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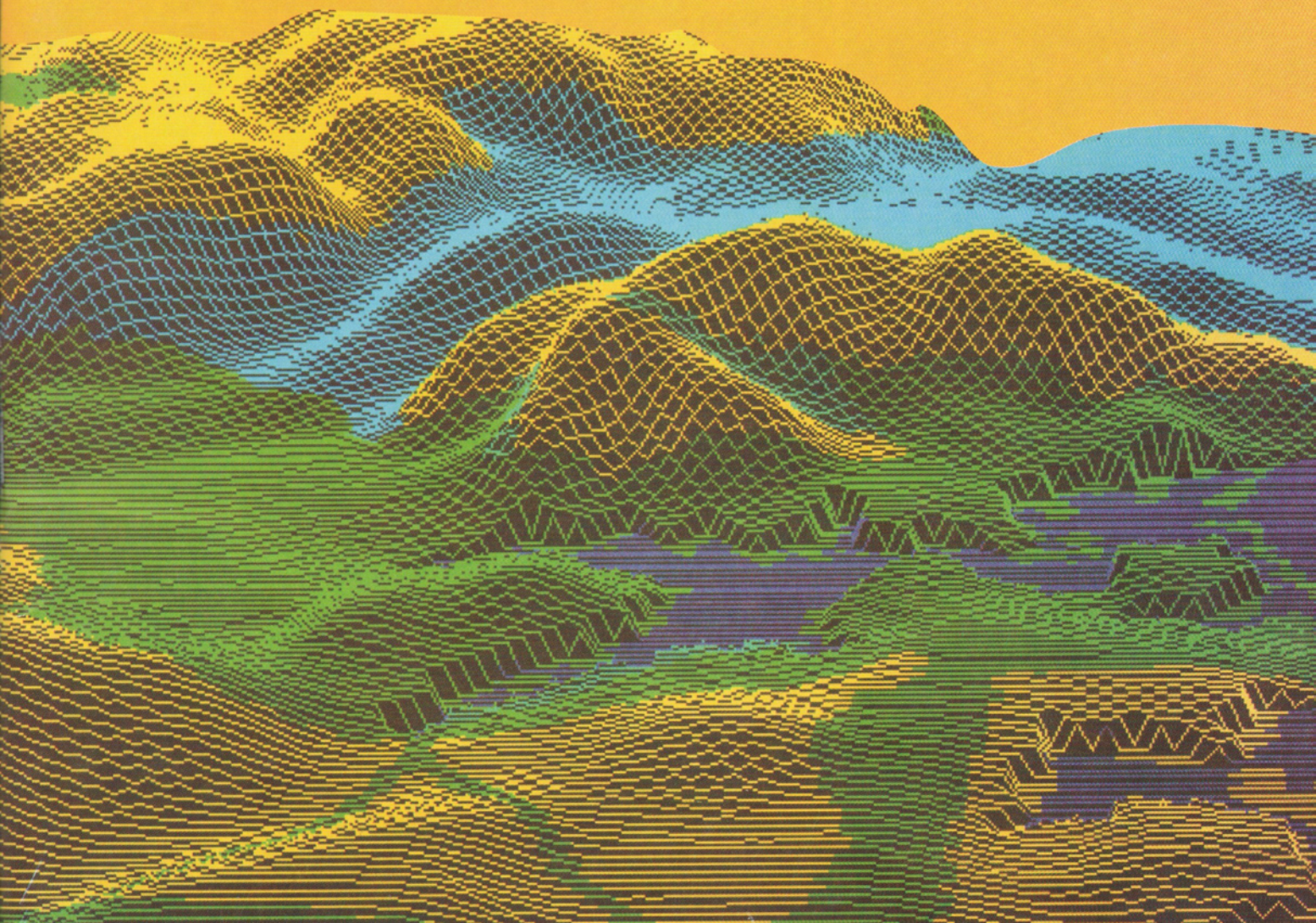

Fig. 4 The complete loess series on the western mining wall. The photograph clearly shows both the PK I swelling near both the right and the left edge, and the end-off of soil W 1-2.

Photograph J. Karásek, August 1969

Fig. 6 The western wall of the Modřice loam pit, September 1997. The pre-loess elevation built up by calcareous clay (light area) in the left part of the photograph, the pre-loess depression with the floor filled up by the parautochthonous set of soils PK II+III which is being telescopically nipped-out towards the elevation head.

Photograph J. Karásek

Illustrations to the paper on of J. Karásek - L. Seitl - K. Valoch

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THE ISSUE OF TRAFFIC REMOTENESS IN SOUTH MORAVIA ON THE EXAMPLE OF THE MIDDLE DYJE RIVER BASIN

Jana ZAPLETALOVÁ

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Abstract

The area under study is located aside off fairly important supraregional and regional road and railway veins. The economic significance of the area decreased in the course of economic transformation and only very slowly shows signs of revival. The structure of settlement, the age structure of population as well as the steadily shrinking job opportunities in the region induced a great dispersity of demand for public transport. This is why the public transport companies gave up the whole-area public transport attendance. The number of traffic lines and connections was reduced. In the period from 1991-1996, traffic attendance on working days worsened in 78 % of settlements in the studied area. On Saturdays, Sundays and holidays, approximately fifty percent of settlements in the area have no traffic connection at present. The motor car becomes a necessity for the local rural population similarly as in other parts of the Czech Republic.

Shrnutí

Studované území leží stranou od významnějších nadregionálních i regionálních silničních a železničních tahů. Hospodářský význam studovaného území v průběhu ekonomické transformace poklesl a jen velice pomalu opět ožívá. Struktura osídlení, věková struktura obyvatelstva a neustále klesající nabídka pracovních příležitostí v regionu vyvolala velkou disperzitu poptávky po veřejné hromadné dopravě. Proto dopravní společnosti ustoupily od plošného zabezpečení dopravní obslužnosti území. Byly redukovány počty dopravních linek i dopravních spojů. Od roku 1991 do roku 1996 došlo u 78 % sídel oblasti v pracovních dnech ke snížení dopravní obslužnosti. Ve dnech pracovního volna a ve dnech pracovního klidu nemá v současné době zhruba polovina sídel žádné dopravní spojení. Stejně tak jako v jiných částech České republiky se pro venkovské obyvatelstvo stává nezbytností osobní automobil.

Key words: The Middle Dyje River Basin, location in traffic network, public transport, traffic accessibility, marginal character of area

1. Introduction

It is nearly seven years that Czech economy has been going through a process of transformation. Although the process runs to identical rules in the whole area of the country, their impacts considerably differ in individual regions. The least negative influence can be seen in areas located on major railway lines and road traffic veins with the colourful structure of manufacturing activities and the well developed technical infrastructure. In contrast, the greatest impact is to be found in marginal areas usually located off the important traffic veins with a very low heterogeneity of manufacturing activities and with climatic conditions relatively unfavourable for agriculture.

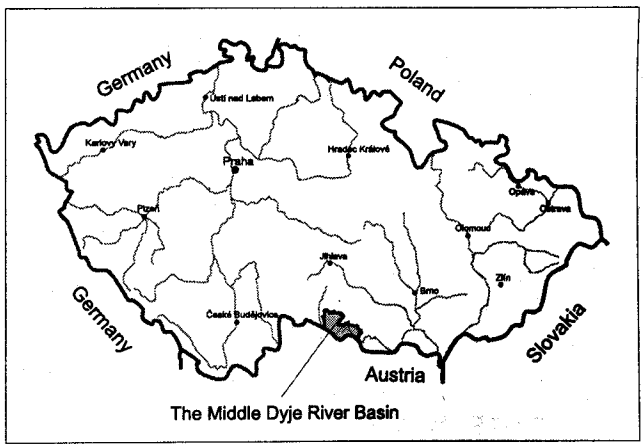

Fig. 1 Model area localization in the Czech Republic

The basin of the Middle Dyje River is one of areas with a number of changes induced by contemporary so-

cial processes. The area became a centre of our attention for studying the transformation in marginal rural regions (Grant No. 347/1996 "New Prosperity for Rural Regions"). A basic geographical characteristic of the model area was published in this periodical in No. 1/1997 in the article of authors Vaishar, A. - Špes, M. - Koutný, R. - Mikulík, O. - Nováček, V. - Pozeš, M. - Zapletalová, J. - Zupančič, J. (1997): "New Prosperity for Rural Regions". Moravian Geographical Reports, No. 1/97, Vol. 5, p. 18-35. This is the reason for us to mention only those general data on the territory in this work, which can affect the traffic situation in the region.

2. Basic characteristics affecting the traffic situation in the region

The area of the Middle Dyje River basin discussed in this work is identical with former judicial districts Vranov nad Dyjí and Jemnice. The present administration of the area has three districts: Jindřichův Hradec, Třebíč and Znojmo. Total area of the territory under study is 472.5 km^2 (Fig. 2).

The model area has passed through a number of political and administration changes since the 20's of this century, which reflected in its present character. The latest statistic data speak of 63 separate settlements associated into 48 administration units - municipalities and the last census of 1991 indicated that the area had a population of 15 590 . The average density of population in the region was 33.0 inhabitants per km^2 which is a very low density even in the comparison with the already low population density of all three above mentioned districts (48, 69 and 77.0 inhabitants per km^2 in the districts of Jindřichův Hradec, Znojmo and Třebíč, respectively, the average density of population in the Czech Republic being 131 inhabitants per km^2). The whole region exhibits a strong depopulation trend. In twenty years between 1970-1991, the local population shrank by 3 801 inhabitants, which is nearly 20 %. Some settlements - mainly in the district of Jindřichův Hradec lost nearly a half of their population in this period of time (Bělčovice, Dančovice, Hluboká, Rancířov, Chvalkovice, Županovice, Podhradí nad Dyjí in the Vranov area).

The settlement structure is characteristic of a great number of relatively small settlements. Nearly a half of municipalities in the model region are very small 5 of them having less than 100 inhabitants, 19 with the population between 100 and 200, and other 16 municipalities having between 201-500 inhabitants. Only eight municipalities have the population of more than 500 inhabitants. One of them is Dešná which consists of 7 independent settlement units where the unit of Dešná itself has more than 200 inhabitants. The largest town in the region is Jemnice whose population were 4 074 inhabitants in the last census. The second largest municipality is Vranov nad Dyjí with 931 inhabitants. Rather than economically important the municipality is popular

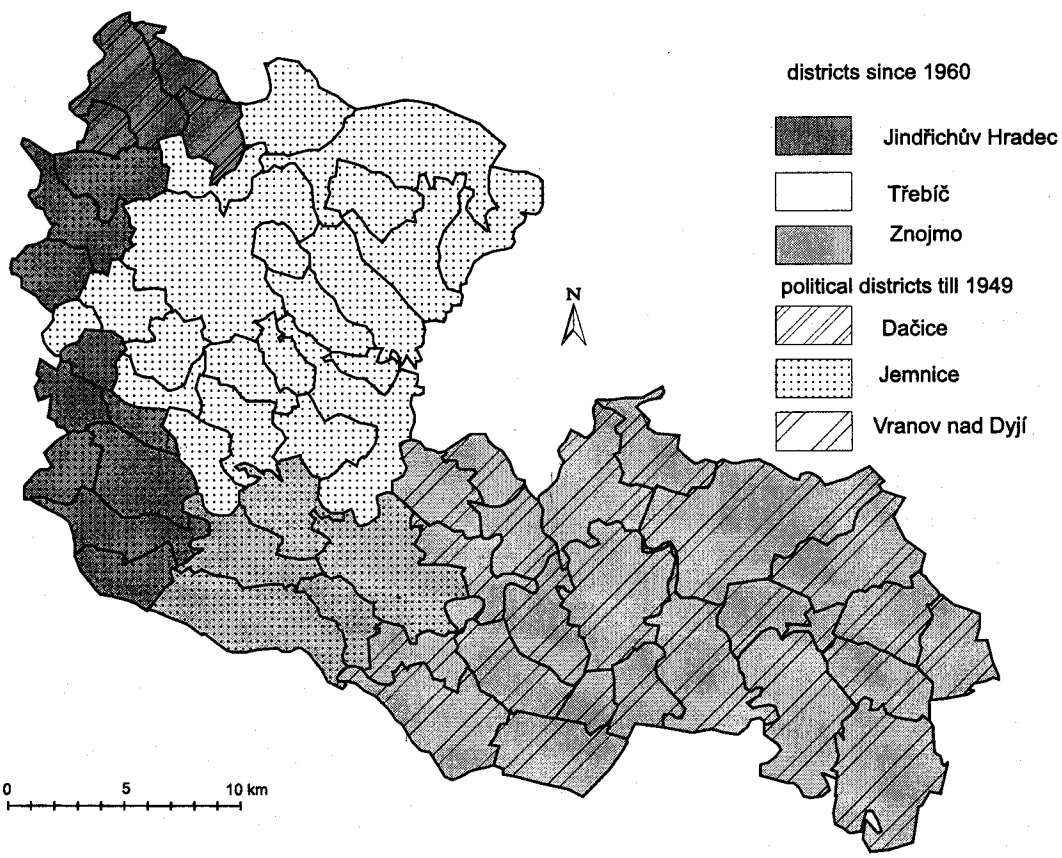

Fig. 2 Administration changes in the model area

with its historical and cultural sights and recreational opportunities.

The economy of the area under study has low dynamics over a long term, which has always been depending mainly on agriculture. In comparison with for example the neighbouring Znojmo district, conditions for agricultural production are not too favourable, however. Traditional crops are still oats, rye, potatoes, and forage crops. Animal production is specialized in rearing cattle, pigs and poultry. Agriculture in the region has to face considerable problems at the present due to high economic costs of agricultural production.

There have never been large industrial plants in the region. The local production mainly included primary processing of local raw-materials and agricultural products, small-scale trades and construction firms. Small brickworks, quarries and lime works used to saturate needs of neighbouring villages, mills and distilleries used to process local agricultural products. Production units whose products were offered on fairly remote markets were just a few. In the area under study, there were several detached plants of larger companies at the end of the 80's such as those of Motorpal Jihlava [422 jobs], Balírny obchodu Jihlava [80 workers] and Otavan Třeboň [245 workers] in Jemnice, TESLA Holešovice [150 workers] in Vranov nad Dyjí, or Snaha in Police. Some lime works and brickworks are still in operation as well as a sawmill at Šumná, which was once a part of South-Moravian Timber Works (Jihomoravské dřevařské závody). The subsidiary plant of Závody Gustava Klimenta Třebíč in Uherčice [300 workers] made shoes from 1979.

