,windblown), loess-like deposits, loose slope deposits	> 17%	humous sand soils, rust brown forest soil, brown forest soil with 'kovárvány' on sand	< 30%	vineyard with contour plantation, garden, arable with row crops

Table 2. Possible integration based on criteria by factors
(4 surface resistance grades for 5 factors = 20 scores at maximum)

1. no erosion hazard if

a)	total score:	max. 5
b)	total score:	5–10 but either slope angle or land use is 1

2. slight erosion hazard if

a)	total score:	max. 10
b)	total score:	11–13 but either slope angle or land use is 1
c)	total score:	below 8 but either slope angle or land use is 3 or 4

3. medium erosion hazard if

a)	total score:	max. 15
b)	total score:	16–17 but either slope angle or land use is 1
c)	total score:	below 10 but either slope angle or land use is 4

4. heavy erosion hazard if

a)	total score:	above 18
b)	total score:	15–17 but either slope angle or land use is 4
c)	total score:	10–13 but slope angle and land use together is 7—8

material. The distance of transport and the site of accumulation is a function of slope length and form and of local base level. In order to estimate in a concrete case from where and how much sediment and chemicals may reach the lake from the watershed (in suspension and in solution), thus deteriorating water quality, an extremely complicated multivariate function would have to be solved. The final aim is to measure this load, to differentiate it in space and time, using geomorphological mapping.

4. Application of the method

The application of the above conceptual-methodological approach is demonstrated for two regions of the Balaton catchment.

The first test area is the hill landscape around Látrány in the southern catchment of Lake Balaton, while the second is represented by the mountain and mountain foreland relief of the northern catchment.

It is the fundamental condition of applying the method to have exact information on the factors determining the grades of surface resistivity. The lithology, the slope angle, the soil, the coverage by vegetation, the land utilisation types as determining factors as well as their areal method and temporal changes are to be known.

The maps of relief assessment for the Balaton catchment provide profound information on the factors of the erodibility of the surface.

CONCLUSION

Erosion hazard maps for the test area of Látrány are presented at 1:5,000 scale. The steps in mapping were the following:

1. First, analytical (surface rocks, slope category, pedogenetic, cover and land utilisation) maps of the area in question were prepared (Góczán, L., Szilárd, J., and Marosi, S. 1971; Juhász, Á. et al. 1974).

2. Overlying the maps a complex thematic map variety was obtained.

3. Based on the information basis of the complex thematic map the erosion hazard was assessed by a series of criteria.

Two possible varieties of surface assessment are presented; their application depends on the availability of information by unit areas and on the scale applied.

a) In the first variety the homogeneous areal units of the map overlays are assessed.

b) In the second variety, as a result of the areal variability, a wealth of information is available and the fragmentary nature of thematic overlays hampers assessment in this case an information grid is applied and the homogeneous areal units of this grid will display the erodibility of the surface.

4. Based on the assessments the thematic map of erosion hazard of the Látrány test area was prepared *(Fig. 3)* as a synthesis map.

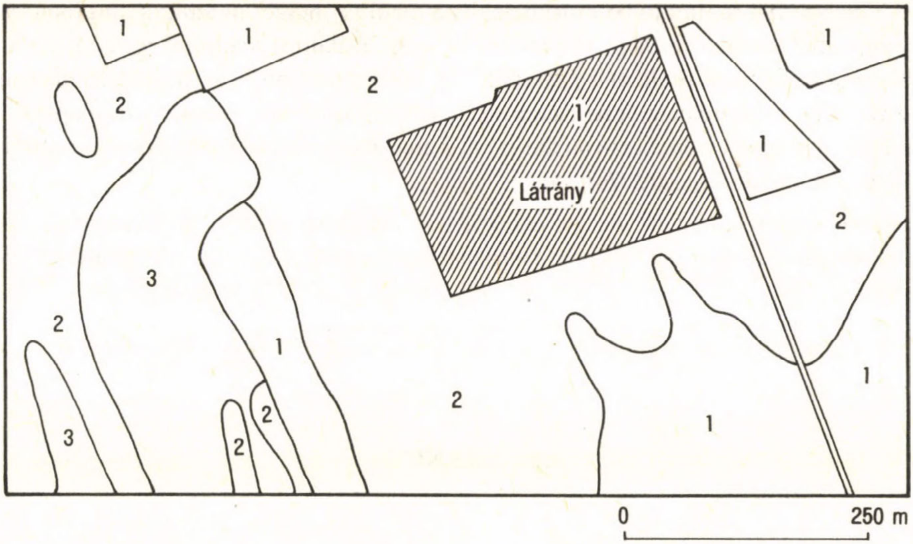

Fig. 3. Map of erosion hazard of the Látrány region. 1 = no erosion hazard; 2 = weak; 3 = medium erosion hazard

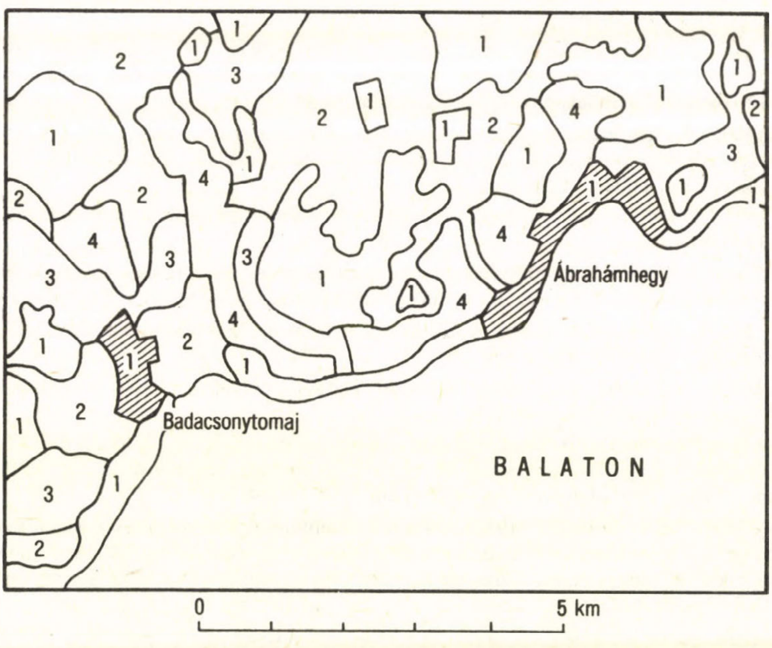

Fig. 4. Map of erosion hazard to the medium-height-mountain and mountain foreland region. 1 = no erosion hazard; 2 = moderate; 3 = medium; 4 = strong erosion hazard

The second region to be introduced is a medium-height mountain and mountain foreland relief on the northern catchment of Lake Balaton. Mapping was carried out mainly at an overview scale of 1:100,000. The mechanism of assessment was the same as above. The lithological, slope category, land utilisation and genetic soil maps as an analytical map series were made on the studied area at a scale of 1:100,000 and combined into a map of erosion hazard *(Fig. 4)*.

The improvement of our object-oriented mapping method is in progress. The computer processing of data and the further refinement of the grades of hazard are also planned.

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RELATIONSHIPS BETWEEN LANDFORMS AND SOIL COVER IN TEST AREAS OF THE NORTH HUNGARIAN MOUNTAINS

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ABSTRACT

The relationship between landforms and soil cover was investigated in two test areas. In the environs of Cserépfalu the relationship between the morphological elements and the soil types was studied with the help of the morphological and the soil distribution maps *(Figs. 2 and 3)*. It has been established that on about 80 % of the area well-defined soil types accompany certain landforms. Therefore, the geomorphological map is also suitable to provide certain recommendations for the farming practice.

In the second part of the work the relationship between cryoplanation and soil cover was studied in the Bodrogkeresztúr test area. It is claimed that the way of material transport, the sorting of grains during transportation and exposure exerts an influence on the grain-size composition of the resulting sediments *(Fig. 5)*, thus affecting the process of soil formation.

INTRODUCTION

The Department of Landscape Geography, Kossuth Lajos University, has been carrying out landscape studies in two test areas in the Bükk and the Tokaj Mountains *(Fig.1)*. One of them is located in the southern foreland of the Bükk in the environs of the village Cserépfalu, the other in the southern part of the Tokaj Mountains near the village Bodrogkeresztúr. In the course of the investigations (Kerényi, A. 1978, Martonné, Erdős, K. 1981; Pinczés, Z. 1974, 1978) we have studied the following landscape factors in detail: relief conditions (genetic geomorphology, slope angle, exposure), slope sediments (soil type, physical and chemical soil properties), meteorological circumstances, surface and subsurface waters, land use and natural vegetation.

The results of the several years of field work allow to demonstrate some regularities in the relationship of morphology and the soil cover on examples. In the present work we also wish to illustrate the practical use of such investigations.

Fig.1. Location of the areas studied on the map of Hungary. S_1= Bodrogkeresztúr test area; S_2= Cserépfalu test area

METHODS

Our investigations constitute of field and laboratory work. The soil cover and the loose parent material were studied in soil pits and drillings. Our field observations, the properties of soil horizons and parent sediments were described in detailed records. The drillings were deepened to the volcanic rock (at places deeper than 5 m). In the 8 km^2 test area near Bodrogkeresztúr 176 profile pits and 360 drillings, in the 10 km^2 area of Cserépfalu 128 profile pits and 230 drillings were made.

Samples were taken at every 20 cm from each soil horizon, also including the transitional ones, as well as from the drillings. The samples were analysed for humus content, $CaCO_3$ content, pH, hydrolitic acidity (y_1 value) and mechanical composition. The results of this latter analysis were represented on grain composition curves to find out whether the given sediment was redeposited or formed on the spot. On the grounds of information from field survey overlaid upon topographic contour maps, morphological maps were prepared. The field records and the laboratory analysis permitted the drawing of the soil maps. The original scale of the maps (1:10,000) is reduced in the figures of this paper.

RESULTS

a) Areal correlations between landforms and soil types

The areal correlations between the landforms and soil types are presented on the maps of the Cserépfalu test area *(Figs. 2 and 3)*. Cserépfalu and its evironment belong to the *piedmont area of the Bükk Mountains*. With its altitude of 260-280 m a.s.l., the top region of the younger pediment is the largest morphological element in the area *(No 16 in Fig. 2)*. The pediment appears as a row of flat ridges of low (below 12 %) gradient. A more or less undisturbed soil formation must have taken place on them so we can find here the zonal soil characteristic of the area: Braunerde, which is — in the Hungarian soil system — one of the main types of brown forest soils. The soil is moderately lessivated, therefore the clay content of the B horizon is higher than that of the A horizon (texture differentiation ratio: 1.2–1.4), however, it does not reach the value (1.5–1.7) characteristic of lessivated brown forest soils. The soil is $CaCO_3$-free and moderately acidic. The same type of soil is characteristic of the interfluvial ridge in the southwestern part of the test area.

The remnants of the older pediment rise in the highest peaks (Székely, A. 1977). On the older pediment of only a few hectare size lithosols or thin ranker soils are found.

The second major landform type is constituted by *river valleys,* incised into the surface deeper than 20 m. The streams built up wide alluvial flats (that of the Hór creek reaches 400 m at places). Alluvial soils with $CaCO_3$ in the case of the Cseresznyés creek and without $CaCO_3$ in the Hór valley, neutral or slightly acidic topsoil are characteristic. Limestone grains, originating from the Bükk Mountains, can only be found in the lower horizons.

The gradient of the valley slopes is most frequently between 12 and 25 %. The typical soil on these slopes is slightly or moderately eroded Braunerde. Since in the eroded profiles the more clayey material of the B horizon is mostly exposed, they show great mechanical resistance and poor infiltration capacity.

At foot slopes, but above the alluvium forest soil deposits (colluvia) are common.

The geomorphological map clearly shows the occurrence of a number of *derasional (dry) or erosional-derasional valleys* in the area studied *(Fig. 2)*. Along the valleys brown forest soil deposits can be observed *(Fig. 3)*. In some cases the slope deposits do not fill up the whole derasional or erosional-derasional valley.

We have mapped derasional and erosional-derasional valleys of considerably different length. In view of soil cover two most important valley types were distinguished and shown in *Fig. 4*. (In the following, for convenience, we only speak of derasional valleys, the same two types, however, also apply to erosional-derasional valleys.)

Type A derasional valleys (dells) have steep slopes (20–26 % at head-valleys). The sketch of the longitudinal section prepared from field data shows that the soil sediment

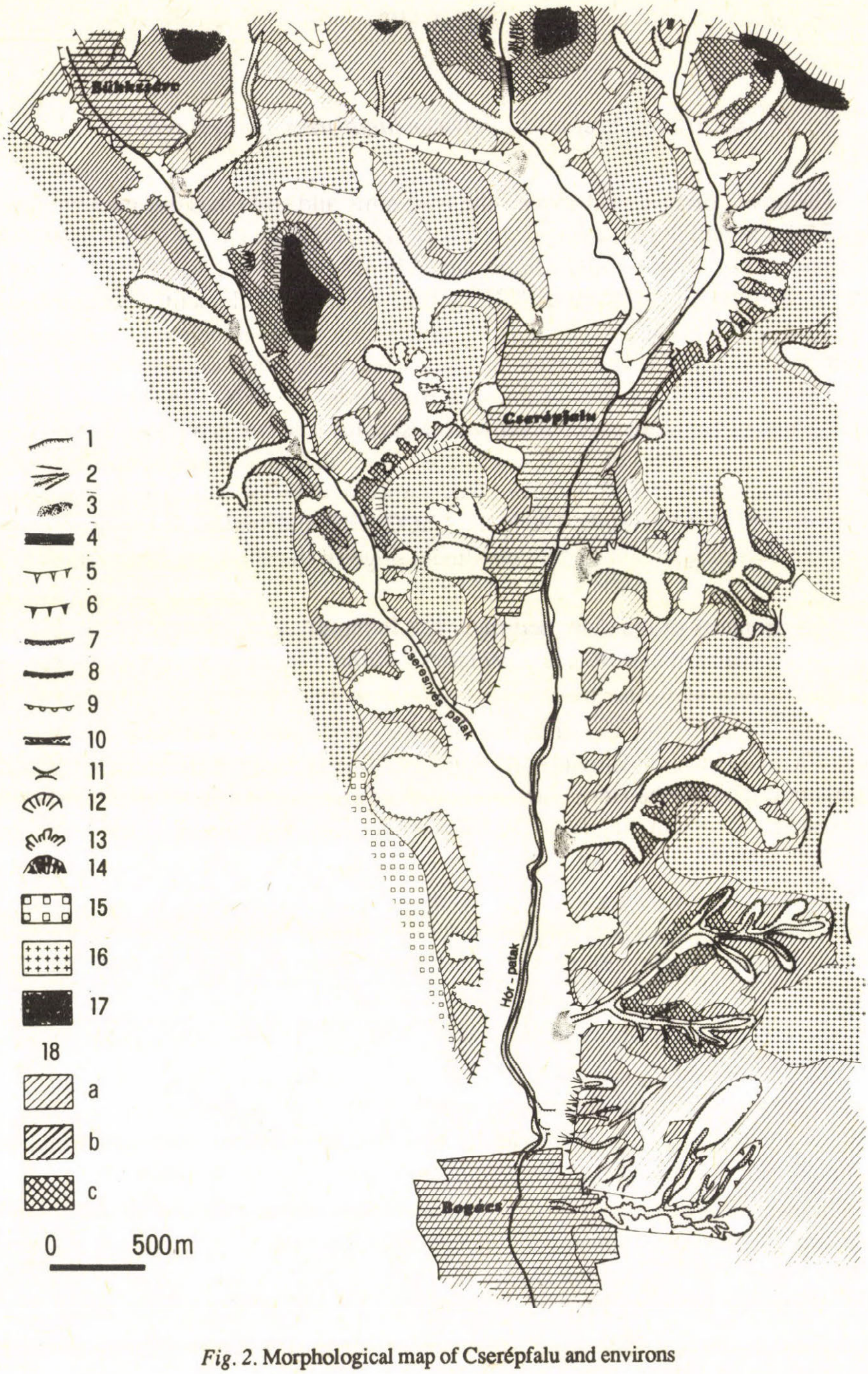

Fig. 2. Morphological map of Cserépfalu and environs

of brown forest soils is the thickest in the valley along the steepest slope section. Down-valley soil depth decreases with the slope angle. The soil was found thinnest in the upper inflexional zone *(Fig. 4 , Section E)*. In the head-valley the soil depth sometimes increases within extremely short distances. For instance, in a derasional valley north of Cserépfalu soil depth grew from 0.3 m to 2 m within a horizontal distance of 10 m.

The slope of type B derasional valleys is also moderate in the head-valleys (below 12 %), and along the longitudinal axis the angle of slope further decreases to 1–2 %. The moderate erosion in the head-valleys and along the upper reaches does not hinder the formation of a zonal soil, however in this area we still find slightly eroded profiles. Soil depth increases down valley, and reaches its maximum in the valley section of lowest gradient *(Fig. 2)*. A good example of type B valley can be seen northwestern of Cserépfalu.

The upper section of the more than 1 km long valley is of typical derasional character, with the prevalence of Braunerde type soil *(cf. Figs. 2 and 3)*. Proceeding downward in the valley erosion also plays a role in surface evolution, but the valley retains its original derasional form: a flat, bowl-shaped cross section. In triggering erosion cultivation has played a particular part. As this surface is regularly ploughed today, part of the year the soil is left without a vegetation cover, and the precipitation induces erosion. The soil aggregates eroded from the slopes have partly accumulated in the mildly slanting lower stretches and partly carried by surface runoff into the Hór river. The accumulated grains form slope sediments of forest soil in several metre thickness along the lower reaches of the valley. The medium-thick soil sediment is of small areal extention, and, consequently, it is not represented on the map.

The further morphological elements only influence the soil cover to a lesser degree. The few metre deep *small erosional valleys, ravines* dissect the soil cover linearly, but they rarely occur in the area. The drift terraces and cuesta margins are also linear features and although the soil cover gets thinner along these lines and narrow stripes, we cannot associate these forms with certain soil types.

In summary, a very close relationship is observed between the morphological and soil maps. In about 80 % of the area particular types of soil appear on well-defined landforms. This, at the same time, means that the two ways of mapping may supplement each other.

←

Fig. 2.

1 = drift terraces; 2 = slope deposit accumulation 3 = valley floor alluvial fan; 4 = ravine; 5 = erosional valley not deeper than 20 m; 6 = erosional valley deeper than 20 m; 7 = shallow erosional-derasional valley; 8 = deep erosional-derasional valley; 9 = derasional valley; 10 = gully; 11 = col; 12 = cuesta; 13 = eroded margin of cuesta; 14 = quarry; 15 = interfluvial ridge; 16 = top region of the younger pediment; 17 = remnant of the older pediment; 18 = angle of slope: a = below 12 %, b = 12-25 %, c = above 25 %

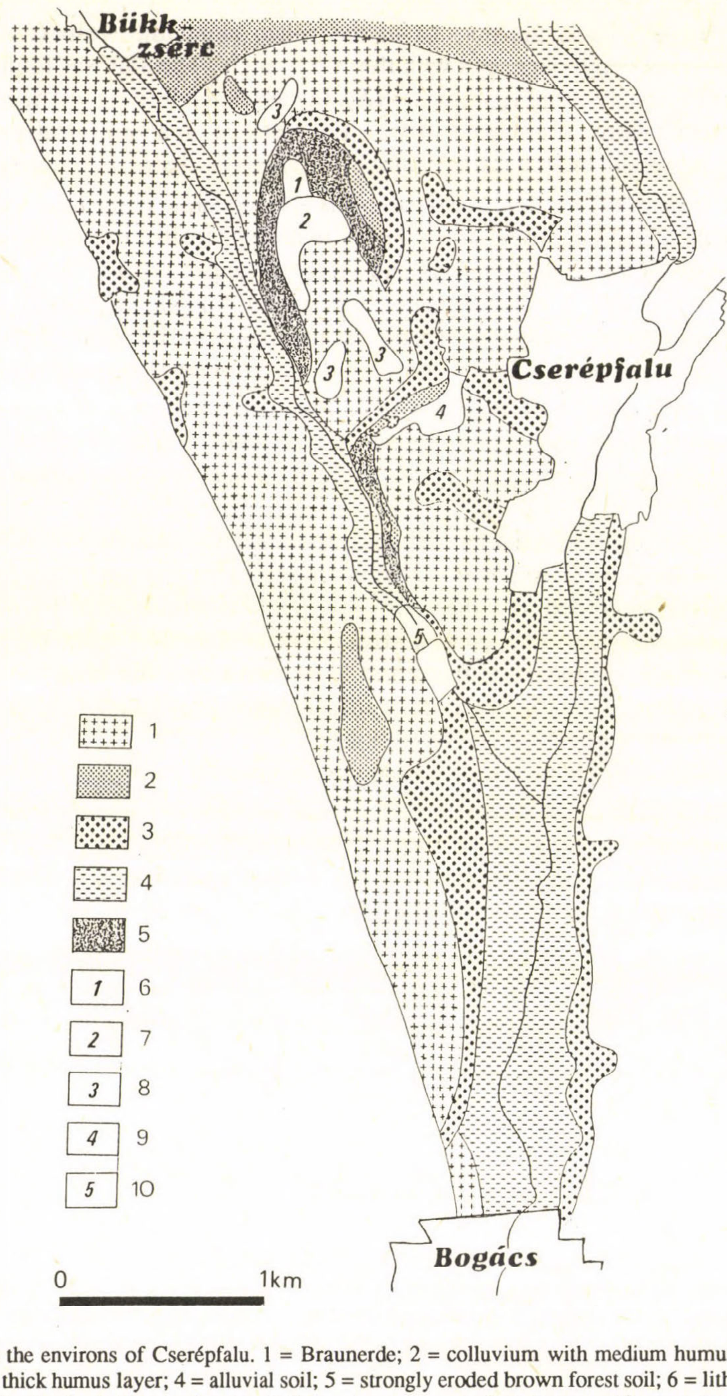

Fig. 3. Soils in the environs of Cserépfalu. 1 = Braunerde; 2 = colluvium with medium humus layer; 3 = colluvium with thick humus layer; 4 = alluvial soil; 5 = strongly eroded brown forest soil; 6 = lithosol; 7 = ranker; 8 = lessivated brown forest soil; 9 = antropogenous soil on terraces; 10 = swamp soil

b) *Relationship between landforms of cryoplanation and soil cover*

In the other test area near Bodrogkeresztúr *(Fig. 1)* a frost-riven scarp was examined on two slopes of different (eastern and southern) exposure. The parent rock of the sediments was rhyolite tuff on both slopes. The most frequent forms of the valleys are dells, spaced at an average of 50 metre interval, with a mean width around 3 m. In the colder stages of the Pleistocene material transport along the slope took place mainly through the dells.

In spite of the homogeneous rhyolite tuff base rock, there is variation in the grain size composition of the weathered mass directly overlying the rock and of the gelisolifluctional material transported in the dell and areally deposited on the slope. Further differences are caused by sorting during transport and the exposure of the slope.

On the grounds of field and laboratory studies the following conclusions can be drawn for the sediments of the frost-riven scarp:

1. The thickness of the sediments on the slope changes from place to place, depending on whether the drilling was performed in a gelisolifluctional sediment or in a dell fill. The former deposits are not thicker than 10–30 cm, the latter may reach or even exceed 1 m. Consequently, maps of reliable detail can only be drawn on the grounds of an appropriate density of the drilling network.

2. In the course of downslope transportation the material gradually becomes finer. The validity of this statement is not affected by the fact that there may be significant differences between the grain-size compositions of sediments located at similar altitudes. These may be due to the different ways of material transport.

3. Exposure also affects the grain size composition of a sediment. On eastern slopes the prevalent grain sizes — due to cryofracturing — are sand and silt whereas on southern slopes — as a result of weathering — the clay content grows considerably (36–43 %).

This can be accounted for by the fact that in the warm periods of the Pleistocene thicker regolith mantles formed on southern and western slopes than on eastern and northern ones. In the subsequent cold stage the thicker soil blanket was eroded slower from the surface, one part was retained and mixed with the cryofractured bedrock or the gelisolifluctionally transported material. Therefore, its clay content increased.

The higher clay content in the cryofractured bedrock confirms that we must reckon, even in the cold stages of the Pleistocene, with more intense weathering on southern and western slopes than on northern and eastern ones. It is probable that the differences in clay content date back to both cold and warm stages.

The sediments of different grain-size composition also influence soil formation. Where the parent rock is exposed or lies near the surface, skeletal soils are found. For them the share of the fraction larger than 2 mm exceeds 50 % in all samples. On gentler slopes 30–50 cm deep, uniform dark brown, mull-ranker was formed. The humus content of this eroded soil remains below 3 %. This acidic soil does not contain $CaCO_3$ (pH= below 5.5, y_1= above 20.0). Quite widespread are the eroded brown forest soils, particu-

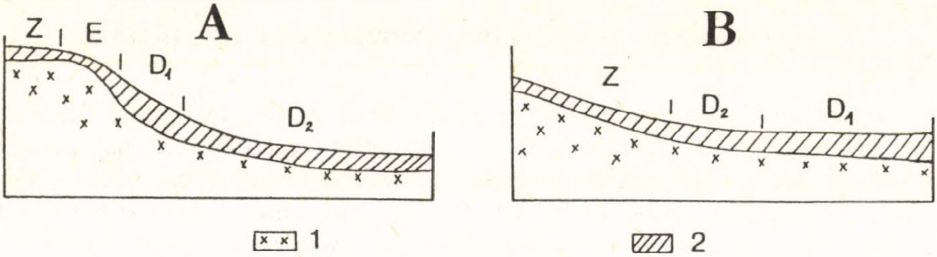

Fig. 4. Longitudinal section of the two types of derasional valleys (A and B) (for explanation see text) 1 = volcanic base rock; 2 = soil layer: D_1 = slope sediments of forest soils with thick topsoil (1.5 m); D_2 = slope sediments of forest soils with medium topsoil (0.8–1.5 m); Z = slightly eroded variety of zonal soil (Braunerde); E = strongly eroded zonal soil

larly at the foot of the frost-riven scarp. Their A horizon is thin or completely missing. It is striking that on the southern slope the clay content of the B horizon is higher than average, in agreement with the fact that here the Pleistocene slope deposit has a higher clay content.The soil is moderately acidic (pH=5.8–6.2). The dells are filled up by sediments of forest soils. They show different properties from those of the soil sediments at slopes: 1. thin soil profile (generally 1 m), 2. lack of genetic soil horizons, 3. traces of downslope redeposition, e.g. countersloping layers, 4. great amounts of coarse (20–30 mm) debris (*Fig. 5*).

CONCLUSION

The close relationship between the morphological processes and soil formation enables us to give recommendations for cultivation on the basis of the geomorphological map. In our test area, for instance, we can identify the plots most favourable for crop cultivation: the alluvia in erosional valleys, lower stretches of derasional valleys (the upper, steeper sections are in need of soil conservation because of the thinner soil layer), interfluvial ridges, the top region of the younger pediment, the slope deposits and valley floor alluvial fans.

One can also point at the areas unsuitable for agricultural cultivation: areas of gullies, ravines, margins of drift terraces, cuesta margins, remnants of the older pediment with frost-riven scarps and hard rock outcrops.

The slope categories denoted on the map also indicate where soil conservation is necessary, and which method is to be chosen: whether agronomic conservation techniques are sufficient or technical measures are also required.

Naturally, the geomorphological map cannot replace the maps of soil distribution and soil charts (e.g. pH-, $CaCO_3$-content-, humus charts, etc.), however, the information

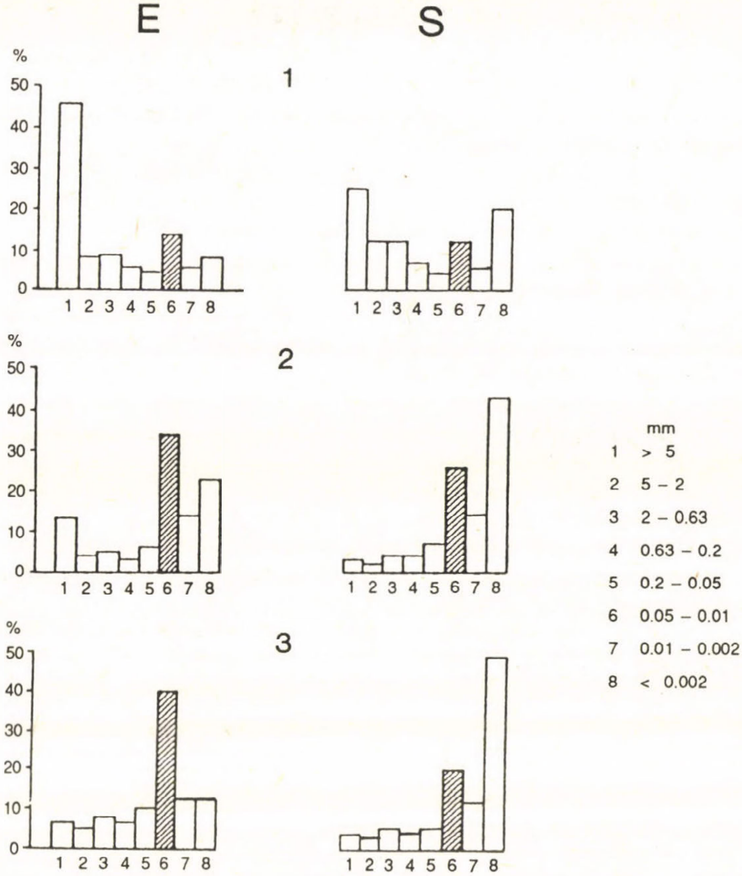

Fig. 5. Grain-size distribution of soil sediments of different origin. 1 = weathered base rock; 2 = gelisolifluctionally transported sediment; 3 = dell soil; E = slope of eastern exposure; S = slope of southern exposure

contained can be useful for those working in agriculture, as well. The map, on the other hand, has to be interpreted by geomorphologists before the farmers can use them.

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ENVIRONMENTAL MANAGEMENT AND LANDSCAPE ECOLOGY

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ABSTRACT

Human loading on the environment threatens the operation of geosystems.

With land use transformation the albedos of geosystems also change. This involves modifications in their solar energy inputs and these quick changes in their energy budget reduce geosystem stability, capacity or endurance, ie. their potential.

Human interference into the energy budget of geosystems unfavourably influences natural cycles and energy circulation in the system, thus extremities may often arise.

When assessing or monitoring a landscape in order to obtain useful background information for effective environmental management, it is advisable to avoid the usage of average parameters for the changeable factors of the geosystems.

In this study we demonstrate our new land assessment method through a county level evaluation of Hungary.

INTRODUCTION

We witness new trends of changes in the social and economic environment of Hungary. These changes always occur bound to geographic sites and regions, causing their modification, and in many cases, their long term degradation. To survey, understand, assess and forecast these changes we have to rely on the results of several disciplines of science. Modern geography also contributes to this research. One of its main topics is to recognize and monitor the changes going on in the geographical environment of society (Pécsi, M. 1979). Geography should reveal the areal interrelationships in these changes and to forecast the future ones. In doing so, geographical research helps accomplish practical tasks in the general interest of socio-economic development.

THE PROBLEM

The hierarchical structure of the physical landscape, part of the geographical environment, consists of constant material and energetic systems which are open and closed at the same time. The open nature of geo(eco)systems (landscapes) is based on their horizontal interrelationships and functioning, while their closed nature on the vertical ones (Armand, D. L. 1975).

The essence of the interrelationships and interdependences within geosystems lies in the constant circulation of material and energy. This is the most important property of the various geosystems with regard to their spatial distribution and changes.

The differences in the functional and spatial structures of geosystems are due to their energy budgets (influencing material cycles and intensity) and to the main sources of energy. Consequently, all the geosystems with specific operation are dependent on the local strength of the two main energy factors in all the earthly physical geographical processes: solar radiation (exogene energy) and inner heat of the Earth (endogene energy).

As the influence of the endogene energy sources (not considering volcanic eruptions, geyser phenomena, thermal water) can be detected mainly on a geological time-scale (mountain formation or sea transgressions), we rather have to concentrate on the exogene energy source, i.e. solar radiation, for it is constantly present, measurable and variable spatially as well as temporally; so it is a dynamic factor.

As it has been mentioned, the intensity of interrelationships in geosystems depends mainly — but not solely — on the available solar energy. This intensity is very important for the stability, utilization and exploitation of geosystems. When we accept this statement we have to pay attention to the following.

The geosystems in the social environment have undergone considerable spatial and temporal changes due to activities of the society. These changes are manifested in the ever changing land use pattern through the human endeavour to achieve a rational and optimal land use. With land use pattern alterations, the availability of solar energy, ie. the energy budget of the geosystem also changes. This statement is corroborated by the fact that the albedos of different land use patterns are also different, therefore, the activation of solar energy in a given landscape can vary in quantity and quality accordingly.

Thus, if — due to human activity — the land use patterns of the geosystems change dynamically and quickly, the stability, exploitability and potential of the geosystems are also affected favourably or unfavourably. The change can take place on local, on regional and even on global levels. The altered amount of solar energy input of the geosystems usually deteriorates their stability.

Another possible consequence of land use (and energy input) change can be manifested in climatic changes. The natural geosystems used to cover large pieces of land with homogeneous surfaces. It means that the energy distribution — apart from zonality

— had no local variations and thus, climatic extremities were unlikely to occur frequently. In our time, however, — because of the rapid change and mosaical nature of land use (and albedos) e.g. in agricultural cropland pattern—significant differences in energy input are generated in relatively small areas. These differences may cause local climatic disturbances, irregularities and extremities in weather conditions.

There is an anticipation that following land use or crop pattern transformations changes in solar energy input have to be expected. Land use patterns have to be designed to avoid great contrasts in energy input between neighbouring areas.

Consequently, when planning land use pattern changes, we have to consider their implications on the energy budget of the geosystem in order to avoid undesirable processes.

METHOD

To verify the problem we surveyed the changes in land use in Hungary between 1975-1985 by counties and average albedos were calculated. This coarse resolution is acceptable for demonstrating and verifying the problem since the modified average albedo of a county brings about changes in the energy budget of the geosystems, too.

From 1:100,000 scale TM images the land use of Hungary was mapped in 1975, 1980 and 1985. According to the proportion of different land use types, the average albedo for each county was calculated *(Figs. 1, 2 and 3).*

An attempt was made to develop a method for land assessment with respect to the changeability of landscape potential. It can define the suitability of the landscape for any land use activity in percentage likelihood. Using statistical functions and data sequences, the results of land assessment can also be projected into future situations.

The ever growing intensity of land use gives way to an increasingly polluted and affected environment. The reduction of the pollution and overuse of the physical environment is getting more and more important in the environmental policy of many governments in the world. It is equally important to detect the degree of environmental hazard caused by economic branches, and to raise the efficacy of environmental protection. Our second aim is to define the overall degree of agricultural environmental pollution through a monitoring system.

The widespread land evaluation methods are mostly static, ie. they consider the average data of the variable components of the environment (e.g. temperature, precipitation, humidity).

Using average parameters makes a method simpler but it "freezes" the result. What are the disadvantages of average parameters?

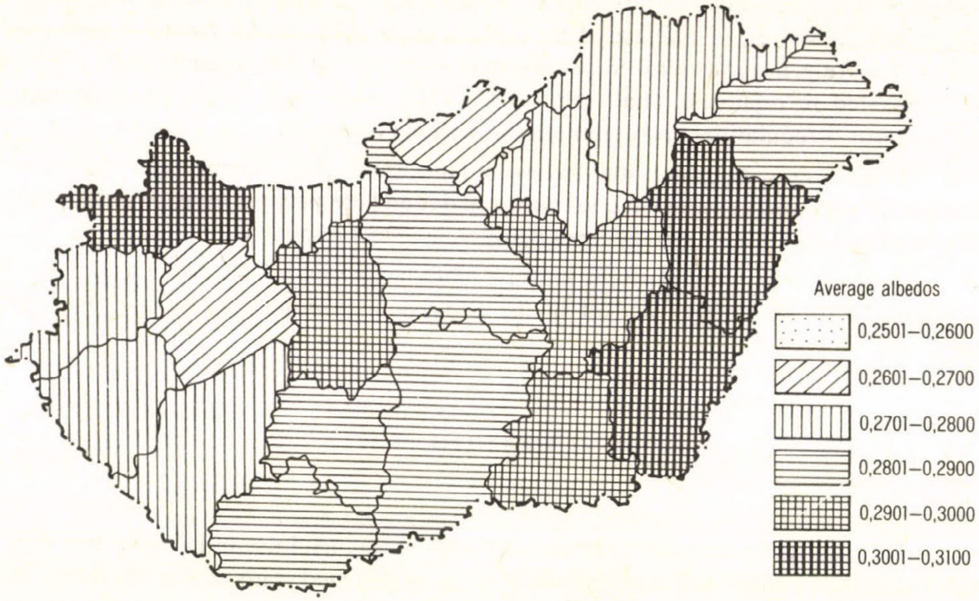

Fig. 1. Areal distribution of solar energy in Hungary according to counties, 1975

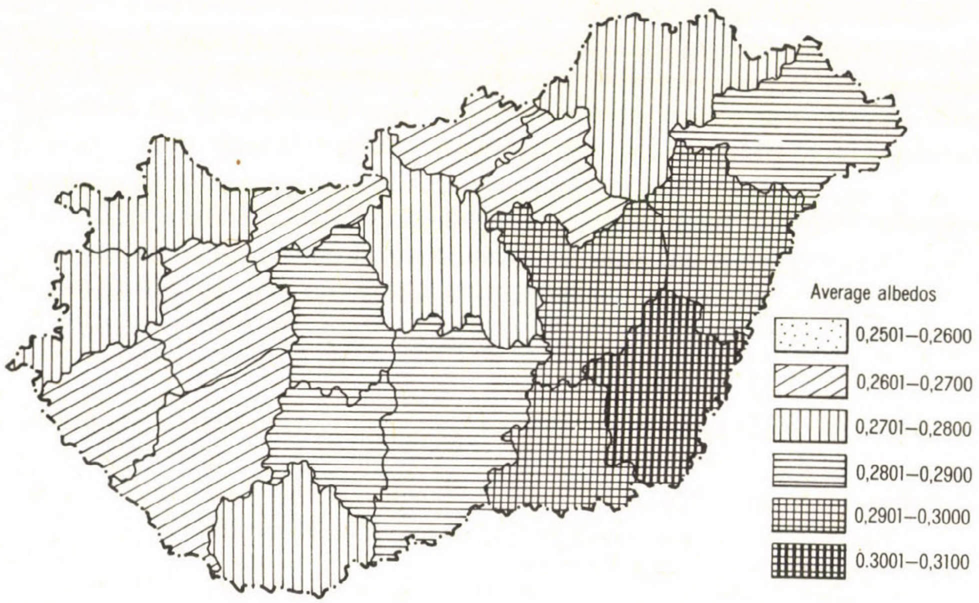

Fig. 2. Areal distribution of solar energy in Hungary according to counties, 1980

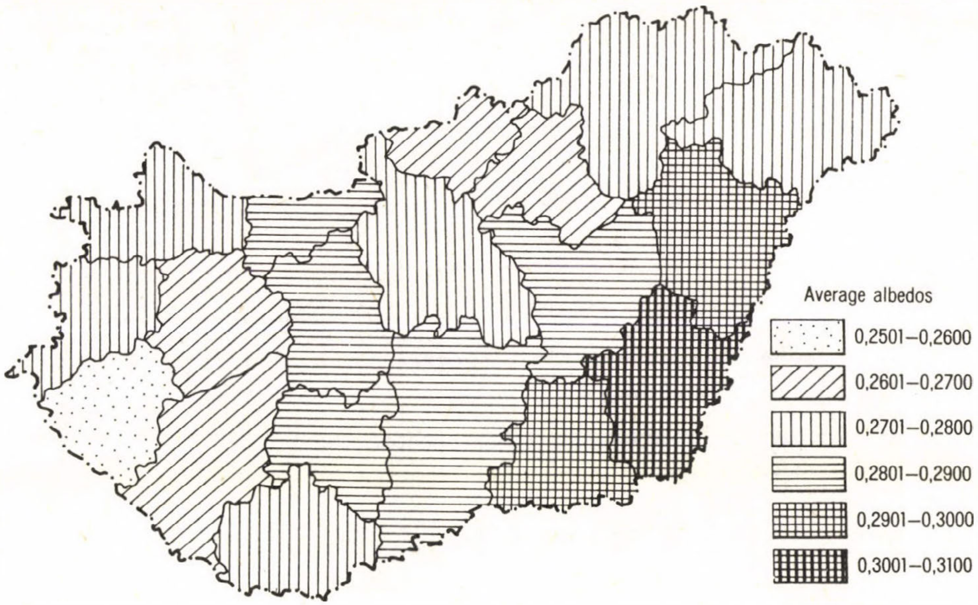

Fig. 3. Areal distribution of solar energy in Hungary according to counties, 1985

a) The statistical likelihood of their occurrence in reality is very low.

b) They may result from a wide range of actual values between the highest and the lowest ones.

c) Average precipitation for instance is not sufficient to characterize the growing site for a plant; instead the actual value of precipitation would be important in a certain period of the growing season (e.g. germination).

d) Average parameters cannot represent extremities like minimum temperature, whereas in most cases the latter strongly influence crop yields.

e) Landscape assessment (e.g. stating the site suitability for growing) with average parameters, provides a constant value or score only, which cannot be used for forecasting the possible future changes in the landscape potential.

Our landscape assessment, on the other hand, can be characterized as follows:

1. The actual values of the changeable factors of the landscape, measured for decades are taken for basis. Then each parameter is weighted from the chosen point of view. Instead of the average values the statistical likelihood of occurrence of the actual parameter values are used in the assessment. Thus, the result of assessment is not a "frozen" quality category but a statistical set, showing the probability of occurrence of the different quality categories. With the previous assessing methods the result of the process was a score (e.g. 9) which showed that for a given utilization purpose an area was favourable or not, so this score represented a quality category. In our method the

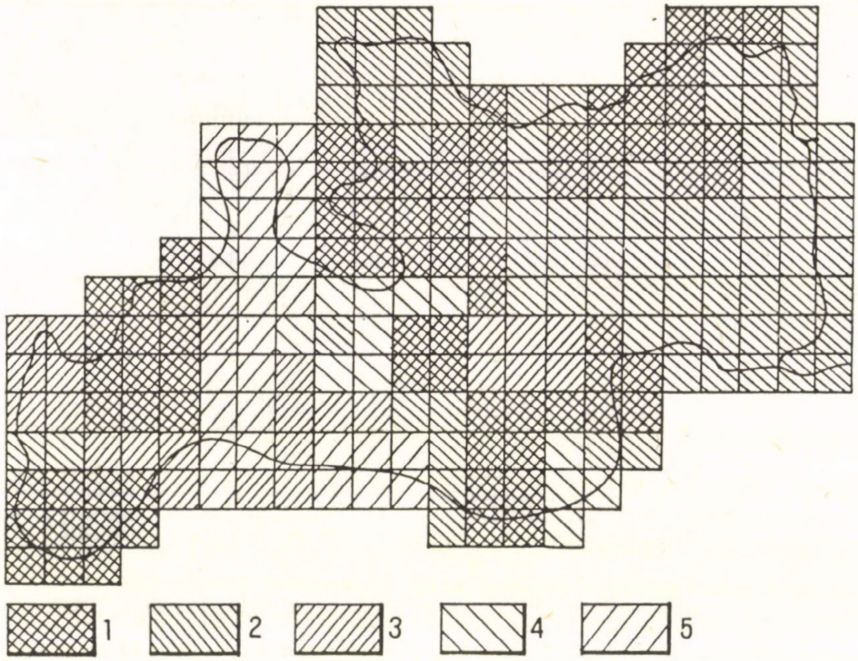

Fig. 4. Assessment result of a Hungarian test area from the viewpoint of growing grapes (Traminer). 1 = quality category – very favourable (The statistical probability of occurrence of the categories: 1. 82%, 2. 16%, 3. 2%); 2 = quality categorie – favourable (The statistical probability of occurrence of the categories: 1. 67%, 2. 24%, 3. 6%, 4. 3%); 3 = quality category – less favourable (The statistical probability of occurrence of the categories: 1. 51%, 2. 26%, 3. 13%, 4. 11%); 4 = quality category – moderately unfavourable (The statistical probability of occurrence of the categories: 1. 17%, 2. 28%, 3. 36%, 4. 10%, 5. 9%); 5 = quality category – favourable (The statistical probability of occurrence of the categories: 1. 0%, 2. 8%, 3. 29%, 4. 14%, 5. 49%)

results are displayed in percentages such as 9–74 %, 8–23 %, 4–3 %. The figures mean that the area in question is favourable (9) and the probability of the occurrence of that condition is 74 %. 8 means a moderately favourable category with a probability of occurrence of 23%, while the moderately unfavourable category (4) occurs with a likelihood of 3 %. In our opinion this kind of land assessment reflects the true landscape potential. When examining areal suitability for cultivation we can gain information regarding crop yield reliability (*Fig. 4*).

2. Having considered data sequences from several decades, we can calculate the future trends of change for the parameters. Thus, the probability of certain parameters is definable and a forecast can be made of the future suitability for a utilization purpose in an area (*Fig. 5*).

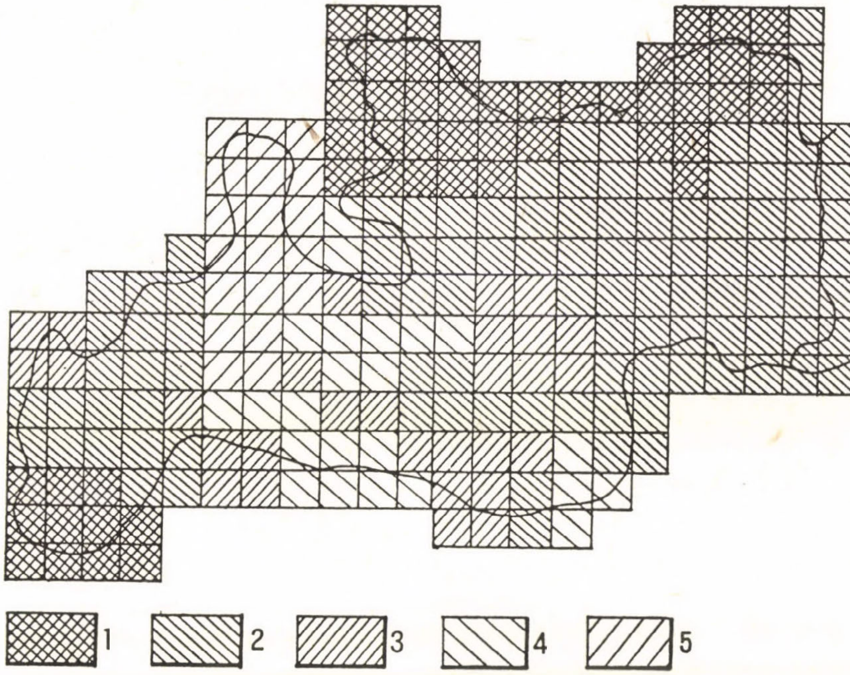

Fig. 5. Suitability prognosis of the test area for 1990 for growing grapes (Traminer). 1 = quality category – very favourable (The statistical probability of occurrence is above 75%); 2 = quality categorie – favourable (The statistical probability of occurrence is above 75%); 3 = quality category – less favourable (The statistical probability of occurrence is above 75%); 4 = quality category – moderately unfavourable (The statistical probability of occurrence is above 75%); 5 = quality category – favourable (The statistical probability of occurrence is above 75%)

When assessing the environmental pollution caused by agricultural activity, the following data base was used:

a)

– types of land use

– intensity of land use

– quantity of applied chemicals (fertilizers, pesticides)

b)

– type of animal husbandry, livestock species

– intensity of livestock raising

– practices for manuring and storing manure

c)

– horizontal dissection of topography

- slope condition and categories
- parent rocks

d)

- annual, monthly, weekly distribution of precipitation
- the same distributions for temperature

e)

- depth of groundwater table
- groundwater reservoirs
- groundwater flow
- surface runoff from small catchments

f)

- genetic type of soil
- thickness of soil, degree of erosion
- soil texture

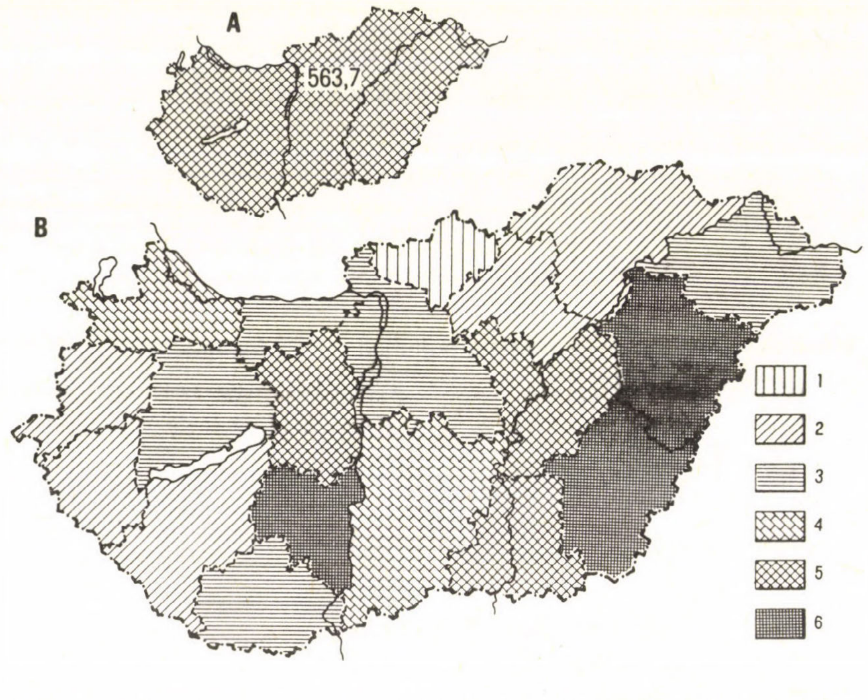

Fig. 6. Environmental pollution from agriculture in Hungary in 1975. A = national average; B = by counties; 1 = hardly polluting; 2 = slightly polluting; 3 = moderately polluting; 4 = strongly polluting; 5 = very strongly polluting; 6 = severely polluting

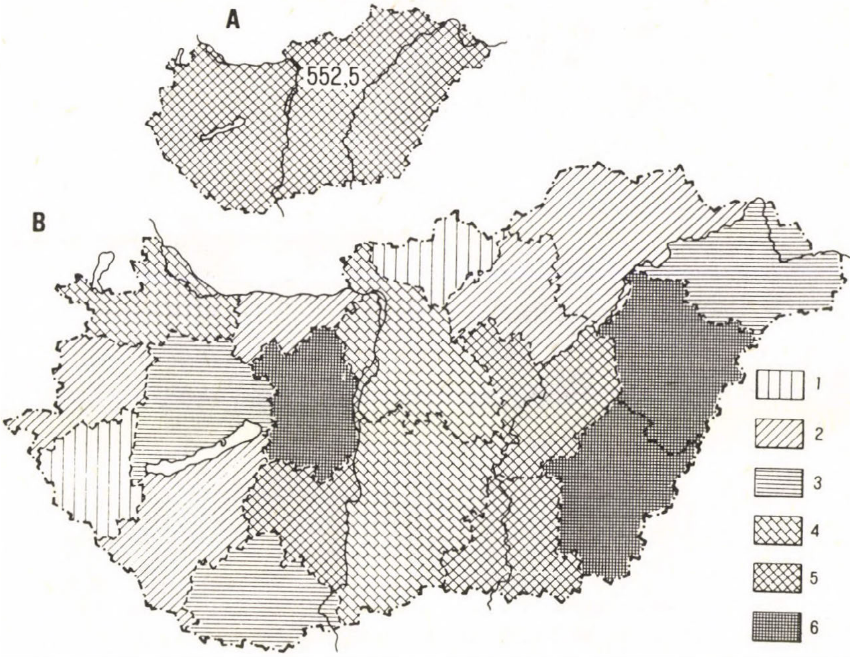

Fig. 7. Environmental pollution from agriculture in Hungary in 1980. (see legend in *Fig. 6.*)

The agricultural environmental pollution depends on the quantity and quality of polluting materials and on the dynamics of the environment (landscape). This dynamics strong influences the buffering capacity of the environment. That is the reason why we do not use the average values of the changeable parameters of environment. With the same degree of pollution, the degree of environmental loading will vary in different seasons or climatic year types (cool — wet, cool — dry, warm — wet or warm — dry).

The scores show the differences in the interaction of the above parameters. Using a PC program an assessment has been made for all Hungarian counties at three dates. The spatial and temporal distribution of environmental pollution caused by agriculture reveals areal differences, even improving conditions owing to social efforts *(Figs. 6, 7 and 8).* A further assessment would be needed to check if it is a temporary improvement or a steady one.

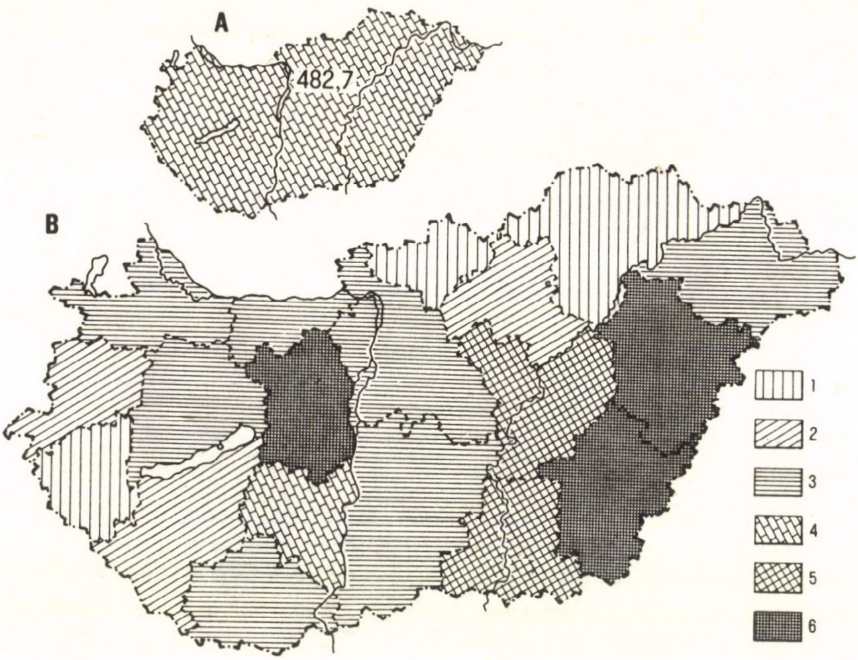

Fig. 8. Environmental pollution from agriculture in Hungary in 1985. (see legend in *Fig. 6.*)

APPLICATION

Through applying this method we get information on the probability of for certain degrees of land suitability for any land use purposes, e.g. growing crops, developing resort places or nature conservation activity. The forecasting procedure of this method can display the future conditions and changes regarding crop yield, nature protection and recreation. This method enables to monitor the changes in landscape potential both spatially and temporally. This kind of new background information is necessary for economic decision making on local, regional and national level alike in order to optimise landscape structures and land use patterns.

Applying the method for monitoring environmental pollution (e.g. by agriculture) we cannot only reveal the spatial and temporal distribution of the pollution, but also the efficiency of environmental protection measures can be assessed. It can be applied also in monitoring the pollution emitted by industry.

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INTERNAL RELATIONS IN THE LANDSCAPE

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ABSTRACT

In the course of geographical investigations a large amount of data has to be processed. The paper introduces methods how to minimize the number of parameters used for geographical studies. It aims at finding those parameters with the help of which we may try to govern the system. The determination of the correlations between the parameters is followed by the selection of key parameters with the help of which the system can be properly described.

Two methods are suggested and a procedure to increase the efficiency of these two methods is described. After the discussion of results an application by the help of *method 2* is shown for the assessment of suitability for wheat and maize cultivation in an agricultural area of Northern Hungary. The novelty of the methods lies in proving that a system of key parameters is sufficient for the characterization of the internal relations in the landscape.

INTRODUCTION

Modelling changes in the geographical environment, Environmental Impact Assessment (EIA) and other environmental assessments require the processing of a large amount of data.

Mathematical-statistical methods, developed recently mainly in the field of integrated environmental assessment and EIA, and the computer-aided techniques often very labour intensive, have significantly modernized environmental studies, increased their objectivity but in their approach they are based on previously elaborated qualitative, verbal principles converted into the language of mathematics. It must be noted that investigations either using mathematical methods or traditional cartographic procedures, do not reflect the structure of the environment in its complexity. We still lack generally applicable methods that show the processes and the complex interrelationships within the environment and measure their extent.

Our analysis of the internal structure of the environment starts from a systems approach (Chorley, R.J. and Kennedy, B.A. 1971; Richling, A. 1984).

The investigation sets a triple goal:

- to find the minimal number of parameters in order to model the system at a high level of probability,
- to find key parameters, whose changes should be monitored in order to reduce the number of factors involved,
- to find parameters controlling the system.

The basic idea of the method lies in determining the correlations between the parameters, and in selecting those *key parameters,*[1] which help describe the system as a whole properly (Mezősi, G. 1984, 1986).

Knowing the structure of the relations between the system factors depending on each other, we may determine certain parameters with the help of others. In extreme cases a parameter may be relatively independent from the other, but in this case it will be selected as a key parameter (Kertész, Á. – Márkus, B. 1989).

The key parameters are not necessarily the decisive ones in forming the type of a landscape. Depending on the aim and character of the studies, the key parameters and the relations may slightly change.[2] Attention must be paid to the fact that in environmental research no reduction of parameters is allowed, because this may lead to the loss of important factors (e.g. in feasibility studies or in environmental assessments a parameter value which excludes the land utilisation investigated may be of major importance).

METHODS

Two methods are suggested for the study of the structure of the physical environment and a procedure to increase the efficiency of these two methods is described. The logical process and the apparatus applied in the two methods are the same, the difference lies in their starting points. The first method is accurate, but difficult to handle, and needs computer aid from the very beginning. The second method has weaker criteria as a starting point, is easier to operate, but still effective and fast.

Method 1 has two steps. First we must examine for each parameter, on which other parameters they are *essentially* dependent. Let p_i be the i-th parameter, then we assume that $p_i = f(p_1, ..., p_{i-1}, p_{i+1}, ..., p_n)$

[1] By key parameters we mean the elements of that minimal set of parameters, which describe the other parameters with a good approximation.

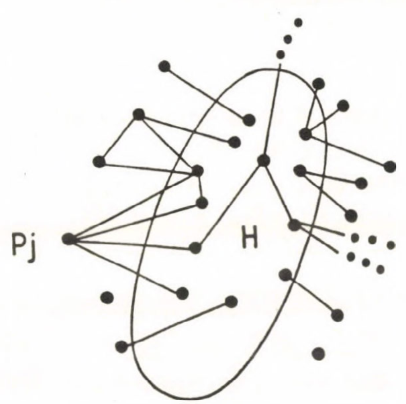
[2] Here we may assume a continuous change, i.e. for similar studies and areas, that are close to each other, the relations and the key parameters may be regarded indentical.

In practice there may occur certain p_j parameters, on which p_i is not essentially dependent. More exactly, when the p_j parameters remain unchanged, the value of p_i does not change substantially. Neglecting these p_j parameters, we may say of the rest that p_i is a function of them (controlled by them with a good approximation). Thus we can select to any parameter those parameters, which determine it with a good approximation. Let us represent the results in a graph.

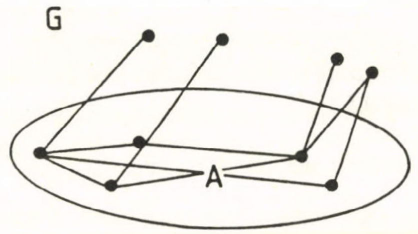
Let the parameters be the vertices of the graph, and the p_i vertex (parameter) is connected with the p_j with an edge, if p_i is essentially depending on p_j. Let us find the following H set of vertices in the graph thus constructed.

First assumption: Let $|\mathbf{H}|$ ($|\mathbf{E}|$ is the cardinality of the set **E**) be minimal, i.e. there should be as few as possible parameters in this group.

Second assumption: Let **H** be so, that to arbitrary p_j parameter either $p_j \in \mathbf{H}$, or each parameter essentially determining p_j is included in the set **H**.



The set **H** is defined as:



Definition I: Minimal matching vertex system is the vertex set **A** with minimal cardinality, which has the following property: to arbitrary *e* edge there exists an $a \in$ **A**, so that *a* is one of the endpoints of the edge *e*.

It is obvious, that for any p_j parameter there is a vertex in the set **A**, or all parameters essentially determining p_j are in the set **A**. Our goal is to find the set **A** in the graph described above.

Definition II: The set $|\mathbf{B}|$ is a maximal independent set of vertices (in some references maximal point set of inner stability) if $|\mathbf{B}|$ is maximal, and there are no two vertices in **B**, which have an edge between them.

We need this **B** — as it is seen from the following statement — because of practical reasons, namely to be able to determine set **A**, i.e. the minimal matching vertex system.

Statement: Taking the maximal set of independent vertices in a graph, the points outside this set form a minimal matching vertex set.

Proof:

i) This set **A**' (the points in the graph outside set **B**) is a matching point system. Indeed, to arbitrary *e* edge there exists a point $a \in$ **A**', that is an endpoint of *e*, as there are no edges inside the point set **B**.

ii) If there were a point set, which were smaller (with a smaller cardinality) than **A**', then **B** — i.e. the maximal independent point set — could be increased, and that would lead to contradiction.

Thus we have proved the statement. Our task is to find the maximal independent point set in a given graph (2nd step). To this end, we used an about 150 step-long Pascal programme based on the algorithm of Bednarek, A. and Taulbee , O. (1966).

In *method 2* the construction of the graph is based on the examination of parameter pairs. In this way the description and construction of the graphs is simpler, and does not require computer work. (We may expect from this method, that the number of key parameters should be small.)

The basic idea in the method is to determine the graph based on the strength and weight of the relation between the individual parameter pairs. Let us identify an α (preferably bigger than 50%) connection factor, relating with the percental strength (which may be changed as desired) of the connection. If we set the connection factor between p_i and p_j, the occurrence of p_i in **A** indicates that the value of p_j can be determined with a probability of at least 0.50.

In the case of parameters we must examine $\binom{k}{2} = \frac{k^2 - k}{2}$ connections before drawing the edges. Also here the vertices are parameters, and they are connected with an edge if the relation between them proves to be strong enough. The method continues with the algorithm described in the previous method, ie. we look for the minimal matching point set.

The drawing of this graph is much simpler, and we need the computer only to find the maximal independent point set. With the help of this we can determine the minimal matching point system, which determines a key parameter set though more weakly, but still acceptably treatable for us.

Method 3. If we want to reduce the cardinality of the key parameter set further, the following is a possible method. Let us consider the set obtained with the first or the second method (depending on the accuracy), and let us take the set called **A**. Repeating the procedure used in point 1 on the graph of set **A** we obtain a substantially more restricted point set **C**, with the following properties:

i) $\mathbf{A} \in \mathbf{C}$

ii) all essential key parameters of **A** are in **C**

iii) all essential key parameters of the essential key parameters of **A** (except a) are in **C**.

The main advantage of this supplementary method is that the cardinality of **C** is very little, but because of the large reduction of the number of parameters it has always to be examined, how exactly the system is described.

RESULTS AND APPLICATION

A program in PASCAL was written to solve this problem. An input condition of this program is a knowledge of the relations between the parameters used. The program disregards the intensity of connections and, thus, it is advisable to reduce their scope to the significant correlations (eg. with coefficients above 0.5).

If one parameter is dependent on no or only one factor, it is chosen a key parameter. With a large number (minimum 20) of parameters, a single running reduces the dimension of the system to half or two thirds.

To make the analysis easier, the program creates separate input and output files. From the resulting large parameter assemblage the parameters of maximum internal stability have to be selected. Thus, two or three dozens of key parameters are given and grouped into clusters. When the number of initial parameters is small, their figures of internal stability may also be low. In this case, the key parameters are unsuitable for the analysis and the resulting parameter assemblages have be merged into larger clusters, which contain the largest possible number of key parameters.

Method 2, the quicker procedure, was applied for an assessment of suitability for wheat and maize cultivation in the agricultural area of Borsod Basin. The 1:25,000 scale source maps were digitised in a 1 cm (250 x 250 m) square grid. The availability of data controlled the range of parameters.

The set of parameters of maximum internal stability were first selected for 12 ecological factors (*Table 1*). The connections with significant correlations were taken into account (for 360 data, at 1 per cent confidency level: 0.13). It is to be emphasised that these correlations vary with regions; they may be similar in landscapes of the same type, while the less stable factors (such as climate and drainage) may show a limited temporal variation, too, which is to be considered in medium to long term forecasts.

The list of connections (*Table 2*) shows an internal connection figure of 3 for the key parameters and, consequently, a combination of the resulting parameter sets containing most of the parameter assemblages of maximum internal stability is suggested: drainage density, maximum slope, slope direction, potential duration of sunshine, and soil quality score. Our experience shows that sets of parameters (less than 15 members) of maximum stability figure (S) can be best described by series of S to 2S number of parameters. (Thus, if, for instance, the internal stability figure is S=3, a suitable parameter series of 3 to 6 members can always be found). If the number of parameters applied is larger, in principle, a series of S parameters is satisfactory, but it is easier to combine the sets into assemblages of S+1 factors.

In method 2 the parameters listed in *Table 3* were used. *Table 4* shows the list of connections and the sets of parameters of maximum internal stability, while *Table 5* contains the list of the key parameters indentified.

Our computations underline that the Solncev principle of interrelationships in the landscape has ever to be formulated *specific to the individual landscape units*, only this way the key parameters can provide a good approximation of the initial set of parameters. A novelty of the method proposed lies, in our opinion, in proving that, in knowledge of the system of connections, the analysis and mapping of the key parameters is sufficient.

Table 1. A correlation system of the parameters used[3]

Altitude	=	1	2(0,53), 4(0,49), 5(0,26), 7(0,23), 8(0,23), 9(0,67)
Relative relief	=	2	1(0,53), 4(0,94), 5(0,68), 7(0,80), 8(0,34), 9(0,50)
Drainage density	=	3	4(0,29), 8(0,22), 10(0,24), 12(0,23)
Average slope	=	4	1(0,49), 2(0,94), 3(0,29), 5(0,88), 6(0,31), 7(0,88), 9(0,55), 10(0,53), 11(0,50), 12(0,58)
Maximum slope	=	5	1(0,26), 2(0,68), 4(0,88), 6(0,28), 7(0,86), 10(0,62)
Slope direction	=	6	4(0,31), 5(0,28), 7(0,20), 9(0,61), 10(0,53)
Actual surface[4]	=	7	1(0,23), 2(0,80), 4(0,88), 5(0,86), 6(0,20), 8(0,42)
Potential duration of sunshine[5]	=	8	1(0,23), 2(0,34), 3(0,22), 7(0,42)
Cumulative temperature in growing season	=	9	1(0,67), 2(0,50), 4(0,55), 6(0,61), 10(0,61), 11(0,53), 12(0,56)
Aridity index	=	10	1(0,73), 2(0,53), 3(0,24), 4(0,53), 5(0,62), 6(0,53), 9(0,61), 11(0,36), 12(0,51)
Soil quality score	=	11	1(0,47), 2(0,47), 4(0,50), 9(0,53), 10(0,36), 12(0,57)
Lithology index	=	12	1(0,55), 2(0,52), 3(0,29), 4(0,58), 9(0,56), 10(0,51), 11(0,57)

Table 2. Parameter sets of maximum internal stability (for 12 factors)

Number of parameters: 12

The arrow is followed by the list of related parameters

1 → 2—4—5—7—8—9—10—11—12—#

2 → 1—4—5—7—8—9—10—11—12—#

3 → 4—8—10—12—#

4 → 1—2—3—5—6—7—9—10—11—12—#

5 → 1—2—4—6—7—10—#

6 → 4—5—7—9—10—#

[3] for 360 data 0.13 significance (1% confidency level)

[4] Percentage of actual surface area growth compared to projected one

[5] Topographically corrected (according to slope angle and exposure)

7 → 1—2—4—5—6—8—#

8 → 1—2—3—7—#

9 → 1—2—4—6—10—11—12—#

10 → 1—2—3—4—5—6—9—11—12—#

11 → 1—2—4—9—10—12—#

12 → 1—2—3—4—9—10—11—#

Sets of parameters of maximum internal stability

1 3 6 3 5 9 3 7 9

2 3 6 3 5 11 3 7 11

3 6 11 5 8 9

6 8 11 5 8 11

6 8 12 5 8 12

Internal stability: 3

Proposed parameter assemblage: 3 5 6 8 11

Table 3. List of parameters used

1. Altitude (m)
2. Relative relief (m)
3. Drainage density (km/km^2)
4. Average slope (m/m)
5. Maximum slope (m/m)
6. Slope direction (0-360°)
7. Actual surface (%)
8. Potential duration of sunshine (in percentage of astronomical value)
9. Cumulative temperature for the growing season (°C)
10. Cumulative percipitation for the growing season (mm)
11. Soil type (quality)
12. Soil texture (quality)
13. Estimated soil erosion (t/ha)

14. Parent material	(quality)
15. Soil reaction(pH)	(quality)
16. Lithology	(quality)
17. Vegetation type	(quality)
18. Estimated biomass production	(t/ha)
19. Average depth to groundwater table	(m)
20. Discharge of surface waters	(m^3/s)
21. Spring yields	(m^3/s)

Table 4. Parameter sets of maximum internal stability (for 21 factors)

Number of parameters: 21

List of connections

The arrow is followed by the list of related parameters

1 → 2—4—5—7—8—9—10—11—17—#

2 → 1—4—5—7—8—9—19—#

3 → 4—8—19—20—#

4 → 1—2—3—5—6—7—9—13—20—#

5 → 1—2—4—6—7—#

6 → 4—5—7—9—10—11—17—#

7 → 1—2—4—5—6—8—#

8 → 1—2—3—7—11—17—18—#

9 → 1—2—4—6—18—#

10 → 1—2—3—4—5—6—9—11—13—15—17—18—19—#

11 → 1—2—4—9—10—12—15—17—#

12 → 1—2—3—4—9—11—13—14—15—#

13 → 4—10—12—14—#

14 → 12—13—16—21—#

15 → 10—11—12—#

16 → 14—20—21—#

17 → 1—6—8—10—11—#

18 → 8—9—10—#

19 → 2—3—10—21—#

20→ 3—4—16—#

21→14—16—19—#

Parameter sets with maximum internal stability

1	3	6	13	15	16	18
1	3	6	13	15	18	21
1	6	13	15	16	18	19
1	6	13	15	18	19	20
1	6	13	15	18	20	21
1	3	6	14	15	18	
1	6	14	15	18	19	20
2	3	6	13	15	16	18
2	3	6	13	15	18	21
2	6	13	15	18	20	21
2	3	13	15	16	17	18
2	3	13	15	17	18	21
1	13	15	17	18	20	21

3	5	9	13	16	17
3	5	9	13	17	21
5	9	13	15	17	19
5	9	13	15	19	20
5	9	13	15	20	21
3	5	13	15	17	18
3	5	13	15	18	21
5	13	15	16	18	19
5	13	15	17	19	20
5	13	15	17	20	21
5	14	15	17	19	20
5	9	14	15	19	20

3	7	9	13	15	16	18
3	7	9	13	15	17	21
7	9	13	15	16	17	19
7	9	13	15	17	19	20
7	9	13	15	17	20	21
3	7	13	15	16	17	18
3	7	13	15	17	18	21
7	13	15	16	17	18	19
7	13	15	17	18	19	20
7	13	15	17	18	20	21
7	14	15	17	18	19	20
7	9	14	15	17	19	20

5	8	9	13	15	16	19
5	8	9	13	15	19	20
5	8	9	13	15	20	21
5	8	9	14	15	19	20

Internal stability: 7

Table 5. Assemblages of key parameters

A(=S) B(=S+1)

I.

1. altitude
2. drainage density
3. slope direction
4. estimated soil erosion + average depth of groundwater table
5. soil reaction (pH)
6. estimated biomass production
7. discharge of surface waters

II.

1. relative relief
2. drainage density
3. estimated soil erosion
4. soil reaction + slope direction
5. vegetation type
6. estimated biomass production
7. spring yields

III.

1. drainage density
2. maximum slope
3. actual surface
4. estimated soil erosion + cumulative temperature for the growing season
5. soil reaction
6. lithology
7. vegetation type

IV.

1. maximum slope
2. cumulative temperature for the growing season
3. estimated soil erosion

4. soil reaction + potential direction of sunshine
5. vegetation type
6. average depth of groundwater table
7. discharge of surface waters

V.

1. actual surface
2. cumulative temperature for the growing season
3. estimated soil erosion
4. soil reaction + estimated biomass production
5. vegetation type
6. average depth of groundwater table
7. discharge of surface waters

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TASKS AND METHOD OF HYDROGEOGRAPHICAL MAPPING

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ABSTRACT

The method of hydrogeographical mapping was elaborated in the Geographical Research Institute of the Hungarian Academy of Sciences (HAS), within the frame of applied geographical studies. To compile the hydrogeographical map, geological, climatic, soil and geomorphological maps were also used. The hydrogeographical map shows surface hydrogeographic phenomena, surface coverage, water regime of the surface (based on rainfall simulation data), bed conditions of water courses, data on suspended and bed load and on the degree of erosion and accumulation. Stations belonging to the hydrometeorological measurement network are also indicated on the map. 9 types of water budget and water management could be differentiated on the basis of natural permeability and on water capacity. Our first map sheet was compiled for the Rakaca experimental area of the Research Center for Water Resources Development (VITUKI). The compilation of other maps is indispensable for a further development of the method.

INTRODUCTION

The goal of geographical studies is to provide an objective and unambiguous explanation of the geographical environment of society, the processes of mass and energy circulation and the concomitant phenomena going on in that environment. Geographical research can give an account of the aims interpreted this way, in several forms: in reports, tables, graphic data analyses and maps. The latter provide maximum approximation to the spatial distribution of the phenomena. Cartographic representation is particular important for the documentation of applied geographical research (Lackó, L. 1968). Concerning the thematic maps containing the research results of such character the objectives and methods of hydrogeographical mapping are discussed below.

Hydrogeographical thematic mapping provides a spatially determined, objective picture on the morphodynamics in the hydrosphere and under the interaction between the phenomena of the lithosphere, atmosphere and biosphere (Marosi, S. and Szilárd, J. 1967; Lovász, Gy. 1969). Our first draft as elaborated in 1965, but it has been modified on the basis of the experience in the course of the field surveys carried out since then (Pécsi, M. and Somogyi, S. 1965).

Existing Polish and French maps of hydrogeographical character were used for our draft. The individual phenomena being represented on the Polish maps, e.g. the representation on the soil conditions - had already been compiled in sufficient detail in the course of investigations carried out by other institutions. (Since 1950 the Hungarian State Geological Survey has been preparing such map series on the ground water regime). The clear representation on the French maps — to show one hydrological phenomena on each individual map sheet —was very attractive but the simultaneous and joint representation on several phenomena on several map sheets from the same area created difficulties. Therefore it was attempted to represent the processes occurring in the hydrosphere and in other spheres being in direct interaction with it in complex way, not to make our map too congested and unreadable (Rátóti B. 1968). In our work several maps in avail were used and we were compelled to adopt certain elements from them because of their indispensable hydrogeographical content. (But they are rather used as an aid to the hydrogeographical maps in order to avoid their further specification).

The most important maps that in every case should be used as an aid to the hydrogeographical maps of 1:25,000 scale are the following:

1. The sheets of map series at a scale of 1:200,000 prepared in the Hungarian State Geological Survey on the geological, hydrogeological and ground-water conditions.

2. The Hydrogeological Atlas (1962) also published by the Hungarian State Geological Survey.

3. The Climate Atlas (1960) published by the National Meteorological Institute.

4. Several versions of genetic maps of soils published by the Institute of Agrochemistry and Soil Science HAS since 1960 at 1:100,000 scale.

5. Synoptic (1:100,000) and detailed (1:25,000) geomorphological maps prepared in the Geographical Research Institute HAS since 1958.

DISCUSSION

The above listed thematic maps of different scales, purpose and content enabled to give as complete a hydrogeographical material as possible and to disregard from the simple adaptation of the material of other cartographic sources. Thus, our maps would be both original and easily readable. Finally with the content of the available maps being taken into consideration this could provide a wide range of application for our map.

The forms and phenomena to be represented on our draft map are outlined below. It should be noted, that the publication of the measured data and numerical values was the main task, because it makes the thematic maps useful in practice and reveals their applied geographical character. Consequently, to compile the map, several field measurements and laboratory analyses are necessary.

On our map are represented:

1. The surface hydrographical phenomena and forms are shown using different symbols and lines. They also figure on our geomorphological map and are mostly encountered among flood-plain relief elements. Neither could we refrain from their representation on the hydrogeographic maps because they form the present erosional-accumulational surface (they have to be taken into consideration from geomorphological viewpoint, too) since their evaluation is important for the water management. Value numbers of territorial characteristics are given throughout which is a quantitative surplus in relation to the qualitative geomorphologic representation. The flood- plain forms, types of surface waters and the spatial hydrographical elements, as well as the springs and the wells are shown in main groups.

2. The crop pattern and plant coverage strongly influencing runoff conditions is shown by colouring. Since a geological map at 1:100,000 scale is at our disposal for the whole country the representation of the surface geological structure is not necessary. Altough the topographic maps contain several references concerning the quality of plant coverage, their representation always differ in details from the reality. The relative relief categories are shown by red contour lines at interrals of 100 m, 50–100 m, 20–50 m, 20 m per 1 km^2.

3. The most important group of phenomena to be represented are the infiltration-runoff conditions referring to the water regime on the surface. In the field they are measured by the rainfall simulator equipment constructed by B. Kazó. With its help a rain of 20–40 mm/hr intensity might be simulated. This value is typical of showers of average intensity, the latter may be regarded as an extraordinary phenomenon in Hungary. Besides, the soil moisture conditions can be determined by cylindrical sampling and laboratory analysis carried out before and after the sprinkling.

Thus simultaneously with the runoff values measured in the course of the sprinkling, data are obtained for water retention capacity of the soil, the degree of surface infiltration and runoff. The permeability categories should be calculated for the intensity values of 20, 20–40 and 40 mm/hr. Values of 20, 20–35 and 35 mm/10 cm or volume per cents were derived for available moisture capacity. The 9 variations (3 x 3), types of the two phenomena groups are marked by brown raster network. For the cartographical representation data provided by the local ombrograph network and those of slope conditions can be used, since they are necessary for the factual analysis of the runoff conditions. The latter factor has a strong influence on the runoff values observed on a plain surface.

4. The bed conditions of the water courses are represented with blue signs and lines, and the objects in the channel are represented with black signs. Their specification being not necessary, they are classed into groups of phenomena.

5. If possible the presentation of the sedimentation conditions of the watercourses

is considered to be important, because they express the performed erosional of accumulation activity. This is represented with the adequate marking of the bed material, bedload and suspended load in the cross section of the bed what is indicated concerning the respective cross section of the watercourses as an extract.

6. The areas of accumulation are shown on the flood-plain, too, with symbols in the colour of the flood plain or the adequate plant coverage. The opposite phenomenon, erosion on the slopes is marked only if an earlier prepared soil erosion map is not available (Szűcs, L. and Kazó, B. 1969).

In this case slopes are classed into $<10^{o}$, $10–25^{o}$, $25^{o}<$, i. e. slightly moderately and strongly eroded types of slopes are identified and indicated with raster. The degree of slope erosion is determined related to the intact soil profile.

7. Finally, the places of the instruments of the hydrometeorological sampling network within the surveyed area should be worked using conversional signs, as to provide proper comparison, conversion and control congested of the measured and represented phenomena.

Probably our map seems to be rather crowded inspite of all our selecting efforts. But it must be remembered that the individual groups of symbols can be drawn onto the map separately from each other (for example the slopes will not acquire the signs of flood plain of channel neither reversely). As the Geographical Research Institute had no experimental area of its own, those of the Research Institute for Water Resources Development (VITUKI) were used for the compilation of the first map sheet.

The most important content of our map is the representation of the infiltration - runoff conditions that determine the character of the water management. Since data collection and processing for cartographical representation constitute a rather complicated task, they will be specified below. The first step is to carry out a measurement series using sprinkling equipment on each relevant unit of the area (within the VITUKI experimental area established in the Rakaca valley). The sampling points have to be chosen to provide a measurement series for each unit different structure, slope categories and cultivation pattern. It is preferable to carry out the measurements on the same place with 40 and 20 mm, intensities too, as to obtain results directly for the different precipitation effect (*Table 1*).

The natural moisture condition and the value number of minimum, capillary and maximum water capacity are determined in the laboratory from the cylindrical soil samples taken in course of the measurements (Sarkadi, J. et al. 1964). The samples are taken simultaneously, from the dry surface and the surface irrigated with an intensity of 20 or 40 mm/hr. It is important to mention the value obtained from the infiltrated proportion of the precipitation distributed with 20 or 40 mm intensity, that is reduced by the natural moisture content of the soil. On the basis of the obtained number the natural (in situ) permeability of the soil is determined high (more than 40 mm/hr), medium (40-20 mm/hr) or low (less than 20 mm/hr).

Table 1. Evaluating table for the application of the rainfall simulator in the Rakaca catchment[1]

			1.	2.	3.
I.	Infiltration:		high	medium	low
		a)	>40 mm/hr	40–20 mm/hr	<20 mm/hr
		b)	>20 mm/hr	20–10 mm/hr	<10 mm/hr
	Available water capacity		high >35 volume %	high >35 volume %	high >35 volume %
II.	Infiltration:		high	medium	low
		a)	>40 mm/hr	40–20 mm/hr	<20 mm/hr
		b)	>20 mm/hr	20–10 mm/hr	<10 mm/hr
	Available water capacity		medium 35–20 volume %	medium 35–20 volume %	medium 35–20 volume %
III.	Infiltration:		high	medium	low
			>40 mm/hr	40–20 mm/hr	<20 mm/hr
	Available water capacity		low <20 volume %	low <20 volume %	low <20 volume %

The following step is the determination of available water capacity. For this purpose the samples taken from the sprinkled surface are used. The computation can be performed based on the minimum water capacity when the differences of the maximum moisture capacities are added to the half value of the former.

In the second method the value of hygroscopic is the starting point. The wanted available water capacity value is obtained from the difference of the stagnant water content calculated from the sixfold hygroscopical value and the maximum water capacity. Both calculation methods give rather similar result though the latter is the more factual and current procedure. The water capacity is expressed in volume percentage and thus the degrees of the available water capacity will be 20, 20–35, 35 volume percentages marked as low, medium and high respectively.

On the basis of the calculated values of natural permeability and available water capacity, the water balance and moisture regime types of the site are determined, they may range from the I.1 (type of high natural permeability and high available water capacity) to III.3 (type of low natural permeability and low available water capacity).

The following step is to prepare the slope category map of the area that the effect of surface inclination on the natural permeability could be taken into consideration. The slopes are taken into account according to the standard categories of 0, 0–5, 5–12, 12–17, 17–25, 25%<. The individual degrees of inclination modifying the infiltration or the runoff are read off from the runoff – permeability diagram.The moisture regime types

[1]Values refer to the upper 10 cm soil layer

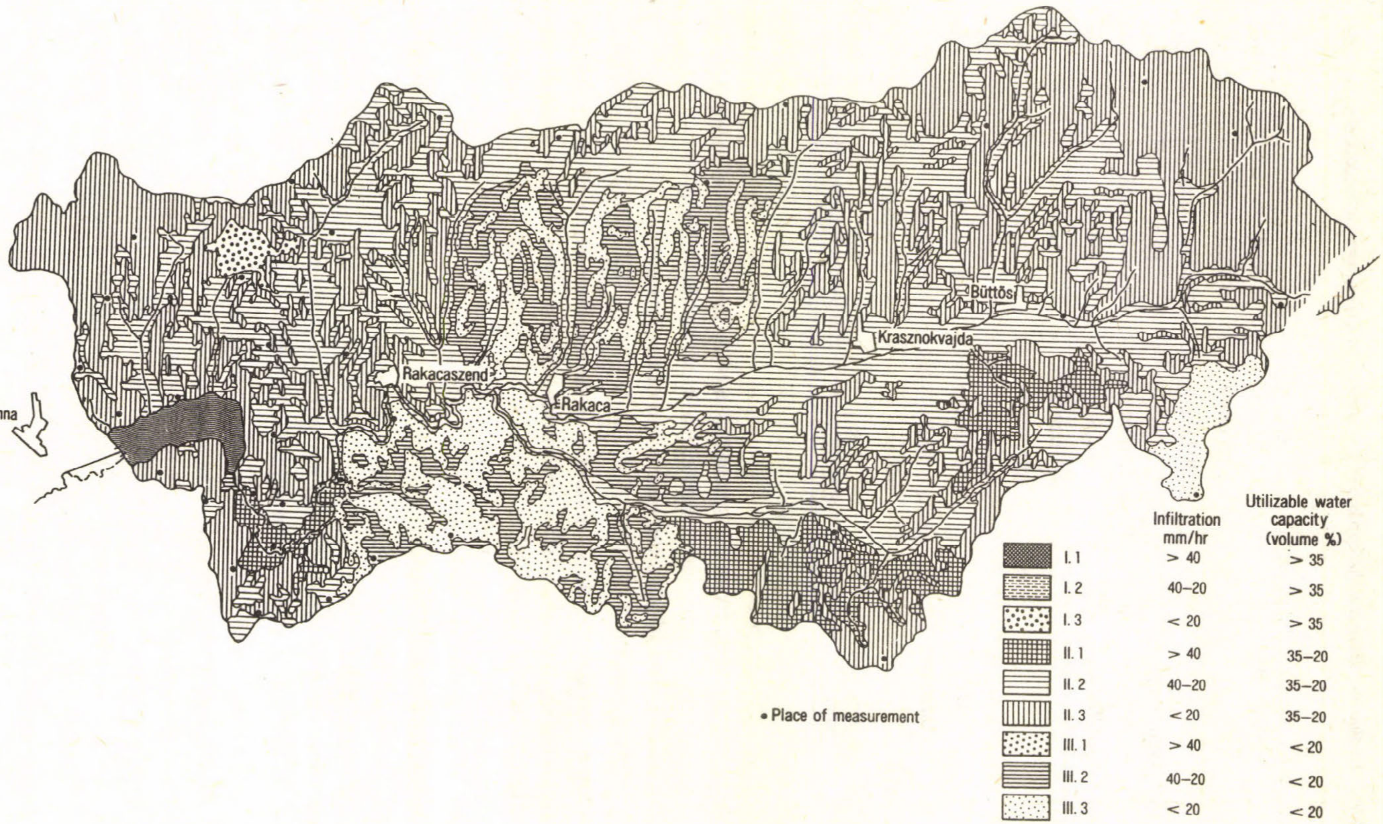

Fig.1. Hydrogeographical map of the Rakaca catchment (Northern Hungary)

determined for the surfaces of no inclination could be corrected according to the runoff naturally increasing with the inclination, and the decreasing permeability.

Our map (*Fig. 1*) represent the VITUKI experimental area established in the watershed of Rakaca Creek. The watershed covers 232 km^2 where 66 measurements were carried out on 45 points. Two main types occur in the area. The western part is built on mesozoic base covered with red argillaceous soils. The eastern part is covered by remnants of Early Pleistocene gravel covered and red argillaceous soil overlying the Upper Pannonia clay. The soil cover is built up mostly of variations of lessivated brown forest soil and marshy-meadow soils that fill the valleys. 80% of the area is under cultivation 14% forest, 4% meadow and pasture of the surface. The inclination varies between 5–25%. Steeper slopes are encountered in some places only, but the flat surface is limited occurs mostly in the valleys. The erosional soil degradation is widely spread but does not show a contiguous pattern.

Perhaps it is not surprising among the described circumstances that the II.2, the soil type of medium natural permeability and medium available water capacity dominantes turning into a type of poor permeability for the slope category of 8–10%.

The fact that we could take into consideration the natural moisture condition of the soil and the surface inclination reflects that the mapping of hydrographical character exist in an initial stage.

After the mapping of regions of different type based on different ideas and conception the synthesis of the individual methods can be performed.

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Land evaluation studies in Hungary

Budapest, 1988. Akadémiai Kiadó. 95 p.

Edited by D. LÓCZY

The Geographical Research Institute of the Hungarian Academy of Sciences has elaborated a method for determining crop-specific land suitability. The first part of this volume briefly describes this procedure and the way land suitability grid maps for individual crops are combined to show the areal distribution of types of agricultural habitat. The resulting regionalization is an important tool for regional planners since it portrays the allocation of land resources on a simple map and promotes specialization.

The agroecological regions thus identified can, however, only reflect the physical potentials in the area. For a complex land evaluation this first stage of the survey has to be supplemented with the assessment of economic factors. As the complete methodology of an economic evaluation of land has not yet been elaborated for Hungary in a final form, an experimental method is presented here by L. Góczán (who has also guided the agroecological regionalization project). In the second part, he attempts to compute another numerical value incorporating gross crop production value, labour and capital investments as well as the numerical value of the agricultural habitat.

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LANDSLIDE PROCESSES AND FORMS IN THE HUNGARIAN MOUNTAINS OF VOLCANIC ORIGIN

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ABSTRACT

On the basis of yet uncompleted field investigations, the paper underlines the importance of landslide processes in the geomorphic development of the Hungarian volcanic mountains, formerly neglected in geomorphological research. Author analyses the geological, relief and climatic conditions of these processes, and reveals that on the steep edge of the volcanic mountains — where the loose sediments underlying hard volcanic rocks are situated higher than in the foreground — typical slide zones developed. The overwhelming majority of the slides developed during the intensive uplift of the mountains, in the humid stages of the Pleistocene.

INTRODUCTION

The geomorphological investigation of landslide processes and features in Hungary has traditionally focused on *hill regions built up of loose, mostly Tertiary sediments.* Obviously, these are the regions where landslides could be particularly intensive in Pleistocene slope valley evolution. In hill landscapes mass movements are also common today. Similarly, it is the frequent occurrence of present day catastrophic *landslides along the Danube* that has called for the study of their conditions, types, mechanisms, as well as the ways of protection against them, performed in detail by researchers of several disciplines.

The case was completely different with *of volcanic origin mountains (Fig. 1).* It is true that some surveying geologists and geomorphologists, experienced in field work recognised, or at least held probable, large scale rockslides also in mountains of volcanic origin as early as the 1920s (Noszky, J. 1927) but, on the whole, they underestimated their *role* in surface evolution, thus, the slides observed at various places were mentioned only superficially. In the morphological works of Láng, S. (1952, 1953) or Leél-Őssy, S. (1952), with exceptionally good knowledge of the terrain, the landslide landforms appear

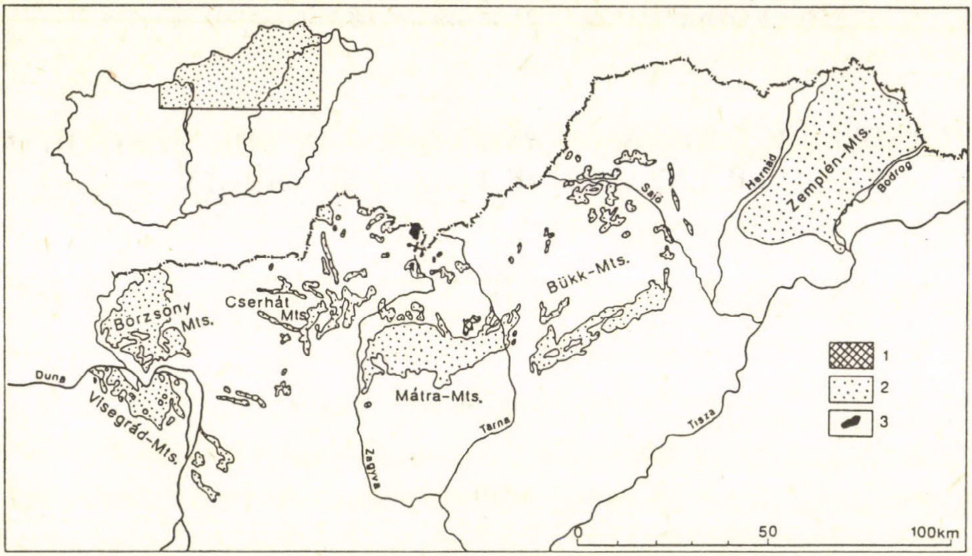

Fig. 1. Distribution of volcanic rocks in the North Hungarian Mountains (after National Atlas of Hungary, 1989). 1 = Eocene volcanites; 2 = Miocene (Badenian, Sarmatian) andesites, dacites, rhyolites and their pyroclastics; 3 = Upper Pannonian, Pliocene basalt areas

only in the short closing chapters on general evolution or are described rather for the sake of completeness.

On the other hand, these researchers *were basically correct in recognising the structural, lithological and climatic conditions of the landslides*. It was Noszky, J. (1927) who first emphasised that in the Mátra Mountains the slides are "most clearly manifest at places where the sandy schlieric clays are overlain by loose volcanic tuffs and breccias". Leél-Őssy, S. (1952), in connection with mass movement phenomena observed in the middle of the mountains, which he regarded as falls, underlined the significance of the loose tuff layers of the stratovolcanic structure. When characterizing the forms of the Visegrád Mountains, Láng, S. (1953) already counts with both possibilities in the development of the slip planes of the slides. "The slip plane formed in the underlying Upper Oligocene or Lower Miocene sediments, or in plastified finer tuff" — he writes. In his opinion the large slides may have taken place "especially during the cold-wet ice ages". In his study on the Mátra Mountains (Láng, S. 1952) he sees the triggering factors of sliding in the melting and loosening up of deeply frozen layers during the thousand years of glaciation. Similar views are expressed in his later physical geographical works (Láng, S. 1955, 1967). Székely, A., somewhat contradicting Láng, attributes the slides in the Mátra (1960), then in the volcanic mountains in general (1973), to wet pre-, post- and interperiglacial stages.

The partial recognition and sporadic survey of the landslide forms of our mountains of volcanic origin was also restricted to andesite (rhyolite) areas evolved in the Miocene (mainly Badenian) era. Their role in the slope evolution of the younger (Upper-Pannonian, Pliocene), Transdanubian basalt volcanos *(Fig. 2)* has been hardly mentioned until quite recently. The passing references of Cholnoky, J. (s.a.) and Bokor, P. (1965) lacked any comment, and even the detailed cross sections by Jugovics, L. (1969, 1971), only show talus cones in general on the edges of basalt-capped hills. It was Borsy, Z. et al. (1987) who first called attention to the fact that the slope evolution of the basalt-capped hills in the Tapolca Basin cannot be understood without the role of mass movements, primarily of slides.

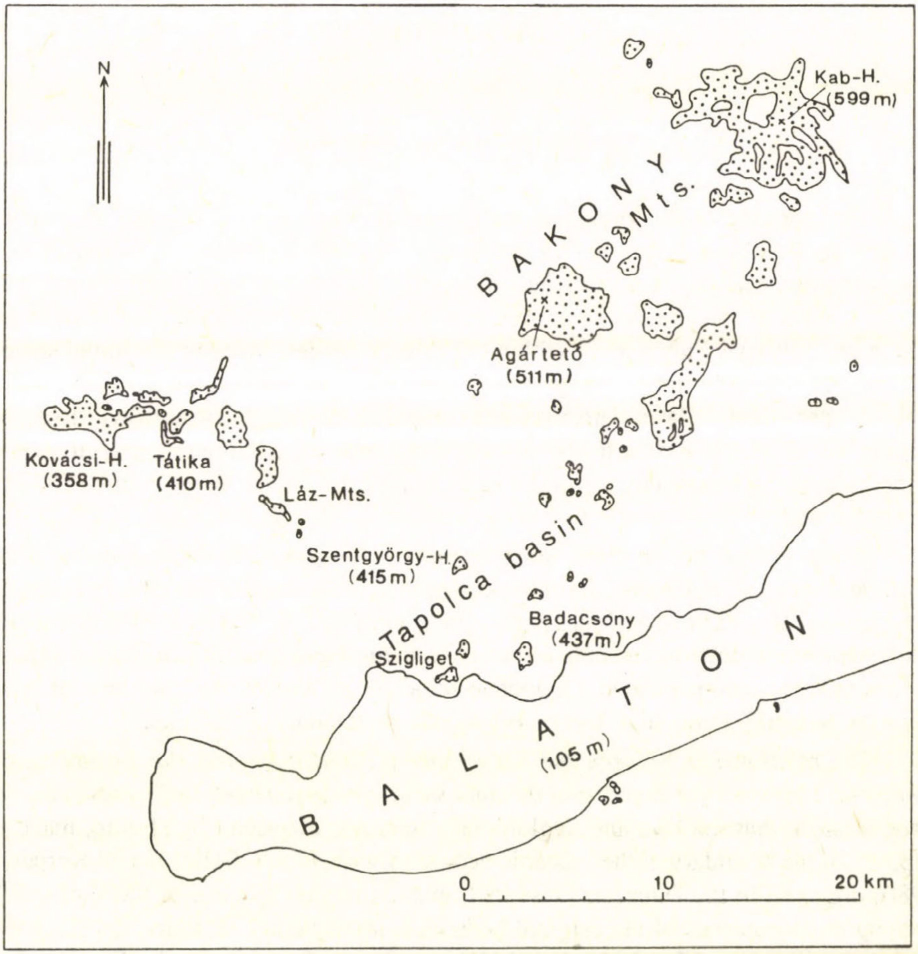

Fig. 2. Distribution of the rocks of final basalt volcanism (Upper Pannonian, Pliocene) in the environment of Lake Balaton (after Geological map of Hungary 1:200,000)

My investigations in the Hungarian mountains of volcanic origin on slide forms, convinced me that *in the previous investigations only part of the landside features had been described* and

1. the occurrence of long-known and recently surveyed identifiable and numerous features is not incidental both in the particular mountains and in the whole of the volcanic belt, but bound to mostly well-defined structures and lithological conditions,

2. the overwhelming majority of the landslides surveyed began to develop under climatic and relief conditions other than the present ones. This is the reason why we can say that these forms are more or less preserved remnants of a previous relief generation.Their presence exerts a considerable influence on recent surface evolution as well.

DISCUSSION

Areal distribution of landslides

The mapping of the previously recognised and described *slide landforms* showed that they are *located mostly along the margins of volcanic mountains* — primarily in the zone where the volcanic rocks and the outcropping underlying loose sediments meet. On the other hand, at some places their appearance can be associated with the *contact zone of lava and tuff layers* alternating within the volcanic series. Since in the initial stage of volcanic activity tuff eruption was generally prevailing, the outcropping hard lava masses of the deeper volcanic layers are frequently mantled by broader or narrower loose tuff strips (collars). On the northern slope of the Mátra ridge e.g., owing to the southward tilt of the bulk of the mountains, the older tuffs rising from deeper levels can be followed especially well.

In the course of our field investigations it has been found that in the above mentioned zones slide features are more common than previously thought. In fact, these forms have evolved also in the inner parts of the mountains, the original volcanic structure of subsequent tectonic movements of valley formation and general denudation exposed the underlying unconsolidated Oligocene-Miocene sediments (in the case of basalt volcanos generally Pannonian layers) or (mostly weathered) tuff blocks.

The relationship between the occurrence of landslides and the surface line of intersection between volcanites and the unconsolidated underlying sediments is in some cases so close that the lava and agglomerate outcrops, displaced by sliding, make the mapping of the boundary of the volcanic bedrock very difficult. Balla, Z. and Korpás, L. (1980) observed in the Dunazug (Visegrád) mountains that because of the slides, cliffs seeming to be outcrops of the original bedrock can frequently be found on the slopes, much below the actual level of the underlying bedrock. For instance, in the area of the Visegrád Mountains shown in *Fig. 3* andesite agglomerates and lavas are exposed both in natural and artificial sections (the unconsolidated Oligocene underlying rock appears scarcely, mostly on the bottom of deep gorges), though according to a detailed geological survey the extension of andesite bedrock is much smaller. The andesite was transported down to the axis of the valleys by the landslides described. Along their lower reaches, the streams were forced locally to run between subvertical walls. The series of slides of Nyerges-hegy, northwest of Budapest, clearly shows that if the underlying unconsolidated strata are exposed above the local base level and the weight of the overlying volcanic mass represents such an excessive load that makes the slopes unstable and releases slides. This unstability is naturally greater when the steepness of the slope is further increased by displacement along the fault line or intensive valley incision. The altitude of the floors of the two main valleys of the area are only 200 m a.s.l., whereas the original level of the underlying unconsolidated rock comes near to 400 m. The geological surveys mark a faultline along the valley slopes, roughly along the volcanite — underlying formation boundary, and an intensive valley incision running parallel with — uplift is also well-documented for the Pleistocene (shown very well by the narrow gorge of the Sztara Voda, locally 50 m deep).