Most of these production units were privatized after 1990 with more or less effect and the number of available jobs in them decreased. Some of them such as distilleries in Pálovice and Oponešice even stopped the production due to improper privatization. The production of shoes in Uherčice was closed as well as the operation of Tesla in Vranov. Newly established companies such as manufacture of hand tools in Mladoňovice, furniture manufacture in Lomy, production of wooden briquettes at Lančov, textile production in Budkov, production of cardboard works in Milíčovice, a slaughterhouse in Lesná and an electrotechnical company in Jemnice are usually firms with a low number of employees as well as with relatively low requirements for transport of raw-materials and products. These are joined by various kinds of small entrepreneurs who mainly provide services and run their businesses as natural persons with usually no employees.

The present most important economic centre of the given area is Jemnice with the highest concentration of available jobs and services. Some 750 jobs are available here in various industrial branches. A limited number of available jobs which cannot be saturated by the local population offer Lesná, Police, Šumná, Uherčice and Vranov nad Dyjí. However, the total number of available jobs in the region under study is lower than the number of economically active inhabitants. This is why many persons must commute for work outside the studied region. In the western part of the region the commuting is directed mainly to the district town of Znojmo other centres being Moravské Budějovice in the Třebíč district, and Dačice and Slavonice in the district of Jindřichův Hradec.

The western part of region is well known thanks to tourism. The area of Bítov and Vranov used to be sought by modest tourists with their families for so called summer stays long before the existing dam was built. At the present time, the area around the Vranov dam lake is an important recreational area with the largest concentration of beds for summer recreation near water in Moravia. Water sports can be combined with hiking in the forested landscape only very little impacted by industry and urbanization as well as with the visit of architectonic and historical sights such as the Baroque Chateau in Vranov nad Dyjí, the Bítov Castle and the ruins of Cornštejn Castle. A certain disadvantage, however, is a massive use of all built-up facilities in summer. The stoppage of ship transport on the Vranov Dam lake explained by the protection of water resources had a negative impact.

3. Location of the model area in the regional traffic network

The whole area under study is aside off important supraregional and regional road and railway veins. The western part of the area is touched by the regional railway line Okříšky-Znojmo with a continuation either to Šatov and further on to the railway border crossing with Austria, or to Hrušovany nad Jevišovkou. A single railway station (and a single stop) on this line in the area of interest is the village of Šumná which is also a goods station (mainly with timber loading). The only local railway line that attends 4 settlements of the area under study (Jemnice, Lhotice, Rácovice, Třebelovice) leads from Moravské Budějovice to Jemnice. The remaining part of the region is without any railway connection.

All settlements in the region under study are attended by roads of 2nd and 3rd class which are generally in poor condition, particularly those in the northern part of the area (Fig. 3). The only road of regional importance is the 2nd class road No. 152 Nová Bystřice-Slavonice-Jemnice-Moravské Budějovice with the continuation to Brno. However, even this road has a range of technical defects. The nearest 1st class road leading in the NW direction already outside the model area is the road from Moravské Budějovice to Znojmo and further on to the border crossing with Austria (Hatě-Kleinhaugsdorf). There are two border crossings with Austria in the region of Middle Dyje River Basin: The border crossing Vratěnín-Drosendorf is a road border

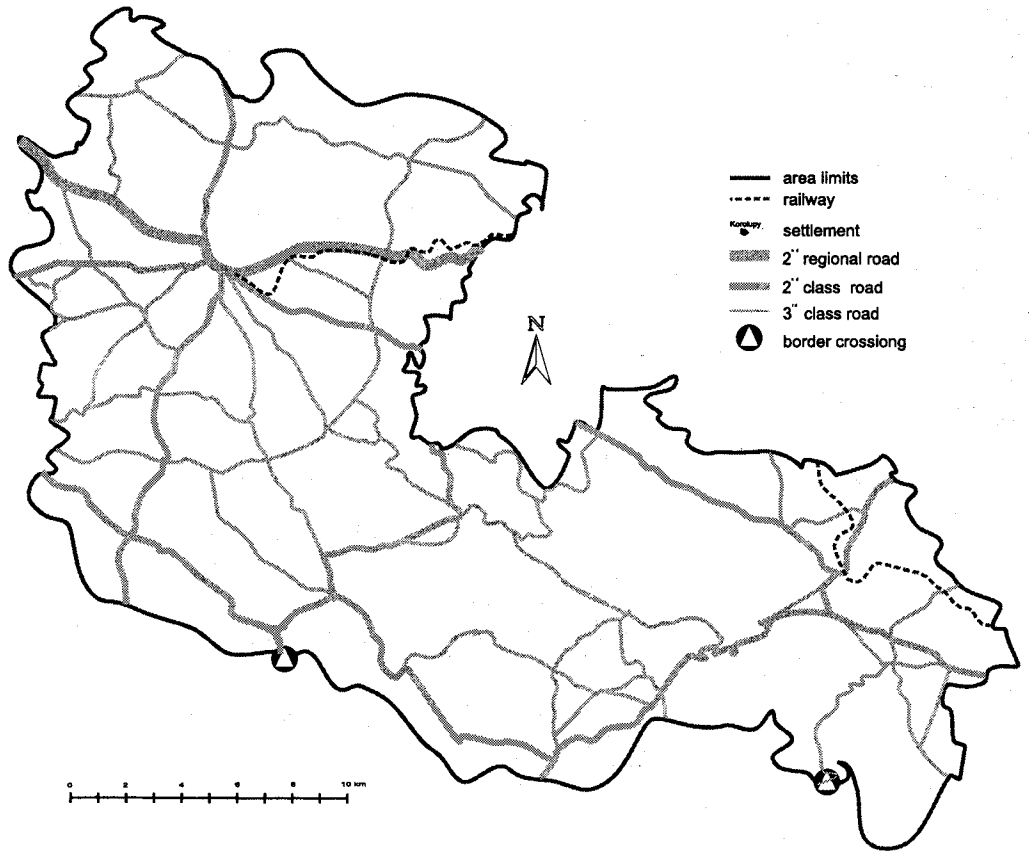

Fig. 3 Traffic network in the model area

crossing for passenger motor cars of Czech and Austrian citizens while the border crossing Čížov-Hardegg operates only for tourists and cyclists from the two countries and does not accept motor vehicles.

Except for the town of Jemnice, there is no other important railway junction or a commuting centre. The model territory is mainly a part of mutually overlapping hinterlands of larger settlements and production centres situated outside the studied area. The fact reflects in channeling the public passenger transport lines of the part of the model area situated in the district of Jindřichův Hradec mainly to Dačice and Slavonice, those situated in the Třebíč district mainly to Moravské Budějovice and Jemnice, and those in the district of Znojmo to Znojmo. Centres of secondary importance are Police (Třebíč district), Bítov, Šumná and Vranov (Znojmo district). In spite of the fact that the new administrative arrangement of the Czech Republic was established more than 45 years ago, the post-war links of economic and secondarily also traffic character still survive (Fig. 4). An evidence to the situation is a relatively good traffic connection between centres of Dačice, Slavonice, Jemnice, Moravské Budějovice and Telč. Some settlements do not exhibit a clear traffic orientation, especially when they are attended by only single transport line. In the Jemnice district, the villages of Jiratice and Pálovice have an identical number of connections to Jemnice and Police. Lhotice, Oponešice and Třebelovice, which are situated on the local railway line Moravské Budějovice-Jemnice have an identical number of connections to both places. The settlements of Hluboká, Županovice and Dešná have an identical number of connections to Jemnice as well as to Slavonice, and finally Pláčovice (a local part of Dešná) have an identical number of connections both to Dačice and to Slavonice (Fig. 4).

4. Load of model area traffic network

The economic significance of the whole area under study markedly decreased in the course of economic transformation and gets back to life again only very slowly. The process shows also in the passage of motor vehicles on roads in the studied area.

A general feature of Czech economy is the growing freight and passenger road transport. The trend applies to the part of road network situated in the area under study, too. However, analyses of traffic frequency on the roads in the model area (according to traffic counts made in 1990 and 1995) indicate that it is mainly the increasing passage of passenger motorcars resulting from the worsening traffic accesibilty of settlements by public passenger transport. The percentage of lorries and coaches in the traffic streams is decreasing. In 22 road sections of total 27 in which the traffic counts were made in 1990 and 1995 the passage of motor trucks was reduced, the decrease of passage occurring in all categories of trucks and coaches. The passage of trac-

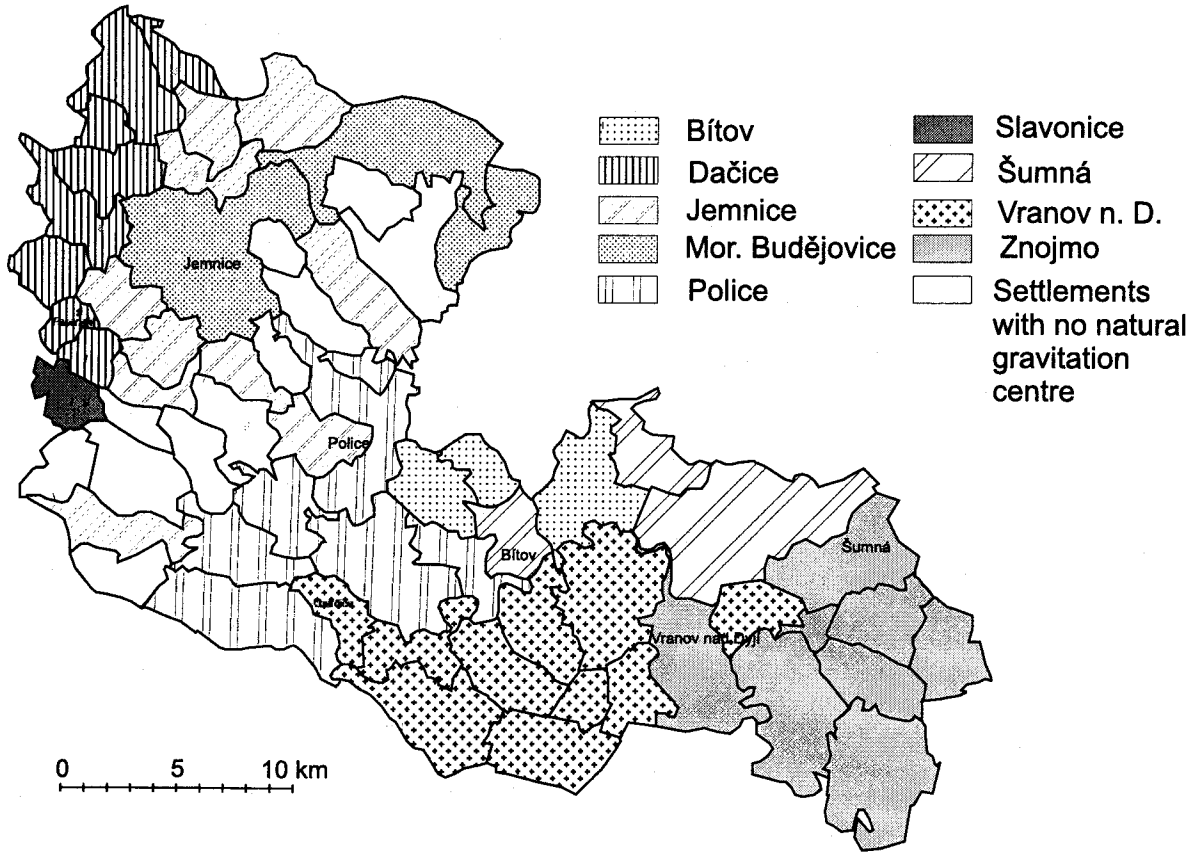

Fig. 4 Settlements gravitation to the centres by the frequency of public passenger transport connections in 1996

tors remained more less same in the majority of road sections. On roads in the southern part of the area under study, between the state border and the Vranov Dam lake as well as in the western part of the studied area the decrease in the passage of lorries and coaches within the mentioned period of five years was so heavy that it could not be compensated for by the increased passage of passenger cars the result of which is a generally decreased car passage (compare Figs. 5 and 6).

5. Traffic accessibility of settlements by means of public transport

Traffic accessibility of rural settlements by means of public transport has been steadily worsening in the whole territory of the Czech Republic since 1990. The coach transport performance in the Czech Republic dropped by a third between 1989 and 1994, which resulted in the cancellation of 24 % coach lines. A general feature is the increasing number of profitable transport lines between large economic centres and the cancellation of local lines mainly in marginal areas. The cancellation of public transport passenger lines has also afflicted the area under study.

The settlement pattern, structure of population and its age as well as the ever shrinking jobs in the region induced a greatly dispersed demand for public transport. Engagement of some lines was very low. This was why all public transport companies gave up the whole-area attendance of the model area. The number of connections was reduced. Nearly all unprofitable traffic connections were cancelled and remaining ones were reduced to the least possible extent (e.g. to ensure the commuting of school children). It means that it was not only the individual traffic connections that were cancelled in the studied area but in some cases also the traffic lines themselves. The traffic attendance of practically all settlements (with the exception of settlements situated on the local track between Moravské Budějovice and Jemnice and settlements in the western part of the area, which are passed by the 2nd class road No. 408 from Jemnice to Znojmo) was markedly worsened. For example, the settlements of Hluboká and Jiratice have only two pairs of regular traffic connections on working days and other 5 settlements in the western part of Znojmo district have 3 pairs of traffic connections. The situation is better in other settlements of studied area (compare Figs. 7 and 8).

As indicated by the analyses, the public transport connections cannot even ensure the basic traffic attendance in some settlement localities. Inhabitants in some small villages have problems with reaching the health service facilities, post office and even the shop with basic food articles. The analyses showed that in the period between 1991-1996, 78 % of settlements in the model area had a certain number of public transport connections cancelled and 22 % of municipalities had the transport connections unchanged. The transport

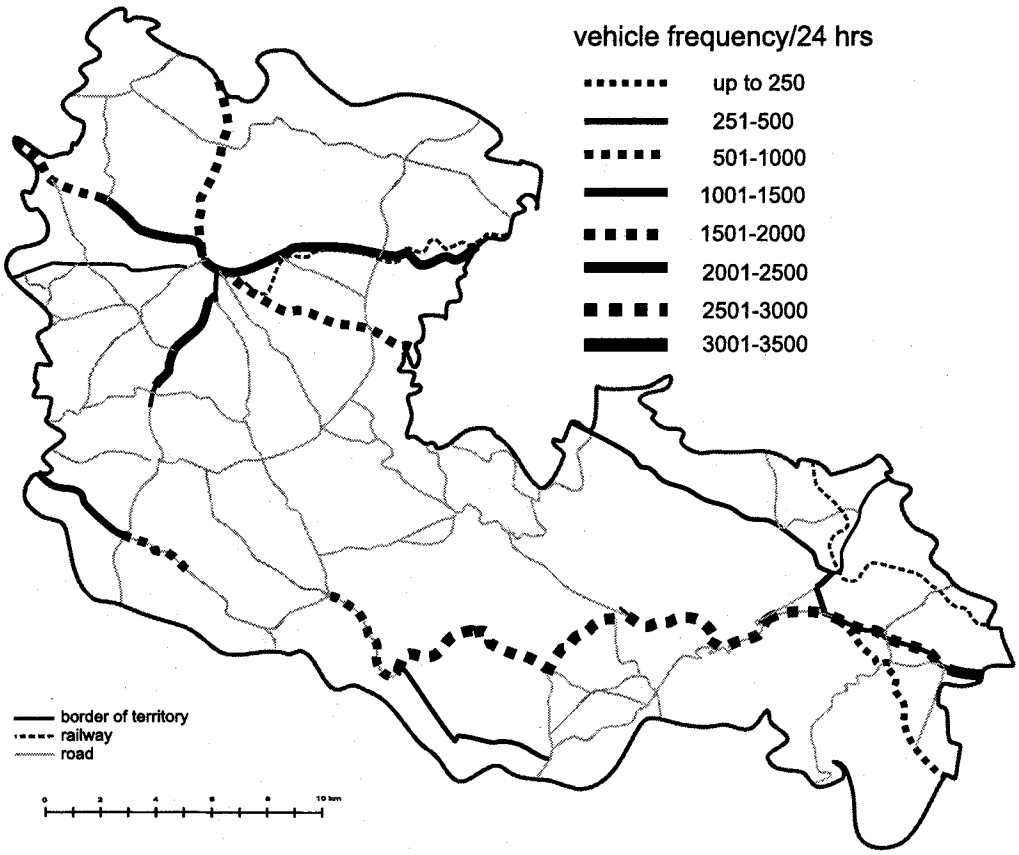

Fig. 5 The frequency of motor vehicles on road sections in the model area in 1990
Source: Results of traffic count made in road and motorway networks in 1990

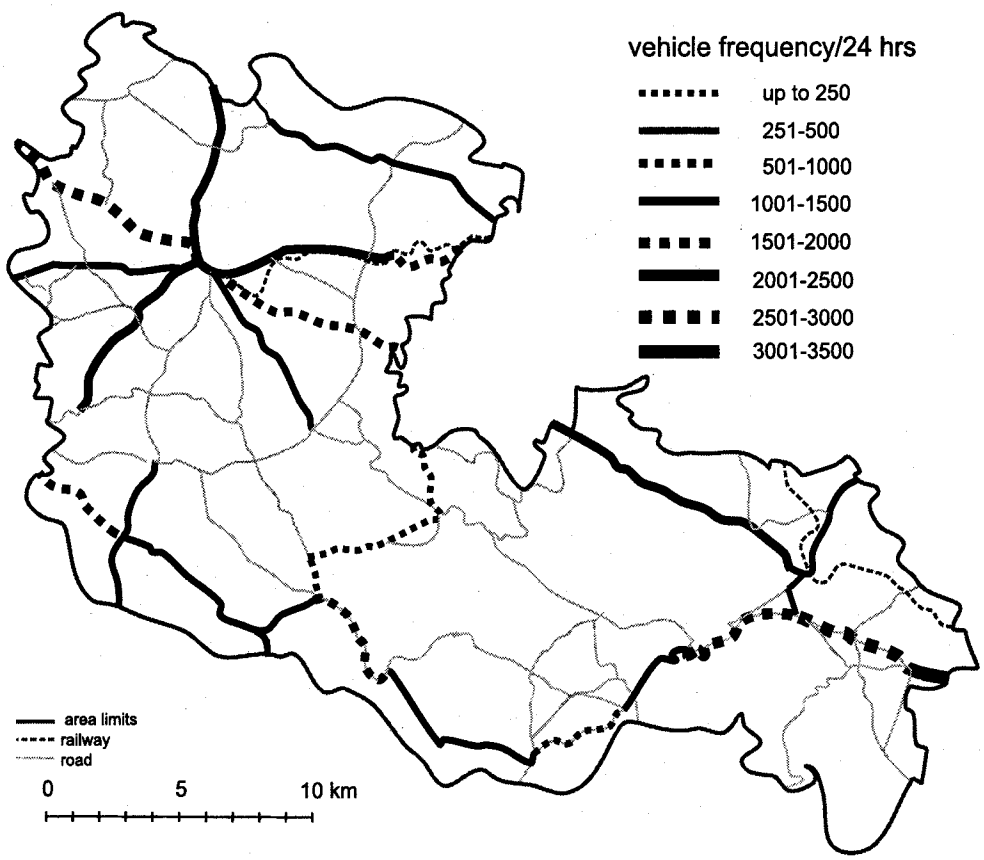

Fig. 6 The frequency of motor vehicles on road section in the model area in 1995
Source: Results of traffic count made in road and motorway networks in 1995

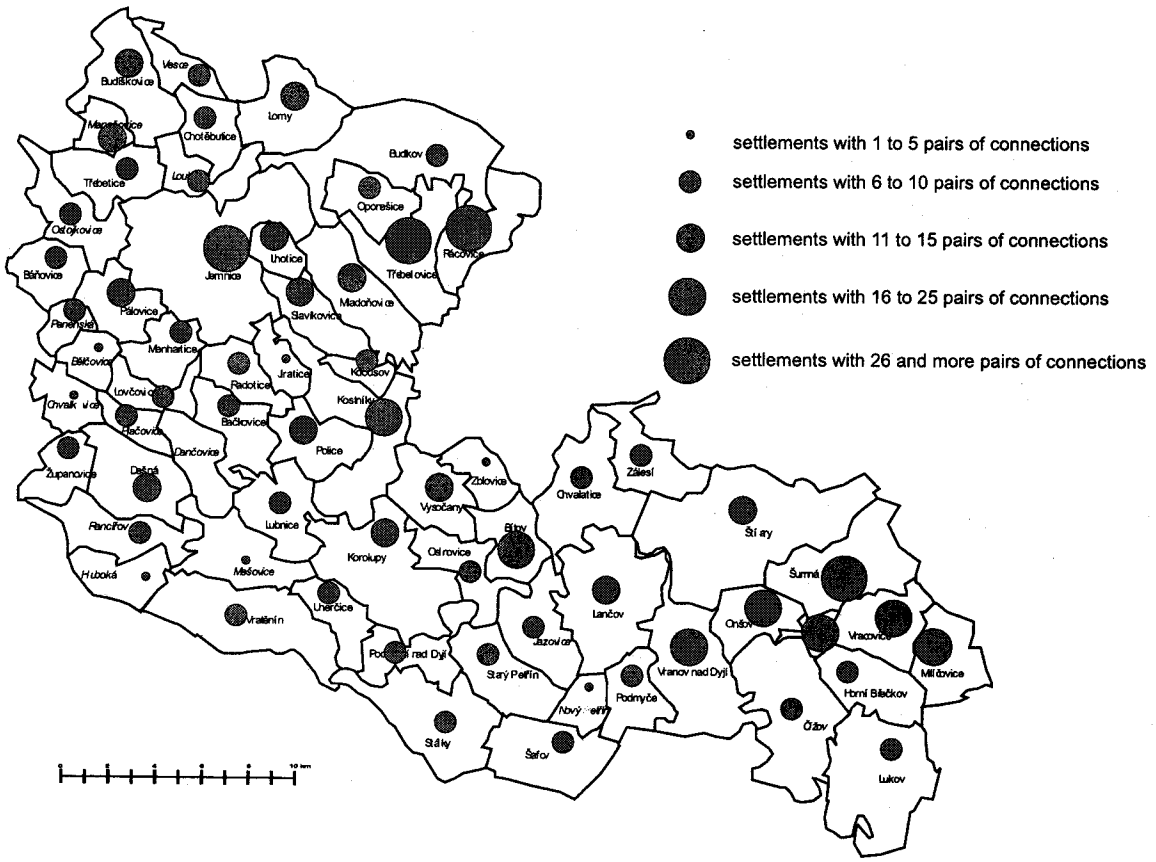

Fig. 7 Traffic accessibility of settlements by public transport on working days in 1991
Source: Railway and coach time-tables valid for 1991/92

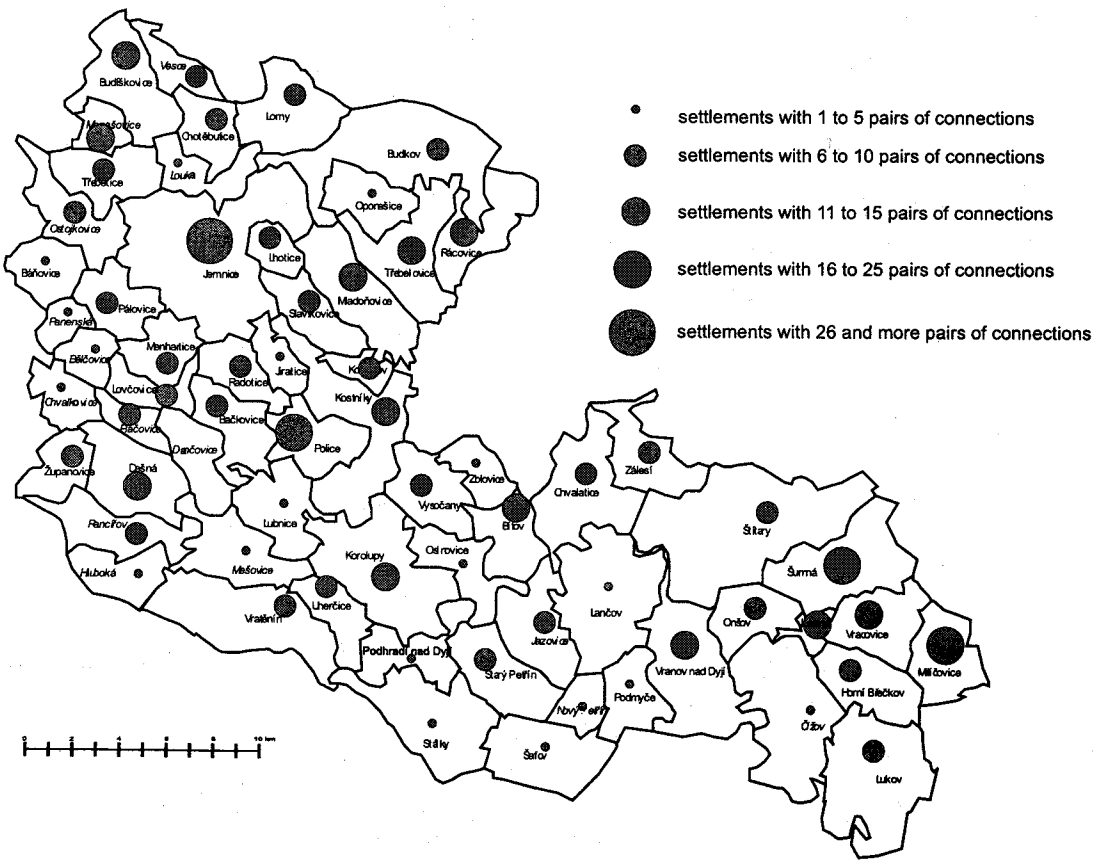

Fig. 8 Traffic accessibility of settlements by public transport on working days in 1996
Source: Railway and coach time-tables valid for 1996/97

connection was not improved in any settlement of the studied area in the mentioned period of time. The situation is now being resolved by municipal councils. For example, the village of Dešná takes part itself in ensuring transport services for its inhabitants. The mayor claims that the solution is economically more favourable for the village than the contribution to cover losses on the operation of coach connections, which would have to be settled by the village to the coach transport company. A similar solution was adopted by some manufacturing companies. For example, the establishment of South Moravian Timber Works in Uherčice has a company bus to take its employees to work and back home and a similar model was adopted by Egston Systém Electronic in Jemnice. Inhabitants of many villages are forced to use their own cars to get to work, especially if working on shifts. Many people cannot work in their professions because they cannot work for example on shifts without their own cars. Mayors of several villages claim that a car has become a necessity for inhabitants of their villages.

The public transport situation becomes critical during weekends and festivals with the marginal character of the area showing most markedly. Practically the whole Jemnice area as well as the eastern part of Dačice area remain without any public transport on Saturdays. A slightly better situation can be seen in the Znojmo district part of the model area with at least one pair of coach connections left (Figs. 9 and 10). An even better situation - at least in the eastern part of Jemnice area - is reported on Sundays and national holidays. The situation of villages situated on railway lines is good. Villages located on the railway line between Moravské Budějovice and Jemnice had 6 or 5 connections in 1996, the village of Šumná having 5 connections (7 on Sundays) to Moravské Budějovice and Znojmo. Settlements in the district of Jindřichův Hradec, however, have no public transport available also on Sundays (Figs. 11, 12; Tab. 1).

Tab. 1 Public transport frequency changes in settlements of area under study in 1991-1996 (in settlements percentage)

Number of settlements in %	Working days	Saturdays	Sundays
With increased frequency	0	0	0
With identical frequency	22	24	11
With frequency decreased by 50 %	69	23	33
With frequency decreased by 51-99 %	9	21	19
Public transport was cancelled	0	32	37
Settlements in total	100	100	100

Source: Railway and coach time-tables valid for 1991/92 and 1996/97

At present, Czech Railways (České dráhy) cancel little engaged connections of passenger railway transport and prepare a reduction of regional railways which appear non-profitable according to strict economic criteria. In the area under study, this will concern the local railway line Moravské Budějovice-Jemnice. The settlements situated on the line (Lhotice u Jemnice, Rácovice, Třebelovice) have so far good railway connections both with Jemnice and Moravské Budějovice, and from here with other centres. Municipal councils in these villages anticipate a further growth of these settlements as settlements with a housing function for Jemnice and Moravské Budějovice. To cancel the railway line would result not only in social consequences for the population in these villages, but also in environmental impacts due to permeability and quality of the road network which would have to take on the channeled traffic (both passenger and goods transport). A possible solution to this situation can be seen in privatization of the railway line, in which two entities showed their interest.