Fig. 3. Landslide features near Szentendre in the Visegrád Mountains. 1 = main failure fronts; 2 = secondary or uncertainly identifiable failure fronts; 3 = blocks of slid rock masses; 4 = uncertainly identifiable slid masses; 5 = closed depressions (mostly with pond); 6 = uneven landslide surfaces; 7 = heavily degraded landslide surfaces; 8 = gorge-like sections of erosional valleys; 9 = young erosional valleys, gullies; 10 = contour lines (altitude in metres a.s.l.); 11 = boundary between volcanic rocks (v) and the loose underlying sediment (o)

Fig. 4 presents that the landslides in the Visegrád Mountains are located along the contact zone of the volcanites and the underlying formation. This does not only apply for the margins of the mountains — although the most illustrative examples are found there — but also in the inner areas where the deeply incised valleys expose the unconsolidated sediments. The multiple system of landslides on the northern side of Dobogókő (north-west of Budapest) is the consequence of the incision of the Rám valley exposing the western wing of the one-time outer caldera down to prevolcanic unconsolidated strata. This system of landslides is worth mentioning since it developed on the inner side of the (outer) caldera, i.e. on strata outcrops (obsequent landslide). Such landslides can be identified also in the *Börzsöny Mountains*. The most beautiful example is the landslide system in Templom valley — not yet mentioned in the literature — which evolved on the slope of the residual caldera of the High Börzsöny stratovolcano. The system consisting of three main stages (at 560, 580, and 610 m altitudes) primarily results from the incision

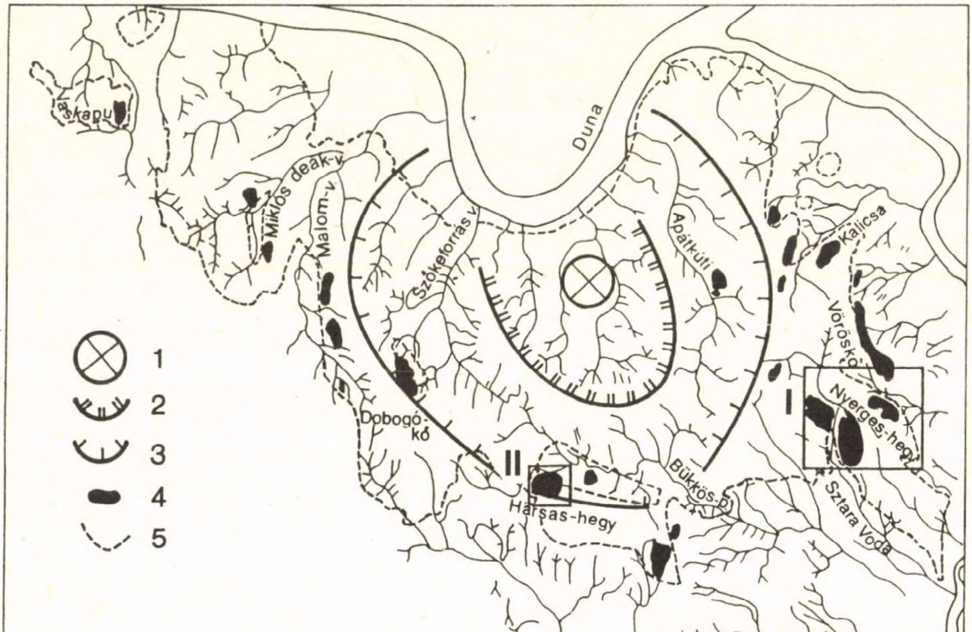

Fig. 4. Network of valleys in the Visegrád Mountains with the reconstructed edges of the volcanic calderas (after Székely, A., 1983) and the location of the landslide areas. 1 = one-time centre of eruption; 2 = inner caldera; 3 = outer caldera; 4 = landslide areas; 5 = boundary of volcanic rocks; I= area of *Fig.3*, II= area of *Fig.8*.

of the deep Templom valley directly at the foot of the steep caldera wall. A considerable part of the slides released in the *Mátra Mountains* are of obsequent type. The frequent occurrence of obsequent landslides proves that the *steep andesite slopes above unconsolidated sediments are endangered by landslides even if the stratovolcanic layers do not tilt downslope*. The immense weight of the thick andesite mass can plastify the sandy-clayey underlying layers even if they are relatively stable without this extra load. This is indicated by the fact that there are only sporadic landslides in the hill region of Oligocene-Miocene "Schlier" material. However, *where over the "Schlier" andesite flowed and solidified with high and steep edges, landslide zones formed.*

The geological structure and relief of the central part of the Mátra Mountains (of the main ridge), and the location of a landslide zone are shown in *Figs. 5* and *6*. According to the reconstruction by Székely, A. (1983) the western half of the Mátra ridge as far down as the line of Csór-hegy is the remnant of the northern edge of a caldera tilted to south (towards the Great Plain), whereas the eastern half is the edge of a lava blanket also tilted to south. The subsidence in the south (or the uplift of the northern background) rendered the mountains asymmetric, and also resulted in the formation of steep slopes on the outcropping strata on the northern side of the ridge. The landslides evolved between the "high surface" (800–1000 m) and the "upper escarpment" (600 m; Székely, A. 1964) generally on slopes higher than 200 m and steeper than 40°, and — together with other types of mass movement (falls, cryoplanation) — led to gradual retreat. The rock masses sliding in several phases over the underlying formation of Carpathian stage (or perhaps

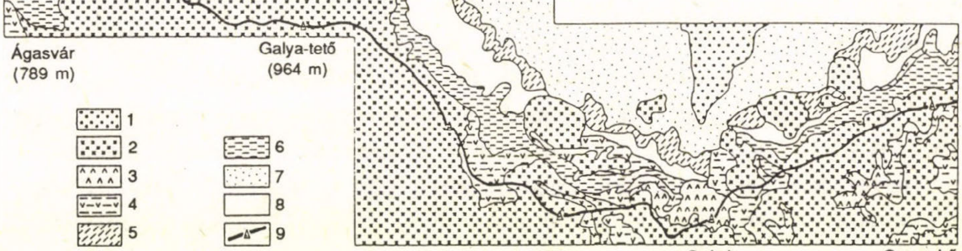

Fig. 5. Geological map of the central part of the Mátra Mountains - environs of the main ridge (unifying maps by Varga, Gy. – Csillag-Teplánszky, E., edited by Dávid, L. and Szabó, J.). 1 = Eocene biotite amphibole-andesite; 2 = Miocene Carpathian-Badenian pyroxene-andesites; 3 = Badenian pyroxene-andesite lava agglomerate; 4 = Carpathian-Badenian pyroxene andesite tuff agglomerate; 5 = Ottnangian-Carpathian "lower rhyolite tuff"; 6 = Badenian pumiceous dacite tuff ("medium rhyolite tuff"); 7 = Oligocene sandstone, clay, marl; 8 = lower and medium Miocene aleurite ("schlier"), partly sandstone; 9 = main ridge of the Mátra

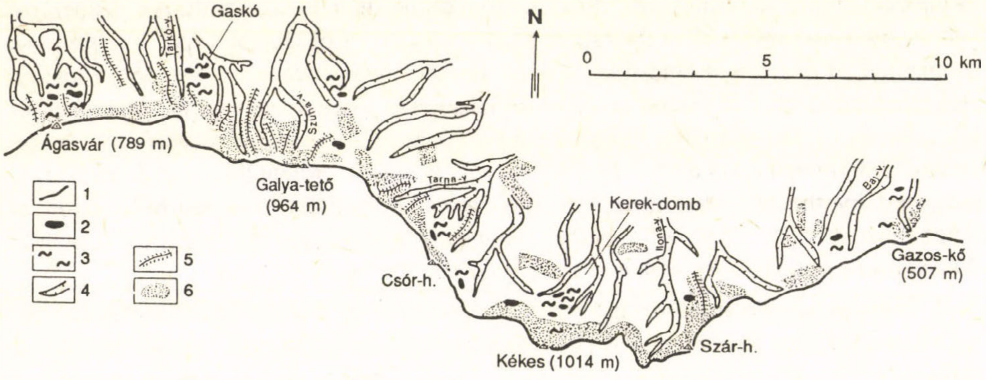

Fig. 6. Geomorphological sketch of the northern side of the Mátra main ridge – with special reference to the landslide areas. 1 = the line of the main ridge in the central Mátra; 2 = closed slide depressions, generally with pond or swamp; 3 = uneven surface of slid masses and landslide blocks; 4 = erosional valleys; 5 = rock ridges, usually step-like, starting out from the main ridge; 6 = slopes steeper than 20°

on the deeper-lying tuff layers) brought about an accumulational zone of locally 1 km width at the foot of the slope. The surface of this zone is characterized by a reduced angle of slope and an irregular sequence of steps, frequently enclosing ponds or swamps. Springing from the discontinuous character of slide processes, this landslide zone, is not contiguous. Where it is missing, the steep slope or even the ridge of the mountain have been cut across by headward erosion from north. On the other hand, where it is present, the large slid masses created a protective foreland for the steep slope against linear erosion. The breaching of the outer (northern) edge of the accumulational zone has only recently begun by the retreating head-valleys and, at places, the closed depressions between the landslide steps are now being tapped. The landslide zone is particularly well-developed under Ágasvár (Ágasvár well, Nádas lake), under Vöröskő (in the area of Gaskó with numerous closed depressions) and on the side of Kékes.

Such accumulational zones along the mountain margins can be observed also elsewhere. There is a remarkable one on the eastern side of the Visegrád Mountains.

In the Mátra Mountains there are also slides in other parts of the mountains, since the stratovolcanic structure, along with deep valley incisions, favours the release of landslides.

The investigations in the *Cserhát Mountains* confirm the findings in the Mátra and Visegrád Mountains. The major features occur in the Eastern (volcanic) Cserhát, mainly along the edges of minor "volcanic blocks" and fragments of the lava mantle, which are rather common there. It is to be emphasized that *slides are rare on the, sometimes very steep, edges of exposed subvolcanic forms*. The characteristic andesite dykes of the Cserhát have "deep roots", thus the Oligocene-Miocene sediments into which the dykes have penetrated cannot function as slip planes for the andesite masses.

In the surveyed Transdanubian regions of *final basaltic volcanism (Fig. 2)*, Balaton Highlands with the Tapolca Basin and further north the Tátika Group, it is generally characteristic that the volcanic material rests upon sandy-clayey sediment series, not older than the Upper Pannonian, and the unconsolidated sediment underlying the basalt (tuff), protected by the hard volcanic material, lies higher today than in the surrounding areas, whose surface, without the protection of basalt, has been considerably lowered since the end of volcanism. Thus, the basalt- covered areas assumed a *residual hill* (butte) character in the Tapolca Basin and the Tátika Group. The main trend in the morphological evolution of basalt capped hills is that the basalt mantle (often of columnar structure), mostly ending in subvertical walls, recedes and shrinks.

The spectacular and still active erosional processes on the edges are the rockfalls. The resulting scree of fallen fragments surrounds in collar-like shape the basalt bedrock, and mixing with the underlying layers on the foot-slope, has shaped and still shapes the slope, primarily through climate dependent types of mass movement. The more thorough investigation of the features on these debris slopes shows that part of them are results of

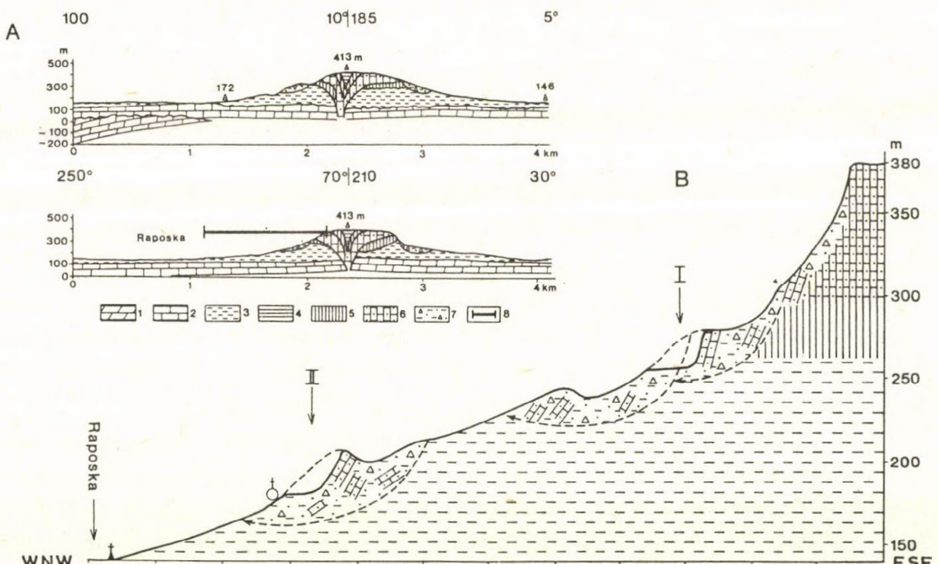

Fig. 7. Cross section of the western slope of Szentgyörgy-hegy (Tapolca Basin). A = structure of Szentgyörgy-hegy, after Jugovics, L. (1971), B = detailed section of the western slope of the hill with identifiable stages of landslides and hypothetical slip planes. I = upper quarry, II = lower quarry. 1 = Upper Triassic main dolomite; 2 = Upper Miocene olitic limestone; 3 = Upper Pannonian clayey sand; 4 = basalt cinder; 5 = basalt tuff; 6 = basalt; 7 = fall; 8 = place of section "B"

large scale sliding. A typical slide character is displayed by the irregularly undulating western slope of Szentgyörgy-hegy (*Fig. 7).* The countersloping escarpments, closed depressions and the basalt columns, seen in old quarry exposures, tilted back and damaged by slides, are unmistakable signs of slope evolution by sliding. In addition to the other basalt-capped hills and the landslide feactures of the Szigliget mountain group (Borsy, Z. et al. 1987, Szabó, J. 1991) we must necessarily mention similar processes from the Tátika Group, further away from the Tapolca Basin.

The most important factors in the release of landslides in basalt areas are held to be the position of the underlying unconsolidated sediments above the base level and the unstability of the slope induced by the great weight of the basalt cap.

Age, stage of development and types of slides

The great majority of the landslide features surveyed are permanently inactive. They have been essentially fossilized, thus the slopes, under the present relief and climatic conditions are, in view of such movements, mostly in equilibrium. There may occur recent and (exceptionally) *active slides,* too, but they are ususally restricted *to a limited sector of an earlier system of slides*. A good example is shown in *Fig. 3*, where the slid masses, forcing the Sztara Voda into a very narrow — a few 10 m wide and of similar depth — canyon-like gorge, are generally in equilibrium, however, along the steep wall of the gorge irregular heaps of house-sized agglomerate blocks are found, which are recently detached from their background. Everywhere the recent movements on the steep edges of the slides narrow down the lower parts of the valley cross sections. This is observed along streams with steep gradient incising mechanism (e.g. Apátkút valley above Visegrád).

The landslide areas at rest suggest that the slope conditions responsible for sliding are not reproduced. From a climatic point of view, one can draw the conclusion that since their development there have not occurred so great climatic fluctuations that could have led to the recurrence of the movements or the formation of new ones.

For the lack of datable cover sediments *the slides can only be dated indirectly.* Since most of the uplift of the Hungarian Mountains, the great majority of significant vertical movements along tectonic lines and the most intense valley incision took place in the Pleistocene, the relief conditions were the most favourable for landslides in this period. The moisture necessary for sliding was ensured by great climatic fluctuations. The general principle that for these movements the pre-, inter- and postperiglacial stages are primarily important, must be supplemented: in our opinion it is particularly the first stage of postperiglacial warming that was decisive, since in the melting stage soil moisture in solid form could be particularly effective in triggering landslides. On the other hand, the periglacial conditions cannot be excluded either. In such periods the movements do not cease, only change their type. The frozen subsurface layer thaws in summer, may function as a slip plane, first of all, for shallow landslides. In this way the large, compact masses of deep-seated rotational slides may be broken into blocks.

These, already fixed and somewhat degrading, slides are clearly recognizable as they are large and well-preserved in volcanic rock material. The mass of deep-seated slides released on steep and usually high slopes remained in one block (hillslides; Szabó, J. 1985), but even if it had fallen apart into several larger blocks (blockslides), on the slopes it formed counterslope steps and closed depressions, which for long periods (for thousands of years) attest the processes that produced them. The degradation of landslides with arcuate failure in lava or agglomerate is also slow, thus they constitute important supplementary information on the origin of forms.

Sliding on many slopes studied could only be proved on the grounds of the forms. Without exaggerating the role of slide processes, in the course of our field work, we only mapped landslides where *we could identify, behind the steps with asymmetric cross sections with steeper fronts and closed depressions, also the place of origin of the displaced mass (failure fronts).* In further field surveys with more developed methods the recognition of further landslides is expected.

The *observed landslides* — although their slip planes are generally difficult to identify — are mostly *deep seated.* As has been mentioned above, the slip planes developed either on prevolcanic unconsolidated sediments or on interbedded tuff layers. As a general rule we can state that the large landslide zones on mountain margins result from the exposure of unconsolidated sediments, however, we have a number of examples for the later release of further landslides from the steep slope above the slide zone. Their slip planes undoubtedly lie *above base point* within the volcanic series (e.g. the landslides of Pap-hegy in the Visegrád Mountains).

The actual proportion and significance of primary shallow slides is difficult to estimate, since they quickly degrade and are hardly noticeable on forested slopes.

It can be regarded as a nearly general phenomenon that the slide systems activate repeatedly *(Fig. 8).* In the mountain slides features of 2–3 main stages, in block slides much more smaller stages of equal rank are detected. The sequences of smaller steps on the hillslide heaps, particularly on the steep front sides, can generally be interpreted as later movements. A good example is the large hillslide in the foreland of Csikóvár, Visegrád Mountains, which blocked two larger lake basins, then both above them in the lower section of the one-time failure front and below them on the foreside of the slid mass, one order of magnitude smaller blocks of later movement accumulated.

CONCLUSION

In summary, we can claim that *landslide features are characteristic in the steep marginal zones of the Hungarian volcanic mountains at all places where the underlying*

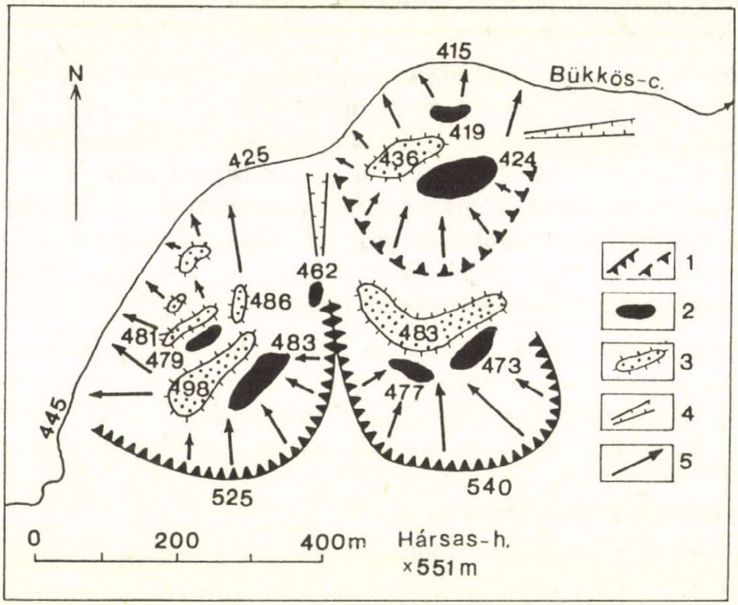

Fig. 8. Multiple landslide system at rest along the Bükkös stream in the Visegrád Mountains (for place of sketch map see Fig.4). 1 = arcuate failure front; 2 = closed depression; 3 = slid rock mass; 4 = recent gully; 5= directions of sliding.

unconsolidated materials (possibly the loose tuff layers of the volcanic series) are exposed on the surface above the local base level. Their general, though non-contiguous distribution indicates that they may have been equal in significance to other processes (other mass movements, linear erosion, and pedimentation), in the geomorphic evolution of these areas. Under favourable stratigraphic and relief conditions they occur in considerable numbers in the inner areas of the mountains as well. On the grounds of their present stability and considerably transformed forms we can draw the conclusion that *most of them belong to a relief generation which attests to stronger slope dynamics than today.* In the case of landslides this primarily means the Pleistocene with an increased vertical articulation of relief and a greater moisture content of the near-surface layers.

Note:

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Vol. 25.

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ECOLOGICAL REGULATION OF KARST DEVELOPMENT

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ABSTRACT

The paper deals with the role of ecological factors in the development of karsts, especially in relation to the formation of solution dolines. The influence of climate and microbiological activity are discussed in detail. Bacterial activity is very strong on the soil surface and on the soil-bedrock boundary, therefore these zones should be further studied. The measurement data show that the pH and moisture content of the soil are the highest and bacterial activity is most intensive on the southern slopes of dolines. The results stress the need of further investigation on the ecological regulation of karst development.

INTRODUCTION

The karstic ecosystem involves several components: the atmosphere, the karst vegetation close to the soil surface, the karstic soil with its specific microflora and fauna, the products of rock weathering, the rock basement, the hydrological conditions, the caves and the karst springs.

The ecosystems developed in limestone areas are as varied as the limestone landscapes themselves, as they are both influenced by climatic and historical factors, and lately by human impact.

The ecosystems on limestone depend upon the type of soils. Soils on limestone are thin, rich in calcium and show a high pH value when formed directly from the base rock. Where allochtonous material is present, acidic soils rich in organic matter are found (Trudgill, S.T. 1976).

Several detailed studies have been made upon ecosystems. According to Viles (1988) ecosystems are divided into three categories: ecosystem upon subaerial limestone surfaces, ecosystems on soil-covered limestone surfaces and ecosystems within cave systems.

Many karst areas present complex patterns of bare and covered rock surfaces, forming a well-linked ecosystem also with an underground component.

DISCUSSION

The flows of energy and of dissolved compounds from the surface to the soil-rock boundary represent a two-way process. The equilibrum of the karst processes is ensured by interaction of spheres lying side by side in this system. From the soil-bedrock boundary the processes have only one direction. The quality of saturating water cannot be changed in the rock body *(Fig. 1)*.

Since the nature of karst corrosion is basically biogenic, the ecological investigations have to play an essential part in karst morphology. The influence of the macro- and microflora and -fauna is more expressed on the karst than on any other surface. Among the ecological factors the anthropogenic effects are of greater significance on the karst area than other ones because the karst is an open system, where – owing to human activity – the environmental factors change rapidly.

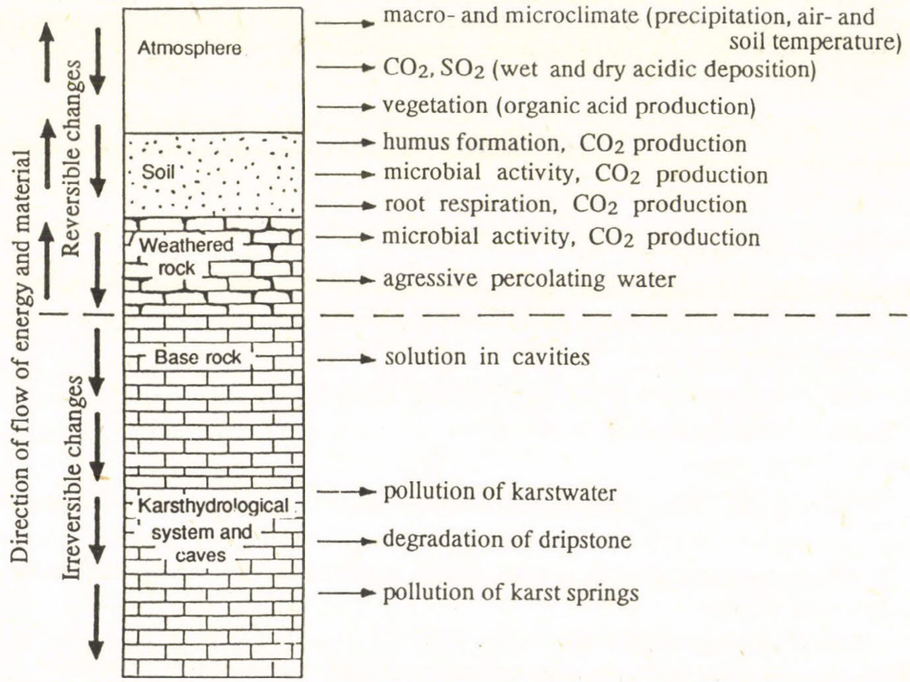

Fig. 1. Scheme of a karst ecological system

The paper presents some of the recent data and results on the ecological factors, especially in relation to the formation of solution dolines.

One of the most important ecological factors of karst processes is climate. Among the climatic factors rainfall and temperature could be of the strongest influence on the intensity of karst processes. The microclimate controls micro-scale karst processes such as the development of solution forms. Differences in microclimate could result in the asimmetry of solution dolines.

The range of temperature in dolines shows rather extreme values. The extreme values of temperature of karstic soil differ considerably on various slopes and at various levels of soils (Bárány, I. 1985).

In a 0.5–1.0 m deep soil zone the microbial activity results in a remarkable production of carbon-dioxide. On the boundary between soil and rock an increased bacterial activity could be observed *(Table 1)*. Our previous investigations on surface conditions in dolines suggest that the bacterial activity is most important on the soil surface and on the soil-rock boundary. Futher investigations should focus on these zones (Bárány-Kevei, I. and Mezősi, G. 1991).

Table 1. Numbers of aerobic and anaerobic bacteria in soil samples from doline

Depth (m)	Aerob 10^6/g soil	Anaerob 10^3/g soil
0.2	2.1	7.0
0.5	1.2	10.5
1.0	0.2	5.0
1.5	0.08	1.2
2.0	0.002	—
2.5	0.008	0.05
3.0	0.023	0.05
3.5	0.006	0.25
4.0	0.194	0.55
4.5	0.06	0.60
5.0	0.06	0.60
5.5	0.133	0.30
6.0	0.53	0.30
6.5	0.126	0.05
7.0	0.001	0.20
Rock boundary	0.256	0.30
Disintegrated rock	1.04	8.50
Rock surface	3.86	2300.00

The number of bacteria is srongly influenced by the moisture, the pH value and the cohesion of the soil. Our measurements data show that the pH and the moisture content of the soil are the highest and the bacterial activity is the most intensive on the southern slope. On the western slope the lower moisture and the microclimatic conditions reduce the multiplication capacity of the bacterial population.

Soil microclimate (temperature and moisture) determines the activity of soil microorganisms as well as the composition of flora. The latter influences the physical and chemical characters of the soil.

As an example, the chemical composition of soils derived from various slopes of grassy and afforested dolines were investigated, with measurements of the amounts of water-soluble cations and anions in various soils (Bárány, I. 1980).

Our results stress the necessity for analyses of ecological factors in the development of karsts.

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THE SOIL EFFECT IN KARST CORROSION

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ABSTRACT

In most cases karstification, including the formation of surface and underground karst features through the interaction of carbonaceous rocks and water, takes place through the medium of soils on the rock surface or in cracks or under redeposited soil mantle. Consequently, soil properties affect karstification and occasionally control its entire dynamics, while in other cases only modify the physical and chemical conditions of infiltration.

The lime solution (or corrosion) capacity of infiltrating water, characteristic of the soil itself, is formed by several processes. The limestone solution capacity (corrosion capacity) can also describe the soil, when it is expressed in relation to the amount of infiltrated water: this figure is normally much higher than that of the solution capacity of rainwater. In order to be able to compare the rainwater and the water migrating in the soil, rainwater samples were also regularly collected during the observations; they were uniformly analysed and their aggressive CO_2 content was calculated; their lime solution capacity was then defined.

INTRODUCTION

Today it is accepted that the soil which mantles the karstifying rock, even if as a thin veneer, plays a direct role on the surface or subsurface and also an indirect role in deep karst formation.

In the soil the influence of several components of the geographical environment (atmosphere, hydrosphere, biosphere and lithosphere) are manifested in a complex manner. These influences are not merely juxtaposed, but appear in interactions to form an independent factor, where soil covers the surface of karstifying rock. This impact is not present in all karstic processes; e.g. it is absent in the solution processes of open karsts in an absolute sense. However, it is present in most karst types, for covered and partially covered karsts or even for parts of open karsts where cracks and depressions are mantled by patches of soil — even if only a small portion of the surface is affected. They have an even more important role in marking sites where corrosion is most intensive, leading to a morphological differentiation of the surface.

The net influence of soil on karst corrosion can only be measured as solution aggressivity per unit rock surface. An attempt was made to express soil impact in the grades of lime solution capacity of percolating water, acquired in the soil.

The hypothesis that the soil cover has an impact on karstic morphogenesis was checked with the comparison of the corrosion effect of various soils and soil accumulation under different physical geographical conditions, with the annual repetition of measurements and with the comparison of corrosion values of various rock surfaces that were not covered with soil and were in similar position, exclusively under atmospheric effects.

With the definition of subsoil *corrosion capacity,* developed as a combined result of several soil phenomena, an important term was gained that can be numerically expressed and compared on various types of karsts.

The joint effect of all pedological factors affecting the karst corrosion capacity of infiltrating water is called *soil effect.* A joint impact of several soil processes, corrosion capacity under the soil can be grasped through certain parameters.

The validity of results in this topic is delimited by the well-known laws of *climatic karst morphology,* as formulated by Priesnitz, K. (1968): "There is variation, combination and compensation between the factors of karstification. The delimitation of climatic karst provinces is only possible through the efficiency analysis and consideration of the individual factors."

THE PARAMETERS OF SOIL EFFECT

Soil temperature

Corrosion in and under the soil depends — through a chain of reactions — on the temperature conditions of the immediate environment. Temperature is among the most important physical factors of solution. Temperature directly affects the lime solution capacity of water, the absorption of CO_2 in water and the rate of solution reactions. Since the formulation of Henry's law, these processes are well-known from many laboratory and field measurements, soil climate analyses and calculations. The solubility of gases (including CO_2) increases with growing pressure and decreases with rising temperature, as the presence of dissolved electrolytes and of some organic matter hinders solution. Many investigations tabulated karst corrosion plotted against temperature and its overvaluation led to erroneous conclusions.

The indirect impact of temperature on solution capacity is manifested in two phenomena: in controlling the rate of weathering and the intensity of biological activity in the soil. Recent geochemical and microbiological papers (Loughman, T.C. 1969; Fehér, D. 1954 etc.) have revealed intricate relationships.

My observations show that only the temperature of the immediate environment of solution has to be considered. The concentration of aggressive materials in percolating waters depends on temperature and varies with depth and only the temperature at the contact is influential in solution. The role of the broader environs is defined by Jakucs, L. (1971), who emphasized the temperature of the solution microspace. Indirectly, temperature figures of the macro- and microclimate are more important, as the amount of aggressive materials on the spot of solution depends on their production in and transport from the broader environs.

1–3 °C differences are observed in simultaneously measured temperatures, resulting from topographic and pedological endowments. These deviations are only important in corrosion under soil if important limits of soil biological activity are very close to them and thus they influence CO_2 production. For instance, the freezing of the whole profile lasting for weeks is reflected in the extremely low average winter solution capacities.

Soil water budget

The amount of water reaching the site of solution depends on the water budget and depth of soils mantling the karst. In addition to quantitative aspects, water budget properties play an important part in the circumstance that how long and over how large a surface seepage water is in contact with the materials of the environment; both the rate and surface of reaction depend on the above properties.

The knowledge of the amount of infiltrated water is indispensable for the determination of the rate of corrosion and for the calculation of local solutional form development. Adjusted to academic and practical demand, numerous measurement and calculation methods have been elaborated.

On slopes, infiltration, the fundamental element of any surface karst form, is controlled by soil cover. In addition to the properties of terra rossa soils, infiltration on slopes is also influenced — as indicated by our investigations — by inclination and subordinately by slope morphology. However, all these effects are manifested in the properties of soil cover and influence the calcareous basement indirectly. Observation sites were identified in order to measure the processes of the widest spread karst slope forms. Data were gathered for a karst plateau, convex steep slope segment and doline margin *(Fig. 1)*. The typical average values of infiltration on the slope sections studied are interpreted to include the infiltrating portion of precipitation reaching the surface in that point together with the amount of water percolating in the direction of slope which reaches the bedrock in the point in question. As a consequence, moving downslope the infiltrating portion of precipitation increases as large amounts of wate· .re involved in throughflow. Expressed in percentages, infiltration corresponds to th· ;mpirical figures for each slope segment and thus can be used for calculation, b· ıt does not derive exclusively from precipitation at the given site.

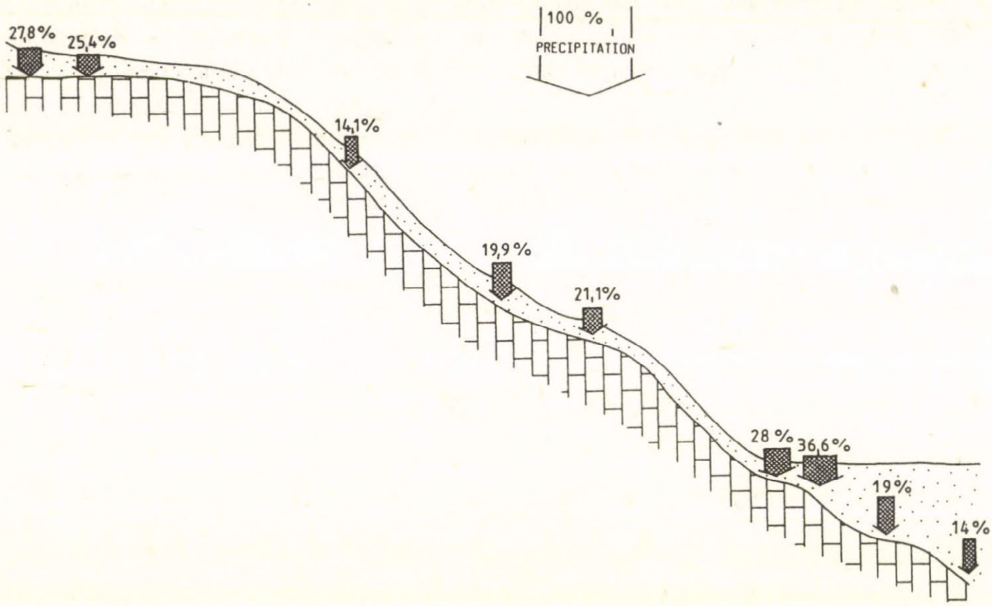

Fig. 1A. Percolation conditions of the karst slopes

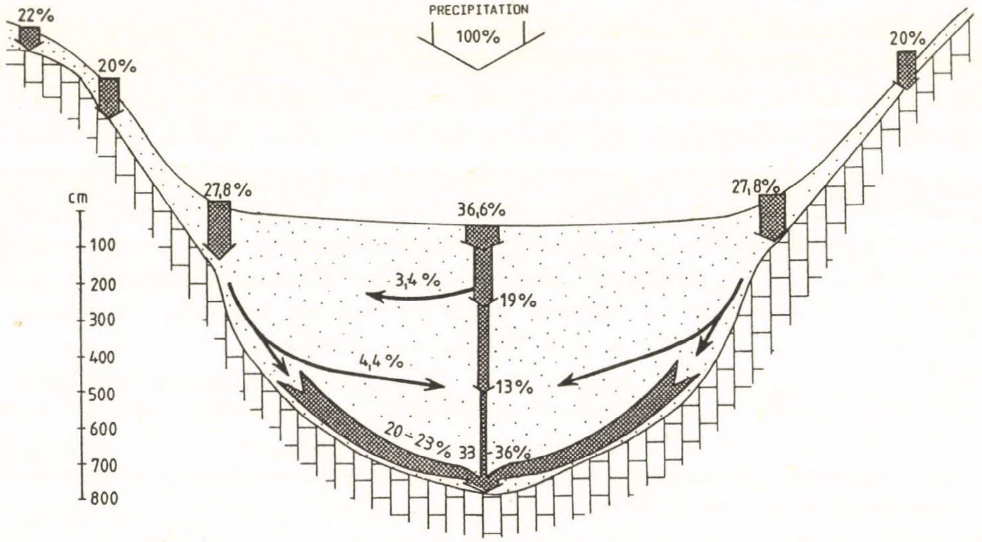

Fig. 1B. Percolation conditions of doline fills

The typical infiltration values of doline slopes and soil fills are shown — relying on 497 measurements — in *Fig. 1*. The typical infiltration calculated from annual precipitation over the doline slopes also includes the part infiltrated from throughflow into the limestone body. In the larger amounts of precipitation along the margins of doline fill, throughflow from higher slopes is also manifested. Over an almost flat surface of doline fill the infiltrating portion also includes water from overland flow. The decreasing amounts of infiltrating water in the lower layers of the fill show water storage in pores as well as throughflow. A considerable part of the high amounts of water infiltrating on the doline floor arrives here by means of throughflow, while a smaller portion comes from vertical percolation. The empirical infiltration model also shows the generalized inner hydrography of the doline.

CO_2 production

Oxidisation and microbial life quickly consume O_2 and the CO_2 content of soil pores increases. In the upper horizons the CO_2 is released by root respiration and produced by aerobic bacteria; in the deeper zones the temporal activity of aerobic microflora is accompanied by the CO_2 produced continuously by anaerobic microorganisms and fermentation processes.

The actual CO_2 concentration of the soil depends — in addition to CO_2 production — on the diffusion of CO_2 into the atmosphere. Also by diffusion CO_2 migrates between soil horizons and accumulation layers. A balance is seldom stricken as recharge in the active horizons of CO_2 production keeps pace with CO_2 diffusion when suitable conditions exist. The velocity of molecular diffusivity can be calculated from the Einstein-Stokes equation:

$$D = kT/\rho$$

where $k = 1.38 \times 10^{-23}$ joule K^{-1} = (Boltzmann constant)

ρ = molecular radius

Velocity is proportionate to T temperature.

The maintenance of the balance between CO_2 dissolved in water (as H_2CO_3) and the atmospheric CO_2 content necessitates continuous CO_2 diffusion between the soil solution and the air, since infiltrating water finds ever changing conditions when moving downward. In the wandering of CO_2 the changes are factors influencing aggressivity. This supports the fundamental concept of the paper that the soil and its inner condition, soil dynamic processes shape the limestone basement through controlling the CO_2 content of the soil solution (its solution capacity).

The total CO_2 of a soil solution exists in three distinct forms. Dependent on the degree of contact and the conditions of solution, $CaCO_3$ affected by carbonate acidic water dissolves and in the form of fixed CO_2 (as $Ca/HCO_3/_2$) forms part of the CO_2 content of water. The remnant CO_2 in water as free CO_2, partly serves to keep fixed CO_2 in solution as balance CO_2 coexisting in water is not tackled here. Analyses were made on the basis of 1205 data from the soil profiles at the observation sites of the dissolved CO_2 forms. The averages of the large number of measurements reflect great diversity for the soil profiles and accumulations. From the average distribution of the CO_2 forms in the whole soil mantle — 2,54 mmol per liter total CO_2, 0.7 mmol per liter fixed CO_2 and 1.32 mmol per liter aggressive CO_2 — the proportions in the individual soil horizons are markedly different and reflect soil properties concerning solution.

A part of CO_2 production, which plays a major role in the changes of solution capacity, is certainly the result of the oxidation-reduction of organic matter, because the amount of CO_2 content in the deeper zones, with no roots and with poor ventilation, is significant; further, its quantitative changes and periodicity cannot be attributed to the diffusion of CO_2 gas, but rather to the activity of soil microorganisms.

The most intensive activity of aerobic bacteria was observed at the 0.5–0.8 m level of the accumulation; it suddenly decreased at 0.8 m and remained low down to 3–5 m depth. Below the activity of bacteria grew again — with a few exceptions — down to 7 m, where it reached a secondary maximum close by the limestone.

The activity of anaerobic bacteria showed similar characteristics, although it was very intensive at the top level and was almost uniform down to the limestone, where the activity suddenly grew and reached a maximum in the profile. The latter is clearly expressed with the ratio of the number of aerobic bacteria to anaerobic ones; this value fell to 1.6 at the contact with the limestone.

Limestone solution capacity in the soil

The lime solution (or corrosion) capacity of infiltrating water, characteristic of the soil itself, is formed by several soil processes. The limestone solution capacity (corrosion capacity) can also describe the soil, when it is expressed in relation to the amount of infiltrated water: this figure is normally much higher than that of the solution capacity of rainwater. In order to be able to compare rainwater and percolating water, rainwater samples were also regularly collected during the observations; they were uniformly analyzed and their aggressive CO_2 content was calculated; their lime solution capacity was defined. The analyses produced the following figures for the research field (partial data are neglected):

average aggressive CO_2 content of rainwater: 0.278 mmol/l

average aggressive CO_2 content of infiltrated water before lime solution: 2.192 mmol/l

ratio of these two characteristic data: 7.5

The limestone solution capacity is defined as the aggressivity calculated for an area unit, where the amount of water involved in solution is also considered. (This amount is formed by the part of rainwater that contacts the limestone: the quantity of effective precipitation, or the infiltrated water that reaches the limestone.) The effective quantity of precipitation over the research field can only be estimated due to the lack of extensive rock surfaces that are not covered with soils at all; this figure is put to 30%. (Only a part of runoff water comes in contact with the limestone surface at molecular level and can express its aggressivity.) This is equal to 200 l/m^2/year, which — expressed in limestone solution capacity — is 5.5 g/m^2/year.

The average limestone solution capacity of water in the soil before solution (from total data) is 26.65 g/m^2/year. The ratio of these two basic data is 4.84.

The value of solution in and under the soil may be normally 5 times higher than the corrosion of free rock surface *(Fig. 2)*.

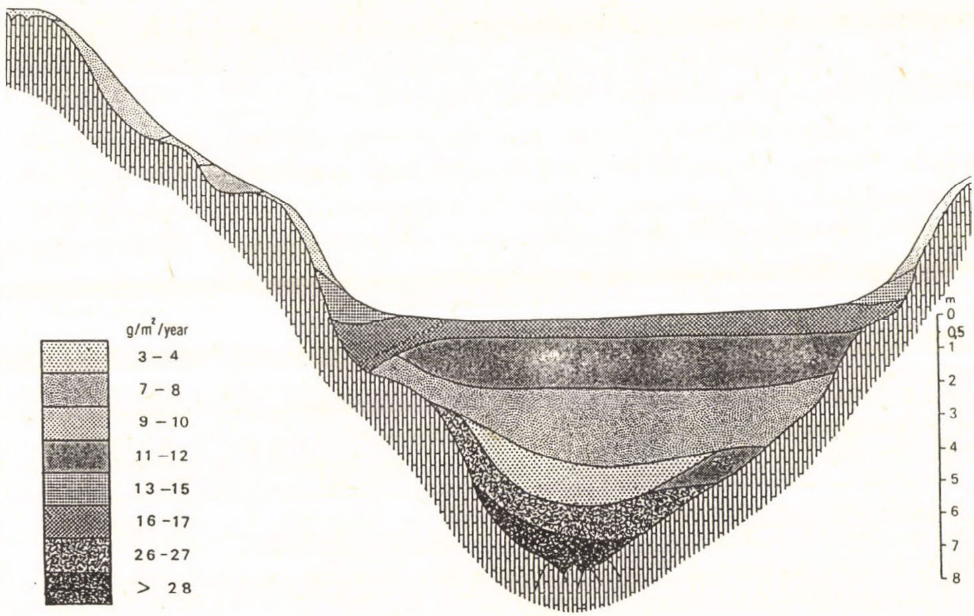

Fig. 2. Corrosion in slope and doline soils

Seasonal changes in the potential limestone solution capacity

Seasonal changes demonstrate the following:

1. Limestone solution under thin soils shows a seasonality. Its maximum values are typical after snow melting and in summer, and a secondary maximum appears in early winter.

2. The solution capacity in the upper layers of thick soil accumulations is often different from year to year, and the seasonality is only evident in the top zone. The changes in the solution capacity of the middle zone show special characteristics and there are no seasonal regularities. The solution processes in the lowest zone are valid for the whole year and periodical changes are not regular.

CONCLUSION

As the amount of water present at the site of solution depends both on soil properties and precipitation, there is no unambiguous relationship between the seasonal amount of precipitation and the rate of solution; there might exist close, medium or poor (positive or negative) correlation between them.

Consequently, without other information the amount of precipitation in itself is not suitable to characterize the intensity of karst corrosion.

The investigations described above demonstrate that soil impact is a major factor in karstic development and in karst morphogenesis; the quantitative expression of soil effect may lead to a new and comprehensive explanation of phenomena over karstlands.

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PHYSICAL AND CHEMICAL ASPECTS OF HYDRO-DYNAMICS OF SOME KARSTIC PROCESSES

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ABSTRACT

Karstic erosion is a process, which takes place on rock surfaces. The dissolution process can be described by a differential equation, e.g. the equation by Rickard, D. – Sjöberg, E.L. (1983 a. b.) and Dubljanskij (1987). Models have been set up for the development of different karstic forms. We think the dissolution of fragments make the dolinas larger and the growing and fusing spherical cavities produce caves inside the limestone. The two spherical symmetrical solving of the differential equation makes it possible to calculate the dissolution process of dolinas and the growth of caves of solutional origin.

INTRODUCTION

In our present knowledge, karstic erosion takes place in two separate zones the upper boundary of which is defined by the karstic relief and the karst water table (Bögli, A. 1963; Jakucs, L. 1971). Karstic dissolution is a surface process either in the case of surface or underground karstification (Zámbó, L. 1987).

Considering the above, models for karst dynamics are proposed. By their means, the rate of karst evolution as well as any past or future condition of different karst regions can be estimated.

DISCUSSION

Dynamics of karstification

a) Surface karstification: Dolines are the most favourable spots for karstic erosion in the temperate belt. Under their thick soil fill there is a clastic zone and an uneven bedrock surface with solution fissures (Zámbó, L. 1987). Outside the temperate belt, besides the dolines and fissures, shafts can occur or even dominate (e.g. alpine karstification).

In the case of dolines erosion proceeds by the dissolution of the fragments of the clastic zone (dolines deepen) while in the fissures and shafts dissolution takes place on the walls. In the former case the karst region lowers (horizontal karstification) and in the latter case it is dissected (vertical karstification).

– Horizontal karstification:

The existence of the clastic zone proves the reproduction of debris (Veress, M. – Péntek, K. 1990). The above process is possible when — after the total dissolution of fragments — the saturation point sinks and the fissures in the bedrock widen and clast is produced continuously.

– Vertical karstification:

When clast is not produced during the evolution of the fissures, clefts and shafts are formed. Evolution of such features is determined by the conditions due to the water film flowing down on the bordering walls.

b) Underground karstification: Infiltrating waters in the karst are already saturated when reaching the level of solutional caves. Thus these karst formations develop in the phreatic zone through mixed corrosion (Bögli, A. 1963). The above process produces spherical cavities which fuse as they grow.

Our experiences show that corrosion caves are formed totally or partly from spherical cavities.

The karstification can be described by Rickard, D. and Sjöberg, E.L. (1983a, 1983b) and by J.V. Dubljanskij's differential equation (1987). The application of the equation to vertical karstification still is in progress.

Equation of the dissolution

When examining the corrosion of limestone, let us start from the supposition that an infiltrating solvent of **v** speed contacts a momentary **S** surface of the limestone. We suppose that the dissolution which is the result of the contact of the rock and water is quasi-stationary depending on the water supply, the flow is laminar and the process is in thermal equilibrium with the environment. Under these conditions a differential equation of the dissolution process can be established.

The corrosion process has the following stages:

chemical dissolution → diffusion of the dissolved material in the boundary zone → transport of the solutes.

The chemical process is defined by the

$$/1/ \quad \frac{dm}{dt}\Big|_K = k_K \cdot S \cdot (C_e - C_s)$$

equation, where

$m\ [kg]$ is the evacuated mass from the activated surface of the limestone,

$k_K\ [\frac{m}{s}]$ speed of chemical dissolution,

$S\ [m^2]$ surface of contact of the limestone and water,

$C_e\ [\frac{kg}{m^3}]$ saturation concentration of the dissolved limestone,

$C_s\ [\frac{(kg}{m^{3)}}]$ concentration of limestone at the surface of the rock.

Diffusion in the boundary zone is described by the formula

$$/2/ \quad \frac{dm}{dt}\Big|_T = k_T \cdot S \cdot (C_e - C_i)$$

where

$k_T\ [\frac{m}{s}]$ is the speed of material transport in the boundary zone,

$C_i\ [\frac{kg}{m^3}]$ initial limestone concentration of the incoming water.

The process is stationary, therefore

$$/3/\quad \frac{dm}{dt}\Big|_K = \frac{dm}{dt}\Big|_T$$

from which after simple transformation

$$/4/\quad \frac{dm}{dt} = \frac{k_K \cdot k_T}{k_K + k_T} \cdot S \cdot (C_e - C_i)$$

follows, which gives general equation of the dissolutional speed (Rickard, D.– Sjöberg, E.L.1983a, 1983b; Dubljanskij, J.V. 1987).

Spherical symmetric solutions

The two spherical symmetric solutions of the general equation:

a) Dissolution of spherical clast: Let us use equation /4/ in the case when on a karstic relief at x[m] depth from the upper boundary of the dissolving zone an ideal spherical limestone clast of R_o[m] initial radius is surrounded by the infiltrating solution. Let us determine the R radius of the dissolving clast as the function of time if we suppose that C_i concentration of the infiltrating water as the function of x depth from the upper boundary of the dissolving zone is

$$/5/\quad C_i = C_e \cdot (1 - e^{-\lambda x})$$

where λ is a constant characteristic of the given structure and determines the saturation rate of the downwards moving solution.

If ρ $[\frac{kg}{m^3}]$ is the density of limestone and dR is the change of radius for the clast during dt time, then

$$/6/\quad \frac{dm}{dt} = -\rho \cdot S \cdot \frac{dR}{dt}$$

follows, by the use of which equation /4/ can be written in

$$/7/\quad \frac{dR}{dt} = -\frac{k_K \cdot k_T}{k_K + k_T} \cdot \frac{C_e - C_i}{\rho}$$

form. In respect of the speed of transport in the boundary zone

$$/8/ \quad k_T = \frac{85}{5} \cdot \frac{1}{d} \cdot \sqrt[3]{D^2 \cdot \nu}$$

holds (Dubljanskij, J. V. 1987), where

$d\,[m]$ is a characteristic measure of the flow system (here the diameter of the clast, d=2R),

$D\,[\frac{m^2}{s}]$ diffusion constant,

$\nu\,[\frac{m^2}{s}]$ kinematic viscosity coefficient of the flowing solution.

Whereas the radius of the clast decreases during dissolution, thus from /7/ and /5/

$$/9/ \quad \frac{dR}{dt} = -\frac{k_K \cdot k_T}{k_K + k_T} \cdot \frac{C_e}{\rho} \cdot e^{-\lambda x}$$

is obtained from which by using /8/

$$/10/ \quad \frac{dt}{dR} = -\frac{\rho}{C_e} \cdot e^{\lambda x} \cdot [\frac{1}{k_K} + \frac{16}{85} \cdot \frac{R}{\sqrt[3]{D^2 \cdot \nu}}]$$

results after the integration of which

$$/11/ \quad t = \frac{\rho}{C_e} \cdot e^{\lambda x} \cdot [\frac{R_o - R}{k_K} + \frac{8}{85} \cdot \frac{R_o^2 - R^2}{\sqrt[3]{D^2 \cdot \nu}}]$$

follows with the initial conditions t=0, $R=R_o$. According to /11/ the total dissolution of the clast takes the time

$$/12/ \quad t_o = \frac{\rho}{C_e} \cdot e^{\lambda x} \cdot [\frac{R_o}{k_K} + \frac{8}{85} \cdot \frac{R_o^2}{\sqrt[3]{D^2 \cdot \nu}}]$$

b) Dissolution of spherical cavities: Let us apply equation /4/ in the case when the solvent arrives by a conduit to a proper point of the rock where the development of a spherical cavity begins. Let us determine radius R of the dissolving cavity as the function of t time.

By using /8/, /4/ can be transformed into the form

$$/13/ \quad \frac{dt}{dR} = \frac{\rho}{C_e - C_i} \cdot [\frac{1}{k_K} + \frac{16}{85} \cdot \frac{R}{\sqrt[3]{D^2 \cdot \nu}}]$$

from which after integration

$$/14/ \quad t = \frac{\rho}{C_e - C_i} \cdot [\frac{R - R_o}{k_K} + \frac{8}{85} \cdot \frac{R^2 - R_o^2}{\sqrt[3]{D^2 \cdot \nu}}]$$

yields with the initial conditions t=0, $R=R_o$.

With close approximation /14/ can be transformed into the simpler

$$/15/ \quad t = \frac{8 \cdot \rho}{85 \cdot (C_e - C_i) \cdot \sqrt[3]{D^2 \cdot \nu}} \cdot R^2$$

form in the case of $R_o \approx 0$ when the age of the spherical cavity is already some years and thus in /14/ the first member in the brackets is negligible compared to the second member.

Formulas used for the calculations

For determining the rate of karstic corrosion the following semi-empiric formulas can be applied after Rickard, D. – Sjöberg, E.L. (1983a, 1983b); Dubljanskij, J.V. (1987):

$$/16/ \quad C_e = A_c \cdot T + B_c$$

where $A_c = 7.58 \frac{kg}{m^3\,{}^oK}$, $B_c = 3.92 \frac{kg}{m^3}$

$$/17/ \quad k_K = A_K \cdot e^{-\frac{E_K}{R' \cdot T}}$$

here $A_K = 5.36 \cdot 10^5 \frac{m}{s}$, $E_K = 5.41 \cdot 10^4 \frac{J}{mol}$, $R' = 8.314 \frac{J}{mol\,^oK}$

/18/ $D = A_D \cdot e^{-\frac{E_D}{R' \cdot T}}$

where $A_D = 2.37 \cdot 10^{-3} \frac{m^2}{s}$, $E_D = 3.72 \cdot 10^4 \frac{J}{mol}$

/19/ $\nu = A_\nu \cdot e^{-\frac{E_\nu}{R' \cdot T}}$

where $A_\nu = 2.59 \cdot 10^{-9} \frac{m^2}{s}$, $E_\nu = 1.46 \cdot 10^4 \frac{J}{mol}$

and $\rho = 2700 \frac{kg}{m^3}$ is the density of the limestone. /17/, /18/, /19/ are the Arrhenius equations, R' is the universal gas constant, E_K, E_D and E_ν are the virtual empirical activation energy which characterizes the chemical solution, diffusion and viscosity according to Rickard, D. – Sjöberg, E.L. (1983a, 1983b).

T is the absolute temperature which is 333 ^oK in the case of hydrothermal spherical cavities and ca. 281 ^oK in the case of cold-water spherical cavities or fragments of the dissolving zone.

With the help of the above data, /11/ and /14/ formulas definite calculations can be performed by which certain processes can be analysed.

Applications

a) Denudation of karstic reliefs: Let us suppose that the limestone of the studied karstic relief is cracked and the crack net divides the bedrock surface into approximately identical cubes (length of cube edge=a). This is a simplification of the true situation because the fault planes are only subperpendicular and the parallel fault planes are not necessarily evenly spaced (*Fig. 1a*). These ideal cuboid fragments are rounded off during solution and the developed spheres continue to dissolve. After simple consideration, if the concentration of the infiltrating water follows rule /5/, the sizes of the clast spheres increase downwards from the upper boundary of the solution zone and finally reach the state of "closed cubic filling" (*Fig. 1b*).