The car becomes a necessity for the rural population here similarly as in other places of the Czech Republic. The last census indicated that 2 875 households owned passenger cars of their own. The lowest number of households with a car can be found in Podhradí nad Dyjí, Podmyče and Lančov. In contrast, the highest number of households with a car (over 70 %) can be found in Zálesí, Rácovice, Třebelovice and Třebětice.

6. Conclusion

The area under study is situated apart from the important traffic veins. With the exception of Jemnice and its connection with Moravské Budějovice, the entire remaining part of the region is very remote to traffic. All roads in the area are classified as 2nd and 3rd class roads. Their condition is rather poor, namely in the Třebíč district part of the area under study. In the period between 1990 and 1996, a reduced frequency of passenger public transport was recorded as a result of economic recession in a number of settlement localities as well as a decreased passage of transport means on some roads or their sections.

The area under study has no important traffic centre. It forms a periphery to large housing and production centres situated outside the studied area. Public transport connections are directed mainly to Dačice and Slavonice in the Jindřichův Hradec district part of the area, to Jemnice, Police and Moravské Budějovice in the Třebíč district part of the area, and to Bítov, Vranov and Znojmo in the Znojmo district part of the area. Šumná is a centre of secondary importance. In spite of the fact that the new administrative arrangement of the CR territory came into force 45 years ago, some economic and traffic links of post-war administrative arrangement still survive.

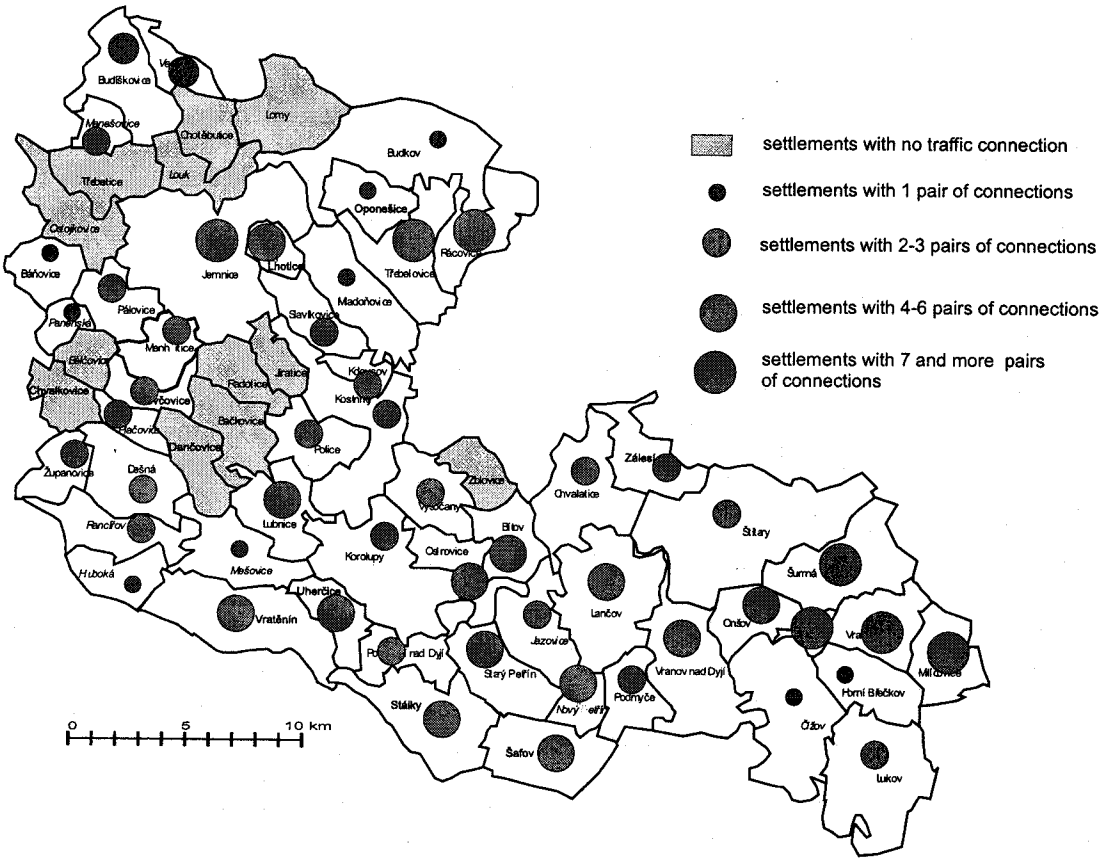

Fig. 9 Traffic accessibility of settlements by public transport on Saturdays in 1991
Source: Railway and coach time-tables valid for 1991/92

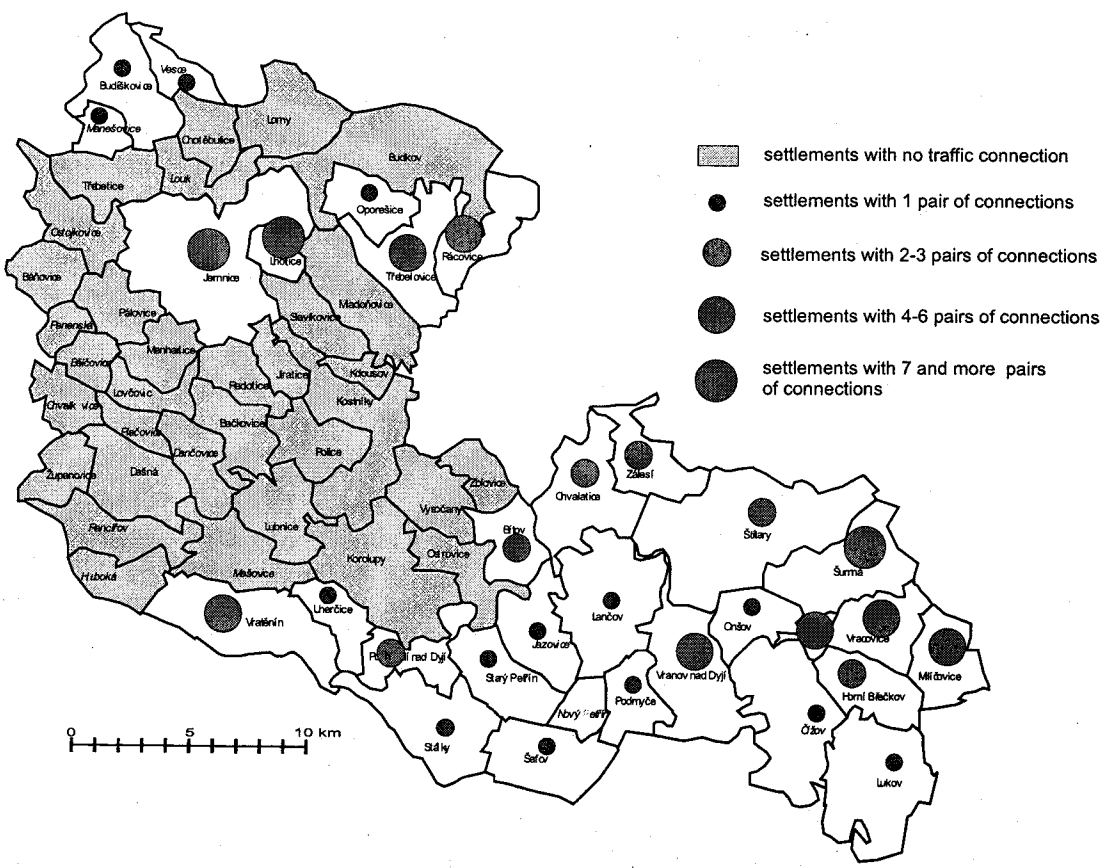

Fig. 10: Traffic accessibility of settlements by public transport on Saturdays in 1996
Source: Railway and coach time-tables valid for 1996/97

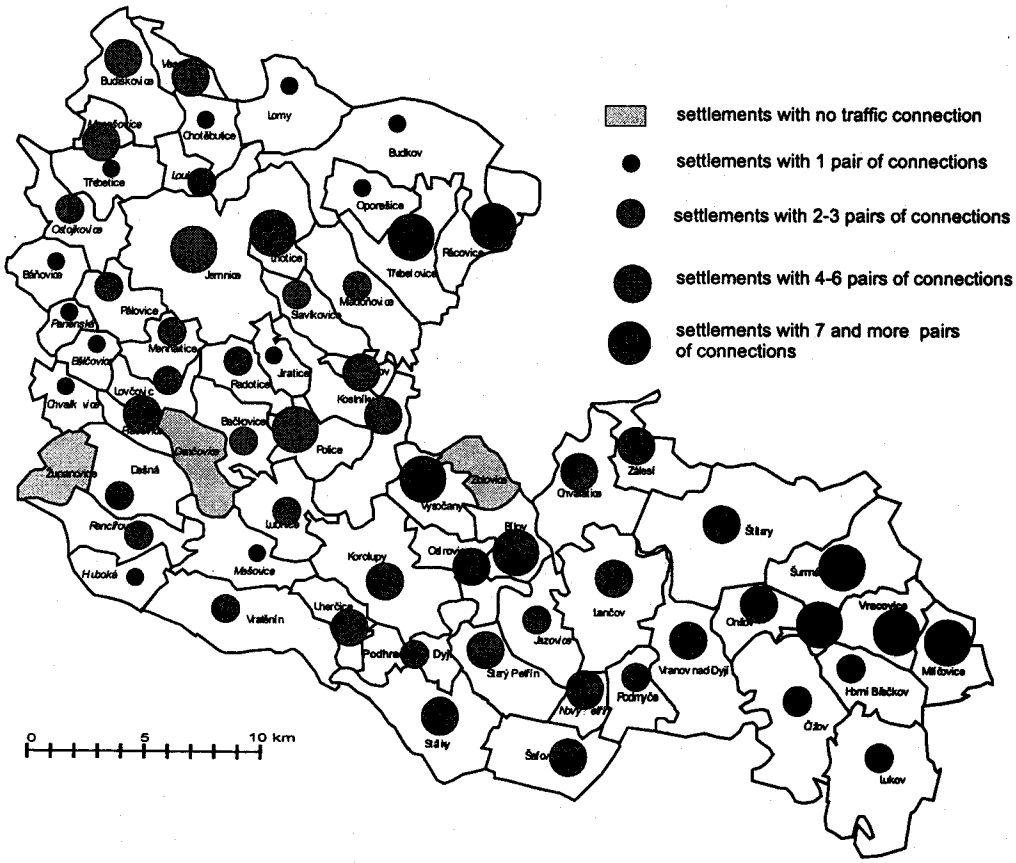

Fig. 11 Traffic accessibilty of settlements by public transport on Sundays in 1991
Source: Railway and coach time-tables valid for 1991/92

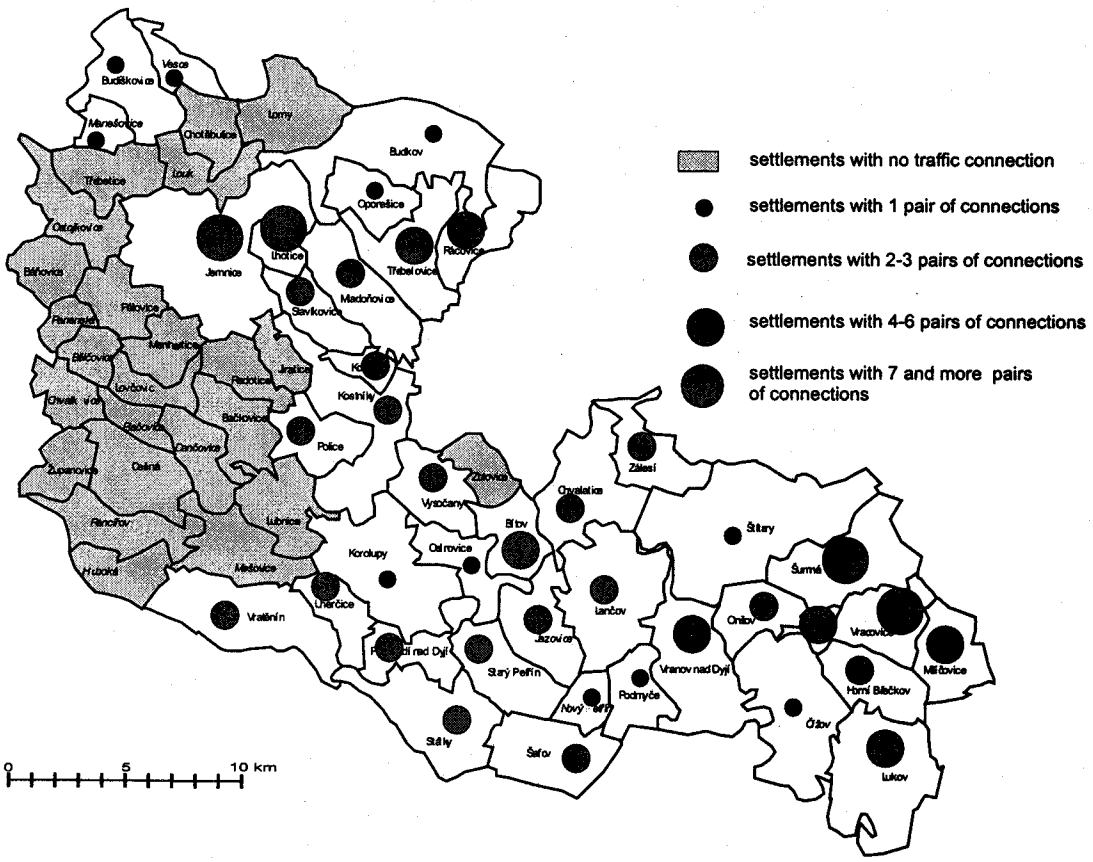

Fig. 12 Traffic accessobility of settlements by public transport on Sundays in 1996
Source: Railway and coach time-tables valid for 1996/97

Due to a greatly dispersed demand for public transport and little engagement of individual coach connections, public transport companies reduced the number of connections in the area to the lowest possible extent with maintaining only connections which can be considered profitable at least partly or those which must be preserved (commuting of school children). It was not only the individual public transport connections but also some lines that were cancelled in the area under study. In practice, the traffic attendance of all settlements (with the exception of settlements located on the local railway line Moravské Budějovice-Jemnice, and settlements in the western part of the area, which are passed by the 2nd class road No. 408 from Jemnice to Znojmo) was impaired.