Counting from the beginning of the solution process the complete dissolution of

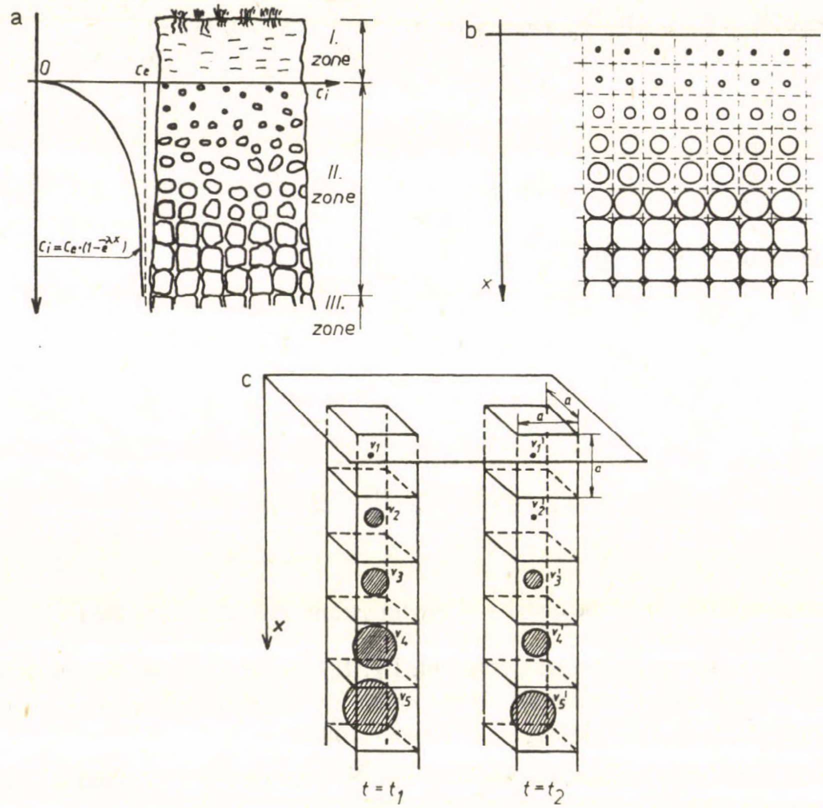

Fig. 1. Zones developed by karstic denudation. a = $C_i = C_i(x)$ function; b = geometric model of the dissolutional zone; c = state of a spherical column in the solution zone at dates t_1 and t_2

the uppermost sphere zone, according to formula /12/, takes — with the substitution of $R_o = \frac{a}{2}$ and $x = \frac{a}{2}$ — the time

$$/20/ \quad t_1 = \frac{\rho}{C_e} \cdot e^{\frac{1}{2}\lambda a} \cdot \left[\frac{a}{2 \cdot k_K} + \frac{2a^2}{85 \cdot \sqrt[3]{D^2 \cdot \nu}}\right]$$

while counting from the beginning of the process the complete dissolution of the second sphere zone, also according to /12/, takes with the substitution of $R_o = \frac{a}{2}$ and $x = \frac{3}{2}a$

/21/ $t_2 = \frac{\rho}{C_e} \cdot e^{\frac{3}{2}\lambda a} \cdot [\frac{a}{2 \cdot k_K} + \frac{2a^2}{85 \cdot \sqrt[3]{D^2 \cdot \nu}}]$

time.

It can be easily seen that during $\Delta t = t_2 - t_1$ time the upper boundary of the dissolutional zone and thus the karstic surface lowers in proportion to the material that leaves an optionally exploited sphere column (*Fig. 1c*).

The ΔV volume dissolved equals exactly the volume of a sphere of **a** diameter, that is

/22/ $\Delta V = \frac{\pi}{6} a^3$

from which, by using /20/ and /21/, the average intensity of dissolution is obtained.

/23/ $\bar{I} = \frac{\Delta V}{\Delta t} = \frac{\pi a^3}{6} \cdot \frac{C_e}{\rho} \cdot (e^{\frac{3}{2}\lambda a} - e^{\frac{1}{2}\lambda a})^{-1} \cdot (\frac{a}{2 \cdot k_K} + \frac{2a^2}{85 \cdot \sqrt[3]{D^2 \nu}})^{-1}$

If the lowering of the karstic relief is ΔX during $\Delta t = t_2 - t_1$ time, by using $\Delta V = a^2 \Delta X$ the average rate of sinking of the surface, according to /23/, is

/24/ $\bar{v} = \frac{\Delta X}{\Delta t} = \frac{\pi a}{6} \cdot \frac{C_e}{\rho} \cdot (e^{\frac{3}{2}\lambda a} - e^{\frac{1}{2}\lambda a})^{-1} \cdot (\frac{a}{2 \cdot k_K} + \frac{2a^2}{85 \cdot \sqrt[3]{D^2 \nu}})^{-1}$

This rate of lowering requires a continuous solution. It reflects the true situation better if we determine a η proportion factor ($0 \leq \eta \leq 1$) at a given place. If the solution zone of the examined karst region is supplied with infiltrating water, for example for t_o time (over T_o time e.g. one year), the

factor is interpreted as

/25/ $\eta = \frac{t_o}{T_o}$

With the help of /24/ and /25/, the actual v_2 rate of relief lowering is

/26/ $v_\eta = \eta \cdot \bar{v}$

Knowing parameters a, λ, η the actual rate of lowering can be determined from the formulas /24/, /25/, /26/.

Formula /26/ is suitable for the determination of the age of a karstic doline as well. If a doline is h deep, its bottom sinks at v_1 and its surroundings at v_2 speed the actual development takes

$$/27/ \quad t = \frac{h}{v_1 - v_2}$$

time, while the part of the previously plain relief forming the doline lowers $h_1 = v_1 \cdot t$ value, the part forming the surroundings sinks $h_2 = v_2 \cdot t$ and $h = h_1 - h_2$

b) Dissolution history of corrosion caverns: If the sequence of the development and fusion of the spherical cavities in a cave can be determined, the sequence of the development of the different parts of the cave can also be reconstructed if they developed from spherical cavities (Veress, M. et al. 1991) *(Figs. 2 and 3).*

If the radius of a spherical cavity is known, its age can be determined (the time of the active period, that is until the formation rises above the karst water table). For the determination of the age one has to know the concentration of the forming solution. Without knowing the above (caves are already located above the karst water table) the relative age of development can be determined in the following way.

Our experience makes us suppose that the intensities of the infiltrating solutions are negligible compared to the intensity of horizontally flowing water in the phreatic zone. After simple considerations the dissolved $CaCO_3$ concentration of the solution can be regarded constant in the flow system. From the above and formula /15/ and considering the ages and the radii of two spherical cavities (denoted by i and j) in a horizontal flow system

$$/28/ \quad \frac{t_i}{t_j} = \frac{R_i^2}{R_j^2}$$

is always true.

If a spherical cavity (e.g. j) is considered the unit age of development the relative (to j) developmental age of any of the spherical cavities on the same level of a given cave can be determined by the formula /28/ after the substitution $t_j = 1$.

The relative age of development can be given only in the case of spherical cavities which were formed in the same plane because the inactivation of the spherical cavities of different localisation is not simultaneous.

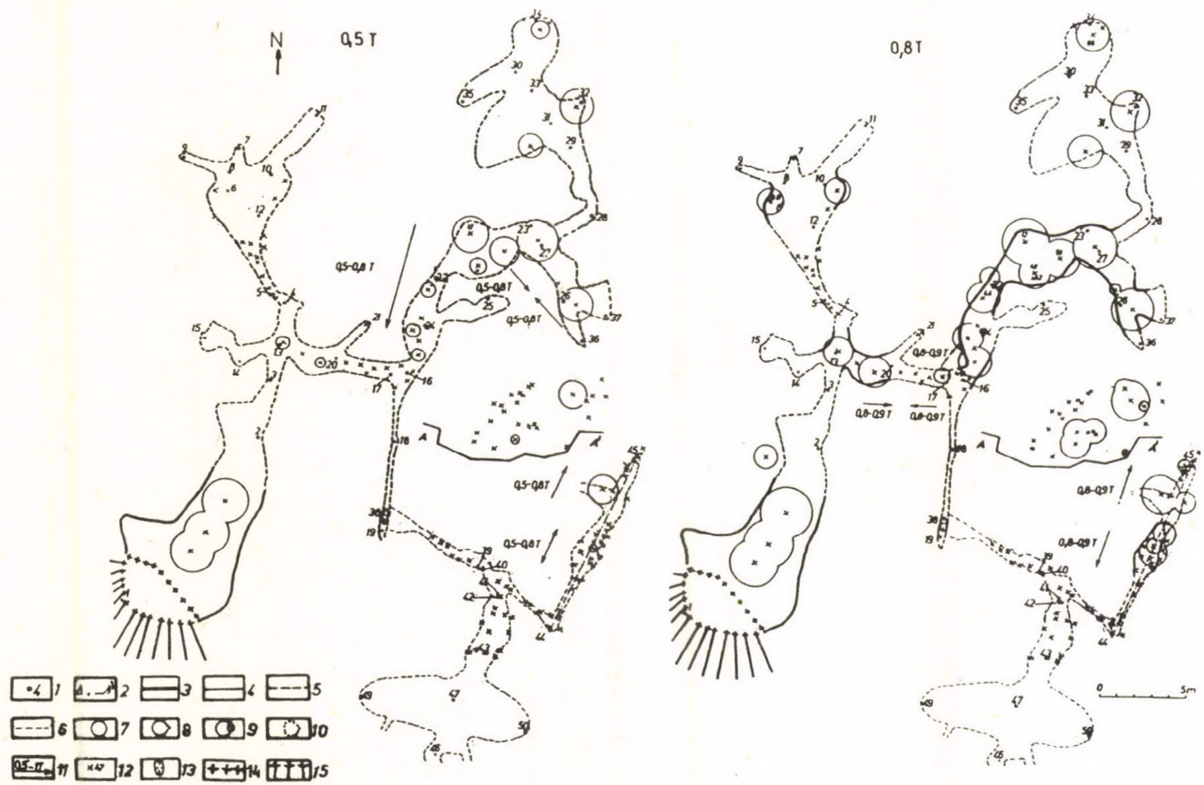

Fig. 2. Dissolutional conditions of a cave (Ördög-lik) in Bakony-Mountains at 0,5 and 0,8 T relative age (after Veress, M. – Péntek, K. – Horváth, E.T. 1991.). 1 = survey point; 2 = side-view; 3 = developed cave section (upper level); 4 = developed cave section (lower level); 5 = cave section yet undeveloped or of unknown age (upper level); 6 = cave section yet undeveloped or of unknown age (lower level); 7 = spherical cavity; 8 = fused spherical cavities; 9 = non-touching spherical cavities in different planes; 10 = overlapping spherical cavities; 11 = direction of spherical cavity development at different phases of the relative ages (according to the relative age since the beginning of the evolution); 12 = spherical cavity center and reference number; 13 = passage to the lower level; 14 = rain line; 15 = valley slope. Comment: - Unknown period of time has passed between the development of the two levels. Spherical cavity centers between points 44 and 45 projected into A-A' section in the side-view. 47 is the spherical cavity of the unit age of development.

Fig. 3. Dissolutional conditions of a cave (Ördög-lik) in Bakony-Mountains at 1,0 T relative developmental age (after Veress, M. – Péntek, K. – Horváth, E.T. 1991). 1 = survey point; 2 = side-view; 3 = developed cave section (upper level); 4 = developed cave section (lower level); 5 = spherical cavity; 6 = fused spherical cavity; 7 = non-touching spherical cavities in different planes; 8 = overlapping spherical cavities; 9 = direction of spherical cavity development at different phases of the relative ages (according to the relative age of the beginning of the evolution); 10 = spherical cavity center and reference number; 11 = passage to the lower level; 12 = rain line; 13 = valley slope. Comment: see *Fig. 2*.

The relative age of a spherical cavity can be determined at any stage of its evolution by /28/, radius from

$$/29/ \quad R = \sqrt{\frac{t_1 - \Delta t}{t_1}} \cdot R_1$$

where t_1 is the relative age of the given spherical cavity, $\Delta t(<t_1)$ optional period of time, R_1 is the actual radius and R is the radius Δt earlier.

In any phase of the unit developmental age of a cave one can tell whether the fusion of two neighbouring spherical cavities has occured. If (x_1, y_1, z_1) and (x_2, y_2, z_2) are the Cartesian coordinates of the centres of the two and R_1 and R_2 are their radii at the given period of time and

$$/30/ \quad d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

then the two spherical cavities have fused, contact or have not fused according to $R_1 + R_2 > d$, $R_1 + R_2 = d$ or $R_1 + R_2 < d$, respectively.

Knowing the sizes and the fusions of the spherical cavities at given periods of time and representing them by circles, a map can be drawn which shows where and to what extent the fusions occur in the cave. Thus we obtain a map series representing the dissolution history of the cave.

CONCLUSIONS

The equation determining the rate of solution was applied in the case of developing dolines and spherical cavities. In karst regions where dolines are formed (temperate karsts and regions with temperate belt karstification) the followings can be determined by the application of the equation:

- which factors and to what extent are responsible for karstification (besides CO_2 production and dissolution time, the size of the clast, surface i.e. the number of cracks in the rock is also an important factor),
- rate of erosion of the karstic relief (the rate of erosion is linear, localized)
- age of development and characteristics of dolines, but future processes are also predictable (if a, λ, η values are known and constant in the past as well as in the future).

Whereas the evolution of the spherical cavities is less climate-dependent, in a solution cave developed in any karst of the Earth and where spherical cavities occur (knowing their radii) the followings can be examined:

- relative beginning of the development of the different parts of a cave,
- relative age of the different parts,
- the degree of dissolution and fusion can be mapped at different relative ages, the evolution of the studied cave can be represented on map overlays.

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TURNING POINTS OF URBANIZATION IN EAST CENTRAL EUROPE

(Social processes and societal responses in the state socialist systems)

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ABSTRACT

The paper gives a summary of the present state of urban and regional structures in East Central Europe. The author provides an insight to the nature of urban development in the region. The hypothesis is that socialist urbanization does not represent a new model of modern urbanization, but it replicates the stages of a global process. In order to prove this hypothesis, a comparative analysis of urban networks has been made for the East Central European countries plus Austria and Bavaria. On the basis of this analysis the author concludes, that similarities between East Central and West European urbanization are of fundamental significance. These similarities express the general rules of modern urbanization and continuity of European urbanization.

INTRODUCTION

Since 1988 fundamental changes have occured on the political map of Europe. State socialist sytems have disappeared and the eight former European socialist countries have started the process of re-integration into the European socio-economic space. The eight countries are as follows: Albania, Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Rumania and Yugoslavia. Their combined population is 130 million. The GDR was absorbed by the Federal Republic of Germany; as for the rest of the region, the historical division between Central and South Eastern Europe has surfaced once again. The Central European countries (Czechoslovakia, Hungary and Poland) form a distinct group, not just because these countries are more advanced in building democracy and a market economy than the Balkan countries, but because of the different cultural, religious, and institutional traditions of these two groups of countries. This dividing line cuts Yugoslavia into two parts, which partly explains the present internal tensions and disintegration of this country. This paper gives a summary of the present state of urban and regional structures in East Central Europe. I do not intend to describe the mechanism of urban and regional development in the state socialist system; it has already been done.[1] I will instead try to provide answers to the following questions:

1. How has urbanization in a spatial sense (i.e. formation of an urban network) developed during the last 40 years? Did it follow an independent model? Does the urban network present a strange configuration in Europe, or have long-term processes of European urbanization continued somehow even within state socialism?

2. How were societal responses formulated and expressed in 'socialist urbanization'?

SPECIFIC URBANIZATION IN EAST CENTRAL EUROPE[2]

My hypothesis is that *socialist urbanization*, more precisely, the post-World War II urbanization in East Central Europe — *is not a new model of modern urbanization*. It replicates the stages of a global process. These countries have reached different stages of urbanization and have developed special features as they reproduced each stage because of delayed modernization and the state socialist system.

In order to prove this hypothesis, a comparative analysis of urban networks has been made for the East Central European countries *plus* for Austria and Bavaria. The series of maps based on census data for 1910, 1920, 1930, 1938-40, 1950, 1960, 1970 and 1980, include all cities over 50,000 inhabitants. All the population data are relevant to the present cities and present boundaries.

At the beginning of the 20th century, *the core area of urbanization* in East Central Europe consisted of Bohemia, Saxonia and Thüringia (i.e. the southern part of the GDR), and Silesia (now in Poland, but at that time in Germany). It has been a historical centre for urbanization since the Middle Ages. This urbanization was characterized by a dense network of small to medium-size cities. (Prague was also a medium-size city at that time.)

The large cities (over one million inhabitants) — Berlin, Budapest, Vienna and Warsaw — lay outside this area. These large cities had poorly developed urban network in their region. Austria, Hungary and Bavaria had similarities in their urban networks: the capital cities were 'lonely stars' within the national settlement network, lacking secondary urban centres.

[1] Enyedi, Gy. (1987). Regional Development Policy in Hungary. International Social Science Journal. Vol. 39. 2. (112) 255–262.
Szelényi, I. (1983). Urban Inequalities under State Socialism. Oxford: Oxford University Press.

[2] For more detailed explanations see Enyedi, Gy. (1987). Is There a Socialist Urbanization? Discussion Papers, The Wilson Centre, Washington, D.C. (Mimeo)
Enyedi, Gy. (1990). Specific Urbanization in East Central Europe. Geoforum. Vol. 21. 2. 163–172.

In South Eastern Europe, Bucharest was the only sizeable urban centre, and only Rumania had a 'skeleton' of an urban network. In the Balkans, there was not a single medium-size city: even capital cities, such as Belgrade or Sofia, did not reach this level.

This overall picture did not change much between World War I and World War II (*Fig. 1*).

Fig.1. Cities over 50,000 inhabitants in East Central Europe (1930). a = national boundaries in 1980

However, in the post-World War II period important changes took place:

- In Austria, Bavaria, and the GDR the number of cities over 50,000 inhabitants rose by 50 per cent between 1950 and 1980. The Austrian urban network remained relatively poorly developed because of its still oversized capital city and the physical environment. Urbanization was characterized by the expansion of small cities.
- In all the other countries the number of cities with over 50,000 inhabitants tripled. Bulgaria, where this number grew six-fold, was an exception. The urban network of South Eastern Europe began to assimilate to the Central European network.
- The case of Czehoslovakia is unique, for Slovakia witnessed a much faster growth than the Czech regions. In Bohemia, urban growth was similar to that in the GDR and in Austria.
- The spatial pattern of urban growth was influenced by national population growth, migration patterns and the size of the countries. Polish and Rumanian urban growth partially resulted from a high natural increase in the urban population. High population growth in the southern Yugoslav republics was cushioned by temporary and permanent migration as Yugoslavia was the only socialist country which permitted free travel abroad for its citizens.

Middle-size cities multiplied in the larger, more populous countries, first of all in Poland. In federal states, regional centres had more importance, more functions, and consequently, exhibited faster growth than territorial administrative centres in other states. Small countries with large capital cities (Austria, Hungary) were unable to develop a substantial number of middle-size city secondary centres. In general, the cities which expanded most rapidly were those in the category of 50,000-100,000 inhabitants.

- The expansion of the urban network exhibited a movement from northwest to southeast during that time span. Urbanization did not change its spatial pattern in the 1950s. Post-war reconstruction and the first wave of 'socialist' industrialization reinforced the position of the already existing urban centres. In Hungary and Poland an urban take-off started in the 1960s, in Slovakia and on the Balkans in the 1970s. In the GDR and Bohemia the network of larger centres remained intact (*Fig. 2*).
- The population in most part of East Central Europe remained overwhelmingly rural until as late as 1950 with over 80 per cent in Bulgaria and Yugoslavia, 70 per cent in Rumania and Poland, and 60 per cent in Hungary. The urban network that developed in this basically rural space during the state socialist period was a replication of the urban network of the more developed Central European space. There is still an urbanization gap between the Central European and the South Eastern European parts of the region, but this gap has been shaped mostly by historical development and *not* by differences in the social system. Forty

Fig 2. Cities over 50,000 inhabitants in East Central Europe (1980). a = national boundaries

years ago South Eastern Europe was as rural as a currently developing country, but urban take-off then was not the same as the present excessively polarized pattern of Third World urbanization. There are a number of publications on the spatial pattern of settlement development in East Central Europe (e.g. on suburbanization, conurbanization and rural depopulation), *but none* of them defined a single feature which is *unique* to socialist countries.[3] I firmly state

[3]Enyedi, Gy. (1978). Kelet-Közép-Európa gazdasági földrajza (The Economic Geography of East Central Europe). Budapest. Közgazdasági és Jogi Könyvkiadó.
Musil, J. (1980). Urbanisation in Socialist Countries. White Plains:M.S.Sharpe

that European forms of modern urbanization were propagated in East Central Europe during the state socialist system.

Does such a phenomenon imply that there was no difference between capitalist and socialist urbanization? Socialist governments had the power to intervene in the urbanization process, and these governments had quite specific ideas about urbanization ('urbanization should be planned and egalitarian').

Similarities between East Central and West European urbanization are of fundamental significance. These similarities express the general rules of modern urbanization and continuity of European urbanization. The similarities stem from the fact that the post-war industrialization in East Central Europe created a modern industrial system with all the inevitable spatial consequences: rural-urban migration, urban concentration of population, spatial separation of workplace and residence, development of functional zones within cities, suburbanization, etc.

East Central European urbanization has important *specific features* as well. These features are partly due to a delayed urbanization and partly to the state socialist system.

- Modern urbanization started late within the region (by the end of the 19th century and in some cases rather more recently in the 20th), but its progress was rather fast, although imperfect and remains so in many respects. The industrial take-off and the rapid urban growth era are over; yet, the rural sector still remains large and important. Except for the traditional industrial zones of the 'urban core', the rural population is between 35–50 per cent in the region, which means that the rural effects of urbanization are of great economic and political significance.
- State socialism has had two important effects on the urbanization process. *First*, it prolonged the rural/urban dichotomy, mainly related to living conditions. The infrastructure, which chiefly served production purposes, has been neglected . Infrastructural development depended on central budget distribution, but was a low priority in the competition for government subsidies. (Inefficient state industry always had priority.) *Second*, state socialism changed the contents and functioning of urban society. Instead of middle-class development, proletarization became widespread. Instead of autonomous, individual decisions made by citizens, centrally designated and strictly controlled rules dominated urban life, including leisure, culture and political activities.

SOCIETAL RESPONSES TO URBAN CHANGES

During the last 40 years, East Central European countries have been fully industrialized and have started the transition to a consumption (tertiary, post-industrial) society.

Two important transitions — or turning points — have occurred within the life-span of a single generation (from a rural to industrial and from an industrial to a consumption society). These transitions were intensified by two fundamental political changes: from a capitalist to a state socialist system and, forty years later, from a socialist to a capitalist system.

Societal responses to the socialist changes were two-fold. *First* new institutions, ideologies, urban and regional policies were formulated. *Second*, society developed a certain shadow mechanism of urbanization, by which it intended to conserve historical continuity and to defend itself against undesirable changes.

Public responses

Urban and regional policies passed through several phases in the socialist era.

Until the mid-1970s, regional policies regarding regional levelling were similar in both the western welfare states and the East Central European countries. Although, the latter similarly provided government subsidies for infrastructural development, they differed in such key elements as direct economic intervention, state industrial location, the exclusion of market forces, and the very limited role accorded to local authorities in regional development. Later, western and socialist regional policies took even more divergent paths. 'Bottom up' indigenous development and the diminishment of the governmental role, which are characteristics of western regional policies, remained alien to the centralized state socialist system. Socialist countries tried to continue central redistribution policies. With the worsening of the economic situation, central sources became increasingly scarce: thus, existing regional policies collapsed, without being replaced by more modern approaches. Local and private initiatives were not accepted as a basis for regional development.

Planning was a decisive part of public policies. Planning covered resource allocation for urban development, industrial location, etc. At the beginning of the socialist period, urban planning had a number of ideological goals, such as assuring equal opportunities for housing, equalizing the standard of living of different social groups, creating the working class basis for provincial cities, etc. Ideological purposes were subsequently replaced by technocratic goals, with only a few exceptions. Evidently, in such a complicated system as a city, processes could not be planned and guided in a normative way. An entirely new process cannot be started arbitrarily. Planners adjusted the goals of planning repeatedly to correspond to the 'normal', spontaneous urbanization processes.

Planning targets were not entirely at variance with Western European urbanization. East Central Europe as a whole has lagged behind Western Europe for centuries and has tried again and again to close the gap. For this reason, countries in the region have imitated the western pattern of political institutions, economic organizations and urbanization.

Communist governments tried again to catch up with the West through rapid economic growth and accelerated urbanization. In political declarations, they praised the Soviet example, but planners were looking for western patterns in physical planning, management and in developing technical civilization in cities.

Informal responses

Informal responses have had a much more important inpact on urbanization than previously supposed. Main tools of government urbanization, such as public housing and centralized development of infrastructure, have evidently been focused on urban centres rather than on rural settlements, whose development was more independent. (The reader is reminded of the high proportion of rural population in the region.)

Government induced urbanization created mainly the built environment for urbanization. That built environment is filled with social functions performed by people, who make individual decisions in selecting a new settlement, accepting a new job, searching for a new appartment, and choosing education for their children. The goals set by individuals are quite simple: (a) adequate housing, (b) accessibility to work, services and other family members, (c) social status, i.e. to live in a good place within the residential area of the city. Average citizens set their goals in basically the same way whether they live in East Central or Western Europe. After all, these choices express a certain perception of the urban space, which is a part of our common European culture.

Everywhere there exists an individual, informal basis for public policy. But the case of East Central Europe was special. Individuals built up hidden mechanisms for defending their interests and for promoting urban social processes in opposition to official policies. *Private urbanization* refused the values dictated by 'socialist' urbanization and tried to continue traditional burghers' values. Citizens did not accept egalitarianism; they intended to demonstrate the improvement of their social status by changing residence. In the cities, where the housing market was — in most cases — abolished, the change of apartments expressed the different prestige values regarding the location of the apartments in a complicated way. This mechanism kept social segregation alive. Where private (detached) family housing was possible — in the suburbs, or in the countryside — the size and the layout of the houses were quite different from the apartments built by governments in large housing estates. In most socialist countries, a limited housing market was re-established after the mid-1960s.

Private urbanization was based largely on the second (black) economy. Services, goods, information related to housing circulated in this private network. The black economy in East Central Europe had a social significance that did not exist in the second economy of the West. Our second economy was the locus of market relations, of consumer free choice, of autonomous economic decisions — it was a real *parallel society*. This second society maintained certain European urban traditions, and even had a modifying effect on official urban policies. The influence of the second society was evidently limited in the most authoritarian regimes (in the GDR and Rumania). Urban traditions were stronger in the Central European part of the region than in the Balkans (in Bulgaria and in the southern republics of Yugoslavia), where egalitarian peasant societies functioned before World War II. Thus, East Central European societies are more or less prepared for the transition to a market controlled urbanization.

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CHANGING ETHNIC, RELIGIOUS AND POLITICAL PATTERNS IN THE CARPATHO-BALKAN AREA

(A geographical approach)

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ABSTRACT

The Carpatho-Balkan area is extremely diverse both ethnically and religiously. This ethnic diversity led to regional wars and world-wide conflicts many times during the history. The aim of this paper is to present the current ethnic and religious distribution of the population in the region, to overview the changing ethnic and migratory trends in the period of 1920-1980 and to provide a historical geographical explanation of the current ethnic and political tensions. The investigated area includes the regions of the Carpathian Basin (Slovakia, Hungary, Transcarpathia, Transylvania, Voivodina), a part of the Balkans (Croatia, Bosnia-Hercegovina, Montenegro, Serbia Proper, Kosovo, Macedonia, Albania, Bulgaria, Rumania Proper) and Moldavia, considering present administrative borders.

INTRODUCTION

The Carpatho-Balkan region, or South Eastern Europe, became known in recent centuries as an ethnically and religiously highly diverse area, with an image of instability due to its peculiar geographic position and the particular political events that have taken place. The unique status of this region, representing a link between western and eastern Christianity and the Islamic world of the Middle East, became even more pronounced following World War II, when the regions to the north (such as Czech Lands, Poland and the West Ukraine, etc.) lost their former ethnic-religious diversity due to extensive forced migration and border changes. This social diversity and the highly varied cultures that exist side by side in a compact area had given rise to regional wars and to conflicts that subsequently extended almost world-wide. In the Carpatho-Balkan region inevitable conflicts broke out following the collapse of the empires that exercised control over the region. Often concealed as wars and struggles of liberation, they were, in fact, wars with the intent to occupy areas or to extend control over small- and medium-size nations (with populations ranging from 0.5 to 12 million) over the past centuries. These events were, for example, the collapse of the Ottoman Empire in Europe (1878-1913), the dissolution of the Austro-Hungarian Monarchy (1918), the retreat of the Soviet army from the region and the disintegration of the USSR (1990-1991). Up to now none of the ideologies or social systems imposed were able to release or reduce tensions or to balance the ethnic, cultural and traditional mix of the region in an environment of artificial and rigid borders of these countries. No change in this respect was brought about by the ideology of 'proletarian internationalism' in the period of 1945-1989/90. The contrary seems to be true, since after the cessation of the Soviet influence in the region the ethnic-religious tensions seem to have strengthened rather than abate — tensions that were suppressed for more than four decades. These events were predicted by some (e.g. King, R.R. 1973, p. 326: 'If Soviet power in Eastern Europe should decline as a result of... serious internal crises, nationalism would undergo a renaissance in the communist states of Eastern Europe').

The European Babel, as this transitional European region that extends from Estonia to Greece is called, has drawn the attention of many, as expressed in professional publications following World War I and after the formation of so-called national states (actually polyethnic states) e.g. Winkler,W. 1931, Macartney, C.A. 1934, 1943, Chmelař, J. 1937, Rónai, A.1939, 1945. This was followed by a relative lull in publication following World War II, perhaps due to the prevailing apathy and indifference to the region, while an upsurge of publications followed from the 1960s that inevitably pointed towards the extreme ethnic diversity of Eastern Europe and to the potential tensions that characterize this region: Bohmann, A. 1963, Breu, J. 1966, Kosiński, A.1969, King, R.R. 1973, Hartl, H. 1973, Peyfuss, M.D. 1976, Sugar, P.F. (ed.) 1980, Varsányi, J. 1982, Horak, S.M. 1985, Suppan, A.–Heuberger, V. 1991, and others. Publications dealing with the ethnic and geopolitical tensions of the Southeast European region, previously regarded as being undesirable topics by authoritarian politics, appeared rather late and even these tended to deal with a particular region or country only (e.g. Šentić, M.–Breznik, D. 1968, Petrović, R. 1969, Zelenchuk, V.S. 1973, 1979, Vlahović, P. 1977, Žuljić, S. 1989, Kocsis, K. 1989,1990 and 1991, Pepeonik, Z. 1991, Čović, B.(ed.) 1991 etc.).

OBJECT, INVESTIGATED AREAS AND BASIC DATA

The aim of this paper is to present the current ethnic and religious distribution of the population in the region, to show the changing ethnic pattern and migratory trends in the period of 1920-1980, and to provide a historical geographical background of the current ethnic, religious and political tensions.

The area studied are the regions of the Carpathian Basin, Moldavia and the Balkans, considering present administrative borders (*Fig. 1*). The total area of the 15 regions is 797,000 km^2, comparable with that of Turkey, and its population (78.5 million in 1990)

Fig. 1. Regions of the Carpatho-Balkan area

is comparable with that of Germany. The primary considerations of delimitation were the geographical position, similar history and distribution of the various ethnic groups.

In the performed analyses of the ethnic structure and ethnic processes that took place in the region, a new approach (compared with the publications up to now) is represented. Instead of using the results of the various population censuses, that were produced in an area where the boundaries shifted from time to time, population data derived around 1920 were considered first and these data were converted to the present areas of national boundaries for comparison purposes.

For investigation of population patterns seven censuses from different dates (containing data with respect to nationalities and languages) were compared. Consequently, the earliest population census considered took place in 1920 (base time) and the latest census considered in 1980.

HISTORICAL BACKGROUND

In order to understand the attitudes of foreign policy in the various countries in South Eastern Europe and the roots of the ethnic conflicts, it is important to study the historical background: the age and stability of the frontiers and the duration of the independence of the Southeast European nations.

Of the nations of the Carpatho-Balkan region the Bulgarians were the first to found an independent state (680), followed by the Croats (870), the Serbs (892) and the Hungarians (896). The formation of the independent states of the Rumanians (1324), Albanians (1443) and Montenegrins (1796) took place considerably later, while the state of Slovakia did not appear on the map until 1939.

The majority of these small states became either influenced or directly ruled by some of the big powers or empires of the region (such as the Frank Empire, the Kingdom of Hungary, the Byzantine Empire, the Ottoman Empire, the Empire of Austria, the Russian Empire, etc.). Many, after a usually brief period of flourishing in medieval times, regained independence as late as the second half of the 19th century. Of the four biggest nations living in the region, the period of state independence may be considered as 789 years allotted to the Hungarians, 661 years to Bulgarians, 448 years to Serbs and 210 years to Rumanians. For the Croats, after an early foundation of the state, national independence was achived for a period of 237 years, the Slovaks — who appeared as a nation first in the 14-15th century — enjoyed independence only briefly during World War II (this was, in fact, the only period of independence for Slovakia). The Macedonians and the Muslims of Bosnia-Hercegovina, together with the previously mentioned Croats and Slovaks, seem to strive for national independence only in most recent times. Each of the nations and states mentioned did have a brief period of time with greater territorial extension than today: the Hungarians between 900 and 1526 and again in the period of 1718-1918, the Serbs between 1345 and 1355, from 1919 to 1941 and again from 1944 until 1991, the Bulgarians from 893 to 927, in the 1187-1256 and again in the 1941-1944 period, the Croats from 870 to 1102 and 1941-1945, the Rumanians between 1918-1944 and the Albanians from 1941 till 1944 (*Fig*. 2).

As in Figure 2 can be seen the borders of the Balkan states were particularly changeable. The territories of the various states were highly variable and their borders have been shifted many times. This applied particularly to Bulgaria and Serbia. During the last millennium the highest stability of borders was represented by the western borders of Croatia (1100 years), the western, northern and eastern borders of Great-Hungary (the Carpathians) (800-900 years) and the Bulgarian-Rumanian border along the Danube (some 800 years).

The sovereignity of the small Balkan states was lost to the slow, but irresistible and inevitable expansion of the Ottoman Empire. Within two or three centuries nearly the entire Carpatho-Balkan region became part of the Ottoman Empire (Bulgaria by 1396,

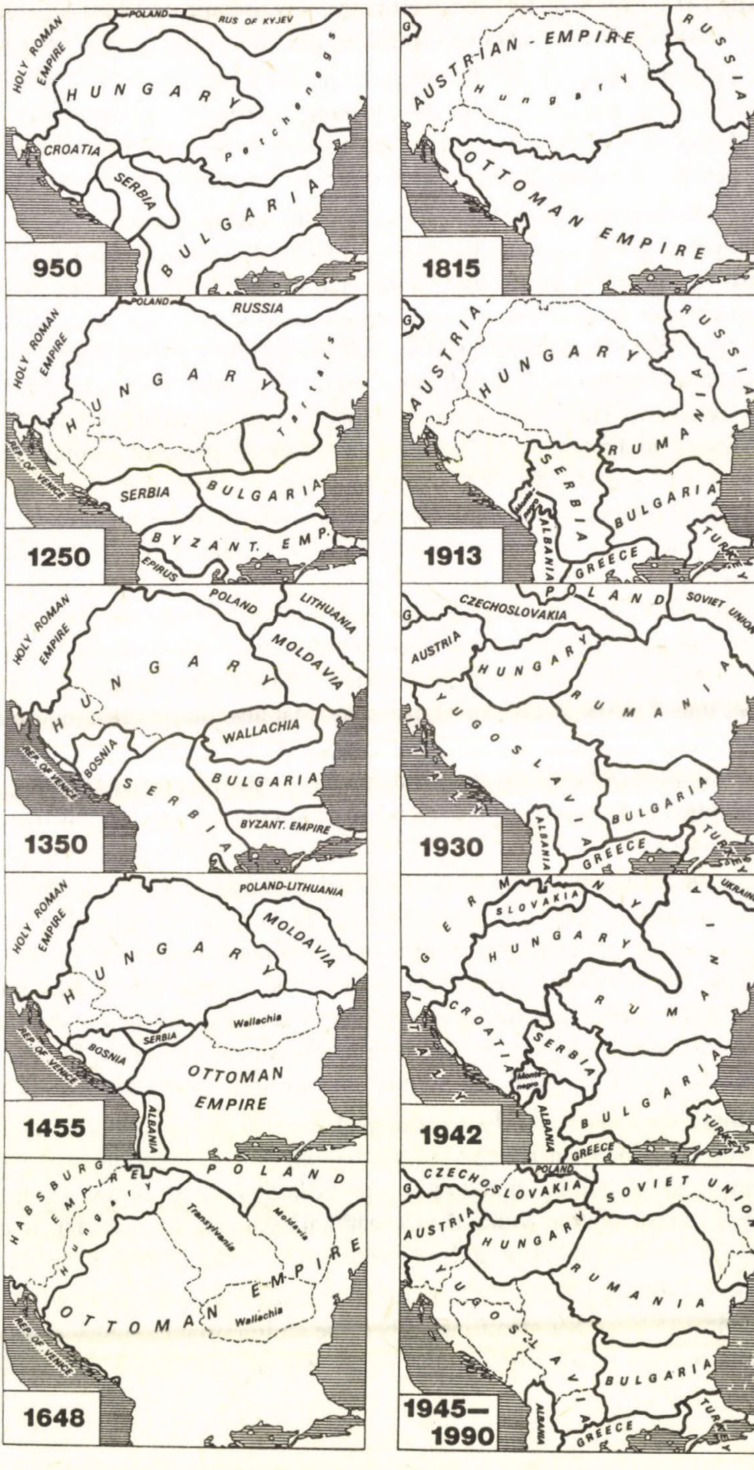

Fig. 2. States in South Eastern Europe (950-1990)

Wallachia by 1418, Moldavia by 1456, Serbia by 1459, Bosnia by 1463, Albania by 1468, Central and Eastern-Hungary (Transylvania) by 1541 and 1551, respectively).

During and following the Turkish occupation the ethnic structure of the area, relatively stable until that time, completely disintegrated due to the large scale migrations of the population. Just prior to and during the Turkish invasion the population tended to shift to the peripheral mountainous areas that provided some protection for the refugees.

The Serbs migrated in the highest numbers from their original areas of settlement. As a rule they fled in eight greater waves after lost battles, to the north and northwest, to the southern regions of Hungary and to the central and eastern regions of the former Kingdom of Croatia, by and large, occupying the areas vacated by the escaping Hungarians and Croats (Kocsis, K. 1989). Having left the regions devastated by the Turks and the Tartars, many Rumanians (Wallachians) migrated into the previously destroyed East Hungarian regions (in Transylvania). As a result of these waves of migration the ratio of Rumanians living in Transylvania had increased from 25 per cent around 1500 to 55.8 per cent by 1761 (Kocsis, K. 1990). Concurrently, starting from the 16th and 17th centuries Turks settled down on the Balkans in areas of strategic importance. In certain areas the local population were converted to the Islamic faith in increasing numbers (this conversion was particularly successful in Bulgaria, Albania and Bosnia). The Kingdom of Hungary became a Hapsburg possession after 1526. Hungary's central and southern regions were ultimately liberated from Turkish occupation only by 1718. From this time, the border between Christian and Islamic states followed the Carpathians, the Danube and the Sava lines for 160 years. These frontiers, that also determined the Southeastern boundary of Central Europe, did not represent language barriers in any sense (mainly due to the mass migration of the Serbs and Rumanians into the Carpathian region) yet, during the above mentioned 160 years and even till the present day they have formed distinct cultural boundaries.

During the 18th century hundreds of thousands of people (Germans, Serbs, Slovaks and Ukrainians) mainly from Germany, Serbia and from the peripheral regions of the Kingdom of Hungary were allowed to settle in the liberated central and southern regions of Hungary. As a result of this large scale colonization process some areas, particularly the southern parts of Hungary (today Voivodina in Serbia and Banat in Rumania), and East Croatia (Slavonia) became the most ethnically mixed regions in Europe. In these regions all the nations of Central and South Eastern Europe are found together.

The more than one and a half century of Turkish occupation and its associated destruction hit the Christian-Islamic frontal nations (i.e. Hungarians and Croats) the hardest. As a result of immigration and settling of large number of non-Hungarians the ratio of Hungarian population within the Carpathian basin had decreased from around 80 per cent in 1500 to about 29 per cent by 1787 (Jászi, O. 1912, Szabó, I. 1941).

At the beginning of the 19th century, by the annexation of Eastern Moldova (Bessarabia) in 1812, the Russian Empire became an important country to reckon with in the region as she had supported the small Balkan nations in their struggle for independence. With Russian assistance, Serbia, Rumania and Bulgaria regained their independence in 1878 and only the most Islam influenced regions with high ratio of Muslim population (Thrace, Macedonia, Albania, Sandjak of Novi Pazar, etc.) remained under Turkish occupation, while Bosnia-Hercegovina came under Austro-Hungarian rule. Following the two Balkan wars Albania gained independence from Turkey in 1913, while the rest of the Ottoman Empire on the Balkans was divided between Serbia, Greece, Bulgaria and Montenegro. The collapse of the Ottoman Empire on the Balkans created numerous conflicts mainly related to the possession of Thrace, Macedonia and Bosnia-Hercegovina.

The Balkan states with ethnically diverse population and the Croats, Slovenes and Czechs laid territorial claims to each other and to the areas of the Austro-Hungarian Monarchy, referring now to their historical rights, to the right of nations to self-determination.The opportunity to fulfill these irredentist claims by the Serbs, Rumanians and the Czechs arose first time at the end of World War I. In January 1918 the Rumanians took over Bessarabia from their former supporters, the Russians. At the end of 1918, taking advantage of their momentary growth in military weight, they occupied vast areas of Hungary together with Serbian, Czech and French troops. This way Rumanian, Serbian and Czech states found a favourable opportunity to enlarge the territories of their countries.

CHANGES IN THE ETHNIC-RELIGIOUS STRUCTURE (1920-1980)

The peace treaties after World War I created small, polyethnic states in the place of the former polyethnic empires. As a result, the ratio of the subordinated nations and national minorities living in the Carpatho-Balkan region had decreased from 35.4 per cent in 1914 to 31.7 per cent in 1920.

The Czechs managed to annex the former Upper Hungary (today Slovakia and Transcarpathia), the Rumanians East Hungary (Transylvania) and Bessarabia from Russia, the Serbs South Hungary (today Voivodina), Bosnia-Hercegovina, Croatia and Slovenia. The ambitiousness of these nations/countries is evidenced by the fact that in some of the areas annexed, large national minorities remained. For instance, the ratio of the non-Czech-Slovak population in Slovakia-Transcarpathia was as high as 42.9 per cent;that of the non-Rumanians equalled 42.7 per cent in Transylvania, and 44 per cent in Bessarabia; while the ethnic population, i.e. non-Serb population in Bachka-Banat-Baranya amounted to 71 per cent(!) of the total (1921). The Kingdom of Hungary (the Carpathian Basin), that up to 1918 represented a natural, economic, historical and cultural unit, was divided among five different states. Out of the territory of Hungary remained merely 28.6 per cent, out of the ethnic Hungarians 67 per cent on the new territory. At the same time the territory of the Rumanian state increased 2.3-fold, that of Serbia 2.7-fold and the Czech state 1.8-fold. The new borders almost totally cut the relations developed between regions during the last thousand years and between the nations of the Carpathian Basin. However, large Central European areas with different religious and cultural traditions and with higher levels of economic development came under the authority of Balkan Orthodox states (e.g. to Serbia: Voivodina, Croatia and Slovenia, and to Rumania: Transylvania). As a net result of the above mentioned facts, the border and other regions (with hundreds of thousands and even up to several millions of national minorities living in these annexed areas) in Rumania, Serbia (officially designated as the Kingdom of Serbs Croats and Slovenes) and in Czechoslovakia experienced almost unresolvable tensions, which has not eased up to the present day and led to extended efforts by these ethnic minorities to preserve their latent national homogeny.

After World War I in almost all the states of South Eastern Europe censuses were held (in the 1920-1923 period). According to the census figures the total population of the area exceeded 44 million (*Tables 1 and 2*). At that time the most populous nation was the Rumanians with 12.3 million, or 27.9 per cent of the total population living in the region, followed by the Hungarians with 9.8 millions (22.1 per cent of the total population of the region). These two nations were followed in numbers by Serbs-Montenegrins (4.8 million), Bulgarians (4.2 million), Croats (2.9 million) and Slovaks (2.3 million). The ethnic majority in the investigated region represented 77.9 per cent, while the dominant ethnic group made up 64.6 per cent of the total population (*Table 3*). The apparent contradiction between the two sets of figures given is due to the fact that the majority and dominant nationalities were not the same in some regions (e.g. Macedonia: Macedonians/Serbs, Croatia: Croats/Serbs, Slovakia: Slovaks/Czechs, Transcarpathia: Ruthenians/Czechs). The most important national minorities were the Albanians (37.4 per cent of the total), Hungarians (27 per cent) and Macedonians (22 per cent). The ratio of Slovaks living outside Slovakia (13.4 per cent of their total number), the ratio of Serbs beyond areas with Serbian majority (14.2 per cent) and the ratio of Croats living outside Croatia and Bosnia-Hercegovina (7 per cent) were also substantial. At the same time the Bulgarian and Rumanian minorities were found to be extremely small (at 4.3 per cent and 2.7 per cent respectively) (*Table 4*). Ethnically, the most homogeneous regions were Rumania Proper, Albania, Hungary and Serbia Proper (*Table 5*). Contrary to the above, in seven regions (Transylvania, Macedonia, Kosovo, Croatia, Moldavia, Transcarpathia and Slovakia) the majority nationality made up a relatively low percentage of the population (between 57 and 68), while in Voivodina and Bosnia-Hercegovina three ethnic groups balanced each other (Serbian-Hungarian-German and Serbian-Muslim-Croatian, respectively; *Table 1*).

According to the statistical data on religion about half of the total population (48.9 per cent) followed the Orthodox Church around 1921 (Serbs, Rumanians, Ukrainians, Bulgarians, Macedonians, etc.), while 41.7 per cent belonged to Western Christianity (Catholics and Protestants) (including the Hungarians, Slovaks, Czechs, Ruthenians, Croats, Germans and the North Transylvanian Rumanians; *Table 6*).

According to the censuses conducted in 1980, substantial and in some cases essential changes took place when these figures are compared with the 1920 censuses with respect to the ethnic and religious compositions of the region. These changes were mainly due to extensive migration, (more than eight million people had moved), and due to profound changes in the social system.

Following World War I (in the 1918-1938 period) 1,157, 000 people sought refuge abroad or were moved by force, while their places were taken by 967,000 settlers in the same areas (Kulischer, E.M. 1948). The greatest share in the refugees were Hungarians (348,800 from the former Hungarian territories annexed in 1918), of the Ukrainians (250,000 from Bessarabia), of the Turks (217,000 from Bulgaria) (*Table 7, Fig. 3*).

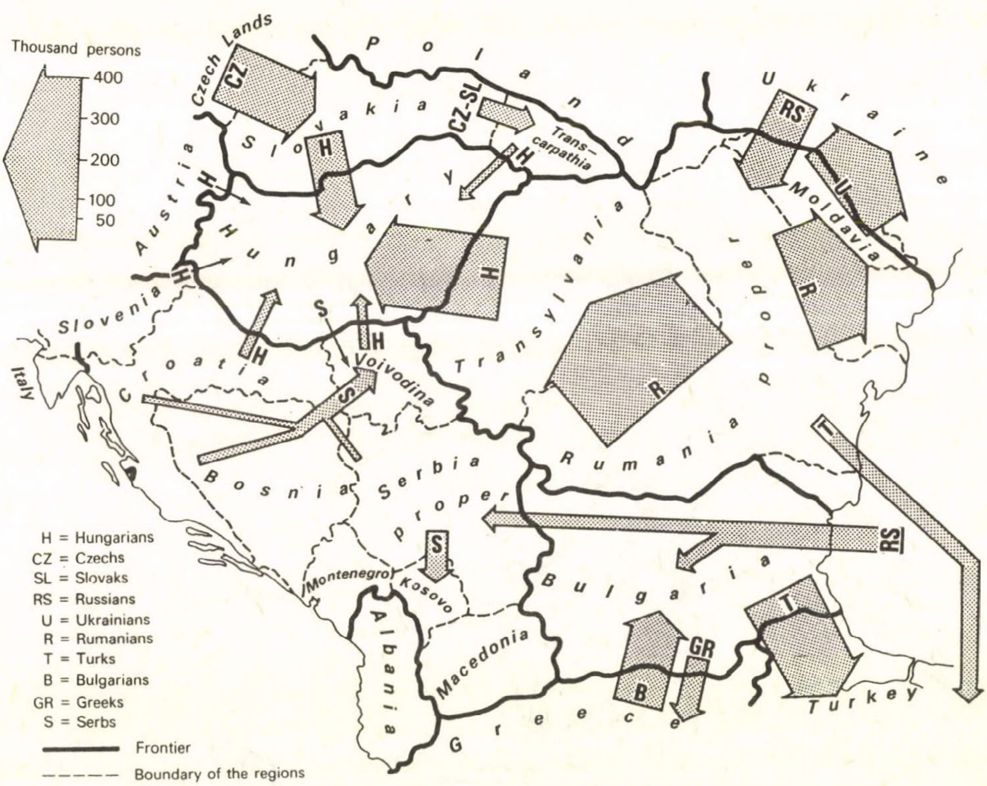

Fig. 3. Interregional migrations in South Eastern Europe (1918-1938)

A substantial population shift occurred following the 1917 Russian Revolution. The number of Russians who escaped from Russia and settled elsewhere amounted to

172,000, the majority of these were settled in Serbia and Bulgaria. Similarly, from the area of Thrace annexed by Greece, 123,000 Bulgarians escaped to settle in Bulgaria in the period of 1918-1926, while, at the same time some 46,000 Greek left Bulgaria to settle in Greece.

The places of Hungarian refugees from Slovakia, Transcarpathia, Transylvania, Voivodina and Croatia were occupied by thousands of Czech, Rumanian and Serbian settlers. This shift of population particularly affected strategic Hungarian townships and Hungarian rural areas in border regions (Kocsis, K. 1989,1990,1991).