Municipal councils of villages afflicted by these limitations of public transport try to resolve the situation with their own strengths. Should funds be sufficient, they operate the public transport at their own costs. Representatives from these villages claim that the operation of their own public transport is financially much more efficient than the contribution requested by public transport companies for ensuring traffic attendance. The solution brings finance to municipal offices and at the same time helps the settlement with its traffic attendance. A certain problem consists in the fact that the connections operated in this way cannot be used by other people except for village inhabitants since in the majority of cases, time-tables and stops are known only to them. This means that it is not possible to use these traffic connections for other inhabitants (or for this analysis).

One of important sources of receipts in Vranov area is tourism. Unfortunately, the majority of recreational localities can only be reached by individual means of transport. With regard to the terrain configuration and capacity of beds, this results in severe problems with parking, air-soil and water pollution. Conditions for the recreational function of the area are thus secondarily impaired. Although the problem is of seasonal nature, it is necessary to bear it in mind and find a solution even if it does not concern the basic traffic attendance of the area.

In order to preserve at least a minimum extent of traffic attendance in the area under study, the budgets of district councils were strengthened in 1996 with a special purpose subsidy from the state budget, paid in addition to current subsidies, which amounted to 541 mil. CZK. In 1997, the traffic attendance of settlements in the Czech Republic was subsidized with 700 mil. CZK from the state budget. However, the subsidies have been permanently shrinking since 1993. In spite of the fact that the Ministry of Transport has prepared a range of provisions which are to theoretically eliminate the negative trends of decreasing traffic attendance - such as for example the renovation of coach fleet, a project for the use of small buses, the legislative support to the development of transport companies, etc. - it is not to be expected that the traffic attendance of small settlements will be markedly improved in the future due to the steadily worsening economic situation of small municipalities. Prognoses rather expect a further situation worsening which necessarily will lead to an even greater every day use of motor cars.

Due to market mechanisms our society gradually inclines to the model of individual passenger transport. The trend is obvious also in the area under study. Even if we dismissed environmental impacts issuing from this model, the condition of road network in the given area, equipment of households with a motor car, the financial situation of some families and last but not least a street network (including parking capacity) in the majority of target centres would not be able to absorb the model. The further worsening of traffic attendance by means of public transport will means a further decline of marginal depopulation regions such as the Middle Dyje River Basin with a low number of available jobs, great dispersity and ageing population. In its final effect, the model will result in changes in the structure of settlement and secondarily also in changes of landscape character. It can be expected that small settlements not only in this area will become a domaine of cottiers - live on weekends in summer and deserted in the winter time.

References

BARTOŠ, J. - SCHULZ, J. - TRAPL, M. (1984): Historický místopis Moravy a Slezska v letech 1848-1960. Sv. 9 - okresy: Znojmo, Moravský Krumlov, Hustopeče, Mikulov. Profil, Ostrava, 343 pp.

BARTOŠ, J. - SCHULZ, J. - TRAPL, M. (1990): Historický místopis Moravy a Slezska v letech 1848-1960. Sv. 12 - okresy: Třebíč, Moravské Budějovice, Dačice. Profil, Ostrava, 321 pp.

Jízdní řád pravidelné autobusové dopravy 1991/92 - jižní Morava, jižní Čechy.

Jízdní řád pravidelné autobusové dopravy 1996/97 - jižní Morava, jižní Čechy.

Jízdní řád Českých drah 1991/91, 1996/97.

ČECHOVÁ, K. (1996): Identifikace relativně izolovaných mikroregionů na Moravě dopravně geografickou analýzou. [Diplomová práce]. Katedra geografie MU, Brno, 51 pp.

KUNC, J. (1997): Geografická analýza trhu práce v České republice. [Diplomová práce]. Katedra geografie MU, Brno. 70 pp.

MRKOS, J. (1948): Hospodářská dynamika země Moravskoslezské v zrcadle jejího populačního vývoje a fluktuace obyvatelstva let 1790-1930. Publikace Zemského studijního a plánovacího ústavu v Brně. Svazek 5, Brno, 72 pp.

PELTRÁM, A. (1997): Služby v obecním zájmu. Vzájemné vztahy dopravy a bydlení v České republice v porovnání s EU. Státní správa a samospráva S'97, No. 19, p. 24-25.

PEŘINKA, F. V. (1906): Vlastivěda moravská. II. Místopis. Vranovský okres. Musejní spolek, Brno, 196 pp.

Statistický lexikon obcí České republiky 1992 (1994). Český statistický úřad/Ministerstvo vnitra České republiky. SEVT, Praha, 895 pp.

VAISHAR, A. - ŠPES, M. - KOUTNÝ, R. et al. (1997): New prosperity for Rural Regions. Moravian Geographical Reports, No. 1997, Vol. 5, p. 18-35.

Výsledky sčítání dopravy na dálniční a silniční síti v r. 1995. Kraj 02 Jihočeský, 07 Jihomoravský. Ředitelství silnic ČR, Praha, 1996.

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THE MORAVIAN-SLOVAK BORDERLANDS: SOME NEW FEATURES FOLLOWING THE DIVISION OF CZECHOSLOVAKIA

Stanislav ŘEHÁK

Abstract

Between 1995 and 1997 a geographical study was conducted in the area close to the new borders between the Czech Republic and Slovakia (Moravian-Slovak borderlands). The article describes the gradual changes in public transport services (buses and railways). Also cited here are some results from a questionnaire study conducted in August and September 1996 in 27 localities in the Czech Republic lying near the border with Slovakia and in 5 other communities (the control localities). The questions related to trips to Slovakia prior to and after the division of Czechoslovakia, the frequency and purpose of the trips, and also about the main sources of information about Slovakia as an independent country.

Shrnutí

V letech 1995 až 1997 byl prováděn geografický výzkum v území poblíž nových státních hranic mezi Českou republikou a Slovenskem. V článku se popisuje postupná změna veřejné dopravy (autobusové a železniční). Dále jsou zde uvedeny některé výsledky anketárního výzkumu prováděného v srpnu a září 1996 na 27 lokalitách v České republice v blízkosti státní hranice a na 5 lokalitách dalších, ve vnitrozemí. Předmětem dotazů byly cesty na Slovensko před rozdělením Československa a poté, frekvence cest a jejich důvody, jakož i hlavní zdroje informací o Slovensku.

Key words: the Czech republic, Slovakia, transportation systems, public opinions

1. Introduction

In the area along the border of the Czech Republic and Slovakia, the division of Czechoslovakia into two successor states on 1 January 1993 has generated tendencies and features of life that are disintegrative in character and which are, of course, difficult to gauge using classic methods and databases.

This area was studied between 1995 and 1997 as a part of Project no. 205/95/1184 of the Czech Grants Agency. The study area included, in the Czech Republic, the districts of Břeclav, Hodonín, Uherské Hradiště, Zlín, Vsetín and Frýdek-Místek and, in the Slovak Republic, the districts known prior to the second half of 1996 as Čadca, Žilina, Považská Bystrica, Trenčín and Senica.

The Moravian-Silesian (Czech) parts of the study area in the Czech Republic had, as of 1 January 1996, a population of 1 007 412. This was represented one-tenth (9.8 %) of the total Czech population, while the area totalled 6 700 km^2, 8.5 % of the Czech Republic's total territory. This means that the area has a somewhat higher population density than the Czech average (150 inhabitants per km^2 against the Czech average of 131 inhabitants per km^2). Long-term monitoring indicates that the area has regularly increased its share of the population in the Czech Lands (in 1930, its share stood at just 7.1 %).

The theme of this article is, on the one hand, changes in transport services in the Czech Republic's new borderland and, on the other, the thoughts and opinions of the population on the Czech (Moravian-Silesian) side about the new state of affairs.

2. Changes in transport systems

The natural basis of the commuter and other territorial unions remains as large as the public passenger transport system is extensive. While it is true that the growing level of car ownership makes it more difficult to prove these phenomena, the year-on-year changes in the amount of repair work carried out on public passenger transport is one clear indicator of more general trends. Here, in the case of the Moravian-Slovak borderlands, we are witnesses to a phenomenon that is otherwise very rare: the gradual separation of transport systems, in this case of the two new states that replaced Czechoslovakia.

The following rail links were examined: Jablunkov - Čadca, Vsetín - Púchov, Slavičín - Trenčianská Teplá, Veselí nad Moravou - Myjava, Veselí nad Moravou -

Skalica, Hodonín - Holíč and Břeclav - Kúty. These are all railway border crossings.

1993 saw a minor fall in the quality of rail links between the two countries, but only along the main corridor near Břeclav and the main corridor near Jablunkov. The largest reduction in services occurred in 1994, but continued even beyond then at various points along the common border. The last changes - changes for the worse, rather than the better - related to the growing role forced on the stations at Horní Lideč and Javorník nad Veličkou/Vrbovce over the period up to 1997. Generally, new border railway stations (in the Czech Republic Horní Lideč and Vlárský průsmyk, and Čadca, Vrbovce and Kúty in Slovakia) began to play a greater role, and a low frequency of passenger travel on the main routes was nothing out of the ordinary. The obstacles tended to occur on the at one time less important lines. Only the town of Valašské Klobouky benefited from the reorganisation of rail services, with its link to Vsetín actually improving.

The bus links across the Moravian-Slovak border area are not, and actually never were exceptionally developed, in part due to the geographical barriers in the border region and in part to the gradualness of developments in these generally stabilised territories when they are a unified whole.

Long-haul bus links have generally remained well preserved even after the division of Czechoslovakia. In some cases there has of course been a reduction in the number of links - for example, from two links to one. All that was added was a certain degree of delay caused by border checks.

Local bus services in the region are another matter. Changes occurred primarily in areas in the White Carpathians (Bílé Karpaty), where it used to be the norm to have parallel services to the urban centres in both Moravia and Slovakia.

One specific feature of the area were and remain the bus services linking the communities of Slovak border region called Kysuce and the Ostrava industrial agglomeration. The crossing point is, most commonly, Klokočov/Bílá (and only in exceptional cases Svrčinovec/Mosty u Jablunkova). The end points on these lines are, on the Slovak side, Velké Rovné, Skalité, Vysoká nad Kysucou, Turzovka, Čadca, Korňa and Klokočov itself.

Bus travel on the Sudoměřice - Skalica line has fallen, and the previously numerous Slovak bus services to Hodonín have in fact been replaced by the introduction of a single short (though more frequent) bus service between Hodonín and Holíč (there are now over 20 runs every weekday).

3. The questionnaire survay

Other than that, I would like to mention, at least briefly, the results of a questionnaire survey conducted during August and September 1996 in the border belt of the Czech Republic. The survey was conducted in 32 localities in all, of which 27 were in the border region. The other five were control surveys in other localities, roughly 40 kilometres from the border (see the appended Fig. 1).

In the border localities, 435 people were questioned (215 men and 220 women), and 76 in the control localities (37 of whom were men). The sample of respondents was also balanced in terms of age. The geographical position of the all localities is marked on the attached map. Where we had in mind two different periods, the cut-off point was January 1993 when Czechoslovakia split.

The purpose of this field study was to ascertain the fall-off in the frequency of travel to Slovakia from the Czech side, to ascertain any changes in the reasons for these journeys, and also to state what actually are the population's main sources of information about events in Slovakia following the break-up of Czechoslovakia.

The frequency of journeys to Slovakia: For the earlier period, 40.0 % of the respondents in the border region said they travelled to Slovakia "more than 10 times a year", while respondents in the control localities either said "one to four times a year" (39.5 %) or "irregular" (in 38.2 % of cases). Only very few of them (7.9 % in the control localities) travelled to Slovakia "more than 10 times a year". The situation has changed very significantly since the division of Czechoslovakia. In the new period (that is, between 1993 and 1996) the most frequent answer of even respondents in the border region was "not at all" (in 45.1 % of cases), while those who continue to visit Slovakia "more than 10 times a year" already comprise only 7.8 %. The proportion of those who did not travel to Slovakia at all reached 73.7 % in the control areas. In one of the control localities not a singe respondent out of a total of 15 drawn from different age categories had been to Slovakia since the break-up of Czechoslovakia. Of the respondents in Nedašova Lhota (in direct contact with the new official border), only 16.76 % gave a negative response.

One unsurprising fact is that the oldest group of respondents quite commonly expressed a negative attitude towards making trips to Slovakia. Here, pure and simple biological reasons (age) play a role.

The reasons for making trips to Slovakia have changed significantly. In border area localities, shopping trips (!) were clearly the main reason in the earlier period, followed by family visits. More recently family reasons have been the main spur in the borderlands, though of course in the context of an overall fall in the frequency of trips. In the control localities recreation

was main spur, while in the later period family reasons are lead the way here as well. The great fall in the importance of shopping trips is of course understandable, since this importance was linked with the relatively better provisioning of the Slovak towns in Považí-region in the retail sector prior to 1990. In this connection it is worth noting that roughly one-third of all respondents answered positively when asked whether they had relatives in Slovakia (in Nedašova Lhota as many as 88.9 % of respondents gave this response, and in Svatý Štepán 70.6 %, while only a few positive answers were registered in of the control localities, 6.7 % in Býškovice specifically).

The division of Czechoslovakia also led to a fall in the level of informedness about events in Slovakia. Here, however, the results are not worrying as yet. In the border region the general opinion is (in 38.9 % of cases) that there is simply less information about events in Slovakia, but 30.6 % of respondents there believe that there is just as much information as before. The same opinion is held, of course, by respondents in the control localities: 35.5 % of them believe that there is less information than before, while 34.2 % said there was as much as before. Differences emerged, however, when the respondent has to indicate the most important source of information about Slovakia. Even though Czech television channels are the most important source even in the border area (for 47.6 % of respondents), immediately behind, in second place, was personal experience (for 26.7 % of respondents). For respondents in the control localities, after Czech television (64.5 %) the second source of information about Slovakia were Czech newspapers (14.5 %). Against expectation, even among inhabitants from the borderlands Slovak television did not make much of a showing (the third source, but with only 8.7 % of respondents), because those that have and use this opportunity give precedence to their own experience as the main source of information. For respondents from the border area, Czech media are four times more important than Slovak media, in the control localities the ratio is already roughly 30:1. There are of course very few uninformed people: only 1.4 % of respondents from the border area and 3.9 % of respondents from the control localities said that they are no information about events in Slovakia.

In response to the question whether the questionee believed that more Slovaks have been staying in their community since the division of Czechoslovakia, as frequently or less frequently, more respondents from the border (31.5 %) than in the control localities (30.3 %) opted for the answer "as often as before". In the control localities, however, some 27.6 % of respondents said that they felt unable to give an answer.

One of the control questions, which was meant to test the role of distance from the new border on political decision-making, was the question how the respondent

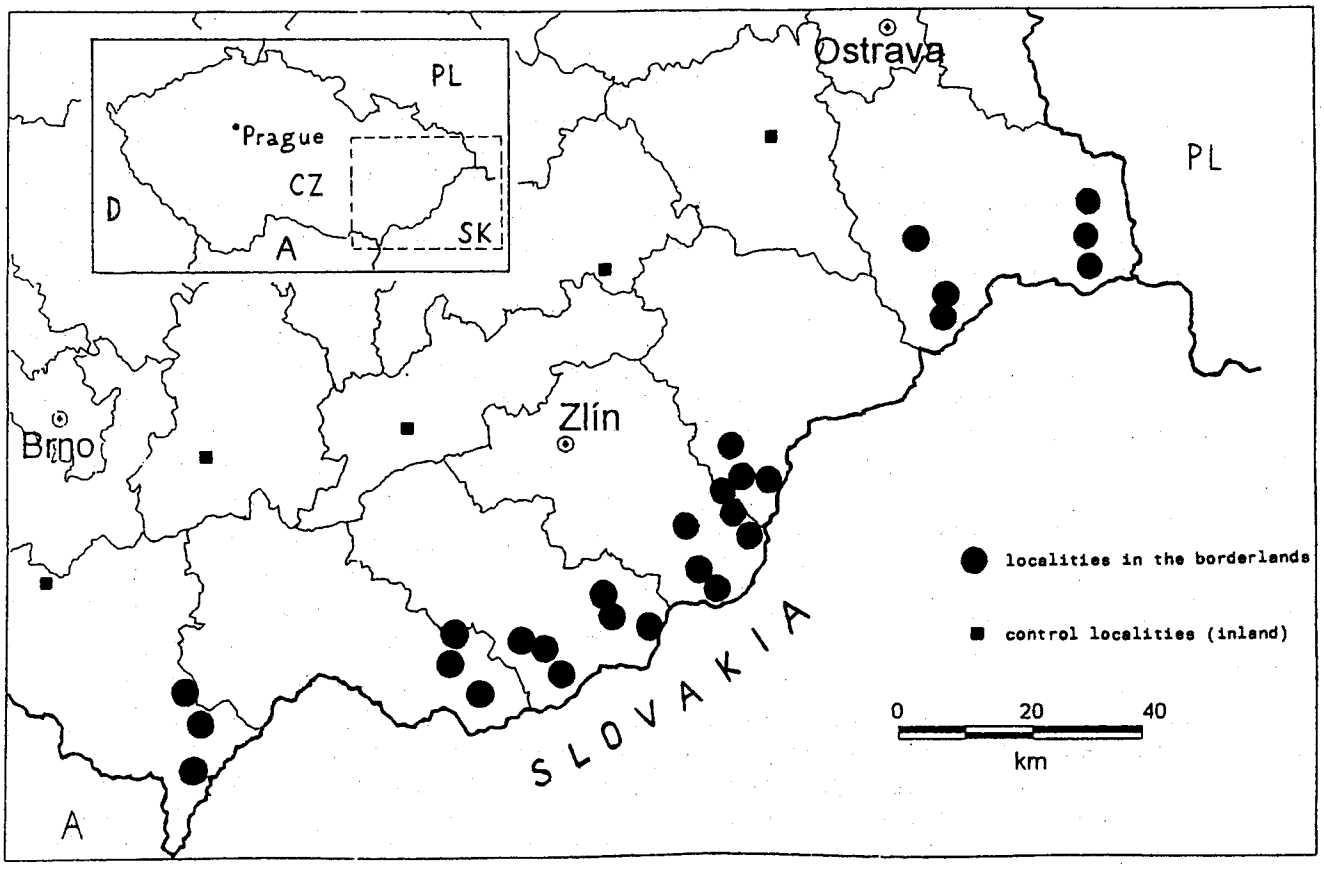

Fig. 1 Location of the localities in which the survey was conducted

would have voted if a referendum about the future of the common state had been held in 1992. In this case it should be mentioned that woman tended to be more "pro-federation" than men, the old and middle-aged rather than the young, employees and pensioners rather than entrepreneurs (however, this is only more of a indication, as there were few respondents). However, in decision-making distance paid no role. The entirely predominant answer (ranging from 33 % to 94 % of answers in individual localities, with an average of 64 %) was that they would have voted for continued federation. Some of the respondents, however, answered spontaneously that their current few already differs from their view then. The proportion of these respondents is not, however, provable unfortunately. "Pro-federation" stances (relating to 1992 of course) were somewhat more prevalent among respondents with relatives in Slovakia.

4. Conclusion

In my opinion, the results obtained enrich our view of a change as significant as the division of Czechoslovakia undoubtedly was. The linguistic proximity of Czech and Slovak, the peaceful disintegration of the federation, and likewise the relatively numerous family ties and ties of friendship continue to make the Moravian-Slovak borderlands as interesting are for further analyses of contacts between both sides. And that despite the fact that the new state border has been stabilised in the long term and that despite the fact that this area is in great part formed by the relatively hilly terrain of the Carpathians, which undoubtedly constitute a barrier.

References

ŘEHÁK, S. (1997): Aktuální změny prostorových interakcí na moravsko-slovenském pomezí. Širší závěrečná zpráva o řešení grantového projektu GA ČR, reg. číslo 205/95/1184. Katedra geografie Přírodovědecké fakulty Masarykovy univerzity, Brno, 36 pp. and maps.

ŘEHÁK, S. (1997): Kontakty se Slovenskem na moravsko-slovenském pomezí: role vzdálenosti hranic. In: Sborník abstraktů z V. vědecké konference Aktuální geografické problémy České a Slovenské republiky. Pedagogická fakulta MU, Brno, p. 10.

ŘEHÁK, S. - DANĚK, P. (1997): Změny prostorových interakcí v názorech obyvatel moravsko-slovenského pomezí, analýza výsledků terénního výzkumu. Výzkumná zpráva. Katedra geografie Přírodovědecké fakulty Masarykovy univerzity, Brno, 35 pp.

ZAPLETALOVÁ, J. (1997): Vývoj dopravních vazeb mezi ČR a SR po vzniku dvou samostatných států. In: Podobnosti a rozdiely vo vývoji SR a ČR po rozdelení Českej a Slovenskej Federatívnej Republiky (Mariot, P. - Mikulík, O. eds.). Geografický ústav SAV, Bratislava, p. 45-52.

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GEOMORPHOLOGICAL AND STRATIGRAPHIC PROBLEMS OF LOESS SERIES IN MODŘICE NEAR BRNO (S. MORAVIA)

Jaromír KARÁSEK - Luděk SEITL - Karel VALOCH

Dedicated to the memory of Prof. Dr. Ing. Josef Pelíšek, DrSc. (1909-1993), soil scientist and one of founders of the New Age Czech Quaternary geology.

Abstract

The loess series opened by the loam pit in Modřice near Brno is known by its well-developed fossil soil complexes since at least the end of the 19th century (McCoy - Oches - Cílek, 1996), having been systematically studied and documented as long as sixty years. It is most probably the only locality of the Czech Quaternary which has been enjoying the long time attention of experts and this is why it would deserve a synthesis of all the hitherto gained knowledge. The main objective of the submitted study is to present a general picture of geomorphological situation in the locality and to integrate this picture into the context of the hitherto stratigraphic interpretations.

Shrnutí

Sprašová série odkrytá hlavním cihelny v Modřicích u Brna je známa dobře vyvinutými fosilními půdními komplexy nejméně od konce 19. století (McCoy - Oches - Cílek, 1996) a je systematicky sledována a dokumentována již 60 let. Je pravděpodobně jedinou lokalitou českého kvartéru s takto dlouhým obdobím odborného zájmu a zaslouží si proto syntetické shrnutí všech dosavadních poznatků. Hlavním cílem předložené studie je podat základní obraz o geomorfologických poměrech lokality a včlenit jej do kontextu dosavadních stratigrafických interpretací.

Key words: Loess series, morphostratigraphy, slope modelling, paleolithic, osteological findings

1. Introduction

The brick-field loam pit in Modřice is one of the longest studied and most discussed loess series profiles on the eastern edge of the Bohemian Massif. A main cause to the undying discussions (compare Karásek - Seitl, 1997) is the fact that the stratigraphic sequence of the loess series and soils in the profile under study changes in the course of mining brick-making raw materials in dependence on the topical topographic position of the main mining wall. The first stratigraphic interpretations (Pelíšek, 1940; 1949) were based on the description of the loam pit situated some 200 meters in the SE-direction from the present mining wall and stretching in the WE-direction (Fig. 2). Their conceptions were then based on a morphostratigraphic scheme derived for the Prague surroundings (Záruba, 1942). The stratigraphic explications of Pelíšek were accepted by authors of a comprehensive comparison study (Musil - Valoch - Nečesaný, 1954) but were later casted doubts upon within the campaign for the "würm of two parts" (Kukla, 1961; Fink, 1964; and other), particularly so by the conclusion made by the INQUA Subcommittee for the loess stratigraphy in the sense that the Modřice loess series is analogical to the series of Dolní Věstonice with the typically "two-part" würm and its pedostratigraphic horizons equivalent to the Stillfried A and B in Fink's conception (1964). This means that soil W 1-2 as in the original Pelíšek's conception is said to be not represented in Modřice. The then situation of outcropped Modřice loess series, documented by published photographs (Bouček - Kodym, 1963; Ložek, 1973) seems to be corresponding with the INQUA Subcommittee conclusion.

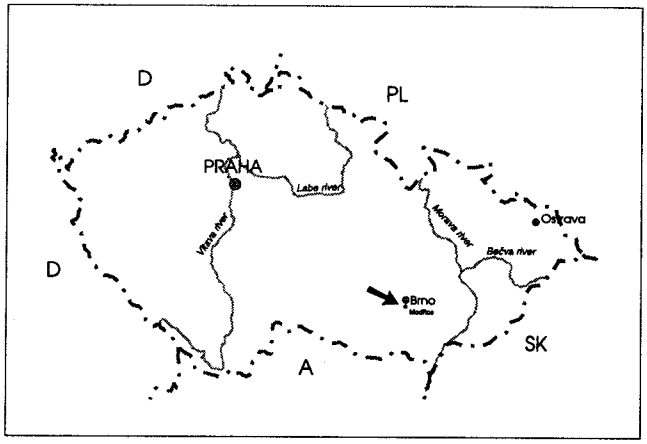

Fig. 1 Topographic position of the locality

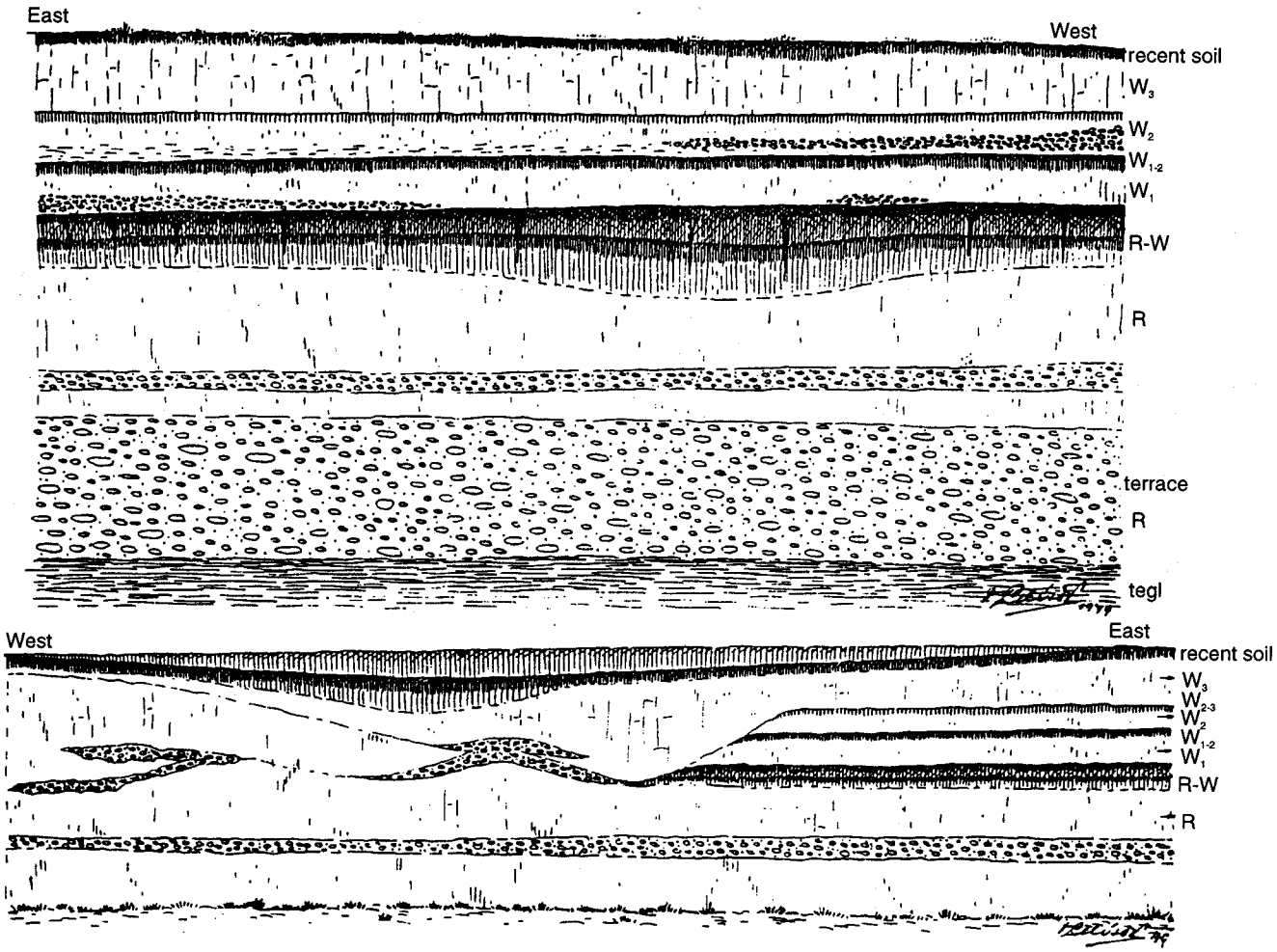

Fig. 2 The original stratigraphic interpretation of the loess series in Modřice (Pelíšek, 1949)

Yet, the circumstances of telescopic nip-out of soil W 1-2 by changing the topographic position of the main mining wall (Musil - Valoch, 1966) were later pointed out and the gradual merging of soils W 1-2 and W 2-3 can also be documented by a historical photograph (Kalášek et al., 1963). After the main mining wall had been shifted southwards in 1965, the discussed soil W 1-2 was again monitored and photographed in its stratigraphic position and typical development (Fig. 3) (Pelíšek 1982). With its further shifting towards the West and South, the main mining wall was again being gradually telescopically nipped-out so that only its northern branch at the NE-edge of the profile could be documented in 1969 (Fig. 4 - see cover, p. 2.).