In the outbreak of World War II and in the temporary territorial revisions the conflicts between national minorities and dominant nations (between Hungarians and Rumanians, Czechs, Serbs; between Albanians and Serbs), and between the subordinated and dominant nations (between Slovaks and Czechs, Croats and Serbs, Macedonians and Serbs etc.) played an important role. The Fascist axis powers were apt to take advantage of the injuries of the humiliated subordinated nations (Hungarians, Bulgarians, Croats,

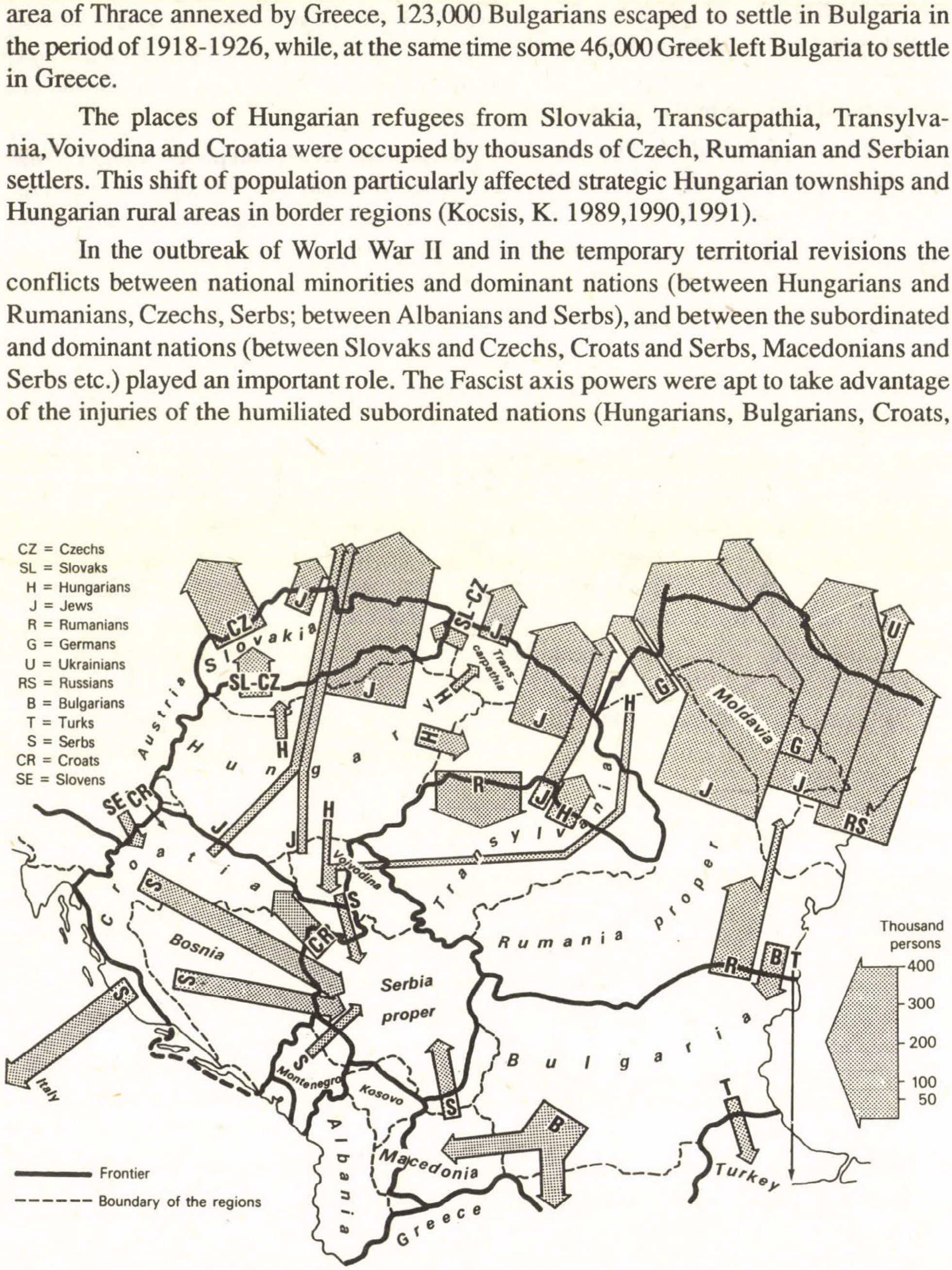

Fig. 4. Interregional migrations in South Eastern Europe (1938-1944)

Slovaks, Albanians) and redrew the political map of the Southeast European region (*Fig. 4*). Hungary regained territories with Hungarian ethnic majority (South Slovakia, North Transylvania, Bachka and Baranya) as well as Transcarpathia and the Mura Region, while the present territory of Bosnia-Hercegovina, just as in the Middle Ages, was given to Croatia. Albania acquired Kosovo and West Macedonia, while part of Serbia, with majority Bulgarian population, was returned to Bulgaria, together with Macedonia, West Thrace and South Dobruja. Rumania was forced to give over the northern part of Transylvania occupied in 1918, but as a compensation she was allowed to annex Ukrainian territories between the Dniester and South Bug (called Transnistria). These large-scale territorial changes and the political processes resulted in the forced mass migration of in excess of 2.9 million of the local population (Schechtman, J.B. 1946, Kulischer, E .M. 1948, Frumkin, G. 1951;*Table 7*). From the Southeast European region, under direct and indirect control by Nazi Germany, more than one million Jews were deported and sent to death camps in Germany and Poland. The majority of Jews deported were from Rumania (520,000) and from Hungary (431,000).

More than 319,000 Rumanians escaped from North Transylvania and South Dobruja or were shifted in the framework of a population transfer agreement, while 273,000 Serbs settled in Serbia Proper from the neighbouring countries. Approximately 200,000 Russians and some 60,000 Ukrainians escaped from Bessarabia, taken by the Soviet army for a brief period in 1940 and reoccupied by Rumania in 1941. In 1939, after Slovakia was declared independent for the first time in her history, 140,000 Czechs were banished from Slovakia. From 1940 onwards, in the framework of the settlement policy of Nazi Germany, a large group of German minority living in South Eastern Europe (194,000) was settled in the present territory of Poland.

A large number of Hungarians (142,000) settled back to the territories recovered by Hungary. A similar number of Bulgarians (122,000) was settled in Macedonia and West Thrace, annexed by Bulgaria.

A really large scale migration took place just prior to the conclusion of World War II, in 1944, that rearranged the ethnic structure of the region. This upsurge of migration was associated with previous territorial changes: the 1938 borders were restored with the exception that the Soviet Union was given Transcarpathia (which meant that the Soviet Union set foot in the Carpathian Basin, for the first time in her history). Similarly, the Soviet Union took over Bessarabia that was occupied twice by Rumania, in 1918 and 1941. Yugoslavia was allowed to annex Zadar, Istria and their surrounding areas. During and after World War II some one million Germans had escaped from the Carpatho-Balkan region, some helped by German troops, while others were deported to labour camps in the USSR. They returned to Germany immediately following World War II. From the territories Hungary lost again, some 220,000 Hungarians escaped to the present territory of Hungary. Several tens of thousands of Hungarians who stayed were forcibly deported to the internal areas of the Soviet Union (e.g. 45,000 from Transcarpathia); to Bohemia (44,000 from Slovakia); and to Hungary (74,000 from Slovakia), while several thousands were slaughtered (for example, 40,000 in Voivodina by the Serbs).

From Bessarabia, now belonging to the Soviet Union, some 200,000 Rumanians escaped to Rumania Proper. Their places were taken by Russian and Ukrainian settlers. Naturally these Rumanians were the majority, settled in North Transylvania annexed once again.

A great number of Slovaks settled back to Slovakia from Hungary, Transylvania and Transcarpathia. At the same time, 250,000 Slovaks settled down in the peripheral territories of Bohemia (Sudetenland), previously vacated by Germans.

In all of the Southeast European regions a substantial demographic vacuum had occurred in the wake of migration (with Voivodina in Yugoslavia and East Croatia the most effected), after that some 350,000 Germans had escaped. In these areas, which represent some of the most valuable farmlands of Yugoslavia, hundreds of thousands of Serbs and Montenegrins were settled from barren and agriculturally poor regions (mostly

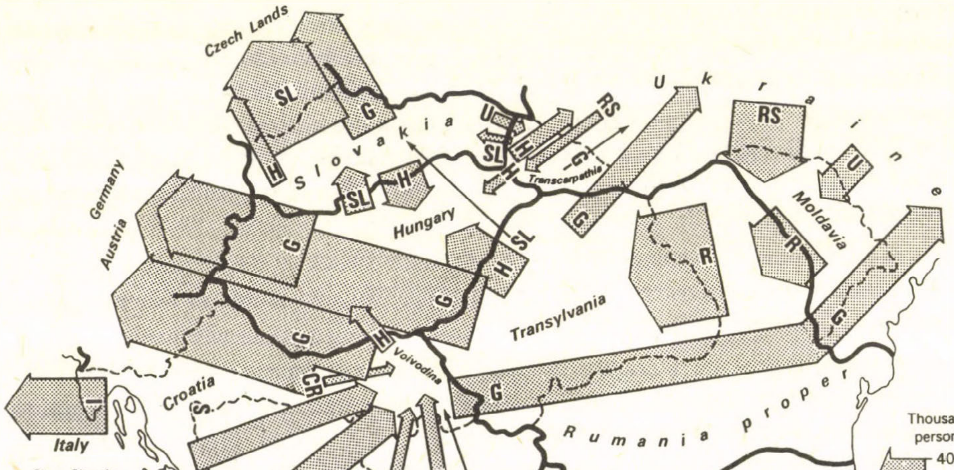

Fig. 5. Interregional migrations in South Eastern Europe (1944-1951)

from Bosnia, Croatia and Montenegro (e.g. 235,000 in Voivodina) starting with the end of 1944 (Žuljić, S. 1989 ; *Fig. 5*). Due to the events described above, the ratio of Serbs in Voivodina had increased from 30 per cent to 50.6 per cent, while the ratio of Rumanians in Transylvania had grown from 56.6 per cent to 65.1 per cent in the 1941-1948 period. Similar 'successes' were achieved in Slovakia in terms of ethnic homogeneity (the Slovakian population in 1941 was 67.4 per cent, this increased to 85 per cent by 1947). As 100,000 Germans, 100,000 Serbs and 140,000 Italians left Croatia, the ratio of Croats living in Croatia increased substantially (68.1 per cent in 1921 and 79.2 per cent in 1948).

In Bulgaria, in spite of the fact that 182,000 Turks left the country between1945 and 1951, the ethnic structure remained largely unchanged.

Following World War II the entire Carpatho-Balkan region came under Communist rule. After the war, in Bulgaria, Rumania, Hungary and Czechoslovakia forced social and economic changes took place to follow the Soviet model, while similar processes affected Yugoslavia and Albania, but with a somewhat different methodology and approach. In this region the urbanization processes were substantially different from those in the western world, since in these countries millions of villagers were indirectly forced to move to the cities and to work in industry. These processes applied particularly to the village population living in backward areas (with high natural growth of population) to the developed, industrial areas (with low natural growth of population). These interregional migrations were particularly intensive in Rumania and Yugoslavia with the characteristic feature that the population shifted, by and large, from the Balkan and East European regions to the more developed Central European regions (Carpathian Basin): characteristically from Rumania Proper to Transylvania, from Serbia Proper, Bosnia-Hercegovina, Montenegro and Macedonia to Voivodina, Croatia and Slovenia. The main reasons behind this settlement policy were economic considerations which served political aims. The main political goal was to help states to become ethnically more homogeneous (these concepts apply particularly to Rumania and Serbia), particularly in regions of key importance that were annexed, mostly in 1918, and that were, at the same time, the most developed parts of these countries. As one of the living examples of these processes it would suffice to mention the high population increases that took place in the towns of Transylvania, where the average ratio of Rumanians has increased from 50.2 per cent in 1948, to 70.7 per cent in 1977 (Kocsis, K. 1990).

Waves of migrations kept reoccurring over the last four decades unabated for different reasons. The most striking ones, involving the highest number leaving the Southeast European region, would be that Yugoslavian citizens found employment in West Europe in the 1950-1991 period; the emigration of Germans from Rumania to Germany that gained substantial momentum in 1990; migration of Turks from Bulgaria to Turkey in 1989; and the large number of Hungarians leaving their country after the aborted 1956 Hungarian Revolution.

THE PRESENT ETHNIC-RELIGIOUS STRUCTURE OF THE CARPATHO-BALKAN REGION

According to the censuses taken around 1980 the total population of this region is in excess of 74 million and the two nations with the highest numbers of population are still the Rumanians (21.9 million) and the Hungarians (13.4 million). These two nations represent roughly half of the population of South Eastern Europe (*Tables 1 and 2*). In the 1920-1980 period the highest population growth were experienced by the Albanians, Macedonians and Muslims due to high natural increases. During and following World War II, the Jewish and German population in the investigated area decreased by 80 per cent compared with1920. Of all the nations living in the Carpathian Basin the most spectacular and dynamic population increase was shown by the Slovaks (93.6 per cent), far exceeding the growth of the Hungarians in the 1920-1980 period (36.6 per cent).

Due to political events and the voluntary migration of the population within South Eastern Europe, the ratio of national minorities has decreased to 14 per cent . The national minorities have the highest share in the case of Albanians (40 per cent), followed by the Hungarians (21 per cent) and the Macedonians (18.3 per cent ; *Tables 3 and 4*).

The ratio of Serbs beyond the borders of Serbia, Montenegro and Bosnia-Hercegovina is 7.3 per cent at present, while the ratio of Croats living outside of Croatia and Bosnia-Hercegovina represents 4.1 per cent of the total nation, due to the natural assimilation and due to migration of the minority to the 'mother region'.

The ethnically most homogeneous regions are Albania, Rumania Proper and Hungary, however, these processes towards ethnic homogenity have accelerated considerably in Serbia Proper, Bulgaria, Croatia, Slovakia and Kosovo as well (*Table 5, Fig. 6*).

The ethnic diversity of the Carpatho-Balkanian region is illustrated by the ethnic map attached (*Fig. 7*). Of the nations of South Eastern Europe the ethnic mixture is the greatest for Hungarians, Rumanians and Germans in Transylvania; Hungarians, Serbs, Rumanians, Slovaks and Croats in Voivodina; Serbs and Croats in Slavonia (East Croatia); Muslims, Serbs and Croats in Bosnia-Hercegovina; Bulgarians and Turks in North Eastern Bulgaria; and finally, the Rumanians, Ukrainians, Russians and Gagauzes in Moldavia. Apart from areas showing extreme ethnic diversity, in some areas the national minorities still tend to form single, homogeneous entities or regions. Examples of these are Croats in West Hercegovina; Serbs in Kraina (Croatia), West Bosnia and East Hercegovina; the Hungarians in South Slovakia, South Western Transcarpathia, West Transylvania, East Transylvania/Seklerland and North Voivodina; the Albanians in Kosovo and in North Western Macedonia; and the Turks in the District of Kirjali of South Bulgaria. The above mentioned, mostly border regions present the greatest troubles to the majority nations, since the authorities in these countries tend to regard these areas as potential sources of irredentist movements. To some extent these considerations lay

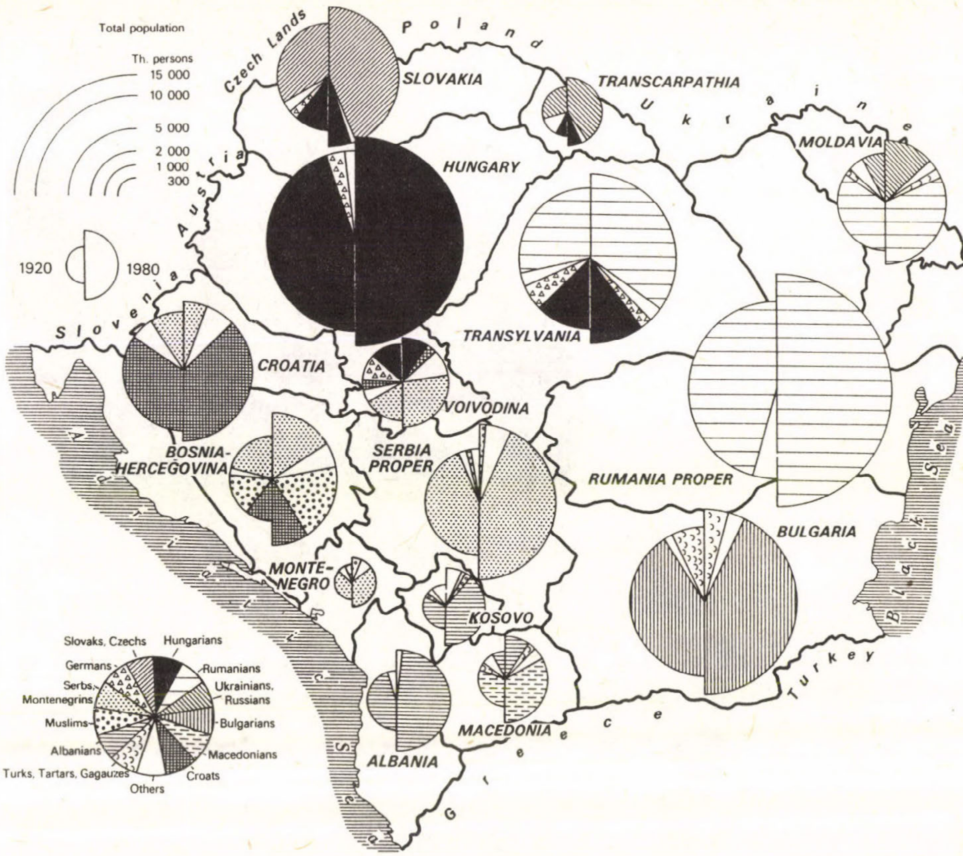

Fig. 6. Ethnic structure of the population living in the regions of the Carpatho-Balkan area (1920, 1980)

behind the fact that the Mureş-Hungarian Autonomous Province (in Rumania) was abolished in 1968 and the autonomy of both Voivodina and Kosovo (in Serbia) was cancelled in the 1989-1991 period.

Recent events that occured in the Carpatho-Balkan region, including political changes, such as the collapse of the Soviet Union and Yugoslavia, brought the long inherited and harboured ethnic problems and tensions once again to the surface, culminating in the war between Croatia and Serbia in 1991.

It is interesting to observe that in the two halves of Europe, the Eastern and the Western parts, opposite processes seem to take place: the integration processes of the West against the disintegration processes in the Eastern parts of Europe. Perhaps, it is in substantial part due to the existing ethnic tensions that seem to have survived for centuries and exploded in the wake of the recent political and economic changes in the region.

These ethnic tensions are further aggravated by religious differences and tensions, a factor that was ignored almost totally by and during the communist dictatorships. The

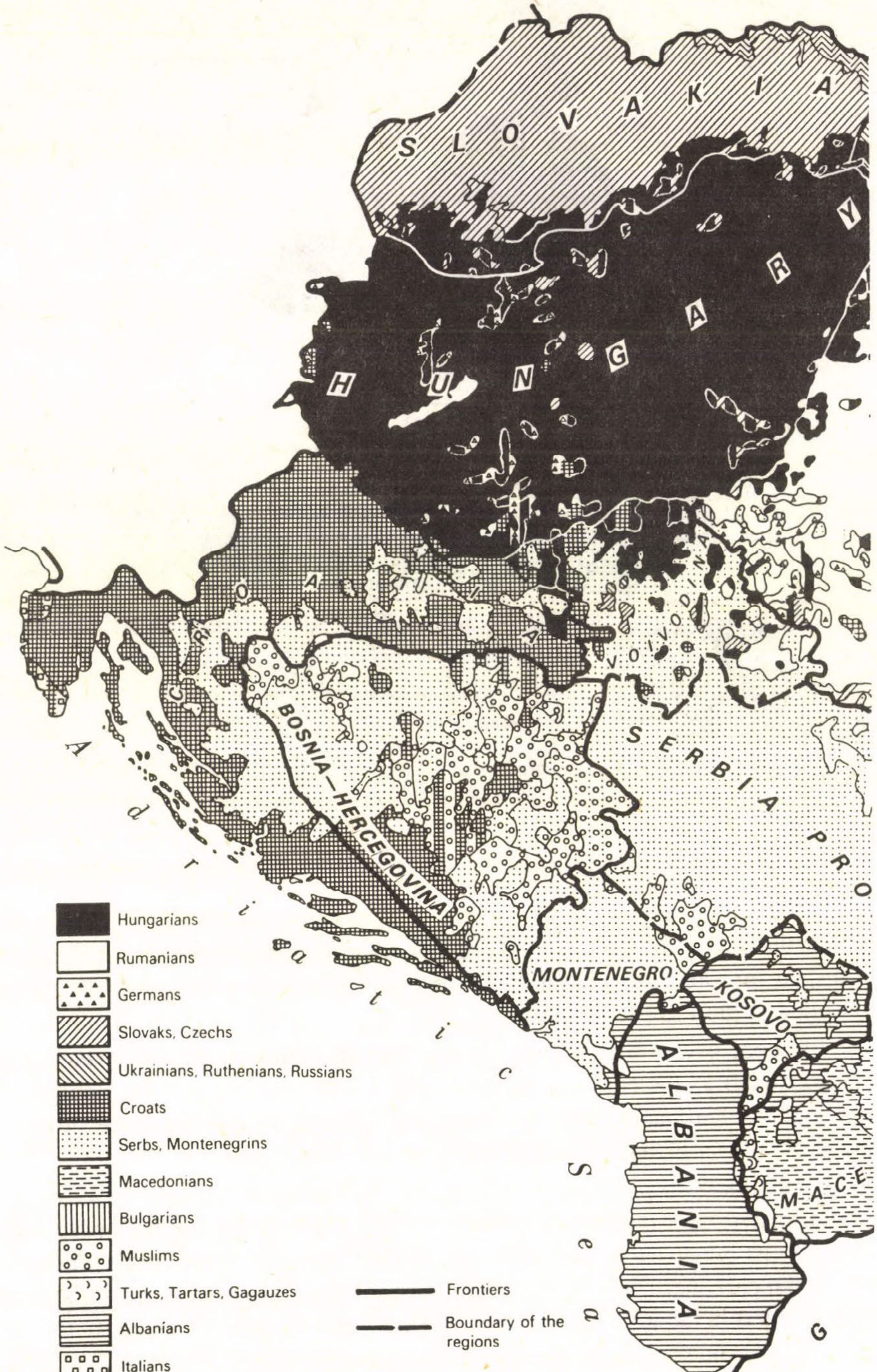
SLOVAKIA
HUNGARY
CROATIA
VOIVODINA
BOSNIA—HERCEGOVINA
SERBIA PRO
MONTENEGRO
KOSOVO
ALBANIA
MACE
Adriatic Sea
G
Hungarians
Rumanians
Germans
Slovaks, Czechs
Ukrainians, Ruthenians, Russians
Croats
Serbs, Montenegrins
Macedonians
Bulgarians
Muslims
Turks, Tartars, Gagauzes
Albanians
Italians
Frontiers
Boundary of the regions

Fig. 7. Ethnic map of the Carpatho-Balkan area (1980)

most obvious religious tensions are those between the Muslim Albanians, Muslims of Bosnia and Turks versus the Orthodox Serbs and Bulgarians and those existing between the western Christian communities (Catholics and Protestants), such as the Croats, Hungarians and the orthodox Serbs and Rumanians (*Table 8, Fig. 7*).

Based on data published by 'Britannica . Book of the Year. 1991' 38.6 per cent of the region's population are Eastern Ortodox, 33.2 per cent are Catholics and Protestants, 5.1 per cent are of Muslim faith, while 23.1 per cent proclaim non-religious and/or atheists (*Table 6*). Since 1920, the number of persons included in the latter category have increased considerably, perhaps basically due to the spread of communist ideologies and politics. The ratio of non-religious people and atheists, seems to be the lowest in Slovakia and in Hungary (10-11 per cent of the total) (e.g. 8.8 per cent in the United Kingdom and 10.8 per cent in Australia)(*Table 8, Fig. 8*). The corresponding figures for former Yugoslavia

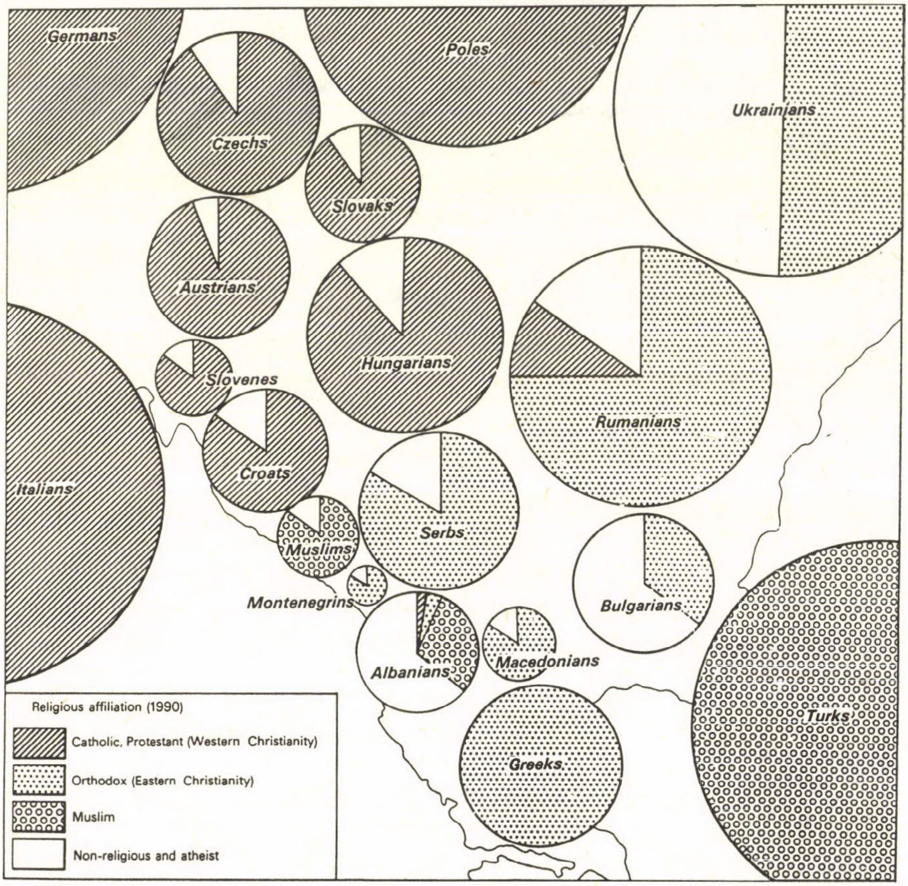

Fig. 8. Religious affiliation of the nations of South Eastern Europe (1990; source: Britannica. Book of the Year. 1991.)

and Rumania are around 16-17 per cent (16.2 per cent in Italy and 15.6 per cent in France). Statistical data show staggeringly high, non-religious, atheistic population in Albania (64 per cent) and in Bulgaria (65 per cent) some of the highest ratios all over the world, even against figures published for China (71.4 per cent).

Naturally, however, it would not seem extraordinary to conceive that the neo-nationalistic renaissance that follows the changes in the political and economic system will be accompanied soon by an upsurge of religious feelings, particularly those of the national religions, namely the Muslim and the Eastern Orthodox creed.

The question still remains unresolved, how to handle these complex ethnic-religious-cultural conflicts which have emerged in South Eastern Europe, feelings that were substantially suppressed and kept under the surface during the last four decades. It is doubtful, whether the present states and nations of the region will be able to accept the formation of self-organizing, autonomous regions based on historical-cultural-economic traditions, or they can imagine their future only in the frame of present state boundaries declared invulnerable. In the future particular attention should be paid to nations (countries) that had no previous experience of national sovereignty or enjoyed national sovereignty only for a short period of time during their existence (meaning first of all Slovenia, Slovakia and Macedonia).

Table 1a. Ethnic structure of the population living in the regions of South Eastern Europe (1920, 1980)

Regions	in numbers																
	Year	Total population	Hungarians	Germans	Rumanians	Slovaks, Czechs	Russians, Ukrainians, Ruthenians	Serbs, Montenegrins	Croats	Muslims	Bulgarians	Macedonians	Albanians	Turks, Tartars, Gagauzes	Jews	Gypsies
SLOVAKIA	1921	2.958.557	650.597	145.844	—	2.025.003	88.970	—	—	—	—	—	—	—	73.621	7.967
49.025 km^2	1980	4.987.853	559.801	5.121	—	4.378.336	42.168	—	—	—	—	—	—	—	—	—
HUNGARY	1920	7.986.875	7.155.979	550.062	23.695	148.450	5.507	17.132	58.931	—	1.277	—	—	333	—	6.989
93.033 km^2	1980	10.709.463	10.579.898	31.231	10.141	16.054	—	3.426	20.484	—	—	—	—	—	—	27.915
TRANSCAR-PATHIA	1921	619.304	111.052	10.326	10.810	19.284	372.523	—	—	—	—	—	—	—	80.132	—
12.800 km^2	1979	1.155.759	158.446	3.746	27.155	8.914	940.319	—	—	—	—	—	—	—	3.848	5.586
TRANSYLVANIA	1920	5.112.205	1.305.753	539.427	2.930.120	30.879	19.123	48.000	—	—	16.000	—	—	—	181.340	39.000
103.093 km^2	19[illegible]	7.500.229	1.651.307	323.477	5.320.526	24.723	41.324	36.427	—	—	8.459	—	—	171	7.830	43.464
RUMANIA (PROPER)	1920	8.157.900	114.537	163.290	7.469.145	1.087	78.525	4.696	—	—	55.103	—	—	41.625	86.039	65.896
134.407 km^2	1977	14.059.681	19.261	8.728	13.886.965	297	27.659	1.825	—	—	808	—	—	41.087	16.837	32.232
MOLDAVIA	1926/30	2.352.706	684	31.887	1.609.477	540	365.502	340	—	—	51.688	—	—	73.391	191.618	11.451
33.700 km^2	1979	3.949.756	—	11.374	2.525.687	—	1.066.409	—	—	—	80.665	—	—	141.000	80.127	10.666
CROATIA	1921	3.447.594	81.835	99.808	896	42.444	9.521	584.058	2.374.752	1.700	—	—	751	260	—	
56.538 km^2	1981	4.601.469	25.439	2.175	625	21.594	6.594	541.320	3.454.661	23.740	441	5.362	6.006	279	316	3.858
BOSNIA-HERCEGOVINA	1921	1.890.440	2.577	16.471	1.334	6.377	10.782	822.000	407.700	584.800	—	—	626	231	—	—
51.564 km^2	1981	4.124.008	945	460	351	1.039	4.908	1.334.758	758.136	1.629.924	180	1.892	4.394	277	343	7.251
VOIVODINA	1921	1.514.008	369.972	317.755	67.667	59.128	19.266	527.333	117.339	740	2.400	—	—	761	196	—
21.506 km^2	1981	2.034.772	385.356	3.808	47.346	71.561	25.352	1.150.682	109.203	4.930	2.525	18.897	3.812	195.279	19.693	
SERBIA (PROPER)	1921	2.855.059	3.136	14.976	151.632	4.345	4.527	2.483.560	8.924	72.709	48.609	—	20.609	2.484	—	—
50.968 km^2	1981	5.694.464	4.965	1.402	31.922	4.791	2.562	4.942.417	31.447	151.674	30.769	29.033	72.484	1.182	395	57.140
KOSOVO	1921	439.010	12	30	402	18	31	90.000	525	27.680	—	—	288.907	27.915	—	—
10.887 km^2	1981	1.584.441	147	92	21	80	124	236.526	8.718	58.562	161	1.056	1.226.736	12.513	9	34.126
MONTENEGRO	1921	311.341	49	172	19	136	209	236.000	18.200	38.300	—	—	17.231	172	—	—
13.812 km^2	1981	584.310	238	107	160	85	131	419.895	6.904	78.080	24.875	37.735	67	5	1.471	
MACEDONIA	1921	798.291	74	106	8.209	132	177	18.300	700	41.500	—	498.000	110.651	101.460	—	—
25.713 km^2	1981	1.912.257	281	288	6.490	231	455	48.553	3.349	39.555	1.984	1.281.195	377.726	86.691	28	43.223
BULGARIA	1920	5.096.530	1.000	4.000	64.220	1.000	10.600	—	—	—	4.044.172	120.000	1.000	763.596	28.459	84.996
110.912 km^2	1980	8.876.600	700	700	4.000	1.200	12.000	500	—	—	7.590.000	220.000	1.200	750.000	3.000	230.000
ALBANIA	1923	814.385	—	—	10.000	—	—	—	—	—	—	7.489	736.000	—	100	10.000
28.748 km^2	1980	2.670.500	—	—	10.000	—	—	—	—	—	—	10.000	2.590.000	—	—	10.000
CARPATHO-BALKAN-AREA (total)	1920	44.354.205	9.797.257	1.809.969	12.347.626	2.338.823	985.263	4.831.419	2.986.571	767.429	4.224.357	625.489	1.176.536	1.012.286	577.360	245.903
796.706 km^2	1980	74.445.562	13.386.784	392.709	21.871.389	4.528 905	2.470.005	8.716.339	4.392.902	1.986.465	7.716.016	1.568.310	4.320.093	1.033.462	113.017	526.625

Table 1b. Ethnic structure of the population living in the regions of South Eastern Europe (1920, 1980)

Regions	in percent														
	Year	Hungarians	Germans	Rumanians	Slovaks, Czechs	Russians, Ukrainians, Ruthenians	Serbs, Montenegrins	Croats	Muslims	Bulgarians	Macedonians	Albanians	Turks, Tartars, Gagauzes	Jews	Gypsies
SLOVAKIA	1921	22.0	4.9	—	68.4	3.0	—	—	—	—	—	—	—	2.5	0,3
49.025 km²	1980	11.2	0.1	—	87.8	0.8	—	—	—	—	—	—	—	—	—
HUNGARY	1920	89.6	6.9	0.3	1.9	0.1	0.2	0.7	—	—	—	—	—		0.1
93.033 km²	1980	98.8	0.3	0.1	0.1	—	—	0.2	—	—	—	—	—	—	0.3
TRANSCAR-PATHIA	1921	17.9	1.7	1.7	3.1	60.2	—	—	—	—	—	—	—	12.9	—
12.800 km²	1979	13.7	0.3	2.3	0.8	81.4	—	—	—	—	—	—	—	0.3	0.5
TRANSYLVANIA	1920	25.5	10.6	57.3	0.6	0.4	0.9	—	—	0.3	—	—	—	3.5	0.8
103.093 km²	1977	22.0	4.3	70.9	0.3	0.6	0.5	—	—	0.1	—	—	—	0.1	0.6
RUMANIA (PROPER)	1920	1.4	0.8	91.6	—	1.0	—	—	—	0.7	—	—	0.5	1.1	0.8
134.407 km²	1977	0.1	0.0	98.8	—	0.2	—	—	—	0.0	—	—	0.5	0.1	0.2
MOLDAVIA	1926/30	—	1.3	68.4	—	15.5	—	—	—	2.2	—	—	3.1	8.1	0.0
33.700 km²	1979	—	0.0	63.9	—	27.0	—	—	—	2.0	—	—	3.5	1.5	0.0
CROATIA	1921	2.4	2.9	—	1.2	—	17.4	68.1	—	—	—	—	—	—	—
56.538 km²	1981	0.6	0.0	—	0.5	—	11.8	75.1	0.5	—	—	—	—	—	—
BOSNIA-HERCEGOVINA	1921	—	0.9	—	—	0.7	43.5	21.5	30.9	—	—	—	—	—	—
51.564 km²	1981	—	0.0	—	—	0.1	32.4	18.4	39.5	—	—	—	—	—	—
VOIVODINA	1921	24.4	21.0	4.5	3.9	1.3	34.8	7.7	—	0.1	—	—	—	—	—
21.506 km²	1981	18.9	0.2	2.3	3.5	1.2	56.6	5.4	—	0.1	0.9	0.2	—	—	1.0
SERBIA (PROPER)	1921	0.1	0.5	5.3	0.1	0.1	87.0	0.3	2.5	1.7	—	0.7	—	—	—
50.968 km²	1981	0.1	—	0.6	0.1	—	86.8	0.6	2.7	0.5	0.5	1.3	—	—	1.0
KOSOVO	1921	—	—	—	—	—	20.5	—	6.3	—	—	65.8	6.3	—	—
10.887 km²	1981	—	—	—	—	—	13.2	—	3.7	—	—	77.4	0.8	—	2.2
MONTENEGRO	1921	—	—	—	—	—	75.8	5.8	12.3	—	—	5.5	—	—	—
13.812 km²	1981	—	—	—	—	—	71.9	1.2	13.4	—	—	6.5	—	—	—
MACEDONIA	1921	—	—	—	—	—	2.3	—	5.2	—	62.4	13.9	12.7	—	—
25.713 km²	1981	—	—	0.3	—	—	2.5	—	2.1	—	67.0	19.8	4.5	—	2.3
BULGARIA	1920	—	—	1.3	—	0.2	—	—	—	79.3	2.3	—	15.0	0.6	1.7
110.912 km²	1980	—	—	0.0	—	0.1	—	—	—	85.5	2.5	—	8.4	0.0	2.6
ALBANIA	1923	—	—	1.2	—	—	—	—	—	—	0.9	90.4	—	—	1.2
28.748 km²	1980	—	—	0.4	—	—	—	—	—	—	0.4	97.0	—	—	0.4
CARPATHO-BALKAN-AREA (total)	1920	22.1	4.1	27.9	5.3	2.2	11.1	6.7	1.7	9.7	1.3	2.7	2.3	1.3	0.5
796.706 km²	1980	18.0	0.5	29.4	6.1	2.9	11.7	5.9	2.7	10.4	2.1	5.8	1.4	0.1	0.7

Table 2. Nations of the Carpatho-Balkan area

Nations	number	in thousands	ratio	in per cent	change in number (in per cent)
	1920	1980	1920	1980	1920-1980
Rumanians	12,347	21,871	27,9	29,4	77,1
Hungarians	9,797	13,387	22,1	18,0	36,6
Serbs, Monteneg.	4,831	8,716	10,9	11,7	80,4
Bulgarians	4,224	7,716	9,5	10,4	82,7
Croats	2,986	4,393	6,7	5,9	47,1
Slovaks, Czechs.	2,339	4,529	5,3	6,1	93,6
Germans	1,810	393	4,1	0,5	-78,3
Albanians	1,176	4,320	2,7	5,8	267,2
Turks, Gagauz.	1,012	1,033	2,3	1,4	2,1
Ukrainians, Ruth., Russ.	985	2,170	2,2	2,9	120,2
Muslims	767	1,986	1,7	2,7	158,8
Macedonians	625	1,568	1,4	2,1	150,7
Jews*	577	113	1,3	0,2	-80,4
Others	868	2,251	2,0	2,9	159,3
Total	44,354	74,446	100,0	100,0	68,1

Remark: *Jews: Ethnic Jews (not in sense of religious affiliation)

Table 3. Distribution of the nations in SE-Europe by numerical and power dominancy (1920, 1980; in per cent)

Year	Majority nations	National minorities
1920	77,9	22,1
1980	86,0	14,0
	Dominant nations	Subordinated nations, national minorities
1914	64,6	35,4
1920	68,3	31,7
1980	87,6	12,4

Table 4. Ratio of national minorities (1920,1980; in per cent)

Nations	1920	1980
Albanians	37,4	40,0
Hungarians	27,0	21,0
Macedonians	22,0	18,3
Serbs	14,2	7,3
Slovaks	13,4	3,3
Croats	7,0	4,1
Bulgarians	4,3	1,6
Rumanians	2,7	0,6

Remark: Data refer to the population living in the region studied

Table 5. Ratio of the majority nations in the SE-European region (1920, 1980; in per cent)

Regions	1920	1980	1980*
Slovakia (Slovaks)	68,4	87,8	83,0
Hungary (Hungarians)	89,6	98,8	96,6
Transcarpathia (Ruthenians,Ukrainians)	60,2	81,4	77,1
Transylvania (Rumanians)	57,3	70,9	67,0
Rumania Proper (Rumanians)	91,6	98,8	96,7
Moldavia (Rumanians)	68,4	63,9	64,0
Croatia (Croats)	68,1	75,1	83,6
Bosnia-Hercegovina**	43,5	39,5	43,5
Voivodina (Serbs)	34,8	56,6	61,0
Serbia Proper (Serbs)	87,0	86,8	87,3
Kosovo (Albanians)	65,8	77,4	78,0
Montenegro (Montenegrins)	75,8	71,9	76,8
Macedonia (Macedonians)	61,6	67,0	67,7
Bulgaria (Bulgarians)	79,3	85,5	85,5
Albania (Albanians)	90,4	97,0	97,0

Remarks: *1980: estimation by K.Kocsis

**Bosnia-Hercegovina in 1920: Serbs, in 1980: Muslims

Table 6. Religious affiliation of the population of the Carpatho-Balkan Region (1920, 1990; in per cent)

Religious affiliation	1920	1990
Western Christians (Catholics, Protestants)	41,7	33,3
Eastern Christians (Orthodoxes)	48,9	38,6
Muslims	5,8	5,1
Others, atheists, non religious	3,6	23,1
Total population	100,0	100,0

Table 7a. Interregional migration in South Eastern Europe (1918-1925)

Years	Ethnicity	Number of the migrated persons	From	To
1918-24	Hungarians	88 200	Slovakia	Hungary
1918-24	Hungarians	18 600	Transcarpathia	Hungary
1918-24	Hungarians	197 000	Transylvania	Hungary
1918-24	Hungarians	17 000	Voivodina	Hungary
1918-24	Hungarians	24 000	Croatia	Hungary
1918-24	Hungarians	3 500	Slovenia	Hungary
1918-38	Rumanians	300 000	Rumania Proper	Bessarabia
1918-38	Rumanians	400 000	Rumania Proper	Transylvania
1918-38	Ukrainians	250 000	Bessarabia	Ukraine
1921-39	Turks	177 000	Bulgaria	Turkey
1921-38	Turks	40 000	Rumania, Serbia	Turkey
1918-38	Czechs	147 000	Czech Lands	Slovakia
1918-38	Czechs, Slovaks	40 000	Czech Lands, Slovakia	Transcarpathia
1918-22	Russians	33 500	Russia, Ukraine	Serbia
1918-22	Russians	32 000	Russia, Ukraine	Bulgaria
1918-22	Russians	4 000	Russia, Ukraine	Hungary
1918-22	Russians	3 000	Russia, Ukraine	Slovakia
1918-26	Bulgarians	123 000	Greece	Bulgaria
1918-28	Greeks	46 000	Bulgaria	Greece
1918-38	Serbs	30 000	Croatia, Bosnia, Serbia	Voivodina
1918-25	Serbs	6 000	Hungary	Voivodina

Table 7b. Interregional migration in South-Eastern Europe (1925-1944)

Years	Ethnicity	Number of the migrated persons	From	To
1939	Czechs	140 000	Slovakia	Czech Lands
1939	Czechs, Slovaks	40 000	Transcarpathia	Slovakia
1938	Czechs, Slovaks	86 000	South Slovakia	Slovakia, Czech Lands
1938-44	Hungarians	32 000	Hungary	South Slovakia
1939-44	Hungarians	20 000	Hungary	Transcarpathia
1940	Hungarians	67 000	South Transylvania	North Transylvania
1940-41	Hungarians	50 000	Hungary	North Transylvania
1941	Hungarians	40 000	Bukovina, Hungary	Voivodina
1940	Rumanians	219 000	North Transylvania	South Transylvania
1940	Rumanians	100 000	South Dobruja	Bessarabia, Rumania Proper
1942-43	Bulgarians	122 000	Bulgaria	Macedonia, West Thrace
1940	Bulgarians	61 000	North Dobruja	South Dobruja
1941	Croats	70 000	Serbia Proper	Croatia
1941	Croats	6 000	Slovenia	Croatia
1941	Serbs	65 000	Croatia	Serbia Proper
1941	Serbs	54 000	Bosnia-Hercegovina	Serbia Proper
1941	Serbs	6 000	Slovenia	Serbia Proper
1941	Serbs	43 000	Macedonia	Serbia Proper
1941	Serbs	27 000	Montenegro	Serbia Proper
1941	Serbs	21 000	Voivodina	Serbia Proper
1941	Serbs	57 000	Dalmatia	Italy
1941	Slovens	30 000	Slovenia	Croatia
1941	Slovens	26 000	Slovenia	Serbia
1940	Germans	67 000	Rumania Proper	Poland
1940	Germans	1 900	Serbia Proper	Poland
1942	Germans	30 000	Croatia	Poland
1941	Germans	1 400	Bulgaria	Germany
1940	Germans	93 500	Bessarabia	Poland, Germany
1939-44	Jews	70 000	Slovakia	Poland, Germany
1944	Jews	200 000	Hungary	Poland, Germany
1944	Jews	80 000	Transcarpathia	Poland, Germany
1944	Jews	151 000	North Transylvania	Poland, Germany
1944	Jews	40 000	South Transylvania	Poland, Germany
1939-44	Jews	280 000	Rumania Proper	Ukraine, Poland
1939-44	Jews	200 000	Bessarabia	Ukraine, Poland
1941-44	Jews	20 000	Voivodina	Germany, Poland
1941-44	Jews	20 000	Croatia	Germany, Poland
1941-44	Jews	10 000	Bosnia	Germany, Poland
1941-44	Jews	8 000	Macedonia	Poland
1941-44	Jews	5 000	Serbia Proper	Poland
1941-44	Jews	6 000	Bulgaria	Poland
1940	Russians	200 000	Bessarabia	Ukraine, Russia
1940	Ukrainians	60 000	Bessarabia	Ukraine, Russia
1939-44	Turks	30 500	Bulgaria	Turkey
1939-44	Turks	7 600	Rumania Proper	Turkey

Table 7c. Interregional migrations in South-Eastern Europe (1944-1951)

Years	Ethnicity	Number of the migrated persons	From	To
1944-46	Germans	120 000	Slovakia	Germany
1944-45	Germans	69 000	Transylvania	Russia, Ukraine
1944	Germans	205 000	Transylvania	Germany
1944-50	Germans	250 000	Voivodina, Croatia	Germany
1945-50	Germans	213 000	Hungary	Germany
1945	Germans	100 000	Voivodina,Croatia	Russia, Ukraine
1944	Germans	10 000	Transcarpathia	Russia
1945-50	Slovaks	250 000	Slovakia	Czech Lands
1945-48	Slovaks	13 600	Transylvania	Slovakia
1946-48	Slovaks	73 000	Hungary	Slovakia
1945-47	Slovaks	20 000	Transcarpathia	Slovakia
1946-47	Ruthenians, Ukrainians	30 000	Slovakia	Transcarpathia
1946-47	Ruthenians, Ukrainians	10 000	Slovakia	Czech Lands
1944-50	Ukrainians	80 000	Ukraine	Moldavia
1944-50	Russians	130 000	Russia, Ukraine	Moldavia
1944-50	Russians	24 000	Russia, Ukraine	Transcarpathia
1945-48	Hungarians	106 000	Slovakia	Hungary
1946-47	Hungarians	44 000	Slovakia	Czech Lands
1944	Hungarians	10 000	Slovakia	Russia, Ukraine
1944-45	Hungarians	25 000	Transcarpathia	Hungary
1944	Hungarians	45 000	Transcarpathia	Russia, Ukraine
1944-45	Hungarians	40 000	Voivodina	Hungary
1944-45	Hungarians	125 000	Transylvania	Hungary
1944-45	Rumanians	200 000	Moldavia	Rumania Proper
1944-48	Rumanians	300 000	Rumania Proper	Transylvania
1946-47	Italians	140 000	Croatia	Italy
1945-51	Turks	182 000	Bulgaria	Turkey
1944-45	Bulgarians	120 000	Macedonia, Greece	Bulgaria
1944-48	Macedonians	8 000	Macedonia	Voivodina
1944-48	Serbs, Montenegrins	235 000	Croatia, Bosnia, Montenegro, Serbia	Voivodina
1945-48	Croatians	20 000	Croatia	Voivodina

Table 8. Religious affiliation of the nations of the Carpatho-Balkan Region (1990; in per cent)

Nations	Western Christians (Catholics, Protestants)	Eastern Christians (Orthodox)	Muslims	Others, atheists, non-religious people
Slovaks	90	—	—	10
Hungarians	89	—	—	11
Croats	83	—	—	17
Rumanians	9	75	—	16
Ukrainians	—	50	—	50
Serbs	—	83	—	17
Macedonians	—	83	—	17
Bulgarians	—	34	1	65
Muslims	—	—	83	17
Albanians	2	5	29	64

Source: Britannica. Book of the Year. 1991.

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THE SOCIO-ECONOMIC TRANSFORMATION AND THE CONSEQUENCES OF THE LIBERALISATION OF BORDERS IN HUNGARY

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ABSTRACT

The aim of this paper is to examine and provide an objective analysis about the consequences of the liberalisation of national borders in Hungary. Among others, the demographic trends of the 1980s, the question of economic restructuring and the subsequent social processes are investigated. The author points out, that the liberalisation of borders undoubtedly accelerated the transformation of the economy which in its turn induced large scale economic immigration to Hungary. The liberalisation of borders has also had negative consequences which came unexpectedly and found Hungary unprepared. The most severe conflicts could be observed in connection with the outdated Hungarian traffic networks, the increasing crime figures and the expanding black market economy. The author concludes that at this date it is probably not possible to present an exhaustive and scientific analysis of the transformation processes in Hungary, and the study can highlight only certain important phenomena. At the same time the main tendencies of the socio-economic transformation which could lead Hungary back into the European mainstream may already be discerned.

INTRODUCTION

A truly objective analysis of the consequences of the liberalisation of borders in Hungary would ideally require a greater historical distance than we have at present. On the one hand there is too little data for a complete study of all the relevant phenomena concerning the liberalisation of borders, on the other hand there is still too much emotion involved in this issue.

Non-professionals even now have only a general picture about the transformation in the political and economic systems of Eastern-European countries during the 1980s and 1990s. The great differences between the individual countries resulted, among other things, from the different degrees of socialist 'development' to which they were subject, tend to disappear. A knowledge of these differences is essential for an understanding of the particular forms of crisis phenomena present in Eastern European countries.

As a result of the striking dissimilarities in their internal socio-economic development, the new socio-economic systems are emerging with a phase lag, while the progress of changes also shows a great variation. (*Table 1*). All this has of course great relevance to the extent, the direction and the purpose of liberalisation of borders in Hungary. In this study I would like to highlight some of the consequences for Hungary.

Table 1. A diary of socio-economic changes in East European countries

Hungary:	a) November 1988–May 1990, Németh government b) Parliamentary elections — Antall government
Czecho-slovakia:	a) November 1989, velvet revolution b) June 1990, parliamentary elections
Poland:	a) September 1989, Mazowiecki government b) Autumn 1990, presidential election, Bielecki government
East Germany:	a) November 9, 1989, the opening of the borders b) July-October 1990, financial and political union
Yugoslavia:	a) December 1989, radical economic reforms package b) Middle of 1989, weakening consensus, political problems within the federation c) December 1990, new reform package
Rumania:	a) December 1989, fall of Ceaucescu b) May 1990 Parliamentary elections — Petre Roman administration
Bulgaria:	a) June 1990, parliamentary elections, socialist government b) November1990, coalition government

SOCIO-ECONOMIC PROCESSES IN HUNGARY BEFORE THE LIBERALISATION OF BORDERS

Social processes between 1980-1990

The population of Hungary was the highest in 1980 (10,710,000 people); since then there has been a reduction of 400,000 (by 1990). This natural decrease (*Fig. 1*) resulted from several causes: the number of women at childbearing age greatly diminished, a large part of the population migrated into urban areas between 1970-1980, and as a consequence, their willingness to have children was reduced. During this period the number of divorces increased and the living standard stagnated. Finally, as a result of the ageing of population, the number of deaths increased.

Since the beginning of the 1980s Hungarian society has experienced a demographic crisis. It was less marked in the towns, but in some rural areas the ageing of population, in a large part due to the out-migration of the younger generations, has accelerated the population loss. Those predicting the appearance of socio-political refugees in Hungary presumed that these rural areas could receive them. This assumption, however, has not been justified, either by research, or by actual immigration following the liberalisation of borders; the majority of the refugees either settled in towns or nearby urban areas, or stayed in refugee camps.

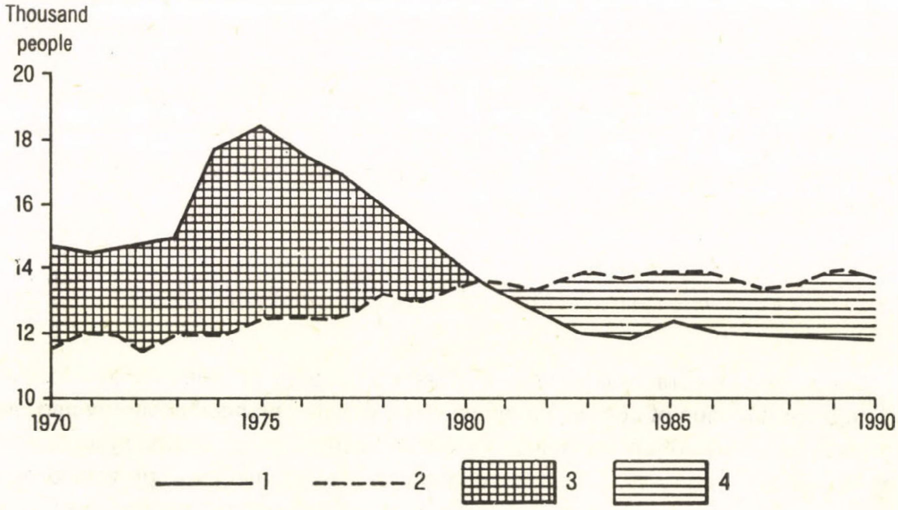

Fig. 1. Demographic trends in Hungary (1970-1990). 1 = number of births, 2 = number of deaths, 3 = natural increase, 4 = natural decrease

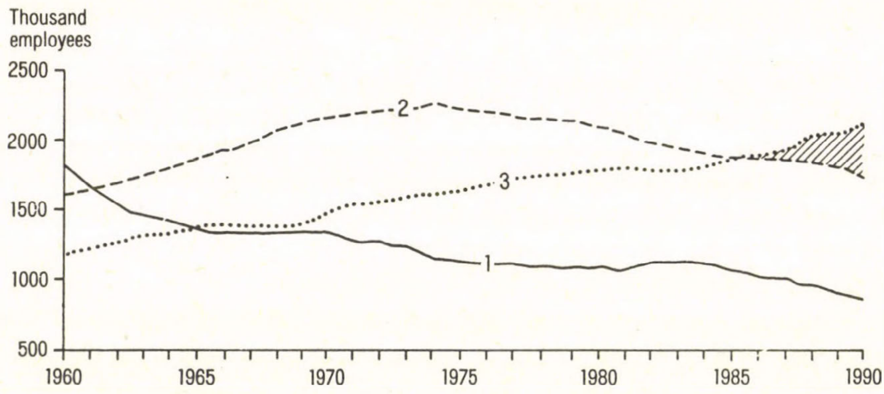

Fig. 2. Structure of employment (1960-1990). 1 = agriculture, 2 = industry, 3 = tertiary sector

Parallel with the population loss, a transformation in the structure of employment (*Fig. 2*) has taken place in Hungary: in 1985-86 the proportion of 'tertiary' employment exceeded the proportion of those employed in the industrial sector. The acceleration of privatisation in the tertiary sector of the economy has attracted a large number of highly qualified young people, a social group with low share in the population. Large industrial enterprises having lost markets and facing lower output, have dismissed primarily their unskilled labour force, which could not be absorbed by the tertiary sector. Consequently, the appearence of refugees in Hungary has taken place against the background of a crisis situation with regard to employment, too.

Economic restructuring and the liberalisation of borders

Since 1968 the economic reforms in Hungary initiated an economic development, based on a combination of certain elements of the socialist planned economy and those of a market economy which was markedly different from the economic systems in the rest of the socialist countries. The planned course of development was prevented by the first and second oil crises. In both cases the political authorities reverted back to the instruments of the socialist planned economy: the internal socio-economic balance was restored over and over again by way of foreign loans. The last step in this process was taken at the beginning of the 1980s, but this time the desired balance and continuity was not achieved and the result was a rapid consumption of domestic reserves. As a consequence, the recession of 1986 was able to destroy the political authority of the socialist government, a process, also promoted by foreign political circumstances.

The figures for Gross Domestic Product (GDP) and domestic consumption illustrate the above described economic process. The political authority responded to the economic recession of 1986 by a broadening of Western relations and rapid liberalisation. Hungary joined several international organisations, which insured against any return in economic policy to the instruments of the previous planned economy and virtually guaranteed the initiation of the transformation of the Hungarian economy into a market economy.

The socio-economic liberalisation provided favourable circumstances for export activities. In 1990-91 the Hungarian economy made significant profit and this resulted in the stabilisation of the transformation of the socio-economic system. The stabilisation of the internal balance of the economy, however, could not be achieved because of the collapse of the COMECON market. Industry and agriculture produced increasing surpluses, since export to COMECON countries ceased because of their inability to pay. The appearance of foreign capital and the commencement of privatisation increased the number of small and medium size companies. The large scale 'socialist' companies also survived and in order to preserve the previous structure of the economy reduced their production, which resulted in a rapid increase in unemployment (in 1989 30,000 people, in 1990 110,000, in November 1991 320,000).

The first results of the crisis management program instigated by the new government have undoubtedly begun to manifest themselves:

a) In the first two years of the transformation approximately 15,000 Hungarian-foreign joint ventures have been established introducing approximately 2 billion dollars into the economy in each year, equalling to the amount of capital invested in all the other former socialist economies together. However,this is obviously not sufficient for the acceleration of the economic transformation process, and cannot lessen the huge regional differences existing in Hungary, since foreign capital being primarily concentrated in Budapest (*Fig. 3*). More than half of the foreign capital invested in Hungary comes from Central Europe (Germany, Austria, Switzerland), but the amount of French capital invested here has also increased, a new phenomenon with regard to the regional economic relations between the two world wars. American and Japanese capital have also played an important role in the Hungarian transformation process.

b) The development of the tertiary sector has been rapid; tourism, catering and retail trade in particular have attracted a significant amount of domestic and foreign capital. In these sectors of the economy the proportion of private capital was 30-40 per cent even before the transformation, occasionally operating within the framework of semi-state enterprises. A significant part of these enterprises have gone into private hands. The number of retail units was 35,000 in 1988, and 60,000 in 1990, from which 9,000

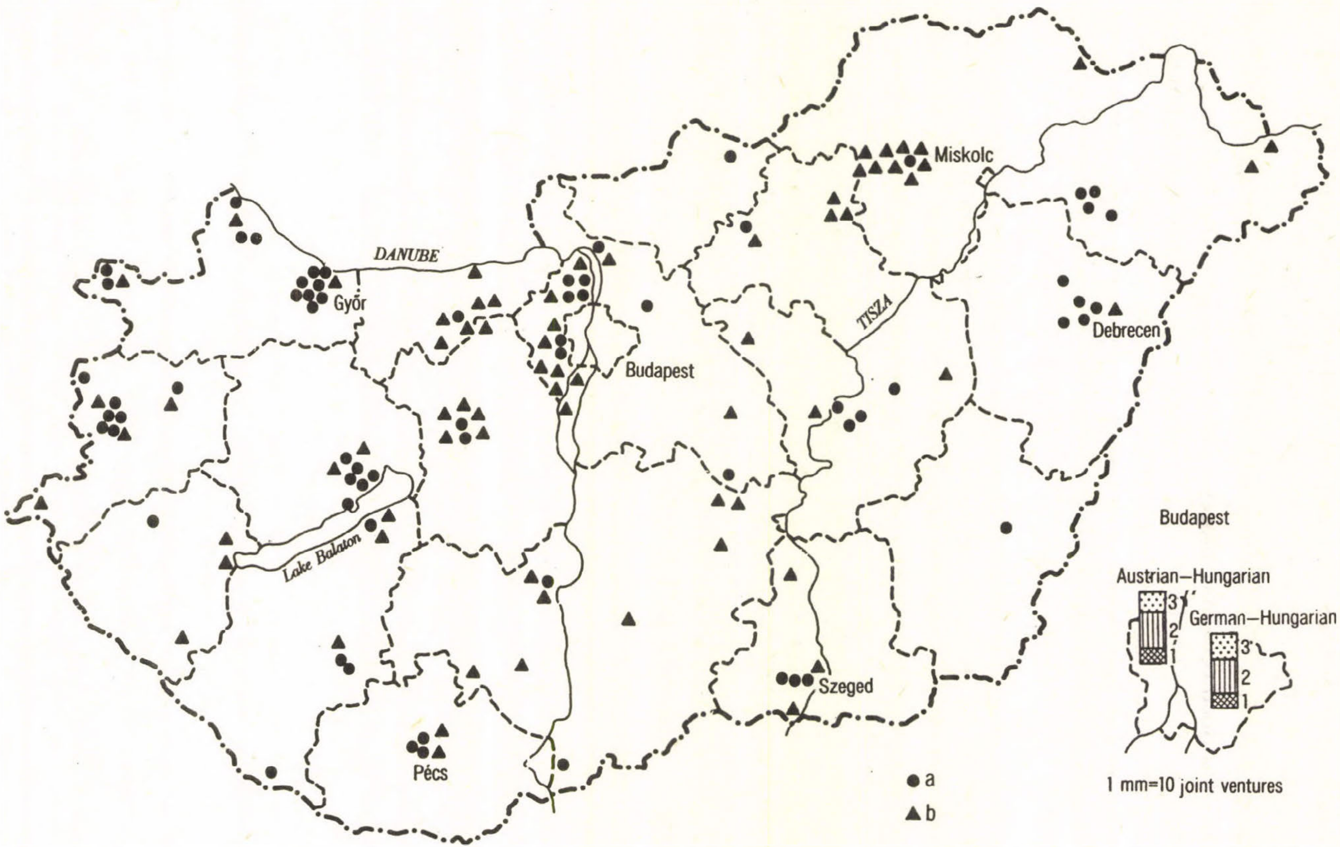

Fig. 3. Spatial distribution of Austrian-Hungarian (a) and German-Hungarian (b) joint ventures (1990). 1 = before 1989; 2 = 1989; 3 = 1990

and 44,000 respectively were operated by the private sector (73 per cent). These premises naturally had many negative consequences too, which became clear as a result of the liberalisation of borders: smuggling, resale of products at a higher price, speculation and a black market in hard currency, etc. These problems were also present before, but it was now that they really came to the surface.

c) The transformation of the monopolistic large company sector has also started, although slowly. There has been a rapid increase in the number of new-type economic formations, replacing the monolithic units of the collapsing large companies (*Table 2*).

Table 2. Economic organizations in Hungary

	1988	1989	1990
Economic organisations having a legal personality	10 811	15 236	29 470
Economic associations having a legal personality	955	5 224	19 401
Of these:			
stockholding companies	116	307	646
limited companies	451	4 485	18 317

The appearance of a great number of economic organisations, however, meant a redistribution of state capital rather than an increase in domestic investment. Domestic investment appeared in the Hungarian economy together with foreign capital. Domestic capital was invested primarily in the banking sphere because of the high interest rates.

The liberalisation of borders undoubtedly accelerated the transformation of the economy, which in its turn induced economic immigration to Hungary.

LIBERALISATION OF BORDERS AND TOURISM

Under the influence of the relatively open policy following the economic reforms (1968) the number of visitors to Hungary already reached 5-6 million a year by the mid-1970s, and this figure had doubled by 1980. From the beginning of the 1980s, as a result of the acceleration of the socio-economic and political changes, the number of foreign visitors has increased rapidly: 16.5 million in 1986 and 37.6 million in 1990. It is obvious that in the latter case only part of the visitors had purely tourist purposes, and this mass migration may be viewed as a result of the liberalisation of borders in 1989. A large number of visitors, in total 28 million people, came to Hungary from the neighbouring countries (Austria, Czechoslovakia, Rumania and Yugoslavia), with the exception

tion of the Soviet Union, from where only 48 per cent were visitors in the usual sense; i.e. who spent at least one night in Hungary. (Hungarian statistics classify tourists in the following way: visitors, who spend more than 48 hours in the country; day trippers, who spend less than 24 hours in the country; and transit visitors.)

The changing number of visitors at different points of the Hungarian border reflects both the liberalisation of borders and the specific political environment. The number of visitors on the Austrian border has been continuously increasing since the borders were opened. In contrast, on the Czechoslovakian, Soviet, Rumanian and Yugoslavian borders in 1988 the number of visitors dropped (because of Kádár's resignation and the acceleration of political transformation), and has only increased after the collapse of the socialist systems in these countries. Mass tourism resulted from the visits of Hungarians from the neighbouring countries, since for many of them it was the first opportunity to see the motherland. However, not so much emotions but rather financial considerations and the deficiency of goods for sale (Rumania, Soviet Union) or the even higher rate of inflation than in Hungary (Yugoslavia) were the background for the arrival of visitors from these former socialist countries to Hungary in such large numbers.

According to Hungarian statistics the following classification can be made for the approximately 60 million border-crossers who visited Hungary in the one and a half year period following the liberalisation of borders (middle of 1989- end of 1990):

a) In 1990 there were approximately 20 million visitors who spent at least one night in Hungary. Presumably a significant part of those regarded as tourists were Hungarians from the neighbouring countries visiting their relatives, because per capita expenditure reduced to half during this period. Although the total income from tourism increased, especially with regard to countries with hard currency, per capita income from tourism fell and the hard currency producing capacity of tourism overall was reduced.

The strengthening role of tourism in the economy was indicated by the fact that between 1980 and 1990, 117 hotels were constructed in Hungary, while other transforming sectors of the economy were facing a crisis situation. Hotel capacities increased and occupancy rates, especially following the liberalisation of borders and in Budapest, rose to over 70 per cent. At the same time utilisation of other holiday resorts (e.g. Balaton), declined. The number of guest nights spent in Budapest was 3.5 million in 1990, although there was a drop in the second half of the year because of increasing prices and the reduction of Soviet tourism. At the same time the number of visits on business and of conference participants increased.

b) The number of day trippers, who spent less than 24 hours in Hungary, rapidly increased following the liberalisation of borders: 4,500 people from Rumania in 1989, one year later 1.5 million; 1.7 million from Yugoslavia in 1989 and 4.5 million in 1990. This kind of shopping tourism influenced primarily the towns along the border. The retail trade infrastructure of Debrecen, Szeged and Pécs had been formed to supply the local population, consequently the appearance of two millions shoppers in these towns resulted in the indignation of the inhabitants. Private shopkeepers, however, protested against any restriction, since increasing turnover resulted in a significant profit and the retail trade sector was able to sell the accumulated stock, deriving from the constant narrowing of the COMECON market. In the border region more and more impressive shops emerged and supermarkets were built in the first half of 1990, just as one year before in the region between Győr and Vienna, where a large number of Hungarian and foreign shoppers had to be served.

c) The number of shopping tourists was also increased by the so-called borderwise traffic (visitors from settlements located along the other side of the border). Inhabitants of settlements in the border region, defined by the authorities of the two countries involved, can travel in order to visit their relatives in accordance with specific regulations. In 1989, 3 million visitors came to Hungary across the Hungarian-Soviet border. This was unilaterally restricted by Soviets in 1990 and as a consequence the number of visitors dropped to one million. There was a similar kind of tourism along the Hungarian-Yugoslavian border, but its volume was smaller than the former one.

d) Finally, the liberalisation of borders resulted in a growing number of transit visitors in Hungary. It meant 7.5 million people in 1990, which is double of the figure registered before the liberalisation. Before the liberalisation of borders one third of the transit visitors came from Czechoslovakia who visited primarily Yugoslavia in large numbers, while in 1989 many tourists arrived from Germany who were heading for Bulgaria. After the borders were opened the number of transit visitors from Poland and the Soviet Union going to Yugoslavia and Turkey increased considerably. Polish tourists often travelled to Yugoslavia just for one day (to Subotica or Novi Sad) in order to do shopping. In 1990 there were many transit visitors (1.2 million) from Rumania as well, who wanted to go to Austria and Germany but the majority of whom stayed in Hungary because of lack of visa. As a result of the events in Yugoslavia in the summer of 1991 approximately half a million Turkish migrant workers travelled through Hungary causing quite a panic.

e) As a consequence of the liberalisation of borders in 1989-91 Hungary has become one of the target countries for refugees. The number, constitution and time of arrival of refugees have always depended upon the latest events in the transformation processes in Eastern Europe:

1989

- East German refugees until Hungary opened her borders to Austria (18–20 thousand)
- From December Rumanian refugees as a consequence of the 'revolution' (10–15 thousand)

1990

- March, from Rumania, as a result of the events in Marosvásárhely (Tirgu Mureş)

1991

- Arab refugees as a result of the Gulf War (approximately 10 thousand)
- As a result of the civil war in Yugoslavia 40 thousand people up to December 1, 1991

Along with the above mentioned larger groups of refugees, there have been constant attempts at illegal immigration into Hungary from the Middle- and Far-East as well as from certain African countries, primarily with the participation of 'people smugglers'. The destination of the majority of such immigrants has been Western Europe.

In contrast to these groups, according to estimates, 5–6 thousand Chinese immigrants have come to Hungary with the aim of settling down here. This is a highly organised group of immigrants with a modest amount of capital. They have established their own self-assisting organisations to promote the integration of their members into Hungarian society, and consequently they have been able to find their place in the retail trade sector under privatisation.

Hungarian refugees arriving from the neighbouring countries seldom turn to refugee camps for assistance, unless they do not want to settle down in Hungary but wish to move on to Western Europe. The majority of Yugoslavian refugees regard their stay in Hungary as temporary and would like to return to Yugoslavia. Most foreign refugees are expecting to get visas and to travel to some Western European country; they only regard Hungary as a transit destination. People living in the locality of such refugee camps have been tolerant with these foreigners, although the economic position of the Hungarian population has declined over this period too. Most people realise that international aid organisations provide significant assistance for refugees, and they also show more solidarity with them. Hostility towards foreigners is, of course, present in certain minor groups in the population, but paradoxically this phenomenon is to be found not in the traditionally closed introverted village communities, but rather in the lowest strata of urban proletariat.

The liberalisation of borders also brought about an increase in the number of Hungarians travelling abroad; the most frequent destination naturally being Austria. In 1986 half a million, in 1990 six million Hungarians visited Austria, 42 per cent of all Hungarians travelling abroad. Another important target was Czechoslovakia (5 million Hungarian entries), where Hungarians were attracted by the opportunity of cheap shopping. In the case of other countries the purpose of travel was usually to visit relatives.

The fact that Hungarian entries to foreign countries have shown hardly any seasonal characteristics — the number of exits from Hungary was only 30–40 per cent higher in the summer — proves that the primary aim of Hungarian tourism has been shopping. In contrast to this, four times more foreigners visited Hungary in the summer than in the winter.

If we consider the number of exits of Hungarians and the entries of foreigners together, then the total turnover of Hungarian border posts was 112 million people in 1990, one third falling to the Hungarian-Austrian border. This meant the exit and entry of 27 million cars at public road border crossing points.

This heavy traffic affected the various regions of Hungary in different way: it had particularly great impact on Budapest and certain counties along the border regions, e.g. Győr-Sopron county on the Hungarian-Austrian border, Baranya and Csongrád counties on the Hungarian-Yugoslavian border or Hajdú-Bihar, Békés and Szabolcs-Szatmár counties on the Soviet-Hungarian, and Rumanian-Hungarian borders (*Fig. 4*).

The significance of *Budapest* has increased after the liberalisation of borders not only from the point of view of tourism, but its macroregional functions exercised in the economic and financial sectors have also revived, functions which were especially strong at the turn of the century and which made Budapest the centre of the Carpathian Basin. With the collapse of the Austro-Hungarian Monarchy these functions were weakened and later disappeared completely in the wake of the centralization trends in the new states. It seems that with the liberalisation of borders Budapest can play a leading role in the region, and this opportunity has already been discovered by multinational companies.

Towns in the *Austrian-Hungarian border region* — Sopron, Mosonmagyaróvár, Győr, Szombathely — have been affected not only by traffic in the West-East direction but also in a north-south direction. The transit nature of the region has been further reinforced and the former tranquillity of these Western-Hungarian small towns has disappeared.

In 1990 near the *Yugoslavian-Hungarian border* Pécs and its surroundings became the target of those arriving from the south. The large number of refugees came primarily to small towns of the southern border region: Mohács, Siklós, Harkány, Barcs, etc. The majority of refugees were given shelter through family relations, although official camps were also set up. Szeged on the southern border has become a transit destination and the centre of travel to the Balkans and a meeting point for Polish, Soviet, Bulgarian, Turkish, Yugoslavian and Rumanian travellers.

In the *Eastern border region* Debrecen and Nyíregyháza received visitors from the Soviet Union and Rumania, since 3 million Hungarian minorities live in the Eastern-Carpathian Basin and these two cities were the most accessible for them.

The increased migration has revived regional relations hundreds of years old and traditional migration routes, from time to time blocked by rigid state borderlines after the First World War. After 1918, historical market towns on the edge of the Carpathian Basin like Košice, Uzhorod, Satu Mare, Oradea, Arad, Timisoara and Subotica lost their former mediating role between basin and hill regions, and in the new situation towns which had previously been insignificant in comparison with them — e.g. Debrecen, Miskolc, Békéscsaba, Szeged, and Pécs — started to take over their central functions.

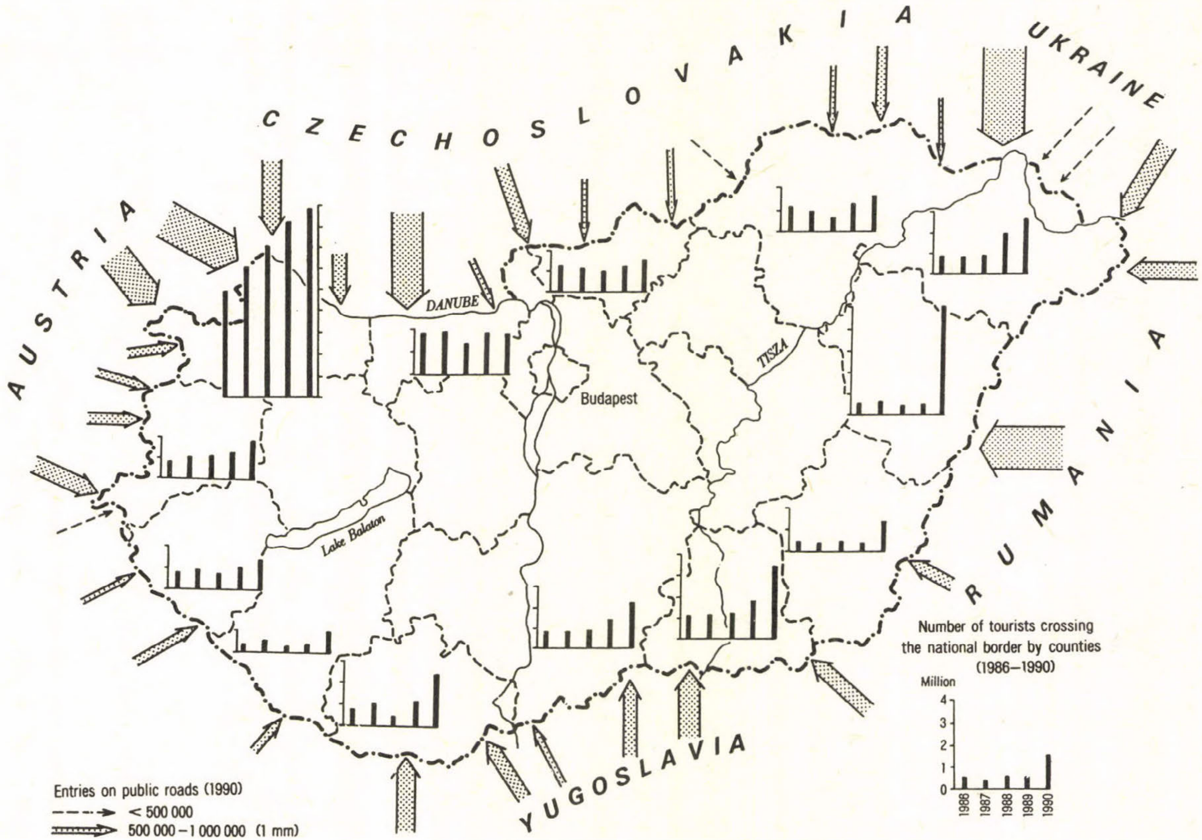

Fig. 4. Number of entries in the counties along the national border (1986-1990)

THE LIBERALISATION OF BORDERS AND ECONOMIC TRANSFORMATION

Though the liberalisation of the Hungarian economy has gradually strengthened since the mid-1970s and has been more fully developed than the political relations, the open borders gave a quite new impetus to economic cooperation primarily with EEC countries. There were already real opportunities to establish joint ventures with foreign partners at the beginning of the 1980s, although the establishment and operation of joint ventures at that time was a troublesome bureaucratic process.

Laws passed shortly before and after the transformation of the political system have simplified the operation of joint ventures. The liberalisation of the issue of export-import licences, the circulation of capital and the acquiring of property, among other things, have greatly accelerated macroregional relations between East European economies. The transformation or restructuring of economic cooperation was initiated by the foreign companies:

- which had to stop their operations in Hungary after the nationalizations (1949), but continued to maintain some sort of relations with the Hungarian economy;
- which could obtain property by way of utilising their family or other connections;
- which were owned by Hungarian emigrants, who could quickly take advantage of the privatisation of small and medium size companies;
- which, being multinational companies, were integrated into the Hungarian economy by state mediation.

No exact statistical data exist on joint ventures, the 'Yellow pages' of 1990 containing only the data of 1053 companies wishing to advertise their activities. According to relevant estimates, the yellow pages cover not more than one-tenth of all joint ventures. This publication may still be regarded as a good sample and provides a reasonable profile of the establishment of joint ventures and their regional distribution, something which is partly related to the liberalisation of borders. It can be claimed that:

a) Although opportunities to establish joint ventures have, in principle, existed for years, only 10 per cent of present day joint ventures were established before 1988. In 1989, the year of the 'political turn', and after the liberalisation of borders, more than 400 joint ventures commenced operations.

b) At the first stage of the establishment of joint ventures East European relations were strengthened; furthermore, up to 1989, 55 per cent of companies, while in 1989 already 63 per cent, were established with the participation of German speaking countries (Germany, Austria and Switzerland). The countries located geographically further away, and as a consequence informed about the Hungarian socio-political situation improperly, started to seek economic ties with Hungarian companies only after the 'political turn' in

1990. Western European companies (from France, Netherlands, UK) started to invest only after the socio-economic changes and thus the share of Central European companies in the Hungarian economy has been reduced to 44 per cent.

c) The degree of participation in the Hungarian economy varies between Central European, West European and overseas companies. Sixty per cent of joint ventures established with the participation of Central European companies are engaged in commerce by way of fully liberalised export-import opportunities, while joint ventures involving West European and overseas companies have interests primarily in the industrial sector.

d) These regional differences in economic relations are also indicated by the fact that Central European companies are mainly small or medium size units, while economic relations reaching across larger geographic distances have the involvement of multinational companies (General Motors, Suzuki, Shell, etc.).

Therefore it can be stated that the liberalisation of borders has played an outstanding role in the deepening of economic relations with Central Europe, but in the case of multinational companies, the decisive factor was the commencement of political changes. The liberalisation of borders, by way of promoting regional relations, directly or indirectly contributed to the influx of foreign capital to Hungary and consequently accelerated the economic transformation.

SIDE-EFFECTS OF LIBERALISED BORDERS

The liberalisation of borders has also had negative consequences which came unexpectedly and found Hungary unprepared.

a) The 40 million foreigners passing through the country, four times of the population of Hungary, put a serious strain on traffic. In 1990 Hungary's outdated road system handled 9 million cars, placing a great burden upon the centre of the traffic network because all main routes pass through Budapest.

Although motorways have been built within a radius of 60–100 km of the capital, a by-pass has not yet been completed around Budapest and so traffic tends to become severely congested here.

The liberalisation of borders also increased the number of private cars; ownership increased from 1.7 million to 1.9 million between 1989 and 1990. Officially 140,000 vehicles were imported and 60 thousand cars were purchased abroad.

b) The liberalisation of borders and the political transformation in 1989 encouraged criminals part of whom have come to Hungary from abroad and managed to find Hungarian partners very quickly. The number of criminals in Hungary at large increased by 4,000 as a result of the amnesty announced by the government when it came to office.

As a result of this the number of crimes reported between 1988 and 1990 increased by 54 per cent while the rate of identified delinquents has fallen from 63 per cent to 50 per cent. Various Hungarian and international organisations have come to the assistance of the Hungarian police to halt the crime wave.

c) Another negative effect of the liberalisation of borders was the expanding black market economy, which cannot be repressed by drastic measures because of the concomitant risk of unrest as a result of declining living standard. Small entrepreneurs and employers are protesting at the local councils against employment in the black economy because no tax or social insurance contributions are paid there, most people however tolerate the many unauthorised street traders and moonlighters.

At this date it is probably not possible to present an exhaustive and scientific analysis of the transformation processes in Hungary, this short study itself aims only at highlighting certain important phenomena. At the same time the main tendencies of the socio-economic transformation which could lead Hungary back into the European mainstream may already be discerned. We should not fall prey to illusions, however: this process will be neither smooth nor troublefree.

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ASSESSING THE POSTWAR URBAN DEVELOPMENT IN BUDAPEST

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ABSTRACT

This paper gives an overview about the urban development of Budapest with special regard to the last forty-five years, when the city developed according to state socialist criteria. Beside the wider historical context the impacts of regional development policy and housing policy on the urban development are also examined. The author concludes that socialist urban planning could not fulfil its original targets. It was unable to abolish housing shortage, diminish the privileged position of Budapest in the national settlement system, or even to decrease the scale of segregation. Although urban processes occured within the framework of a planned socialist system, they appear to differ little from those opearting in Western cities. Urban inequality is examined and demonstrated through the spatial differences of dwelling prices. It is remarkable how stable the spatial hierarchy seems to have been over the last forty years, in spite of the advent of state socialism.

INTRODUCTION

If we speak about the prospects of East European cities, first we have to study their past and their contemporary transformation. The postwar centrally planned, state- socialist era has come to an end in Eastern Europe, where rapid social and economic transitions are taking place. In our opinion the current changes can be best observed in the big cities, where the societies are relatively more advanced.

The aim of this paper is to overview the urban development of Budapest with special regard to the last 45 years, when the city developed according to 'state socialist' criteria. I tried to highlight the most important factors, which characterized the socialist phase of urban policy in Hungary, and influenced the growth of Budapest.

PRE-WAR DEVELOPMENT OF BUDAPEST

Budapest is one of the youngest capital cities in Europe. It was officially established only in 1873, through the unification of three independent and geographically more or less separated towns: Pest, Buda and Óbuda. At the time of unification Budapest was still a provincial place by European standards. The upper-class normally lived in Vienna, and the language of the town was dominantly German. The petty bourgeoisie and the industrial working class were very weak.

The last three decades of the 19th century was the peak of urban and economic development in the life of Budapest. Due to an extensive industrial growth the social composition of Budapest also changed fundamentally. For instance, at the turn of the century only 64,000 people were employed in industry, a figure which doubled in the following decade. This extensive late 19th century capitalist development turned Budapest from a provincial East European town into a modern, cosmopolitan metropolis (Lukacs, J. 1989).

At the time of the 1869 census, with a population of 280,000 the Hungarian capital ranked only seventeenth among the large cities of Europe, while by the turn of the century the population had increased to almost three quarters of a million, and the city advanced to the eighth place in Europe. The rate of population growth was especially dynamic during the last decade of the century (45 per cent in one decade), which was the highest among contemporary capitals. The extensive industrial development created a significant demand for labour and housing, which resulted in mass immigration and a housing construction boom (*Fig. 1*). Due to overstrained population growth, the late 19th century construction was dominated by speculative builders. At the fringe of the city overcrowded

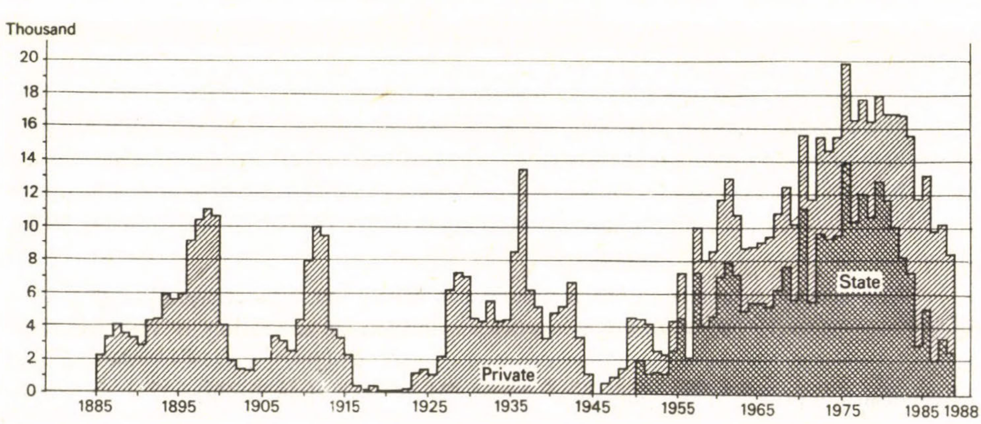

Fig. 1. New dwellings constructed in Budapest (1885-1988)

construction was dominated by speculative builders. At the fringe of the city overcrowded shanty towns were expanding and the quality of the building stock was very low, except along the main boulevards.

The World War I and the consequent dissolution of the Austro-Hungarian Monarchy altered the spatial relationships of Budapest. Until 1919 Budapest was the capital of a much larger state. In 1920 Hungary lost 71 per cent of its territory and 66 per cent of its population and the weight of Budapest in the socio-economic pattern of the country became disproportionately large. According to the statistics 62 per cent of the Hungarian industrial output, and 45 per cent of the country's blue-collar employees concentrated here.

During the inter-war period the development of Budapest slowed down. This was partly connected with her extreme size and the economic stagnation of the country. The rate of population growth was also much lower than in the previous decades, and since the natural increase was almost zero throughout the whole period, the registered population rise could be attributed to immigration. This was also the epoch of extensive suburban growth. First the world economic crisis, later the pre-war economic boom generated mass-movements towards the suburbs. As a consequence, the population of the suburbs of Budapest increased from 130,000 to 540,000, between 1900 and 1949. This flow of labour from the provinces to the suburban belt led to the rapid expansion of the 'red outskirts' (e.g. Csepel, Ujpest). Soon after the war these suburbs were attached to Budapest, in part to counterbalance the 'right wing' bourgeois city.

In fact Budapest and her subordinate settlements reached the peak of their population growth with 2 million people by 1941. As a consequence of the World War II the population of Budapest dropped by more than half a million, and the pre-war figure was reached again only in 1972.

THE DEVELOPMENT OF BUDAPEST AFTER 1945

The capitalist development was belated in Hungary and in other East European countries, basically for historical reasons (Enyedi, Gy. 1990). These countries were underdeveloped compared to the West on the eve of communism, both in terms of the level of the economy and urbanization.

After 1948, when the communists took over power, industry and industrialization was considered as the only possible way to catch up with the Western countries. Therefore emphasis was placed on developing heavy industry in the economic plans of the 1950s. The cities and the industry became the symbols of modernity, while the villages and the agriculture meant the evil past. Since a significant part of the Hungarian industry concentrated to Budapest, a major part of the post-war industrial investment was also the Hungarian economic pattern even more unbalanced, and increased the hegemony of Budapest to the extreme.

The overstrained industrial development of the 1950s and the consequent demand for labour attracted many immigrants from the provinces and resulted in very intensive population growth again in Budapest during the first decade after the Second World War. In this period the average rate of the annual population growth was even higher than at the peak of the capitalist industrial development. Enyedi (1990) identified this rapid socialist urban development as the first stage of global urbanization, which was in fact the completion of the capitalist urban boom, interrupted by the world wars and by the inter-war stagnation.

1956 saw a break in the rapid growth of the city, when approximately 100,000 people left Budapest. However, urban development speeded up remarkably again after the revolution, mainly as a response to the forced collectivization of agriculture. The higher standard of living and vast job opportunities attracted masses of landless agrar-proletarians towards Budapest and other industrial centres.

In accordance with national demographic trends and the new regional development policy, the growth of Budapest gradually slowed down from the mid-1960s, and the city entered a new phase of urban development.

This stage of urbanization embodied technical and structural changes in industry, which resulted in a decline of factory employment and the rapid growth of services. Indeed the number of industrial employees peaked in Budapest in 1964 and since then it has fallen by 50 per cent.

In this process, a conscious policy of decentralization, and consequent administrative regulations played an outstanding role (i.e. only those who had spent at least five years at a workplace in the capital had the right to settle down there).

Approximately 250 industrial plants were closed down, or removed from Budapest between 1968 and 1981, mainly for ecological reasons, while new establishment was strictly restricted. Virtually the same measures were taken in other East European countries too (Hamilton, I. 1982). As a consequence the role of Budapest in the industrial employment of Hungary fell from 51 per cent (1950) to 22 per cent (1988). Nevertheless, the relative weight of the capital has little diminished because Budapest contains the most advanced and most productive branches of the Hungarian industry. As Berényi (1986) pointed out, parallel with the slowed down dynamism of Budapest, the suburban zone has gone through a dynamic take-off in the last decade. While the population of the capital stagnated, substantial population growth was generated in the agglomeration by the rapid motorization and due to the administrative limitations introduced.

In the following I intend to comment on the impact of regional development and housing policy, which influenced the development of the city most substantially.

The extreme size and weight of the city, which could be originally attributed to border changes, was further enhanced by socialist urban and regional development. Despite decentralization efforts by the government in the last two decades, Budapest is Hungary's only real metropolis, and as many call her in Hungarian, the 'waterhead' or 'swollen head' of the country. About one third of the country's industrial production and one fifth of the total population are concentrated here. The infrastructure is relatively developed in almost every respect, to a degree which is often resented by inhabitants of the provinces. For instance 48 per cent of Hungary's telephone units and 63 per cent of telefax machines are found in Budapest. We may add that the concentration of human capital is even higher, in view of the large proportion of intellectuals and institutions. According to Tóth (1990) in 1987 about 72% of the Hungarians with scientific degree worked in Budapest, which underlines the fact, that in the most innovative sphere the capital is absolutely dominating.

The removal some of the outdated industry from the late 1960s onwards did not lessen the economic importance of Budapest. Moreover, it further widened the technological gap between the capital and the rest of the country. As most of the relocated plants maintained their Budapest headquarters and main offices, in response to the rigid, centralistic planning and management system, the industrial relocation could be considered as simply the 'socialist colonization' of the countryside, especially of backward agrarian regions (e.g. Great Hungarian Plain).

Following the introduction of the New Economic Mechanism in 1968, a new regional policy was implemented, which put more emphasis on the accelerated development of second and third tier, medium-size cities. Urban and regional policy struggled to diminish regional inequalities, to limit the expansion of Budapest and the major industrial centres. However politicians and government bureaucrats could not get rid of the false vision that 'big is beautiful', that large plants, large housing estates, large schools etc. are more efficient than small ones. As Enyedi (1990) commented with reference to this controversial policy, urban and regional planners searched for a proper compromise between equality and efficiency. Several strategies have been suggested to find this compromise, such as concentrated decentralization (i.e. location of industry in a few selected major centres of an underdeveloped region), or to maintain branches in the countryside under the strict control of large enterprise headquarters. The biggest failure of the socialist urban and regional development policy was probably, that it did not recognise the importance of the gradual construction upwards from the basic elements of the settlement system. To fulfil the short-term voluntaristic economic plans the central government redistributed money, labour and investment from agriculture to the dynamic elements of the urban network. For instance in 1979, 88 per cent of the country's total communal investment was realised in towns, while the remaining 12 per cent was implemented in the villages, which possessed 47 per cent of the population.

This settlement development strategy was apostrophised by Szelényi (1983) as the Prussian way of urban and regional development policy, on the analogy of the East European type land policy.

Urban development and housing policy

Housing and public infrastructure received very low priority in the economic plans of the 1950s. Housing development fell below the levels of the inter-war period, and severe tension arose between supply and demand, partly because of the high rate of immigration from rural areas. To ease the housing shortage some administrative measures were also taken. Most of the property and dwellings of the old ruling class were confiscated by the state and redistributed to members of the new ruling strata (i.e. party apparatus, armed forces).

A new housing policy was introduced in 1960, which aimed at constructing 250,000 new dwellings in Budapest. It could be considered as a significant element of the Kádár regime's living standard policy. The succeeding years saw a rapid increase in state housing expenditure and construction, a dynamism almost comparable to that of the late nineteenth century. The Hungarian housing industry, as in other socialist countries relied on prefabricated technology and gigantic 'housing factories'. By 1975 already four housing factories operated in Budapest, with a total annual capacity of 15,000 dwellings. As Hegedüs (1987) points out, this highly concentrated housing industry produced a vast number of almost identical two-roomed flats from the late 1960s, in the form of huge concrete housing estates. These monotonous dormitory estates constituted the melting pot of the socialist society.

On the other hand the 1960s and 1970s also experienced increasing private construction as part of the liberalization of the economy. Thus housing tension of the 1950s was partly concealed by the 1980s due to high level state and private construction. However, from the end of the 1970s — as the economy started to stagnate — housing construction began to fall. In 1986 the number of dwellings constructed was scarcely 50 per cent of what it had been in 1981.

Although the dwelling stock in Budapest has nearly doubled in the last forty years, housing shortage has remained a striking problem. I believe — despite the considerable achievements — socialist housing policy failed both from an *economic* and a *social* point of view.

The *economic failure* of the state housing sector can be attributed basically to the low rent and poor management system. Low rent policy has been one of the constant elements of state-socialist housing policy. This policy goes back to the earlier theory of the socialist housing model, when housing was proclaimed to be a universal right and the state had to provide accommodation for urban people at low costs. It meant that wages did not contain an element for housing, and that the housing costs were supposed to be financed from the budget. Low rents meant that a selected fraction of the society enjoyed an accommodation subsidy from the state. Although rents were increased in 1971 and 1982 significantly, they remained very low by western standards and amounted to approximately 8–10 per cent of family income until recently.

The organization responsible for the management of state housing (IKV) was meanwhile unable to run the public rental sector in an economical way, partly because of low rents but also because of its bureaucratic nature and monopolistic position. According to statistical data operating costs used up nearly half of the rent revenues in the years of 1976-1980.

The housing policy of the state-socialist period could not fulfil the original goals of *social policy* either. The manifest aim of social policy was to reduce and eventually abolish the old forms of social inequality, and specifically to do away with social segregation. The state was supposed to satisfy the housing demands of the lower strata, whereas the better-off were expected to solve their housing problems without state assistance. Szelényi gave evidence in his well known critique, that state housing was allocated systematically to the higher income groups and not to the working class in the 1950s and 1960s (Szelényi, I. 1983). The new socialist middle class — professionals, intellectuals, bureaucrats and the like — were overrepresented in the new socialist housing estates. This meant that 'merits' surpassed 'social criteria' in the allocation process. Although a significant part of white collars left state housing from the mid-1970s onwards, parallel with the expansion of private sector, socialist type housing allocation has generally favoured the better-off.

SOCIAL TRANSFORMATION OF THE CITY: SOME CONCLUSIONS

After 1945, in line with the political changes, a huge social transformation took place in Hungary.

The wealthiest sections of the former landlord and capitalist strata (in Budapest this comprised 7.9 per cent of the population by the 1941 census) left the country by the end of the 1940s. Moreover several thousand persons, mainly members of the former ruling class were deported from Budapest in 1951-52 for political reasons. Certain extremes of inequality were attacked and to a large extent eliminated through different channels e.g. housing policy, nationalization etc. As a result, the very rich and very poor have disappeared, egalitarianism became the new social policy.

In Budapest the rapid expansion of heavy industry and the consequent high rate of immigration considerably strengthened the working class, as did the annexation of 23 formerly independent suburbs in 1950. However, since most of the immigrants came from rural areas, the extensive industrialisation phase resulted a massive 'ruralization' of the capital's society. The elimination of the private sector led to the dissolution of the petty bourgeoisie, which was the leading stratum in shaping the pre-war face of Budapest. Whatever Marxist-Leninist principles dictated, certain distinctive forms of inequality have persisted, whilst some new ones have appeared for the first time. The party apparatus and the armed forces, being the basis of the new regime, have enjoyed privileges from the very beginning.

The biggest loser of socialist transformation was probably the urban intelligentsia. The anti-middle class, anti-intellectual nature of the regime became more obvious, especially when Kádár came into power after 1956. Before the war the wage difference between white and blue collar employees was 2.5–3.0 to 1, in favour of white collar professionals this virtually disappeared by the 1960s.

As far as social and residential segregation are concerned, the anti-segregational policies in the 1950s and 1960s were reflected in decreasing segregation (Ladányi, J. 1989). Housing was proclaimed to be a universal right, and state construction in the 1960s and early 1970s diminished housing segregation. After 1968, however, Hungary moved away from the Stalinist model of redistributive economy, with the liberalization of economic life. The role of private initiatives associated with the market increased. In the meantime, artificially repressed inequalities came to the fore again, and residential segregation started gradually to increase. Economic difficulties in the 1980s further intensified this segregational trend, consequently urban inequality is remarkably high in Budapest. The spatial distribution of dwelling prices reflects more or less accurately the dimensions of residential segregation (*Fig. 2*). Very rich areas with luxurious architect designed detached or semi-detached houses contrast with overcrowded tenement blocks from the Austro-Hungarian period, with very poor living conditions and unhealthy environments (Kovács, Z. 1990).

The increasing social and residential segregation of the city also spread to the suburbs, where many have moved permanently in the last decade after failing to acquire a flat in the centre. In this suburban segregation process the white-collar strata gravitated towards the environmentally more attractive hilly areas to the north and west of Budapest, whilst manual workers were preponderant on the eastern and southern sides of Pest. What is remarkable at the end of the 1980s, is how stable the spatial hierarchy seems to have been over the last forty years, in spite of the advent of socialism and its conscious anti-segregation policy.

The greatest challenge to the urban planners is undoubtedly the inner city slum. Much of the development here was speculative and of poor quality. The crowded dwellings and outdated infrastructure provide very poor living conditions (*Fig. 3*). The average age of the local residents is very high, and the buildings have deteriorated visibly.

These old slums occupy the most valuable plots of the inner city, and are also sources of a good many social problems. The worst slums are probably those located in the district known as Józsefváros, where a high proportion of the contemporary population is Gypsy, and in that part of the seventh district where the Jewish 'ghetto' was located in the final stages of the Second World War. Both these districts stand out due to their

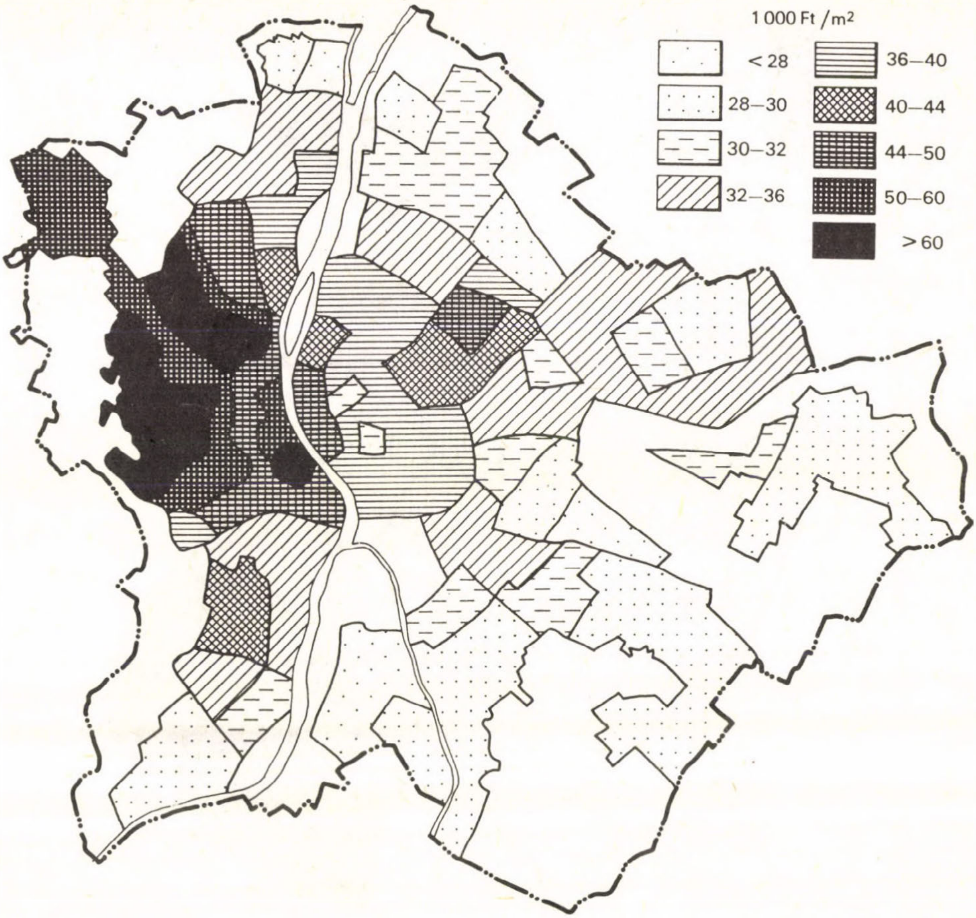

Fig. 2. Apartment prices in Budapest (1990)

lack of minimal sanitation and comfort, and their high crime rates. According to the latest data, in these districts the annual rate of crime and delinquency is three times higher than in the upper-class enclaves of the Buda side. Thus ghettoisation is now proceeding along easily recognizable Western lines.

The post-war development of Budapest implies, that 'socialist' urban planning and management could not fulfil its original aim in many respects. They were not able to abolish housing shortage, diminish the privileged position of Budapest within the country, or to decrease the scale of segregation. Although urban processes occurred within the framework of a planned socialist system, they appear to differ little from those operating in Western cities (Compton, P. 1979). Thus state socialist urban development did not represent a socialist way of urban management, rather it was an unsuccessful experiment to combine socialist ideology with the European practice of urban planning.

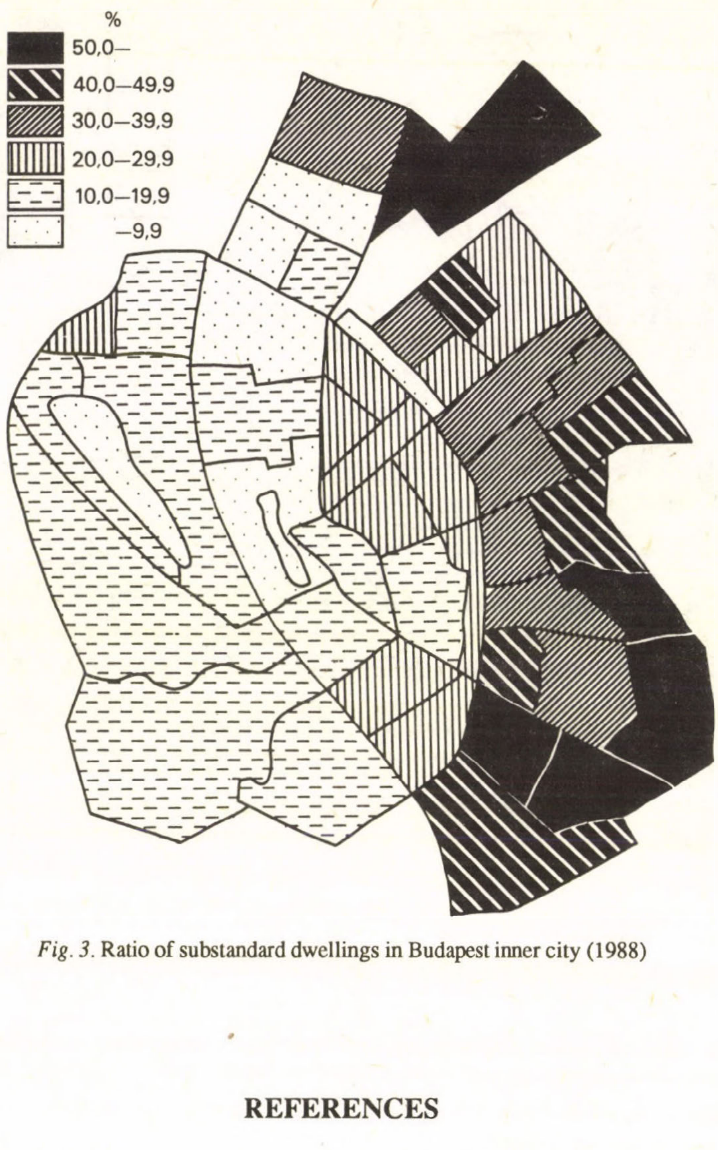

Fig. 3. Ratio of substandard dwellings in Budapest inner city (1988)

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SOME HISTORICAL AND GEOGRAPHICAL ASPECTS OF THE REFUGEE ISSUE IN HUNGARY

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ABSTRACT

The study deals with the major characteristics of the refugee problem in Hungary from the end of World War I to recent times. Over the more than seven decades of the research period, the refugee problem has reoccurred with varied significance and characteristics, thus making it possible to analyse the different migration waves. The first period was directly after World War I, when about 350,000 Hungarian citizens fled into the newly created borders of Hungary. A similar wave of refugees also occured after World War II. However, at the same time 200,000 German-speaking citizens were transferred out of Hungary. A third huge wave of refugees took place after the 1956 revolution, when more than 200,000 people left the country. Beginning in 1988, this problem began to come to the fore again, when — due to political turmoil in their own countries — refugees from Rumania, and later from Yugoslavia poured into Hungary.