At the beginning of the 80s the parent rock of loesses was first uncovered to the greater extent (river gravel sands in the rock cover of Miocene sediments) and the allochthonous-slope-position was stated of some loess locations and soils (Seitl, 1983). It became ever more obvious with the increasing information and knowledge that any momentary situation of outcropped local loess series is in an apparent correlation with the configuration of pre-loess form elements. Paraautochthonous or explicitly allochthonous positions of some partial blocks sometimes even led to experimental revisions of the local stratigraphic conception (Valoch, 1992). One of necessary pre-requisites to an at least partial clarification of the extremely complex local morphostratigraphic relations and bindings became the geomorphological analysis that was implemented by J. Karásek for this study. In Chapter 3 the study is complemented with a brief description of all hitherto osteological findings (L. Seitl). In Chapter 4 the study includes a description of artefacts (K. Valoch) found in the Modřice loess series and deposited in the Anthropos Institute of the Moravian Regional Museum in Brno.

2. Geomorphological analysis of the locality

The loam pit of the Modřice brick-field is situated on the right valley slope of the River Svratka, extended in the N-S direction, with the E exposition and inclined in the same direction at an angle of 5-7 degrees (some 2 degrees in its foot part). The sloping area, extended in a length of about 1 km from the Moravanský potok (Brook) valley up to another transverse valley formation

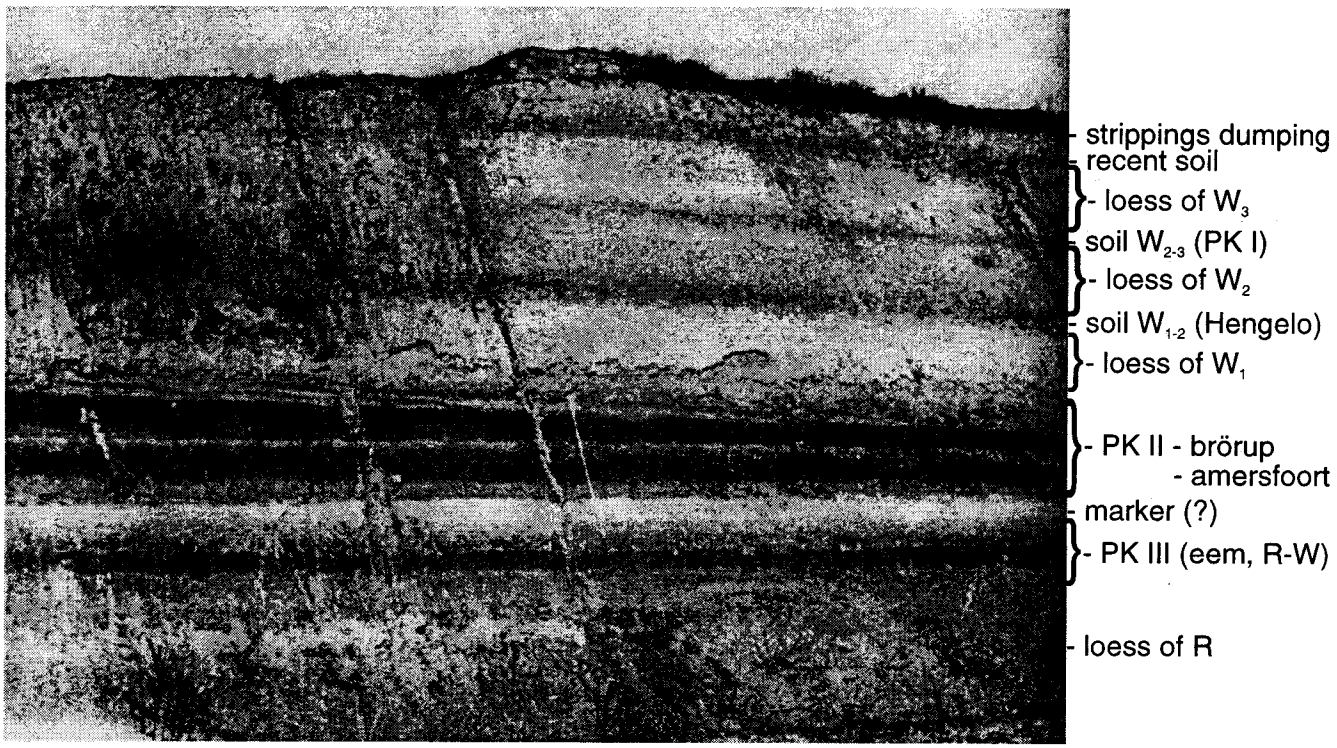

Fig. 3 The complete loess series on the southern mining wall - situation in 1965. Photograph J. Pelíšek (ex Musil et al., 1982)

of W-E direction (the erosion rill under the northern foot of the Želešický hřbet (Ridge), is smooth and forms a continuation of the same valley slope of Svratka - perhaps with a milder gradient of some 4 degrees - between the valley of Leskava and the Moravanský potok (Brook) at a length of some 2 km. Taking into regard the generally recognized presumption that the clastic loess component in this country was deposited mainly by winds of western directions (Ambrož, 1947), the spatial position of the Modřice loess series would be that of a drift (Havlíčková, 1966; Czudek, 1997). A consequence of this position is a scaly structure of the series in the W-E direction and the resulting telescopic superposition (Kukla, 1961a), i.e. gradual nip-out of lithostratigraphic and pedostratigraphic horizons towards the West, i.e. towards the deflation slope edge. Should the slope which forms the existing surface of the loess drift be just a slightly shape-modified copy of a pre-loess slope, the gradual end-off could be currently monitored on the withdrawing loam pit wall in the course of mining. It was clear, however, as early as long before the loess parent rock outcrop (e.g. in 1969 - see Fig. 4) that the point of intersection of stratigraphic horizons with the subvertical plane of the western mining wall are not horizontally even but undulating into a profile picture of transversal depressions and elevations. With the mining proceeding westwards, and especially after the pre-loess parent rock had been uncovered (Fig. 6 - see cover, p. 2.), the disproportion between the existing and pre-loess form elements became pronounced to such an extent that it was possible to start with a reconstruction of the pre-loess relief for the loam pit site (Fig. 5).

The transverse articulation of the pre-loess relief slope area built by the Badenian calcareous clay in its upper part resulted in the channelling of modelling processes in the destruction stages of the Upper Pleistocene not only in the W-E direction as it would have followed from the existing orientation and smooth surface of the slope area, but also towards the bottoms of the transverse depressions, i.e. with certain angle S and N deviations from the general W-E direction.

The slope modelling in the Modřice loess series has been known since the very beginning of research in this locality in the form of gravel sand positions inside the loess covers and they individual manifestations have been correctly interpreted (Pelíšek, 1949). All other different explanations were proven to be erroneous (Karásek, 1968; Karásek - Seitl, 1997). After the pre-loess parent rock was uncovered, there were also ever more manifestations of the "transverse" slope modelling with preponderant conserved slides bound to the calcareous clay loess parent rock by their slip surfaces. Should we take into consideration that the gradient of the conserved slopes on the calcareous clay amounts up to 10 degrees at some places, their disturbance by fossil slides can be anticipated with a certain logic. Remarkable is for example the crossing of an apparent solifluction position inside the loess cover (solifluction with the W-E movement vector) by a slip surface tilted to SE,

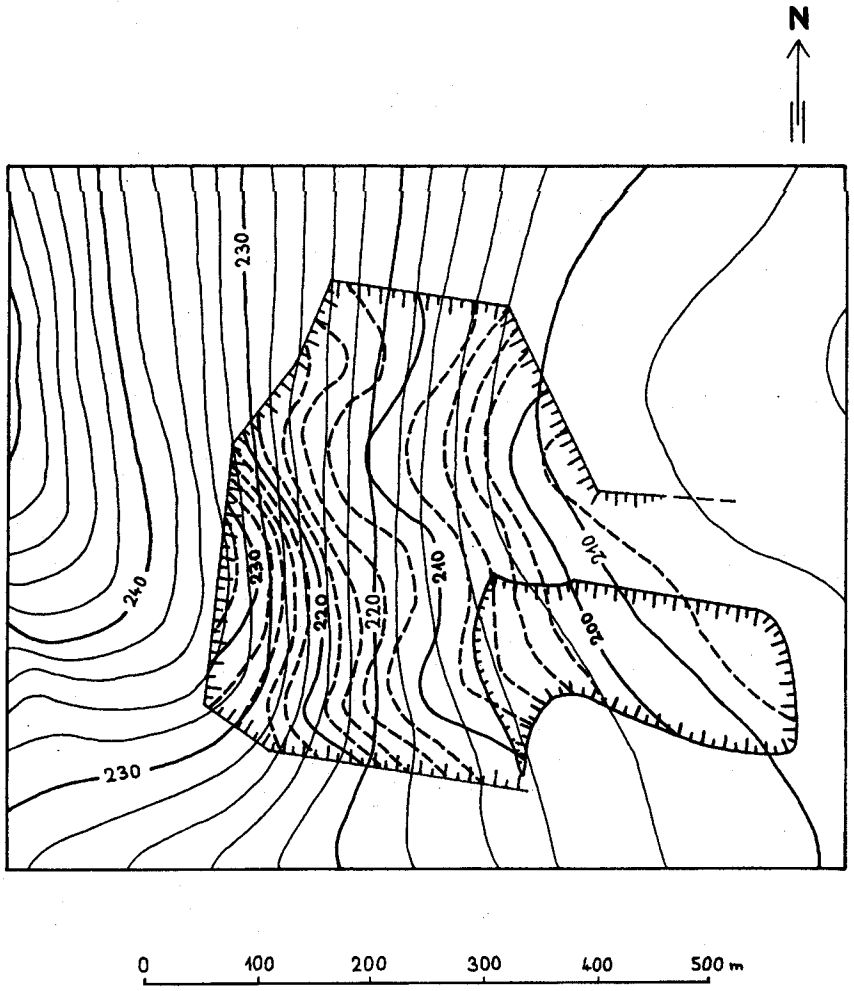

Fig. 5 The reconstruction of the pre-loess relief in the Modřice loam-pit. Orig. J. Karásek, 1997

i.e. towards the floor of the northern transverse depression (Fig. 7).

Block slides and other processes of slope modelling (solifluction? creep?) also affected the local relic of the Tuřanská terasa (Terrace) (Fig. 8) which rests on the calcareous clay parent rock (Karásek - Seitl, 1997). The slope modelling processes thus put into the secondary slope position not only the blocks of loess series members but also the gravel sands of the Tuřanská terasa (Terrace) and the calcareous clay. An unambiguous indicator of the calcareous clay slope displacement here is its position towards the altitude position of the stratigraphic interface of the calcareous clay and the parent rock Badenian basal clastics. The interface has a stable altitude position of approx. 226 m and this is why it appears as a horizontal line in the western mining wall in the N-S profiles. Any occurrence of the calcareous clay below this altitude, be it in the loess parent rock or sometimes even between two "loess" blocks, provides an evidence of its slope displacement.

Any dating of slope movements here is very difficult since the movements occurred in several stages rather distant from each other in terms of time. The oldest movements were undoubtedly "pre-loess", the other occurred in the loess ages (Fig. 2) with creep and rainwash occurring even in the periods of predominating pedogenetic processes. Any following loess cover conserved the forms of preceding slope movements, a result of the latest conservation being the present flat and smooth slope area.

Another problem of the area, which has not been resolved yet, is the existence of the "Rissian river terrace" (Pelíšek, 1949) that was later renamed as the Modřice terrace (Sýkora, 1961). To better explain the morphostratigraphic position of river terraces which were given names by various authors in the Brno region according to unofficially set up morphostratotypes (Karásek, 1992), the authors add to the text an idealized profile of which the morphostratigraphic as well as chronostratigraphic relations of the river terraces to the destruction levelled surfaces clearly follow out (Fig. 9). The mentioned river terraces are well stratigraphically defined either by their altitudinal position (Tuřanská terasa) or by their relations to their terrestrial rock cover (Husovická terasa). The relations of the terrestrial rock cover to the river terraces in the Brno region were already described in detail (Musil - Valoch, 1961) which is the reason for the authors to in-

Fig. 7 The slip area projection into the vertical plane of the mining wall. The slip area cuts oblique through the horizontally oriented positions of solifluction sediments in loess. Photograph J. Karásek, August 1990

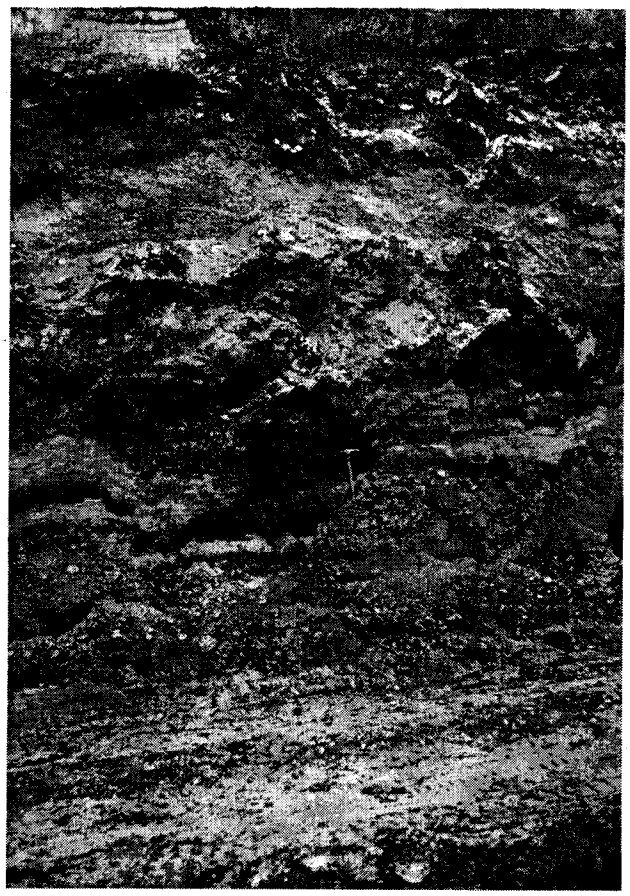

Fig. 8 The surface of the Tuřanská terasa (Terrace), outcropped by the western mining wall and disturbed by dislocations (along slip areas of small block slides). Photograph J. Karásek, December 1996

clude in the text only the comments to the stratigraphy of loess series in the rock cover of the Modřická and Husovická terraces.