INTRODUCTION

Exodus represents a special type of migration, which could be classifed as forced migration, involving large numbers of people from time to time. It has been particularly common during the 20th century, which is often called 'the century of refugees'. International data seem to reveal that during the first 60 to 70 years of this century some 100-150 million people were forced to leave their homes for various reasons. In the 1970s, for instance, more than 15 million refugees were officially registered in the world, and the process has not stopped yet (Leib, J. – Mertins, G. 1986).

One of the features of the refugee issue is its high flexibility in space and time, shifting from one problem area to another, thus creating enormous problems. As far as the 20th century is concerned, it is evident that the refugee problem caused great difficulties in many parts of the world, including Europe, where it seems to be ever present somewhere. Despite significant differences from country to country, the problem should be considered as a universal one.

Hungary belongs to those European countries where the refugee problem, one way or another, appears to be constant. As Hungary has been both a sending and a recipient country of refugees in the past, the historical and geographical aspects of the refugee issue allow some useful conclusions.

The definition of a refugee applied intends to follow the five criteria of the Geneva Convention: a person who can prove that he/she was forced to leave his/her homeland for religious, racial, political, ethnic reasons or due to hindrance to use his/her mother tongue.

THE FIRST REFUGEE PERIOD: 1918-1944

The first time when Hungary faced the problems of refugees during the 20th century, occurred at the end of World War I. Prior to World War I a different kind of migration was experienced, i.e. emigration from Hungary. Due to social and economic problems in the period of 1899-1913, nearly 1.4 million people emigrated from the Kingdom of Hungary, mainly to the United States. With the outbreak of World War I this process came to an end, while after World War I the number of persons emigrated from Hungary fell to a fraction of the above mentioned period.

From 1918 this trend was reversed, and Hungary became a recipient country of refugees. This was caused by the disintegration of the Austro-Hungarian Monarchy into several new states. Hungary was the biggest loser of this transformation, losing more than two–thirds of its area and almost 60 per cent of its population. Some 3.2 million Hungarians were divided from the motherland by the new boundaries. The Hungarian nationalities in almost all the surrounding countries were subjected to discriminations and forced measures. These were intolerable to many of them, who consequently escaped to Hungary, now shrunk in area to 93,000 km.

In the last two months of 1918 almost 59,000 Hungarians escaped to Hungary, but the real rush of refugees did not start until the summer of 1919, when Hungary received more than 110,000 refugees to which almost 122,000 refugees were added in 1920. In the following years the number of refugees decreased considerably (ca. 26,000 in 1921, 21,000 in 1922, 9,000 in 1923 and 900 in 1924). The main reason for this gradual decline was that Hungary imposed a ban on refugees in July 1921 (except in special cases), because it was no longer able to cope with the influx of people.

Thus, the refugees arriving to Hungary in the 1918-1924 period numbered 350,000 people, who eventually settled in their 'new homeland'. This number represented some 10 per cent of the Hungarian ethnic minority living outside the country, and more than 4 per cent of the total population of Hungary in 1920. The number of ethnic Hungarians received by Hungary from its neighbouring countries varied widely. Some 56.3 per cent of the refugees arrived from Rumania (197,000), representing 12 per cent of the Hungarian population living under Rumanian authority. Some 107,000 Hungarians escaped from Czechoslovakia, representing 30.5 per cent of the total number of refugees and 10 per cent of the ethnic Hungarian population in that country. The number of refugees arriving from the Kingdom of Serbia-Croatia-Slovenia (renamed later as Yugoslavia) was much lower (ca. 45,000 or 12.8 per cent), and represented 9.8 per cent of the Hungarian population in Yugoslavia. The number of refugees from Austria was negligible (1,221) (*Fig.1*).

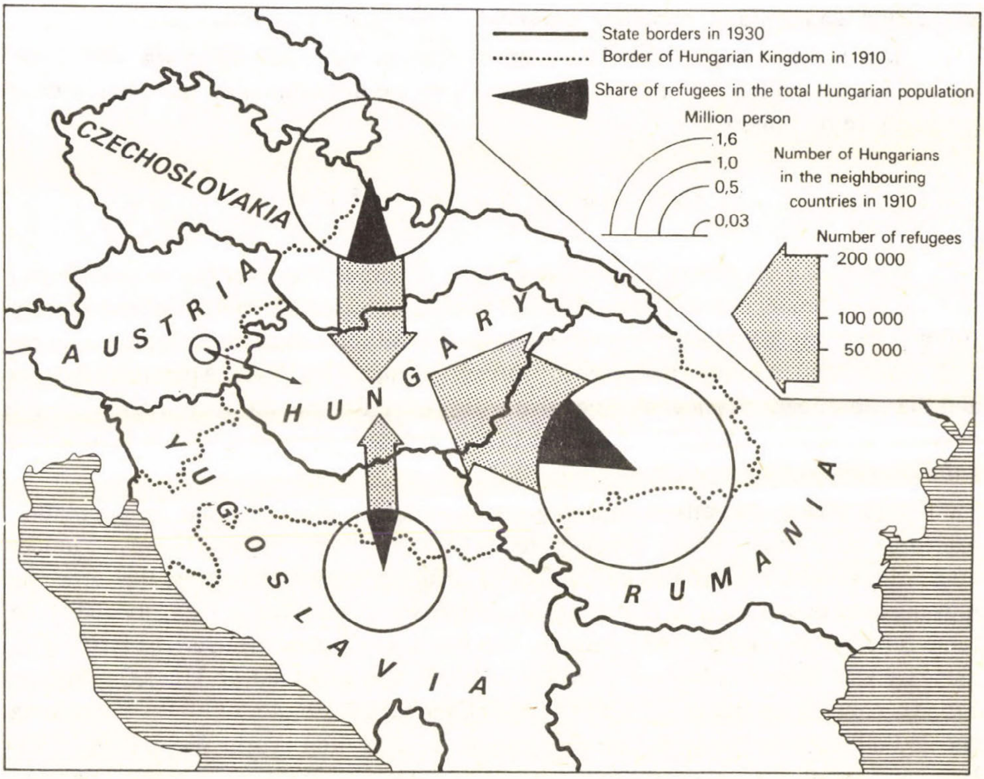

Fig. 1. Hungarian refugees after World War I

The various strata of the Hungarian ethnic population were affected to different extents by discriminations in the neighbouring countries. Former civil servants were in the worst situation. They were dismissed from their jobs, thus the only solution for many of them was to escape. This group represented the largest category among refugees. Out of the 350,000 refugees, 104,804 were employed, 42.2 per cent of which were former government officials.

For a relatively small country like Hungary, with limited resources, settling down such a mass of people and to provide them with job opportunities, represented a huge task which lasted many years. A disproportionally large part of the refugees moved to the capital (Budapest) and to its agglomeration. Relatively large numbers attempted to settle down in towns and only a very small portion in villages.

In the 1918-1945 period a fascinating issue was represented by the arrival *of refugees from Poland.* Shortly after the outbreak of World War II some 130,000–140,000 Polish refugees (the majority of whom were soldiers), were received by Hungary. The greater part of the Polish refugees (some 100,000) left Hungary in the following summer, yet several ten thousands remained and stayed in the country for many years.

In the corresponding period the number of people leaving Hungary was very small, mostly Jews, who left the country to escape from the discriminating laws which were gradually being imposed.

DISTURBING SCENE: 1945-1948

Following World War II a greater number of people than ever before were forced to leave their homelands in Europe and had to escape, especially in Central and Eastern Europe. According to incomplete data, almost 20 million people were forced to leave their motherland in Europe within a few years (Gyarmati, Gy. 1988). Apart from the war and the subsequent political changes that swept over Europe, the main reason for the post-war migration could be attributed to the Potsdam decisions, which resulted in enforced evacuations.

It is always the ethnic minority group which is most affected by population exchange, thus Hungary was affected greatly by the Potsdam Treaty. However, unlike after World War I, when a large number of refugees entered Hungary, this time the movement of people became bidirectional: refugees were received in Hungary and at the same time, large numbers left Hungary. The number of ethnic Hungarians arriving in Hungary was almost as high as after World War I. Out of a total of 316,000 refugees, 125,000 came from Rumania, 120,500 from Czechoslovakia, 45,500 from Yugoslavia and 25,000 from the Soviet Union. Contrary to the case after World War I, most of the Hungarian ethnic refugees came to Hungary from Slovakia, in fact more than 53 per cent of Hungarians that had lived there (!). The migration loss of Hungarian population in the Carpathian region (Soviet Union) was also substantial (43 per cent of the total), and relatively smaller in Transylvania (17.5 per cent of the total Hungarian population living in Rumania) (Kocsis, K. 1990).

Large numbers of people also left Hungary following World War II. The largest group was represented by the Germans, who were labelled at Potsdam with collective responsibility for the events of the war. Concurrently with the withdrawal of the German army, some 20,000 ethnic Germans left Hungary and a further 185,500 had suffered enforced evacuation later. It is difficult to decide whether the 73,000 Slovak left Hungary to Slovakia could be considered as refugees. They might be classified as emigrants since no force or compulsion was applied on the Slovaks in Hungary to leave the country (Gyarmati, Gy. 1988) (*Fig. 2*).

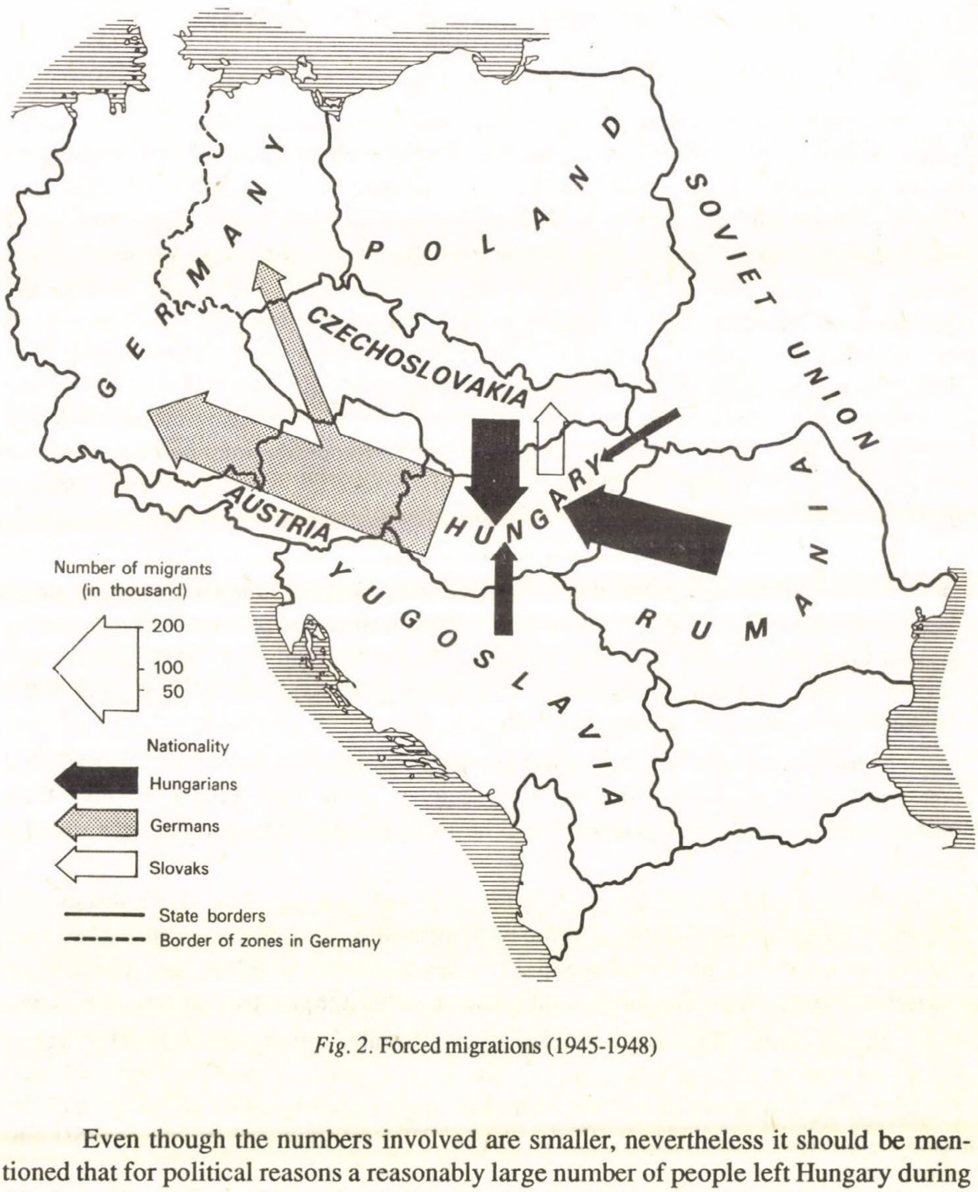

Fig. 2. Forced migrations (1945-1948)

Even though the numbers involved are smaller, nevertheless it should be mentioned that for political reasons a reasonably large number of people left Hungary during this time. Hence they, without the slightest doubt, should be regarded as genuine refugees.

Since in this period communist takeover was in progress, many people had to escape in their own interests. No accurate data are available, but they should have numbered several thousands. The emigration of this group meant the decapitation of the political elite of Hungary.

A LONG 'OUT RELEASE' PERIOD: 1949-1987

Behind the 'iron curtain', Hungary was almost completely isolated from Western Europe following the communist takeover and as a result people could leave Hungary only in small numbers, sporadically, but, at the same time, almost continuously. Yet, after the 1956 revolution, when the western borders were opened, a very large number of Hungarian refugees left the country. The accurate figure is — for various reasons — not known, but about 200,000 is estimated. Representing some 2 per cent of the total population of Hungary, they emigrated in two different directions. The Ministry of Internal Affairs of Austria registered 174,407 refugees entering Austria between October 23rd 1956 and April 6th 1957. The number of Hungarian citizens who found refuge and registered in Yugoslavia up to May 26th, 1957 was 19,181. Yet, many thousands failed to register in either of the two countries mentioned and hence, the total number of people left Hungary in this period would have presumably exceeded 200,000 (Az illegálisan... 1990).

The impact of this mass exodus on the Hungarian society was rather uneven in many respects. About half of the above figures are accounted by inhabitants of Budapest proper. Similarly, many of the refugees who left for Austria had previously lived close to the Austrian border region, while the smallest numbers escaped from the eastern regions of Hungary (*Fig. 3*). From another viewpoint it also appears that some 79 per cent of the refugees from Hungary were city dwellers.

More than half of the refugees left Hungary within a very short time in November 1956 and further quarter of the total in December 1956. Following December their number rapidly decreased, explained by the fact that the 'iron curtain' was quickly restored.

The composition of refugees in terms of sex and age was also substantially different from the country average: some two-thirds of the refugees were male and more than half of them were under the age of 25. Likewise, the 25 to 39 age group was over-represented (about 30 per cent of the total), whereas other age groups were less significant.

Highly qualified people were also overrepresented among the 200,000 refugees, one quarter being university graduates. The high number of persons with technical education was also rather remarkable. On this single occasion some 10 per cent of the engineers left the country. Similarly, the number of physicians was also unusually high.

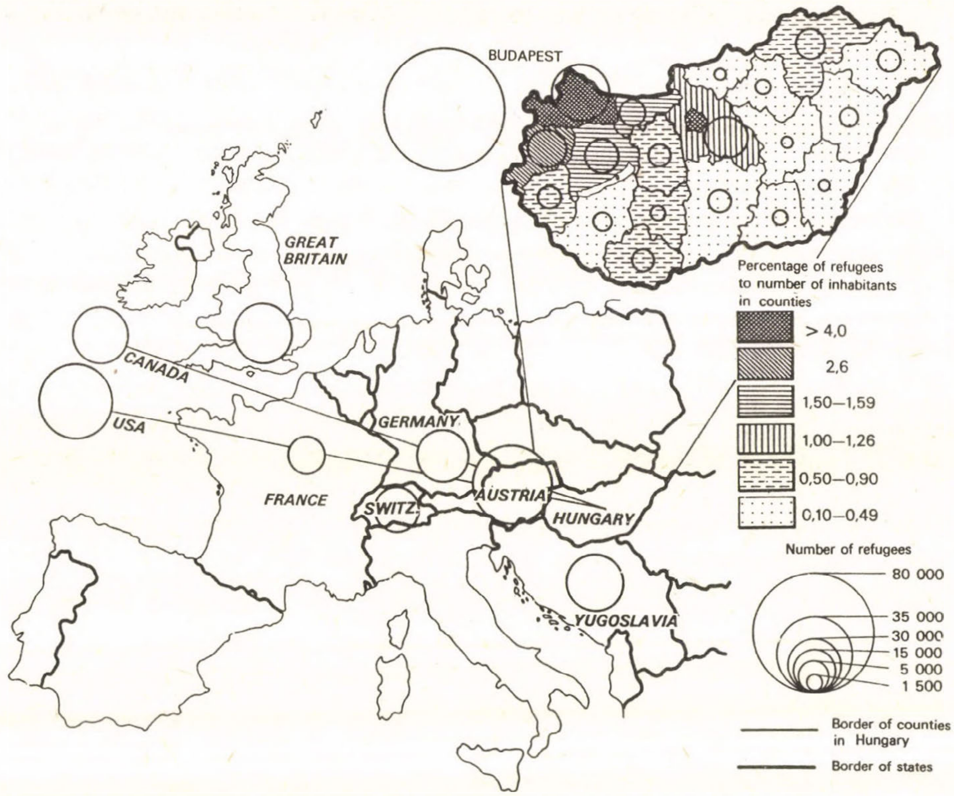

Fig. 3. Hungarian refugees after the revolution 1956

More than half of the physical workers that fled represented skilled tradesmen, many were mechanics and turners.

No accurate data exist to analyse the destination of the refugees around the world. According to a United Nations report dated on March 31st 1957, 35,000 refugees were still residing in Austria and a further 17,000 in Yugoslavia. It is highly probable that only a small number of refugees settled down permanently in Yugoslavia. By the time this report appeared, some 30,000 refugees had already moved to the United States and an additional 18,000 to Canada. Among the European countries large numbers were admitted by the UK (almost 20,000), by the FRG (14,500), by Switzerland (11,000) and France (8,000) (*Fig. 3*).

The loss of so many young and skilled people has affected the demographic and population pattern of Hungary adversely. The effect was more than merely the loss of two years of natural population growth but was extenuated by the fact that the descendants of these young people were born outside the country. The impact of the loss of some

2,000 engineers, the 1,000 physicians, the more than 1,000 artists should, by no means, be ignored.

From the spring of 1957 the 'iron curtain' went down again and made it very difficult to leave the country illegally. From this time only a few Hungarians could emigrate. This continued until the second half of the 1960s, when travel restrictions to Western Europe were partially lifted. Some people, taking advantage of the new travel regulations asked for political asylum, while being outside the country. According to official data in the 1963-1988 period some 71,000 Hungarians asked for political asylum in the west, an annual average of 2,700 persons (Rédei, M. 1990). No regular pattern can be detected in the behaviour of Hungarians not returning to Hungary; the annual averages seem to be quite random.

Yet, not all members of this group, that left Hungary in the above period could be classified as refugees under the definition of the Geneva Convention. The recipient countries considered all persons who left Hungary in this period as political refugees in spite of the fact, that the great majority of them were economic refugees, simply seeking a higher standard of living and by no means because of being subjected to some sort of political or ethnic harrassment. It is not possible to ascertain the number of genuine refugees, nor those who left the country for economic reasons, but it would be fair to state that those seeking political asylum were in the minority.

During this time a small but constant number of Hungarians were leaving their country, refugees from various trouble spots of the world were also admitted to Hungary, for political reasons since they were either communists or belonged to various leftist 'sister parties'. The number of refugees involved was not extremely large, even those entered Hungary after the Civil War in Greece (1946-1949) numbered only a few thousands.

THE SECOND PERIOD OF ADMITTING REFUGEES: 1988-?

It is difficult to identify an actual date for the beginning of the flow of refugees, but it possibly started around the last few weeks of 1987 from Transylvania and this process became rather obvious by early 1988. The causes behind this more recent exodus were similar to those experienced after World War I: apart from the serious economic problems, the Hungarian population had to endure ethnic discrimination under the Ceauşescu regime, and therefore many of them decided to leave Rumania.

Until the middle of 1991 the refugee problem faced in Hungary was of Rumanian origin only. The number of refugees registered by the Hungarian authorities numbered 13,000 in 1988, 17,000 in 1989 and 18,000 in 1990. When the available figures are investigated quarterly, considerable fluctuation is apparent, and the peak of refugees admitted to Hungary coincided with unfavourable political events. It can not be accidental, that the highest refugee inflow from Rumania occurred during the last few months of the Ceauşescu regime, when not only ethnic Hungarians were involved in it. The peak flow of refugees was in the spring of 1990, which clearly coincided with the ethnic disturbances experienced in Marosvásárhely (Tirgu Mureş). At that time, however, almost all the refugees were members of the Hungarian minority. Similarly, the disturbances that took place in Bucharest in the summer of 1990 were also reflected in an increasing number of refugees. Following this event, however, the number of refugees entering Hungary has declined steadily (*Fig. 4*).

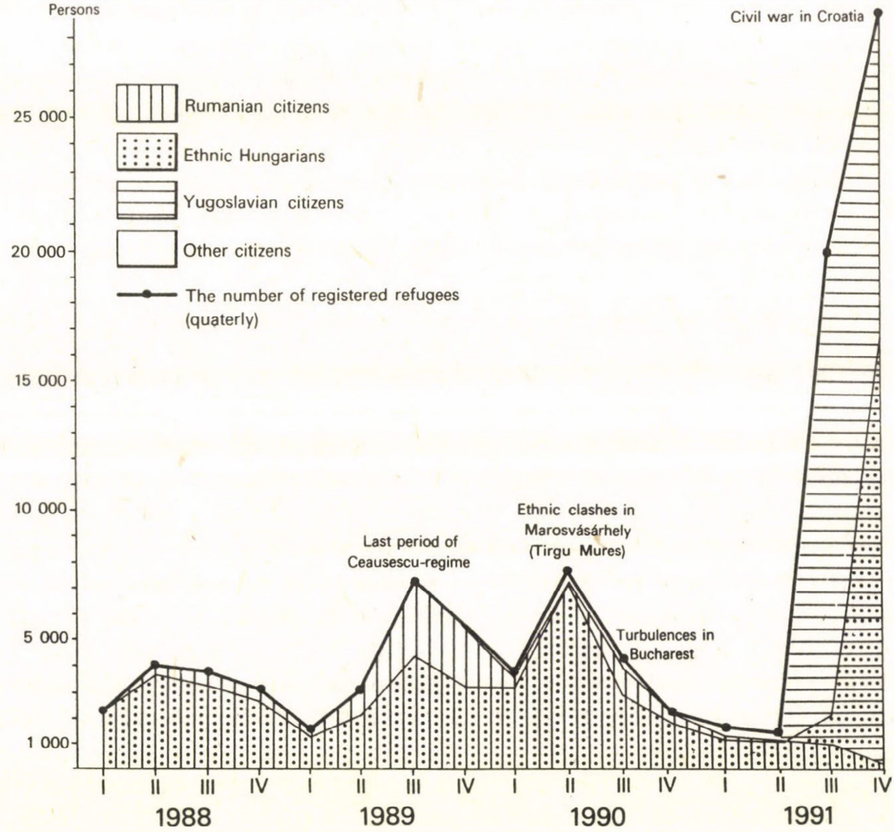

Fig. 4. Change in the numbers of registrated refugees in Hungary (1988-1991)

By the summer of 1991 it appeared that this process came to an end. However, a civil war broke out in Yugoslavia, followed by another wave of refugees coming to Hungary. A substantial difference is that more refugees were admitted from Yugoslavia (mainly from Croatia) into Hungary within half a year, than the total figure of the refugees who arrived from Rumania in two years. According to official statistics, more than 50,000 people escaped from Croatia during the last five months of 1991, or more correctly, these were the figures registered by the Hungarian authorities. In addition, there are several ten thousands of people who have failed to register with the authorities and stay with relatives and friends, waiting for the end of the war.

In terms of national composition these two waves differed from each other significantly. While the great majority of refugees arriving from Rumania belonged to the Hungarian ethnic community, two-thirds of those left Yugoslavia were, in contrast Croatians and only 25 per cent of them were Hungarian by origin. Similarly both the age and sex composition of the two refugee waves differed from each other quite considerably. More than two-thirds of those coming from Yugoslavia to Hungary were women and children, since the men stayed at home. While from Rumania the biggest single group is represented by young men, with a 2:1 ratio of males to females initially, later the share of females tended to increase somewhat.

Fortunately, the geographical distribution of these two groups of refugees had significant differences. The majority of the refugees from Rumania tended to settle down first of all in Budapest and in the eastern counties situated close to the Rumanian-Hungarian border. Whereas, the refugees from Yugoslavia preferred to stay along the Yugoslavian-Hungarian border, because of the close proximity of their homeland and the presence of a substantial number of southern Slavic minority with long established linguistic and family contacts. The ethnic cohesion among the Croatians is well manifested by the fact, that ethnic Croatians living in Hungary near the Austrian border gave substantial assistance to their compatriots. This assistance was highly valued by the Hungarians since providing accommodation for a growing number of refugees was an increasing burden on the authorities. By the end of 1991, 20 receiving stations and refugee camps were operating in various parts of the country (*Fig. 5*).

The fact cannot be ignored that a great majority of the refugees coming from Rumania wish to stay and settle down in Hungary, whereas the refugees from Yugoslavia wish to remain in Hungary only until the end of the war, since their only desire is to survive this current crisis. Obviously the treatment of these two groups requires different approaches, one group must be helped to integrate into the Hungarian society, the other group needs help to survive.

A GLANCE AT THE FUTURE

There are many signs that Hungary will remain a 'front state' in the refugee problem for some years. Due to its geographical location it cannot avoid its destiny. It seems to be certain that the next big wave of refugees will come from the area of the formal Soviet Union for which Hungary must be prepared. Yet, apart from these crisis

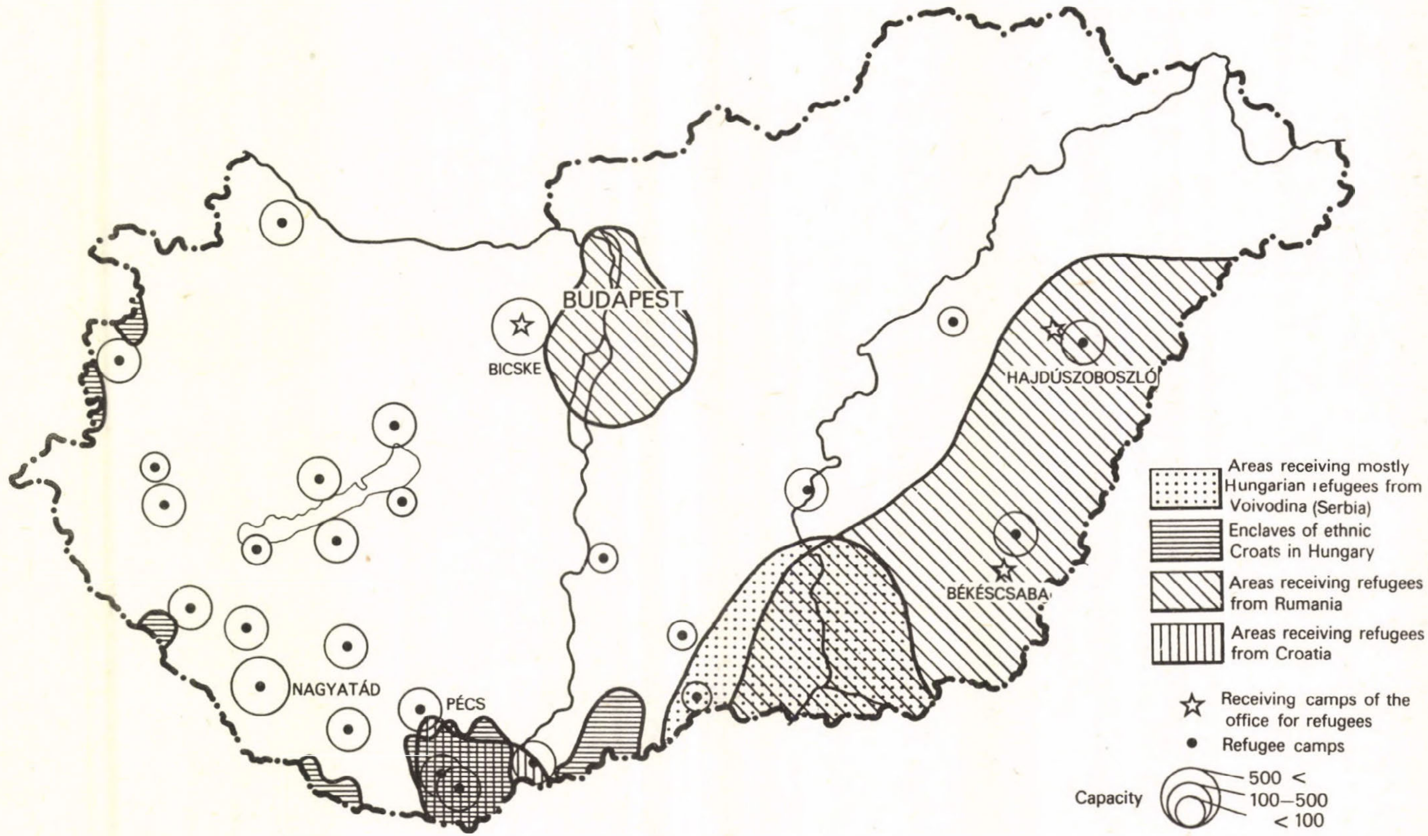

Fig. 5. Refugee issue in Hungary today (end of 1991)

areas the danger exists that a great wave of refugees from Asia and Africa will flood into the country in the near future.

It is evident that Hungary is unable to admit and accommodate hundreds of thousands of refugees, in order to protect the Western European countries of a sudden and substantial influx of refugees. In theory this problem could be tackled in two different ways:

- Hungary, Czechoslovakia and Poland would build up a new 'iron curtain' along their eastern borders on this occasion simply trying to 'shut off' their countries from the refugee inflow.
- the rest of Europe realize that a common and mutual approach is necessary to treat the problem and act in unison.

In the long run it is obvious, that the second approach would be preferable. The main question is: would all the European countries come to the same conclusion?

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SOCIAL AND ECONOMIC ASPECTS OF REGIONALISM IN HUNGARY

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ABSTRACT

An overview of fundamental concepts is followed by a comparison of the major features of Hungarian regionalism before 1918, between the two world wars and in the post-war period. The impacts of different political situations in Europe are analysed. Outlining the present-day picture, the author investigates the internal divisions of the country, the reorganisation process after the cul-de-sac stage of lost decades and the chances of Hungary's integration into the 'Europe of regions'. A major conclusion is that Hungary is greatly interested in any form of regional cooperation, due to its geopolitical location.

INTRODUCTION

In dealing with regionalism one cannot avoid defining the term *region,* as a precondition to defining regionalism. This is the only feasible way no matter if we examine regionalism in general terms or in a concrete correlation system. The definition of region has to be our starting point even if we know that this complex, multifold concept has various definitions and approaches of more or less equal value.

In my own interpretation, a region is an area where — due to the similarities in natural endowments and historical development — settlements possess similar socio-economic structures. Consequently the problems of development are the same. When society is normally practising its organizing, developing and operating functions, it can rely on the region as an already existing unit, enabling social activities on a cheaper, and at the same time significantly more effective level. However, the exploitation of these advantages is severely hindered.

The region in the above sense is a product of the long-term development of the productive forces and of the division of labour, interpreted in multiple ways locally, and it rarely corresponds to the independently and more quickly changing territories of sovereign states and military power relations. Between these two types of socio-economic structures of different origin, nowadays unnecessarily separated, there are three possible kinds of relationships.

- on a larger regional territory several sovereign states have been formed;
- the territory of a larger sovereign state comprises several regions;
- the two units of similar size do not overlap.

Taking into consideration that the region can also be interpreted on more than one hierarchic level, and that under the level of the territories of state (administrative division) and above (international integrations) there are territorial formations with organizing-operating-developing functions which can only be connected with conflicts. What is to be noted is that power systems which were shaped by a centralized model usually do not make their organizing-operating-developing decisions with regards to the regions since they do not want to share power. Thus they lose all the advantages which come from decisions built on organic development and also become less effective. On an international level, isolation, the obsessive attachment to territories obtained, lack of trust and unequal relations can have similar consequences. The alternative of an international integration is opposed to this. It comprises states with democratic inner structure, where regional relations are natural and the advantages from the existence of regions manifest themselves undisturbed.

It is only natural that *regionalism* which incorporates the intricate concept of region cannot be easily defined either. In my interpretation it means an approach, a conceptual system which acknowledges the existence of regions on different levels being aware of their importance and promoting the mobilisation of their resources. A region is considered as equally significant as the territory of state, its divisions or their international cooperations and integrations. Obviously it is characterized by a multidisciplinary approach and reaches beyond the scope of the so-called regional science.

In general, the importance of regionalism increases with the development of the productive forces, but at historical turning points — as the one we are now encountering in Eastern Europe — it is especially so. The inner reconstruction of the countries involved, the reformation of their relations with each other and in broader terms, provides a better chance than ever to put the conceptual system of regionalism in practice. To be able to achieve this, we have to get rid of the distrust between our countries, and we have to support the integrational processes similar to those in the western part of Europe. This is a precondition to a more homogeneous development of Europe and to the welfare of its countries. Despite the awkward demagogue slogan of the western press adopted by a good part of the turbulent political forces inside our country, we have always been part of Europe. Therefore, we do not need to 'return' to Europe, but we have to bring down the artifical wall which was built between the two parts of Europe, in order to create a united Europe.

HISTORICAL ASPECTS OF REGIONALISM IN HUNGARY

Regionalism can only be examined correctly if examined in a historical perspective. In Hungary this has to be done by identifying three periods.

Until the end of the World War I

Disregarding earlier history and considering only the fifty years preceding the World War I, we can state that since the Compromise of 1867, Hungary (integrated in the Austro-Hungarian Monarchy) reacted to the question of regionalism in a rather contradictory way. On the one hand, it acted — as a sovereign unit extending over the entire Carpathian Basin — as a member state of a bigger Monarchy and as a country with the strongest manifest interest. It had established legal bases for its relations with Croatia, it considered each and every regional process related to the territory of the Austro-Hungarian Monarchy and especially to the Carpathian Basin as natural. The only disturbing factors were the centralization efforts within the country, which were trying to reinforce the role of the city of Budapest as opposed to Vienna.

On the other hand the regional relations on the borderlands of the Empire were different. The Austro-Hungarian Monarchy did not 'cover' all of East Central Europe, a region with uncertain borders. In all directions (Galicia—Poland, South Tirol—Italy, and related to Hungary: Transylvania—Rumania, Southern Parts—Serbia) the state power — motivated first of all by the policy towards the nationalities — wanted to prevent the strengthening of regional contacts.

Naturally, the result was also ambiguous: on the one hand, the processes inducing regional relations did not cease to strengthen, on the other hand centralization left its impact on certain areas, which were later attached to sovereign units — and can still be felt today. (A good example is Poland, which was unified after several divisions, and where certain regions still preserve significant characteristics due to their past national status during this period.)

In this half century of rapid capitalization, Hungary was moving towards unification: industrialization, unified market, railway network, public administration, a capital on the way of becoming a metropolis and getting undoubtedly to the top of settlement hierarchy etc., but at the same time the tendencies of regional development were present and increasing. The appearance and institutionalization of certain regional functions (higher education, administration, legal, ecclesiastical, financial, cultural, commercial etc. activities) began a regional centre type development in cities like Pozsony (Bratislava), Kassa (Košice), Kolozsvár (Cluj-Napoca), Nagyszeben (Sibiu), Brassó (Braşov), Temesvár (Timişoara), Arad, Debrecen, Nagyvárad (Oradea), Pécs, Szeged, Újvidék (Novi Sad) and of course Zágráb (Zagreb). Some of them fulfilled relatively complete regional functions (Beluszky, P. 1990), others partial ones(in division with other centres), although on a reduced scale as opposed to the capital. In those days regions only took shape in Hungary, so their centres can only be considered as initial regional centres.

The Trianon Peace Treaty found the country at this initial phase of regional development and placed the majority of Hungary's forming regional centres outside the new borders of the country (*Fig. 1*).

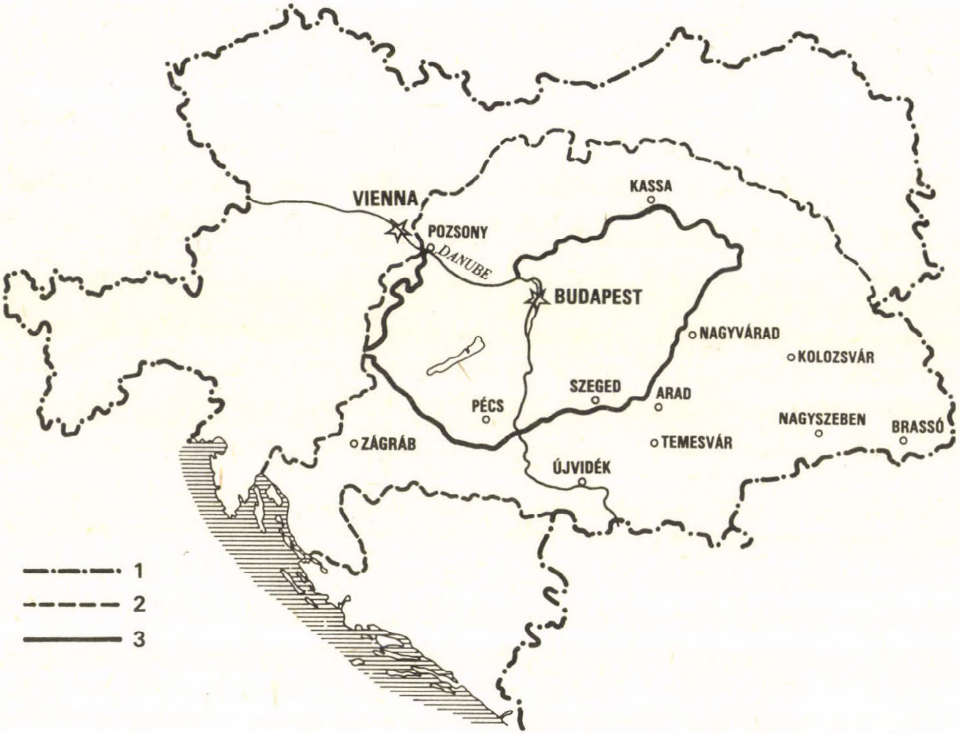

Fig. 1. Regional centres in Hungary at the beginning of the 20th century. 1 = border of the Austro-Hungarian Monarchy; 2 = border of Hungary; 3 = present border of Hungary

Between the two world wars

Regarding regional development, the quarter century between the two world wars brought undoubted disadvantages. The new borders cut thousand year old contacts, and the weight of Budapest, in a country which was reduced to one third of its territory, became overwhelming. Centralization became ever stronger for several reasons. However, with the university of Kolozsvár (Cluj-Napoca) moving to Szeged, and the one in Pozsony

(Bratislava) to Pécs, and with the transfer of other functions, the scopes of activities of the larger cities remaining inside the country increased, but this could hardly compensate for the loss of their hinterlands. In the Carpathian Basin, which had suddenly become international, regional development was also blocked by the fact that the defeated Hungary and the successor states were equally wriggling in the spasms of hate and fear, cooperation was impossible, and a series of absurd situations was appearing in the borderlands. The leading slogan of Hungarian politics was revenge, and the successor states — in accordance with the French superpower interests which prevailed in this area — formed the Little Entente which surrounded and isolated Hungary. As a consequence, the only partner for regional cooperation remained Austria. From the point of view of regionalism, before or during the war there was no change in this situation, the short-lived borderline corrections mostly stayed within the confines of nationality areas.

After the World War II

In what evolved after the World War II, there were some elements which seemed to be leading towards regional cooperation and towards a general advance of regionalism (for example the Rumanian — Hungarian reapproachement under the prime ministry of Petru Groza, the federalism in Yugoslavia, the prevailing ideology of proletarian internationalism whose phraseology later emptied, the fetishism of the economic zone theory regarding the inner territorial division etc.), but these could not be influential or prolonged. They were suppressed by strong, from the point of view of regionalism, disadvantageous features of state and alliance system, like centralization, the favouritism of relations with the Soviet Union at the expense of natural cooperation.

Motivational factors were accidental but also typical elements — as the deportation of the Hungarian population from Czechoslovakia under the disguise of a population transfer, the deportation of the Germans from the whole area, the referendum in Ruthenia, and as a consequence, the appearance of the Soviet Union in the Carpathian Basin, the deterioration of relations with Yugoslavia, the appearance of the 'iron curtain' during the Cold War, the elimination of Hungarian-Austrian relations, border areas finding themselves in an unfavoured position, military occupation, a general mistrust and mistification.

Centralisation was reflected in the fact that each and every important decision was made in the capital. Thus, in the common affairs of projects located on both sides of the border, at the end of a lengthy and in most cases hopelessly bureaucratic process, positions were taken up by people who knew nothing about local conditions (*Fig.* 2). This way mutual interdependence or identical interests could not prevail and foreseen integrational zones could not form. Similar consequences arose from the efforts of the Soviet Union to promote bilateral relations to attach the 'satellite countries' to itself by means of political and economic pressure and seeing a threat in any effort of these countries to strengthen their relations. This is how the COMECON, an organisation sharply different from the EEC, operated. It was undoubtedly favourable for the Soviet Union, leaving the

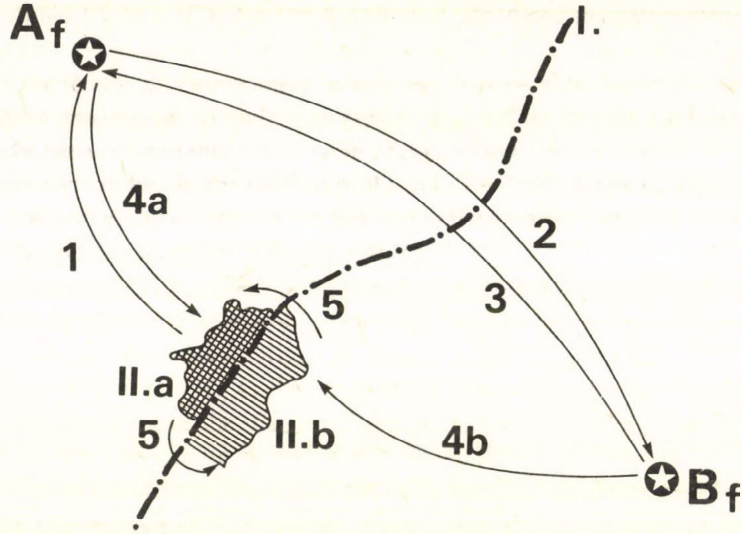

Fig. 2. The typical pattern of connections between the border regions of COMECON countries. I = national border; II.a = border regions of country 'A'; II.b = border regions of country 'B'; A_f = the capital of country 'A'; B_f = the capital of country 'B'; 1-4 = the stages of setting up connections; 5 = normal connections

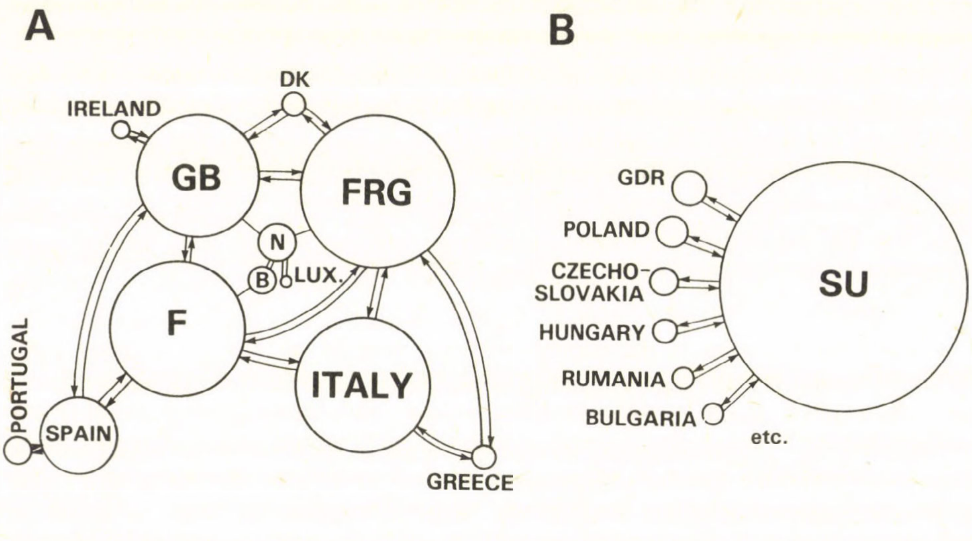

Fig. 3. Differences between the relation structures of COMECON and EEC countries. A = EEC; B = COMECON

other member countries, possessing much less economic potential and unilaterally allied, at its mercy (*Fig. 3*).

This was the time when — on a macro-level — Eastern Europe was created, isolated from Western Europe by an 'iron curtain' (even forgetting de Gaulle's call, according to which Europe lies between the Atlantic and the Urals), Western Europe was spoken of as Europe, and Eastern Europe was tied to the Soviet Union. Contrary to declared principles between its satellite countries, regional relations actually were not strengthened. The centralized model did not exert a positive influence on inner regional development either. In spite of the changes in the allocation of the productive forces which followed large-scale industrialization, and the collectivization of agriculture and the changed international orientation working in the same direction, regional development in Hungary did not strengthen. It is an interesting and apparent contradiction, that while the central power apparatus concentrated in the capital, the principal guarantee of centralization became the counties 'reorganization' in 1950. Since in the centralized model territorial units are created from above, placed there by the central apparatus and play a secondary role in redistribution, they had nothing to do with the forming of regions, or even with a medium-level of self-government (*Fig. 4*). As important stabilizing elements of the power structure, they could always prevent the introduction of the

Fig. 4. The administrative division of Hungary. 1 = national border; 2 = county border; 3 = county seat

otherwise ideologically accepted and supported economic sphere-system, and the adjustment of the administrational system to it.

Although, among the great number of 'rayon' (i.e. planning district) projects there were some professionally sound (*Fig. 5*), and the elements of which can still be accepted today (Krajkó, Gy. et al. 1969), the 'rayon' projects were put forward either too early or too late, the counties remained in possession of their power positions, and hindered the emergence of regionalism, and the growth of regional centres.

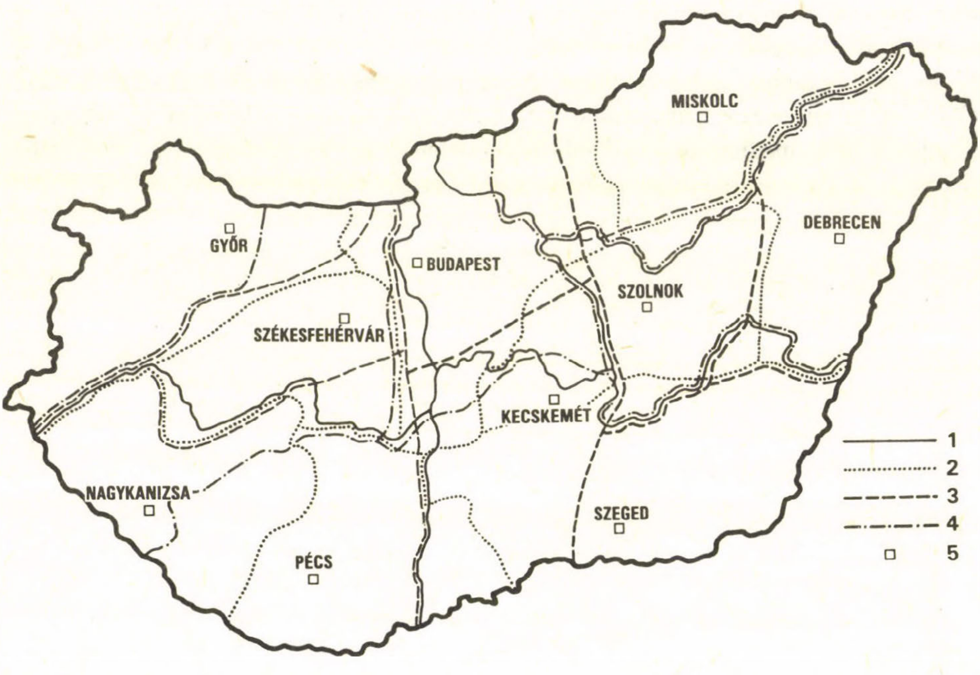

Fig. 5. The major 'rayon' (planning district) plans in Hungary. 1 = Regions defined by: National Planning Office; 2 = Perczel, K.; 3 = Karl Marx University of Economics; 4 = Krajkó, Gy.; 5 = regional centres

REGIONALISM IN PRESENT-DAY HUNGARY

The situation of regionalism in Hungary is affected by the internal political changes, which began a longer time ago and accelerated in the last couple of years, and the changed relations with the neighbouring countries. The evolution of the democratization process, and further, the redistribution of power through democratic elections, the increased representation of local interests, the appearance of local authority as a factor, the reformation of the financing system, the decentralized model, the gradual development of the self-governmental system all support regionalism.

The need for a regional approach has become obvious at the lowest level of territorial development, among the settlements. It was generally accepted that the virtually exclusive hierarchical order had to be supplemented by numerous horizontal relations. In spite of the still rather strong resistance, the settlement (local) financial basis of regional developments, built (also) on a system of horizontal relations are appearing gradually.

In the new situation the contradiction, for a long time present between the units of the next level, different in their origins and functions, the counties and configurational units which are the results of the development of the regional division of labour, inevitably deepens. The counties of heterogenous configuration have naturally complex institutions for the representation of their interests, but as they are incapable of functioning in a productive way (because of their heterogenous nature), they are not clearly expressed. Meanwhile the homogeneous interests are not represented by an institutional system, and so they are either averaged or fragmented and cannot be identified anymore. In short, the component with an identifiable interest has not got its appropriate representation while where interests can be represented there is nothing to be represented. The best example of this contradiction is the Mid-Tisza region (Beluszky, P. 1981, Csatári, B. 1989). The area for several reasons is in an unfavourable situation, it is a homogenous unit, and its territory is divided into four counties (*Fig. 6*).

Hence the interests of this region has never been articulated except in scientific research, in the present situation the effort to eliminate, basically reconstruct the county system and to substitute it with a certain kind of regional system is getting stronger. However, it is very difficult to predict the chances of this effort for success. A prediction is especially difficult in a multi-party system during the learning (re-learning) phase of the practice of democracy. Now we have administrative regions above the county-level, but they are only quasi-regions.

In the past few decades following the 'policy of opportunities' we have gradually improved our relationship with Yugoslavia, and new ways of cooperation have been explored in the border areas with our neighbours. For years, we have been successful to create cordial relationships with the neutral Austria, examplary ones between two countries with different social systems. We strengthened our efforts to become economically and politically independent from the Soviet Union, to create a Polish-Czechoslova-

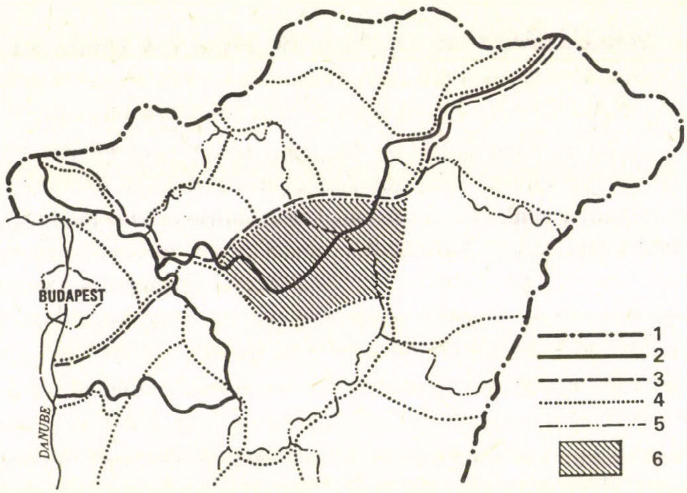

Fig. 6. The geographical position of the Mid-Tisza region. 1 = national border; 2 = border of planning district; 3 = border of macro-region; 4 = border of meso-region; 5 = county border; 6 = the spatial unit of Tiszafüred

Fig. 7. The countries and regions participating in Alps-Adria Team. 1 = national border; 2 = border of the regions

kian-Hungarian bloc which could cooperate more intensely within the COMECON, and to intensify the Austrian-German relations. Hungary has become more and more engaged in the regional actions of the Alps-Adria Work Team (*Fig. 7*). We have repeatedly expressed our readiness for regional cooperation with our neighbouring states, and proved our openness, in relation to either the great region and the whole of Europe, or to other parts of the world. To be open is a national interest of Hungary: there cannot be a change in the world, no matter how sudden or profound, which would find Hungary unprepared for cooperation.

After the change of our social system we are ready to use the new opportunities for international cooperation: with the newly independent Slovenia, Croatia or the Ukraine (*Fig. 8*).

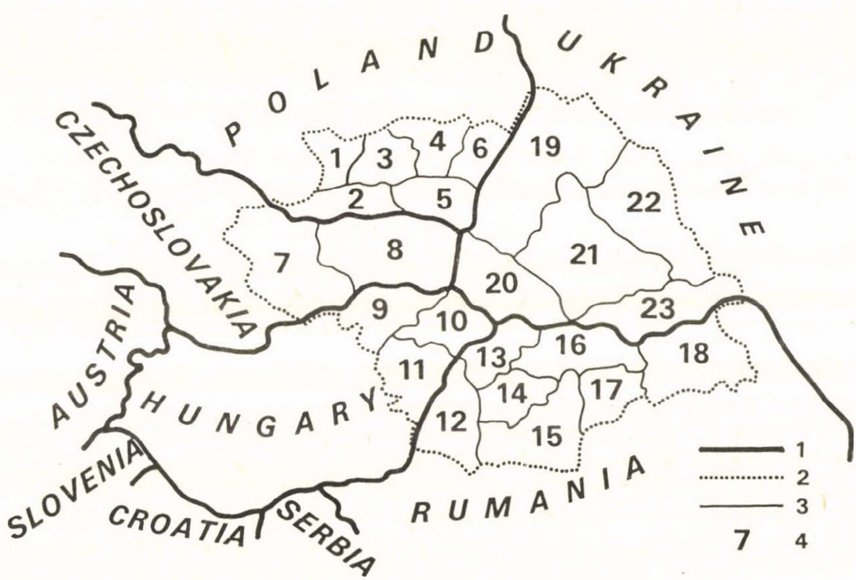

Fig. 8. The Carpathian-Tisza region (after Illés, I.). 1 = national border; 2 = suggested border of the region; 3 = border of administrative units; 4 = key-number of administrative units

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THE CHANGING ROLE OF TELECOMMUNICATIONS IN THE RECONSTRUCTION OF THE CITY OF BUDAPEST

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ABSTRACT

This article deals with the role of telecommunications in the process of reconstructing the city of Budapest, while focussing on the Central European context of the problem. The first part of the study gives a short historical survey about the establishment of the telephone network of Budapest in the late 1800s. Telephone lines within Budapest and international telephone connections to Vienna, Berlin, Prague and Pozsony (Bratislava) made Budapest an information centre in Central Europe at that time. After 1945, there was a change in the political and economic systems of Hungary. Telecommunication development slowed down during the era of a centrally planned economy and Budapest had only a very limited share in the information flow of Central Europe. The current level of telecommunications in Budapest is far from the standard of developed countries. Furthermore, the speed of telephone network construction in Budapest is still low but the quality of international links connecting the Hungarian capital with big Central European cities is better due to development projects started two years ago. The renewal of telephone networks and the appearance of telematic services will contribute to the reconstruction of Budapest by drawing foreign capital into the development of linear infrastructure. It will also promote the transformation of Hungary into a modern market economy within a few years.

INTRODUCTION

In the last decade of the 20th century urban development in East Central Europe faced new challenges. One of the features of our time, named by leading economists as a time of 'post-industrial economy', is a trend towards a so-called 'information economy and society'. It means, that in the future the determining factor in the development of a given region will be its ability to create a rapid mode of information processing and its ability to utilize this information rather than the size of a region, its richness in natural resources or even the volume of its industrial output.

The regions closest to being information economies and societies are the urban regions of developed countries with sophisticated market economies (such as in Japan, in the USA or in Western Europe). In these regions, the information economy and communications are on a high level with well established and available telecommunication networks.

With the technical development of informatics a revolutionary new era has come in information processing. In rapid succession new and up-to-date telecommunication systems have been created that are capable of processing a large volume of information and then transferring this information rapidly and over long distances without a loss of quality. These systems have become the key and indispensable factors in communication of the society and the economy of urban regions.

In the developed countries the basic technical conditions necessary for two-way communications, such as telephone and telex services, and for receiving information and entertainment (radio and television), were already available by the end of the 1950s and the beginning of the 1960s. As for traditional telecommunication equipments and receivers mentioned above the market of the developed countries of Western Europe reached saturation point during the 1960s (e.g. 85–90 per cent of the population had their own telephone, radio and television together with the associated services).

In the eastern part of Europe this process started only many years later and the diffusion of basic telecommunication services is still going on. Moreover, this development was deliberately slowed down in the socialist period. Infrastructural development has been hindered for decades, due to a lack of funds and restrictions, since the socialist concept of economic development regarded telecommunications as a non-productive sphere of the socialist economy. At the same time a centrally planned economic system requiring neither rapid decisions nor effective information processing had no need to modernize the telecommunication infrastructure of the country. Furthermore, at a time of ideological and political conflicts of opinion with the West, good telecommunications was even undesirable for the political leadership. For the political establishment of socialist countries the free flow of information was considered dangerous. Therefore, party leaders did their best to hinder it permanently for fear that it would undermine their political power base and safety.

A HISTORICAL REVIEW

The technical development in the field of communications that took place in the second half of the 19th century was of great importance to the process of urban development in Central Europe. The appearance of two major means of telecommunications — telegraph and telephone — which replaced one of the most important functions of traditional postal services, led to closer political and economic connections among Austria, Bohemia and Hungary. The multilateral connections between Austria and

Hungary played a leading role at that time and the new techniques applied in information transferring made the economic prosperity of these two countries possible.

The first telegraph line between Vienna and Budapest was constructed in 1849 and the second one was put into operation in 1855. The latter also connected Pozsony (now Bratislava), one of the largest towns of Hungary, to the Vienna—Budapest information channel. Eight years later a third telegraph line was built and the telegraph links of Budapest were extended to Cracow, Galicia.

These telegraph lines served as an important factor for helping the functioning of the stock exchange in Vienna by giving prompt information about the prices of Hungarian commodities and goods on the Austrian stock exchange. The telegraph contributed to a prosperity and boom in commercial activities which were profitable for both countries. As the main telegraph lines centred on the Hungarian capital, in the 1870s Budapest became the information centre of Central Europe.

The second and real revolution in information flow was caused by the invention of the telephone. The first local telephone network in Hungary started to operate in Budapest with 50 users in 1881. The first interurban connection was international at once. It was the Budapest—Vienna telephone link with three lines (established in 1890) which marked the very important political and economic connections between these two capitals of the Austro-Hungarian Empire.

By 1893, seven lines were in operation between Budapest and Vienna. Furthermore, nine larger Hungarian country towns — including Pozsony — built their own local telephone networks and stepped into direct phone connection, not only with Budapest but with Vienna, as well.

In 1897 the opening of the Budapest—Berlin direct telephone line marked the political and economic orientation of Hungary, too. Prague was connected to this Budapest—Vienna—Berlin information axis only through the Austrian capital and stayed in peripherical status in the international information flow.

In 1894 Berlin had the greatest number of telephones compared with the other cities mentioned above. There were about 27,000 phones in the German capital, while Vienna had about 7,800, Budapest had only 3,500 and Prague operated 1,600. Pozsony had merely 260 phones in 1894.

The most important indicator of intercity telephone connections is the number of calls. There was a real boom in the quantity of calls destined to Vienna from Budapest between 1894 and 1913. During this 20 year long period the number of calls increased from 143,000 to 322,000. Whereas the same data for the Budapest—Berlin links was only 3,000 up to 10,000 calls. (There is no data for Budapest—Prague relation, but the frequency of calls was probably similar to the Budapest—Berlin rate.)

The Hungarian government helped private investment in the telephone business in the 1880s. So the extension of the Hungarian telephone network was very rapid in Budapest and in the larger country towns such as Pozsony (Bratislava), Nagyvárad

(Oradea), Temesvár (Timişoara), Kolozsvár (Cluj), Fiume (Rijeka), Zágráb (Zagreb), Debrecen and Szeged.

Between 1891 and 1900 a widely built and modern telephone network went into the possession of the Hungarian state (*Fig. 1*).

After 1900 the number of calls between Budapest and Vienna increased permanently from year to year, and by 1910 the telephone became the main means of rapid telecommunications in Central European cities instead of mail or telegraph. At that time Budapest preserved its dominant role in the international calls of Hungary. About 65 per cent of all international calls running from Hungary to abroad originated from the capital.

Among the negative effects of World War I were the disintegration of the Austro-Hungarian Empire and the serious territorial losses of Hungary by the Trianon Peace Treaty in 1920. These facts caused problems in telecommunications development too. Largest country towns were annexed to the newly organized neighbouring states, such as to Yugoslavia (Zágráb), Czechoslovakia (Pozsony) and to the enlarged Rumania (Arad, Nagyvárad, Temesvár, Kolozsvár). Consequently, a considerable part of local telephone networks and hundreds of kilometres of interurban telephone lines fell out of Hungarian possession together with all their technical equipment (*Table 1*).

Table 1. Number of telephones in some Hungarian towns between 1895 and 1936

Town	1895	1900	1905	1910	1915	1920	1925	1930	1936
Arad	347	475	551	821	..	*—	—	—	—
Budapest	3481	5040	7790	15020	21938	26903	32490	47032	63537
Debrecen	187	243	456	868	1234	905	1512	1728	1802
Fiume (Rijeka)	278	603	755	1300	..	**—	—	—	—
Kolozsvár (Cluj)	337	492	599	992	..	*—	—	—	—
Nagyvárad (Oradea)	273	395	605	1112	..	*—	—	—	—
Pécs	114	142	345	644	912	1143	1375	1705	1881
Pozsony (Bratislava)	268	479	733	1084	..	***—	—	—	—
Szeged	220	412	543	972	1354	1587	1822	2137	2764
Temesvár (Timişoara)	211	503	802	1132	..	*—	—	—	—
Zágráb (Zagreb)	228	487	789	1511	..	****—	—	—	—

* Annexed to Rumania

** Annexed to Italy

** Annexed to Czechoslovakia

****Annexed to Yugoslavia

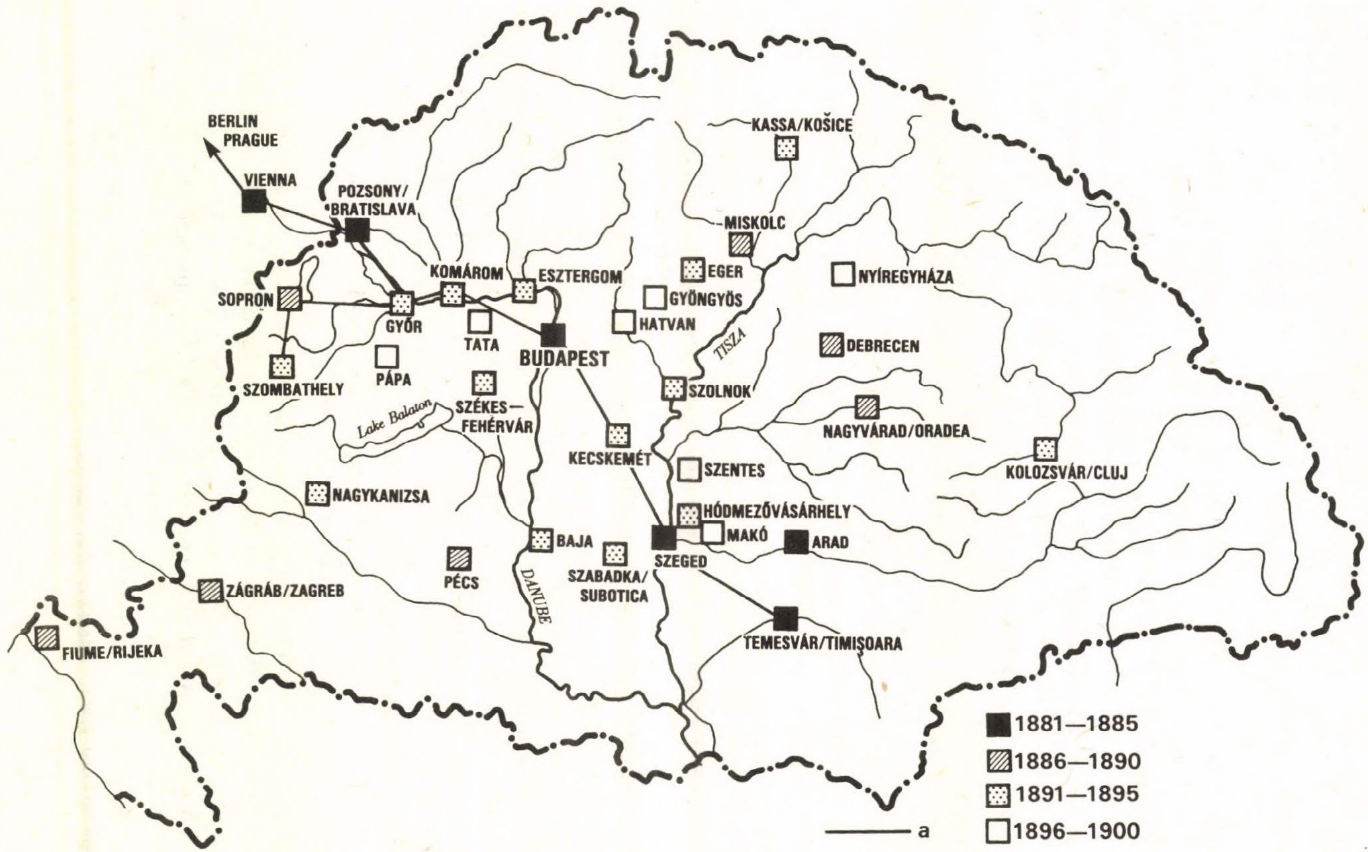

Fig. 1. Year of opening local telephone network in Hungarian towns between 1881 and 1900. a = first interurban connections

Despite the serious war losses, the economic ties between Austria and Hungary survived the critical era of 1918-1921. Moreover, the increasing number of telephone calls between Vienna and Budapest made it necessary to build a cable connection with high forwarding capacity. (The new cable link offered 210 lines for simultaneous telephone conversations in 1927).

With the help of this new axis direct connections became possible with other big European cities (e.g. London, Paris, Rome, Amsterdam, Frankfurt) and overseas telephone connections started to operate, too.

In 1925 there were about 33,000 telephones in Budapest (41 per cent of the total Hungarian stock) and the interurban calls between Vienna and the Hungarian capital exceeded 480,000. Ten years later Budapest had already 64,000 phones and the number of calls destinated to Vienna was more than 800,000 per year.

At the end of World War II (1944-1945), the technical equipment and installations of Hungarian Post were seriously damaged in Budapest. Nearly every telephone exchange was bombed, destroyed or damaged, and the lines were generally cut. Though efforts to rebuild the telephone network of the capital were made after the end of fights, the poor conditions for recovery (e.g. general lack of materials and spare parts, missing energy supply and technological background) hindered a quick reconstruction.

During the general reconstruction period of the Hungarian economy (1946-1949) the development of the telephone network had low priority. Because of poor investment possibilities its renewal did not involve application of up-to-date techniques. From 1948, the copying of the Soviet political and economic model in the economic growth of Hungary (i. e. a centrally planned economic system) led to the general negligence of infrastructural development.

On the other hand, the appearance of the 'iron curtain' reduced information exchange with Austria to a minimal level. Hungary changed direction of its commerce radically. With the establishment of COMECON in 1949 Hungary turned away from the West European market economies and became dependent on the Soviet export-import links. Of course, this transformation process was followed by changes in the Central European flow of information as well. Budapest had close international telephone connection to Moscow at that time, but Warsaw, Prague and East Berlin played also an important role as to the number of international calls.

Geographically, the importance of Budapest as an information centre in Central Europe was suspended for decades but the Hungarian capital kept, and even increased, its leading role in the country. Consequently, Budapest had advantages in all types of development projects — among them the renewal of telecommunications — over other parts of the country. Despite this favourable situation, the lack of sufficient financial support from the state budget meant, that it was not possible to realize a rapid growth in the telephone supply during the last four decades.

Emerging from the 'détente policy' of the European countries and from the positive effects of the economic reform in Hungary in the mid 1960s, the economic boom contributed to an increased commercial activity between Austria and Hungary.

This process was reflected by the ever increasing volume of international telephone calls between the two countries. In the 1970s this tendency became stronger and by the early 1980s Hungary had much closer information channels with the advanced European countries (mainly to Austria and West Germany), than even before 1945. While the proportion of international calls to the COMECON members was steadily decreasing in the late 1980s, West Germany and Austria increased their share in the number of calls originating from Hungary. About 75-80 per cent of calls to Austria were destined for Vienna (*Fig. 2*).

Despite these positive tendencies in international connections, telephone supply in Hungary advanced very slowly. The low rate of investment in telecommunications, the overcentralized information flow, the bureaucratic status of the Hungarian Post and the negative technological effect of the COCOM on the import of high technologies seriously hindered the development of Hungarian informatics for a long time.

Until September 1989, the political 'iron curtain' was a reality too, so it was impossible for Budapest to return to its former positon as an information centre of Central Europe. The situation changed only in the early 1990s.

TELECOMMUNICATIONS IN HUNGARY AND IN BUDAPEST TODAY

By now, the development of telephone services in Hungary has been lagging behind both the level of development of national economy and public expectations. Though about 2,300 telephone exchanges handle about 3.5 million local and 0.8 million long-distance calls a day, only 21 per cent of local main exchanges are automated, the others are manually operated. Most of them have only limited service hours (from 8.00 a.m. to 4.00 p.m.) on workdays and the services are suspended on the weekend.

The level of automation for inter-city telephone services is 92 per cent. Direct long-distance dialling came into general use only, in 1970 and by 1990 less than 900 settlements (31 per cent) were connected to the automated long-distance dialling network. At present long distance calls are possible from 870,000 main telephone stations (82 per cent of the total). There are great differences in the telephone supply of settlements of various types.

Today 46 per cent of all telephones are concentrated in Budapest where 19.8 per cent of the Hungarian population lives. All the villages (42 per cent of the population) share only 5 per cent of all the telephone lines in Hungary.

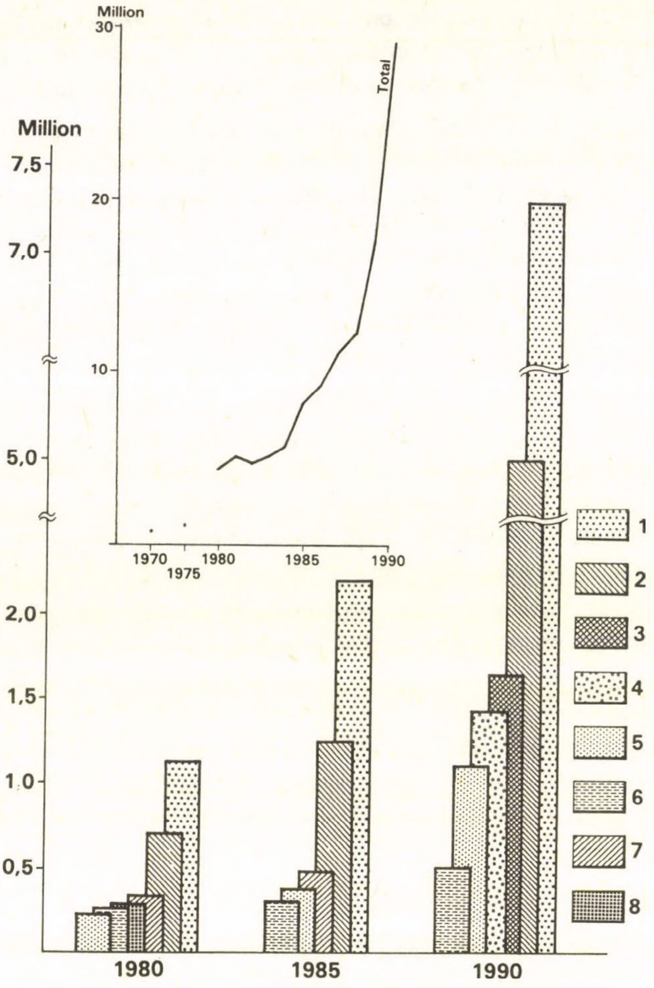

Fig. 2. Initiated international calls from Hungary (1970-1990) and the number of calls by dominant countries. 1 = West Germany; 2 = Austria; 3 = Italy; 4 = Rumania; 5 = Czechoslovakia; 6 = East Germany; 7 = Switzerland; 8 = USSR

The number of telephone stations per 100 inhabitants was 18.1 in 1990, but the same figure for main lines was only 9.6. It is far behind the European average.

Because of the highly centralized political-economic system the previous establishment supported only telecommunication systems and networks which enabled the centralization of information. Consequently, along with the public postal telephone network many non-public special telephone networks were built in Hungary to serve directly the power of the political elite and the productivity of the economy (e.g. telephone network of mines, water management, internal security, direct-line network of party leaders, etc.).

This practice led to difficulties in the development process and caused a serious deficit in the telephone supply for the population all over the country. The low figures of relative telephone supply of the country between 1950 and 1990 reflect the realities and show the results of a very slow development process in information techniques (*Table 2*).

Table 2. Change in relative telephone supply in Hungary between 1950 and 1990

Year	Number of telephones per 100 inhabitants	Number of main lines per 100 inhabitants
1950	1.9	1.2
1955	3.5	1.9
1960	4.6	2.4
1965	5.6	2.7
1970	7.9	3.9
1975	9.9	4.8
1980	11.8	5.8
1985	13.9	6.9
1990	18.0	9.6

Nowadays Budapest is relatively well equipped with telephones (42 telephones per 100 people) but it is far less than necessary to join the developed telecommunication networks of Western Europe.

When comparing the phone supply of the Hungarian capital with the same values of Prague and Vienna, considerable differences can be seen (*Table 3*). Table 3 shows that Prague falls behind Vienna for about 15 years as for values of relative supply. The same time lag exists between Budapest and Prague.

Table 3. Relative telephone supply in Central Europe 1975-1989
(Number of telephones per 100 inhabitants)

Year	Countries			Capitals		
	Austria	Czechoslovakia	Hungary	Vienna	Prague	Budapest
1975	28.3	18.4	9.9	61.0	48.4	29.2
1980	40.6	21.5	11.8	65.6	55.7	32.6
1985	49.2	23.7	13.9	..	..	35.5
1989	57.8	26.1	17.2	83.4	64.2	41.8

The functional distribution of telephones in Budapest can be characterized by the following:

- 72 per cent of phones are located in private homes,

- 26 per cent are owned by institutions and enterprises,
- 2 per cent are public telephones.

A special indicator of poor telephone supply is the number of inhabitants waiting for their first telephone. Their total number in Hungary was about 600,000 (among them 260,000 in Budapest) in 1991 *(Table 4)*. There has been a permanent deficit of telephones and the number of claimants does not decrease *(Fig. 3)*. Those applying for a telephone in Budapest in spring 1992 are facing to wait for about 10-12 years as an average. To reduce this unacceptably long waiting time the Hungarian Telecommunication Company (HTC) tries to get money for telephone network development and for modernization of

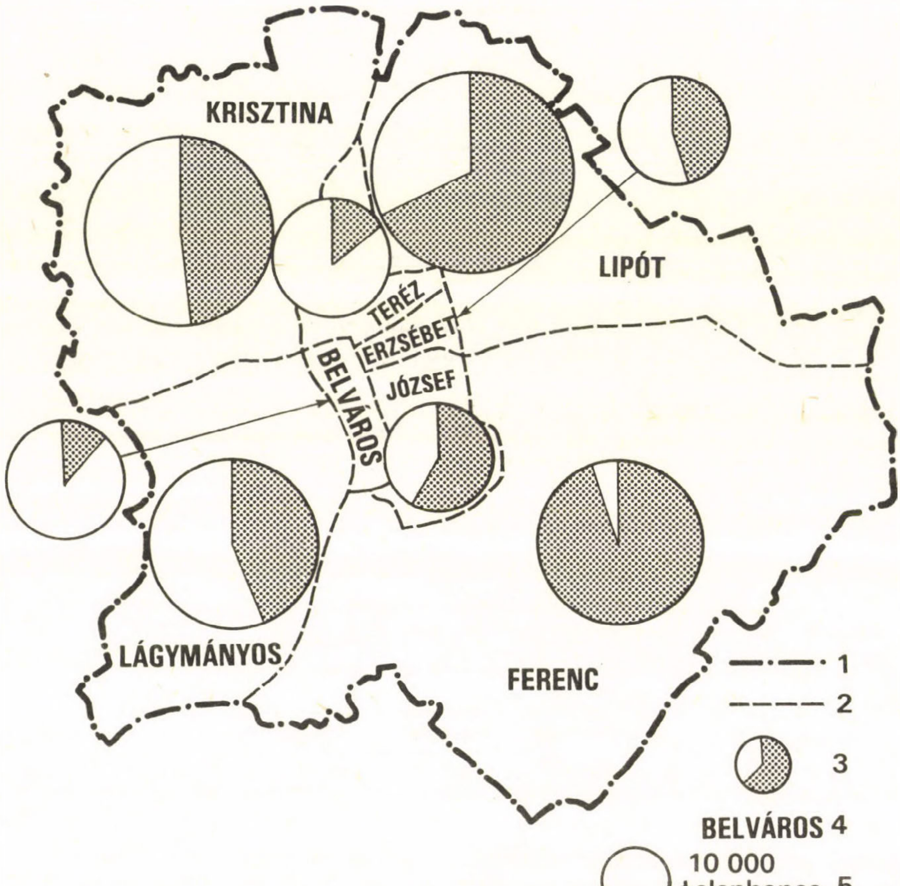

Fig. 3. Demands on telephones in Budapest (1991). 1 = administrative boundary of Budapest; 2 = borderline of main telephone exchange district; 3 = proportion of missing telephones related to total number of telephones in the district; 4 = name of telephone main exchange; 5 = total number of telephones in a district

telephone exchanges from different sources (e.g. from World Bank, subsidies from the Government, from private firms, from the local councils, from the inhabitants, etc.) but its insistence on its monopoly status in the operating of all the telephone networks causes a lot of difficulties.

Table 4. Connected main lines and deficit in telephones in Budapest between 1980 and 1990

Year	Connected telephones		Inhabitants waiting for telephone	
	1000 phones	per cent	1000 inhabitants	per cent
1980	358.9	100.0	161.6	45.0
1985	392.6	100.0	246.7	62.8
1986	404.4	100.0	234.8	58.1
1987	417.7	100.0	231.2	55.3
1988	430.4	100.0	241.0	56.0
1989	441.5	100.0	249.0	56.4
1990	459.1	100.0	252.9	55.0

The building of an automated long-distance dialling system made it possible for Budapest to have modern connections with many European cities. Against this modernization process, however, the relatively poor information forwarding capacity of the international telephone lines in Hungary causes much time to be wasted. So the relatively few telephones and the limited capacity of exchanges are the main technical bottlenecks for Budapest in becoming a real information centre in Central Europe.

In 1992 it was possible to make direct trunk calls to more than 150 countries with the help of automated long-distance dialling systems from the Hungarian capital but the problems mentioned above still exist in nearly all international connections.

CONDITION OF FULL RECONSTRUCTION OF TELECOMMUNICATIONS IN BUDAPEST

With the changes in the political and economic system of Hungary in 1990, the sudden appearance of private enterprises, joint ventures and especially the location of foreign industrial and trading companies has created an urgent need for better communication possibilites, primarily in Budapest.

Big trade centers and new hotels have been built in the CBD of the Hungarian capital. Furthermore, hundreds of offices have been reconstructed for commercial and business purposes necessitating telephone and telefax lines. To meet their demands HTC is making efforts in telephone network development in different ways.

a) To finance the rapid enlargement of telephone networks between 1991 and 1995, HTC is trying to use different types of finanical resources (e.g. issuing shares in a sum of HUF 1 billion, raising credit for a 5 year long run in a sum of HUF 7.5 billion, getting credit from the World Bank in an amount of USD 150 million, from the European Investment Bank USD 100 million, and from the EBRD ECU 90 million).

b) To carry out a radical technical renewal of telephone networks HTC concluded an agreement with Western companies such as Siemens and Ericsson to build complete networks of digital exchanges and to replace the old, manually operated and rotary type systems with high-tech ones. The first digital telephone exchanges for international use were put into operation in 1989.

c) The Hungarian Government helped this process legally by passing Act No 12/1991, which describes priorities in distribution of new telephones among claimants. This act says that telephone needs must be fulfilled according to the date of the application, but

- authorities (such as police, fire brigade, ambulance and special services of public health care) have advantages over firms and institutions in getting telephone lines,
- firms and institutions have priorities in distribution of telephones over common city dwellers,
- claimants asking for their first telephone line have advantages over those desiring to have the second or third line,
- transferring of a line has priority over setting up a new one.

Although considerable amount of capital has been invested into telephone network development, it will take a long time to meet all the requirements and to eliminate regional differences in supply.

Much capital is pumped into the development process by private, enterprises founded in 1990 and 1991. To promote better telephone supply in the fringe area of Budapest private investors wish to build local telephone networks independently from the HTC projects. The real problem is that the monopol status of HTC to operate all the telephone networks in Hungary exclusively is guaranteed by laws and orders. This legal right hinders the connection of new local networks belonging to private investors with the automated national and international networks of the HTC. Negotiations held between the representatives of HTC and the investors led to temporary results. Joint ventures have been founded where HTC is the owner of significant part of shares and considerably contributes to the cost of development.

The cost of establishing a telephone line depends on the type of user. The rates are different. For example in spring1992 this rate was HUF 90,000–60,000 for firms and institutions (for main lines or extension lines) but only HUF 12,000–8,000 for individuals. These costs have doubled for the last 5 years and because of the relatively high inflation rate they will probably increase in the near future, too.

Resulting from the development, 133,000 new telephones were connected to the national network in 1991. Of these Budapest had a 45 per cent share. By the end of 1992 a further 150,000 new lines will be set up and in the third period of the 3 year project an additional 170,000 telephone lines will be joined to the core and branch networks in 1993. Despite this big boom and the favourable tendencies outlined, there are still considerable regional differences in telephone supply inside Budapest. New trade centers were built in the CBD and business activities became widespread in other parts of the downtown area. They are all equipped with the modern technical installations necessary for information exchange (telematic services). The situation is nearly the same in inner Buda where many small enterprises have settled in private flats. Outer districts in northeast and southeast Pest are in unfavourable situation for the number of claimants several times exceeds that of existing telephone lines in the area (*Fig. 3*).

The most essential thing to be solved is to eliminate bottlenecks in information flow and transmission. Namely, in spite of the good telephone supply of Austrian, German and other foreign companies settled in the CBD the congested and overloaded lines are unable to transmit a great number of calls in time and this situation is seriously hindering the information flow between Budapest and the other Central European cities.

Here we have to mention that Budapest — and Hungary in general — is in a more favourable situation in telephone supply and in the technical level of core and branch network compared with most of the former socialist countries such as Rumania, Yugoslavia, Poland and Bulgaria. But without solving the problems of overloaded core networks in the international and national automated long-distance dialling it will be impossible for Budapest to become an information centre in Central Europe again.

Meanwhile, the position of Budapest is getting better and Hungary is standing among the first in East Central Europe in the regional diffusion of telematics. In April 1992 there were about 16,000 telefaxes and more than 10,000 radiotelephones (mobilphones) in the possession of private and non-private businessmen and of inhabitants. Moreover, about 360,000 flats have been connected to different types of satellite television programmes or cable television systems, etc.

TELECOMMUNICATIONS AND CITY RECONSTRUCTION

Experiences of the interviews, carried out with the representatives of the HTC and the leaders of the community of Budapest about the role of telephone network development in city reconstruction can be summarized as follows.

The leadership of the HTC is optimistic when looking at the development prospects of Hungarian telecommunications. The same optimism can be shared in the case of Budapest too, where the political, economic and cultural life increasingly approaches the democracies of the developed West. Telecommunication experts and bosses are aware of their key position in city reconstruction policy, and in the essential role a linear infrastructure plays in the modern market economy. It is a strategic question in Hungary, to give enough telephone and telefax equipments and lines in suitable quality and quantity for newly established firms, for joint ventures and for all participants of business and social life. A good telephone situation is an important element of a high living standard and of manysided social services.

It is also obvious for the HTC leaders that the quality of our telephone services did not meet the requirements desired either in the capital or in the country. To diminish the big deficit in telephone supply — there are about 260,000 missing telephones in Budapest and an additional 340,000 in the country — HTC worked out its 5 year development project. After finishing this programme not only will 500,000 new telephones have been put into operation, but the main part of core and branch networks will be modernized as well.

For 1991 and 1992 financial and technical obstacles seemed to have disappeared but limited transmission capacities and legal problems remain as real bottlenecks in this process. According to the regional chapter of the HTC project manuscript the development concentrates:

- firstly, on the modernization and the capacity increase of core information networks in Budapest—European cities and Budapest—Hungarian county seats relations (Lake Balaton resorts included);
- secondly, on the renewal of inter-city branch networks in the country;
- thirdly, on widening telematic services in Budapest and in the largest country towns to have considerable economic activities.

Long term projects plan to make more favourable telecommunication possibilities for all the towns and for larger villages, but these goals can only be reached after the year 2000 by drawing such famous foreign co-operators as AT&T or ALCATEL into the technical reconstructions.

Leaders of Budapest handle the problems of telecommunication in differen vays. Some consider it an important section of infrastructural reconstruction for the Hung. ·n capital which must get priority in the general renewal process both from financial ar from legal point of view.

The emerging number of foreign investors, the boom in tourism and the disappearance of the 'iron curtain' led to a big expansion in international information exchange between Budapest and other European capitals. Mainly, the Austrian and German connections started to be very prosperous from the year 1990, not to speak of the increasing American influences on Hungarian economic and business life.

The visible concentration of business activities in the CBD of Budapest requires an up-to-date level of information services in district 5. The next step in the spatial diffusion of information will touch the intermediate territories between the CBD and the fringe area of the city (districts 6, 7, 8, 9 and 13). Characteristics of expansion of telematic services show the rules of hierarchic diffusion which has taken place similarly in the regional spread of small enterprises and joint ventures.

The telephone supply situation in the fringe area (outer districts) and in the agglomeration zone of Budapest is much worse than in the inner part of the capital. It is an important task for the city leadership to equalize the telephone supply differences between Budapest and its agglomeration settlements in a long-term period. Their economic and cultural symbiosis undoubtedly requires it.

The new Telecommunication Act which will be discussed by the Parliament soon will also contribute to faster reconstruction of telephone networks in Budapest and will probably offer a large scope for development process. (E.g. by making an attractive economic and legal environment for further foreign telephone companies to invest a lot of money into the telephone business. One part of the money saved by the city dwellers could be invested into telephone network development and investors should be given privileges in telematic services in exchange for their invested capital. Shares should be issued for development purposes, etc.)

After executing the development projects outlined above and after breaking the monopoly of HTC in exclusively operating Hungarian telephone network, the telecommunication conditions of Budapest could make the city the economic and cultural centre of Central Europe.

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RESTRUCTURING EAST(ERN)-EUROPEAN AGRICULTURE

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ABSTRACT

To this day in most former European socialist countries large-scale farming has been predominant. For theoretical considerations, which can be summarised in two principles, big producer cooperatives and state farms were deliberately created by governments. The first principle was specifically Marxist and claimed that private ownership leads to the exploitation of labour hence it is inconsistent with a communist society. The second was a more general principle, referring to economies of scale. Both principles proved to be erroneous over the time. Even economy of scale could not be sufficiently exploited owing to the lack of interest of managers and workers.

The efforts of economic reforms in the sixties and eighties tried to correct the failures. The furthest-reaching reform measures were carried out in Hungary where they involved some privatization and some turn to small farming. Owing to the resistence of left-wing party leaders and the intervention of the Soviet Army in Czechoslovakia in other European socialist countries the reforms of the sixties have almost entirely failed. The reform attempts of the second half of eighties had just started when socialist systems collapsed. The unexpected collapse found both reformers and political opposition unprepared. After free elections in Poland, Czechoslovakia, Hungary and the GDR, or even after the reunification of Germany, governments are still bewildered concerning the restructuring of the economy and particularly of agriculture. There is an agreement about the task that a market economy has to be created. Well-elaborated conceptions to reach this end, however, are failing. There are opposing views concerning even the pivotal question of ownership restructuring. Everywhere deregulation and privatization take place slowly and reluctantly, also hindered by bureaucracy and governments trying to strengthen political power by keeping economic strongholds.

The restructuring of agriculture is especially difficult, as farming in state and cooperative farms represent not merely forms of production but also the lifestyles of people. The new generation has born into this type of farming. Most people will not take the risk to be full-time farmer.

Yet large-scale agricultures have proved to be highly inefficient and badly need restructuring. Their transformation into real cooperatives of members could be a solution. Small farming may not be predominant in Eastern European countries in the near future, but a mixed agriculture of cooperative and individual farmers seems very probable.

A NEED FOR RESTRUCTURING OF ECONOMY

After democratic changes in Eastern Europe, countries of the region are trying to break out from their forty-year segregation from the rest of the world and fit into the global world order. The change in politics, however, seems to have been easier achieved than one in economy. Parlamentary democracies could be reinstated within a short period of time, while changes in economy need much longer time.

State ownership made industries, farming and services highly inefficient in most Eastern European countries. In order to increaseng their efficiency, ownership problems has to be first resolved.

In industry and trade widespread privatization seems to be the best solution. In agriculture, however, a specific approach is needed. Land privatization should be connected with at least partial maintenance of large-scale farming through voluntary cooperation of land-owners. This could preserve the advantages of economics of scale and decrease the risks of producers.

THE PAST

Under socialism large-scale farming was predominant in most countries of Eastern Europe. Big producing cooperatives and state-farms were deliberately created by governments. Their organisation rested on two major principles: 1.) Private ownership involves the exploitation of labor, hence it is inconsistent with a communist society; 2.) Large-scale production is more efficient than a small-scale one. Both principles proved to be wrong since state ownership or state-controlled cooperative ownership did not involve people in production the way private farming could. Hence the economies of scale could not be properly exploited and large-scale socialist farms became much less efficient than family farms in the West.

Ownership relations in the agriculture of Eastern Europe were somewhat different from the nationalized industries. The total nationalization of land was only carried out in the Soviet Union. In most Eastern European countries only partial nationalizations took place. In Hungary, for examples, state farms occupied 15 percent of agricultural land.

Parallel with the nationalisation of land a land reform was introduced in every country even in Russia. Land was distributed between landless peasants and smallholders. Soon after the land reforms, however, a forced collectivization took place in every country, except Poland, and producer cooperatives and state farms were organized. Yugoslavia gave up the attempt of collectivization in the 1950s.

The initially not too large collective farms were merged into bigger units later on, explained by effects to increase their efficiency, but in reality in order to allow their closer central control.

In the Soviet Union and Bulgaria many producer cooperatives merged into huge (state) farms, and in the 1970s agricultural-industrial complexes were organized. In East Germany, apart from mergers, farms of land cultivation and stockbreeding were separated from each other and both were put under control of sectoral centres. In Hungary cooperative farms, being initially of 1000 ha and state farms of 4000 ha of average size, were merged into larger, 4000 and 7000 ha, units respectively (*Table 1*). It has to be mentioned, however that household plots and part-time small farming was more widespread in Hungary than in other Eastern European countries.

Table 1. Land-ownership in Hungary and the number and average size of farms in 1988 (per cent)

	State farms	Collective farms	Smallholders	
Land	15	76	9	
		share of household farms from it	share of full time farms from it	
		7	3	
Number	133	1253	1 375,000	
Size (ha)	7000	4000		
		Agricultural land-use in per cent		
Cropland	Garden	Fruit	Vineyard	Pasture
72,5	5,2	1,5	2,2	18,6
from it: Grain 60,8 Wheat 27 Maize 24				

In some countries land titling remained unchanged even in cooperatives. That was the case in East Germany. In Hungary about 60 per cent of land was bought up by cooperatives at low prices in the 1960s and only about 30 per cent remained further on titled.

In most countries the productivity of large farms did not fare any better than that of industry. Food shortages, increasing import needs marked the 'development'. Hungarian agriculture was an exception in this respect since there has not been a food shortage since the sixties. On the contrary, exports increased rapidly, to 30 per cent of production in the seventies and eighties. Yields have significantly risen (*Table 2*).

The reasons for good results could be partly found in the subsidising of mechanization and modernization, partly in the greater freedom of farms compared to other enterprises. A fairly strong agricultural lobby fought for the rights of agriculture. The greater freedom could be also attributed, however, paradoxically to the neglect of agriculture by central authorities. Agriculture was less controlled centrally than industry and producer cooperatives has more, although limited, freedom in decision making. For instance, presidents and other managers were reelected from time to time through vote by members, however approved by local administration. Since the incomes of members depended on results of the cooperative, it even happened sometimes that inefficient managers were replaced.

Table 2. Yields of some crops in Hungary (t/ha)

	1961-65	1971-75	1981-85
Wheat	1.1	3.3	4.6
Maize	1.5	4.2	6.1
Sugar-beet	21.8	33.0	38.9
Sunflower	1.1	1.2	2.0
Potatoes	4.6	11.7	18.2

The Hungarian economic reform of 1968, abolishing central targeting system, promoted the independence of cooperatives, and in a lesser degree of state farms as well. Although at the beginning of 1970s central control has been strengthened again, it was eased repeatedly at the end of the decade. Farms wanted and had to increase their self-reliance at that time, since central subsidies have dropped significantly. They broadened their non-agricultural activities, decentralized their farm management in order to increase efficiency, and on contract they alloted land and equipment to individuals, groups of workers and smallholders, who undertook the production of labour-intensive produces (pig, poultry, vegetables, fruits, grapes, etc.) This was urgently needed since agricultural labour decreased and the egalitarian low wages backed also by strongly progressive wage taxes (recently by income taxes) and the low working morals, led to a low productivity. Since only the major crops were completely mechanized, a major part of labour intensive products were produced by household plots and other small farms.

In spite of their small land areas smallholders' output made up 20-40 percent of gross agricultural production in Eastern European countries. This was no wonder since these produces brought the highest value per land and could be sold generally at free prices.

By the 1980s in Hungary more than two-thirds of pigs, poultry, vegetables, fruits and wine was produced by smallholders and contracting members of cooperatives. In fact, many Hungarian large farms turned to be a mixture of producer, trading and servicing cooperatives, far removed from the original Soviet model.

In other socialist countries of Eastern Europe agricultural performance was much poorer, explained by the insufficient resources available for agriculture and the lesser motivation of people in production. According to the report World Agriculture. Toward 2000' (1988.) increase in agricultural production has diminished from year to year for the last decade, at the same time increasing grain imports were needed (*Table 3*). In 1969/71 the Soviet Union imported 5 million tonnes of grain and in 1983/85 already 38 million tonnes.

Table 3. Increase in agricultural production
(per cent)

	63-78	64-79	65-80	66-81	67-82	68-83	69-84	70-85	71-86
Soviet Union	2.8	2.3	1.9	1.4	1.2	1.1	1.0	0.9	0.9
East Europe	2.5	2.4	2.1	1.9	1.8	1.7	1.8	1.6	1.5
Total	2.7	2.3	2.0	1.5	1.4	1.3	1.3	1.1	1.1

EASTERN EUROPE NEEDS NEW INITIATIVES AND MORE CAPITAL

After ten or twelve years of recession. Eastern European countries found themselves on no man's land. Their economies are no more socialist and not yet capitalist. The socialist organization is falling apart, the capitalist reluctantly comes to life. A deep crisis is characteristic (*Table 4*). The generally mentioned reasons for the crisis are: piling-up debts in countries like Hungary, Poland and Bulgaria (*Table 5*); the collapse of the Soviet market; western trade barriers hampering Eastern European goods in reaching Western markets; increasing inflation, boosted by the curbing of subsidies, by sudden price liberalization and import liberalization, by increase in Eastern European import prices to be paid in hard currencies according to the recent Eastern European trade agreement, etc.

The true reasons are, however, the lack of a comprehensive economic policy, the lack of clear concepts and prospects, uncertainities in privatization both at governmental and enterprise levels. Bureaucracy and managers of state enterprises are blocking privatization fearing of losing economic power. There is much discussion about the need of restructuring of the economy, but both conceptions and acting are failing for carrying it out. There are few new investments, few inventions, enterprises use up their capital and most of them can neither die nor survive. The only clear policy is the restrictive monetary policy. This bring, however, the economy into an even deeper depression. Living standards are falling, domestic and foreign demands are decreasing and, hence production is also decreasing. Unemployment is growing.

Table 4. GNP in percent of previous year

	1986/90 (planned)	1986/90 (fact)	1989 (fact)	1990 (fact)	1991 (estimated)
Bulgaria	5,4	-0,5	0,4	13,6	-10,1
Czecho-Slovakia	3,4	1,0	1,0	-3,1	-8,0
former East Germany	4,6	-1,8	2,1	-19,5	-19,5
Hungary	2,8-3,2	-0,5	-1,1	-5,5	-3,0
Poland	3,0-3,5	-0,5	-0,2	-13,0	4,0
Rumania	10,3	-3,5	-7,9	-10,5	2,8
Yugoslavia	—	-1,3	0,6	-7,6	—
Soviet Union	4,3	1,3	2,4	-4,0	-1,5

Source: Figyelő, May 2. 1991.

Table 5. Net debt (USD billion)

	1986	1987	1988	1989	1990*
Bulgaria	3,6	5,1	6,1	8,0	9,8
Czecho-Slovakia	4,4	5,1	5,6	5,7	6,3
Hungary	14,7	18,1	18,2	19,4	20,3
Poland	31,9	35,8	34,1	37,5	41,8
Rumania	6,3	5,1	2,0	-1,3	1,3
Total	60,9	69,2	66,1	69,3	79,6
Soviet Union	16,6	25,1	27,7	39,3	43,4
Sum total	77,5	94,3	93,9	108,7	122,9

* Preliminary data

Source: Magyar Hírlap April 8. 1991. (Review of an OECD Report)

Although the GDP has fallen by 1-2 percent every year since the beginning of eighties and real wages dropped to 93,5 per cent from 1980 to 1989. Hungary is somewhat more fortunate than the other Eastern European countries. There was a 5-6 per cent decrease in GDP and 7-8 per cent fall in consumption in 1990, and the forecast is not better for 1991, there are also some signs of improvement. Foreign trade shrank but it showed a positive balance. At the same time, the share of Soviet exports decreased to 30 per cent in 1990 and 20 per cent in 1991 from the ca. 65 per cent of the seventies and 50 per cent of the mid-eighties. The budget deficit was also reduced to some extent, but rather on account of cutting cultural and social expenses than those of administration. The relative good results could be attributed to a stronger economy, than in the neighbouring countries, to fairly good agricultural performances and to some experiences in market economy, due to the more or less successful achievements of the economic reform of 1968. The extensive shadow economy also, helps survive. Nevertheless, the crisis seems to be persistent and the upswing yet far away.

PRIVATIZATION

There is a political consensus in privatization, a great confusion exists, however, even in united Germany, concerning its implementation, extent, schedule etc.

Some political parties and groups prefer reprivatization, i.e. giving back properties to their original owners. Others prefer selling or giving them free of charge to people interested. In Germany as a rule, only those properties will be given back to the earlier owners, which were nationalized after 1976, others only exceptionally. In Czecho-Slovakia old owners can claim back their ownership nationalized after February 25, 1948, but part of the assets will be free alloted to the population. Land owners might claim their land expropriated after 1948, up to 150 ha of arable and 250 ha of other land. The Polish government would prefer partly a free privatization, alloting shares to workers and people, partly selling the state-owned properties. In Rumania old land owners or their heirs might claim land up to 10 ha, in Bulgaria up to 30 ha.

According to recent Hungarian law, earlier owners or their heirs might claim a small compensation for their properties expropriated after 1949, in the form of bonds. The bonds could be used for buying any assets to be privatized (shops, industrial shares, and land). If bonds are used for buying land up to 50 ha, government provides some additional subsidies if buyer binds himself to cultivate the land at least for five years. Producer cooperatives have to offer for sale at least 30 percent of their land area.

HOW SHOULD AGRICULTURE BE RESTRUCTURED?

Privatization is a precondition of raising efficiency. In agriculture it could lead however, to the revival of small-scale farming. There are several reasons against re-creating an agriculture of smallholders.

Firstly, although collectivization was forced, large-scale farming has been gradually accepted by rural people. The new generation was born in this environment and it is natural for them. Most members of producer cooperatives do not want major changes. For this reason cooperatives cannot be dissolved even in former East Germany. The above assumption is supported by the relative few claims for land in Hungary after the declaration of the Compensation Act.

Secondly, the present-day smallholders are part-time farmers with few expertise in running full-time farms. The carried out recently in Hungary, also by our research group at the József Attila University, proved that most part-time farmers do not want to do full-time farming. They are reluctant to take more risk and to give up their full-time jobs.

Thirdly, capital is also lacking for small-scale farming. Eastern European agricultures are equipped with large machines and large buildings. The infrastructure for trading is also based on large farms. Supports and low-interest credits for smallholders are not available and governments have even no intention to provide them. Recent bank interest rates are on the average 35 percent in Hungary and the most reduced rate for agriculture is 20 percent. At the same time the average net higher in agriculture is not more than 4-5 per cent.

Fourthly, the economy of scale is undoubtedly an advantage of big farms, and would be foolish to sacrifice it. The large-scale farming alone, however, does not provide the expected efficiency if proper equipment and interest are lacking. The Chinese example and labour-intensive production in Eastern Europe have proved that smallholders can fare better with poorlyer mechanisation and equipment than big farms.

Finally, the prospects of agricultural production are grim in Eastern Europe. Regarding the falling purchasing power of the population and the shrinking export market of the Soviet Union, there is an agricultural overproduction in Hungary, Checho-Slovakia and Poland at present . Getting into the highly protected EC market will be difficult even after the new agreement of association in the autumn of 1991.

Owing to the falling demand, the survival of many big farms will be even doubtful, however, they dispose of much more capital, experience and trade contacts than new smallholders. Agriculture will need much less employment in the near future and must find new ways in production, processing and marketing. Better marketing and information systems will be needed for finding out which produces will be demanded, which agricultural sectors should be reduced or increased. Under the conditions of stronger competition, branding, packing, processing has to be developed. Probably part of the land, first of all in less fertile and hilly regions must be set aside. Plans have to be developed for using these areas for touristic or other purposes and improve their supply with utilities.

The new smallholders could not tackle all these problems, let alone without being threatened with mass banktruptcy. Therefore, individual and cooperative farming have to live side by side for a while completing each other. Socialist producer cooperatives could transform into real, voluntary cooperatives, whose members cooperate in producing, marketing and servicing. This perspective, towards which the first steps have already been made, seems to be the most promising in view of a least painful transition.

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QUATERNARY ENVIRONMENT IN HUNGARY

(Studies in Geography in Hungary, 26)

Edited by
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In past decades a detailed subdivision of the Quaternary was carried out with special emphasis on climatic or environmental phases with the Last Glacial cycle of the Pleistocene. Most recently studies on global and regional scale of the Late Quaternary ecological changes have come to the fore.

This collection of papers gives an overview of the long- and short-term terrestrial records of the Middle Danube Basin (Hungary), of paleogeographical, environmental or climatic changes since the Last Interglacial, of the cycles of solar climatic types since the Riss Glacial, of the Upper Pleistocene events and of the vegetation history of the Great Hungarian Plain. Relying on complex sedimentological and radiometric investigations the Holocene evolution of the Lake Balaton is described, radiometric data are given on the Holocene deposition of the Danube, a mineralogical study for dating the thin tephra layer in Hungarian loess profiles is presented, as well as mass movements on steep loess slopes occurring on agricultural land are analysed.

The contributors of the volume meant to provide information on the recent results of their investigations for the participants of the XIIIth Congress of the International Union of Quaternary Research in Beijing.

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