Unlike the adjacent terraces (Tuřanská and Husovická) the Modřická terasa (terrace) represents a certain problem with its morphostratigraphic level. Its original unambiguous classification in the Riss (Pelíšek, 1949) is hampered by a range of accompanying events both in the eponymic locality in Modřice and in other localities of the Brno region. It does not follow from Pelíšek's description whether the terrace was caught by him right in the stage of outcrop or only in drills. More recent data about the altitudinal position of the surface of river gravel sands (206 m) and their thickness of about 6 to 8 m (Musil - Valoch - Nečesaný, 1954) are at variance with Pelíšek's findings (200-201 m, 3 to 4 m), which raised doubts about their autochthonous position. In the course of mining, and particularly so during the 60s and 80s, the loam pit floor appeared to be below the level line of 200 m, and if there were any gravel sands found at this altitudinal position, their slope deposition character was evidenced at all cases (Karásek, 1968; Karásek - Seitl, 1997), or the loess series had a direct link with Miocene sands here (Seitl, 1983).

Thus the eponymic marking of the "Modřická terasa (terrace)" (Sýkora 1961) for a pre-Eemian, i.e. "Rissian"

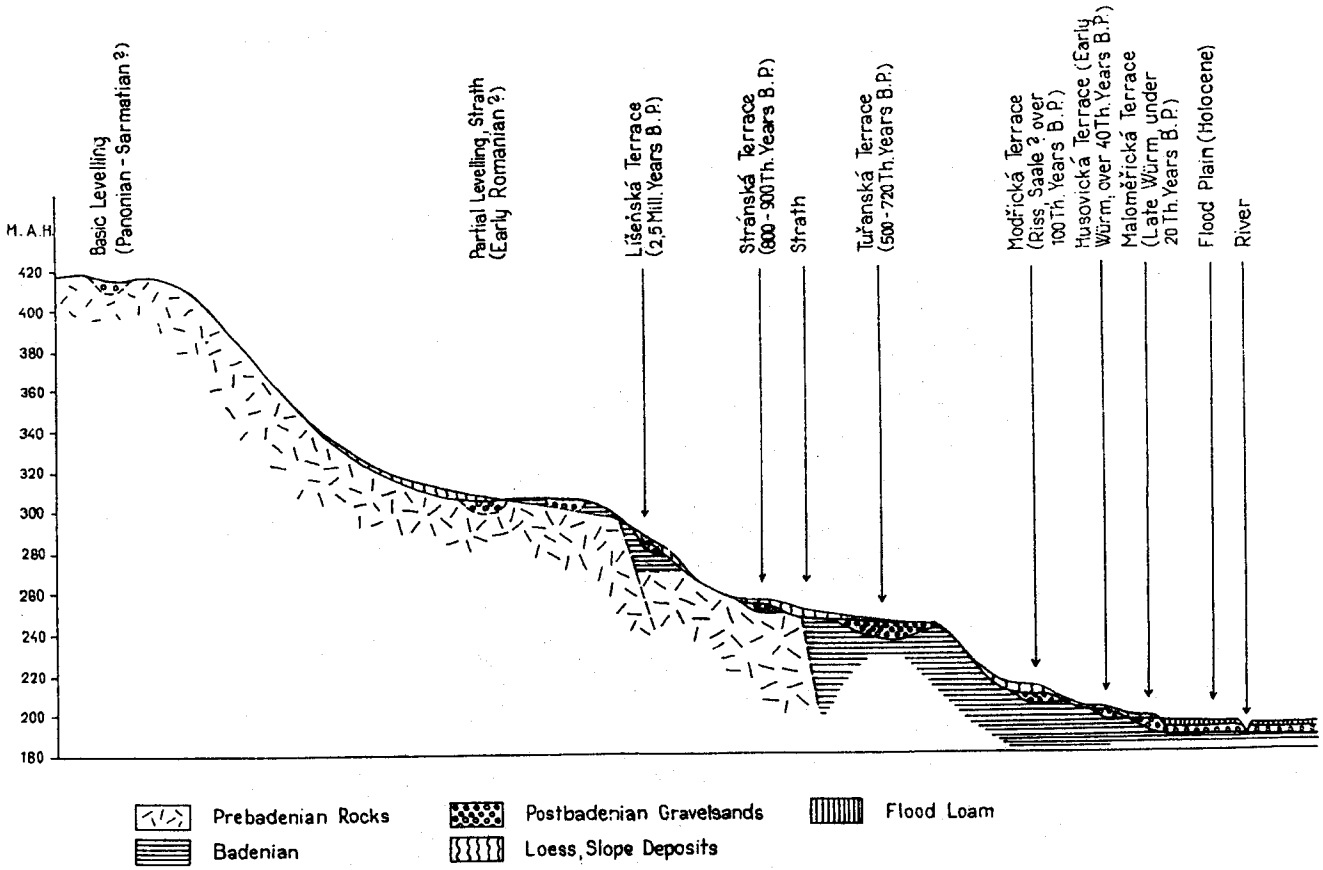

Fig. 9 The idealized schematic cross-section through the valley of the Svitava River in the Brno territory. Orig. J. Karásek, 1992

river terrace (Pelíšek, 1949) is most probably erroneous and became a cause to a number of misunderstandings. The large and in morphological terms rather pronounced plateau towards the western end of the Dyjsko-svratecký úval (Graben) in Brno and its southern surroundings, used for example by the railway Brno-Břeclav, is demonstrably a true post-loess copy of a river terrace built by intact fluvial gravel sands with the surface at an altitude of about 200 m in Brno-Horní Heršpice (Fig. 10). However, the loess series in the rock cover of this terrace ends with a soil on its base, which is a probable equivalent of soil W 1-2 of the Husovice profile (Musil - Valoch, 1961) and most possibly also of the same soil from the Modřice loess series. With respect to the striking coincidence of the lithostratigraphic development of its rock cover in many localities, the authors take this so called Husovická terrace (Karásek, 1992) for a synchronic morphostratigraphic level for the whole Dyjsko-svratecký úval (Graben) with its origin being dated in the Lower Würm or in the period between interstadials of brörup and hengelo (Karásek - Valoch, 1996). Its morphostratigraphic position was photographically documented in Brno-Husovice (Musil - Valoch, 1961), in Brno-Horní Hršpice and near the Brno Main Railway Station (Karásek, 1985) and in Kupařovice (Valoch et al., 1985).

An actual equivalent to the pre-Eemian ("Modřická") terrace is the "terrace V" in Brno-Maloměřice (Musil - Valoch, 1961). Its altitudinal position is corresponded to by stratigraphically disputable localities Brno-Žabovřesky (Valoch, 1982) and Brno-Pisárky (Musil -Valoch - Seitl, 1996; Smolíková, 1996; Karásek, 1996), which were mapped already by Zapletal (1927) but which were not plotted in new geological maps (Novák et al., 1991; Pálenský et al., 1997). The existence of this morphostratigraphic level in the space between Brno and Modřice cannot be excluded (see Chapter 3), but it has never been provided any evidence in the documentation from the Modřice outcrops, and it cannot be identified with the morphologically pronounced plateau of the local Lowerwürmian Husovická terrace.

3. Osteological findings

A number of skeletal findings from the cadastral area of Modřice is deposited in collections of the Anthropos Institute, Moravian Regional Museum in Brno, of which some older ones are marked merely by the locality: "Modřice". These findings were not included in the presented analysis.

Some of findings with more detailed localizations were publicized (Musil - Valoch - Nečesaný, 1954).

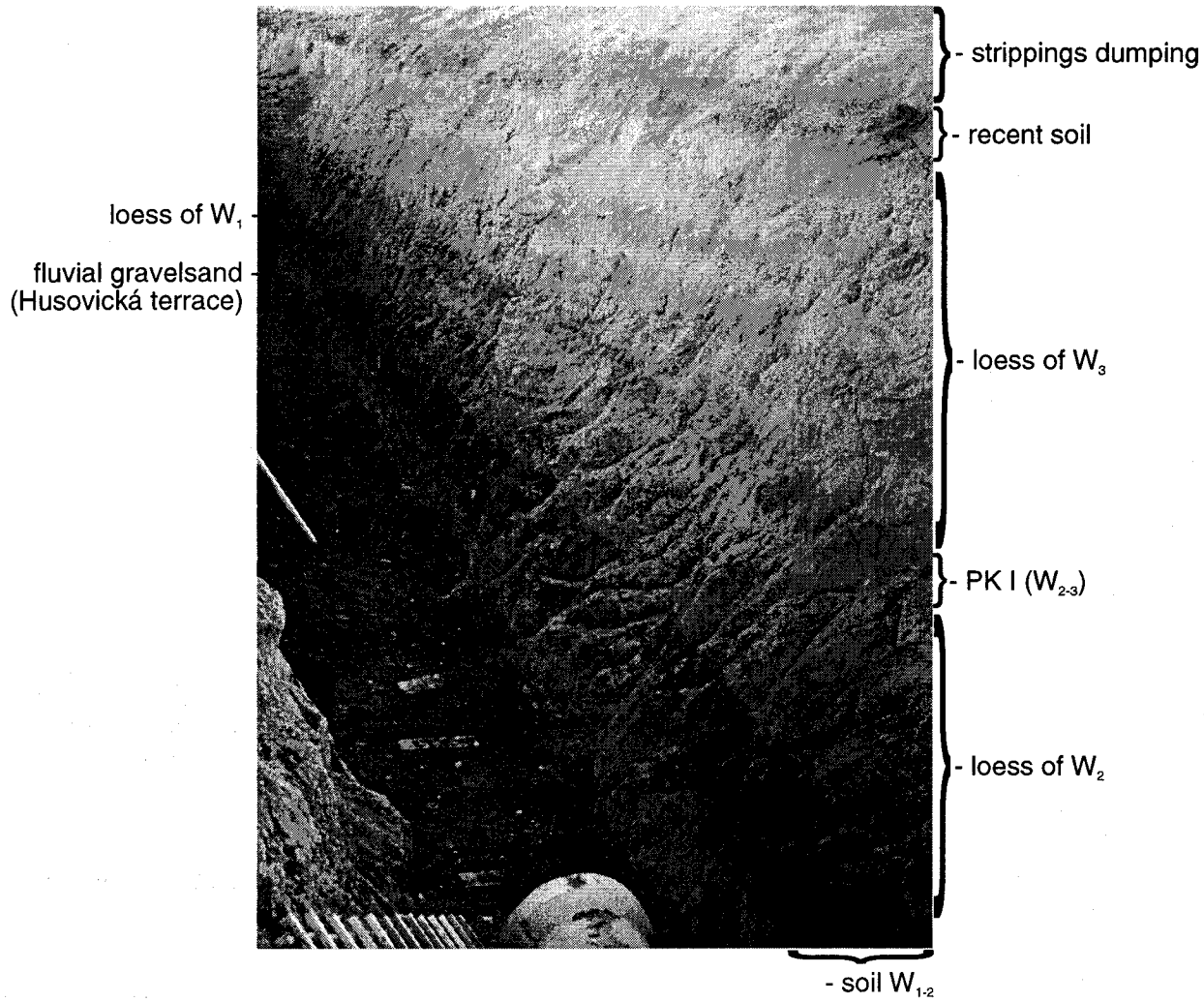

Fig. 10 The loess series in the rock cover of gravel sands of the Husovická terasa (Terrace) in Brno-Horní Heršpice. Photograph J. Karásek, December 1973

When listing the new findings it is useful to mention that the finders did not mention any precise stratigraphic position of the finding in many a case. Pelíšek's finding of a proboscidean pelvis fragment is said to be originating "from the loess above the lowest terrace" and is dated in 1967. A rib fragment and a crashed fragment of the mammoth skull were found in 1970 (in basal loess?). A rhinoceros ulna of Coelodonta antiquitatis is marked with the same year of finding. Fragments of C. antiquitatis tibia were prepared from the upper part of the second chernozem (brörup?) and at the time of the finding (1971) there were two other unpronounced soils recorded above this soil by the finder (R. Klíma).

A mass bone finding was made in the northern part of the outcrop in 1972 (finder M. Drmola, depositions and documentation - Moravian Regional Museum). A damaged fragment of horse jaw (Equus sp.), a tooth, rib fragments and 123 fragments of C. antiquitatis skull originate from the upper part of the upper chernozem (brörup?). A fragment of dislocated rhinoceros diaphysis was post-sedimentarily displaced into the rock cover loess and sintered here. The same chernozem is a place of origin to a greater number of reindeer (Rangifer tarandus bone fragments and several bone chips of horse (Equus sp.). A heavily sintered artefact was found nearby.

A tusk and two ribs of mammoth (Mammuthus primigenius) were found in the same year. The ribs were crashed by the sediment weight and secondarily welded together by the sinter. The tusk originates from the black-brown soil (eem?). A nearly complete shoulderblade of a small form of the horse (Equus sp.) in the depository is labelled as a finding from "W 2-3".

In 1975, fragments of horse phalang and calcanea with a heavily corroded fragment of a long bone, most probably belonging to mammoth were found in the lower chernozem (amersfoort?, marked as "R-W" in the finding report).

It follows from the list that the osteological findings exhibit a certain regularity as related to the westwards mining proceeding. The large-scale method of extraction makes it almost impossible to rescue the bones in spite of the fact that their findings might be cummulated.

The greatest number of findings from the 70s can be explained by the fact that the then mined level was topographically lower situated and its stratigraphic conditions were more favourable as compared with the present mining.

A cummulation of findings in the upper part of the second chernozem (brörup?) is rather striking in the analysis of their frequency . The most represented species include Equus sp., Mammuthus primigenius, Coelodonta antiquitatis, Rangifer tarandus and also small animals as can be guessed by corroded fragments that can be determined with more difficulties. It is a faunistic composition which suggests with a certain probability the presence of man at the decline of the steppe climate of the given cycle.

It is also worth mentioning in the regional context that a mammoth tusk was found in Popovice near Rajhrad. The finding originates from the loess in the rock cover of interglacial soil complex (eem?) dwelling on intact river gravel sands whose topographic positioning is unambiguously lower than the Tuřanská terasa (Terrace) and morphostratigraphic positioning higher than the Husovická terasa (Terrace)(see Chapter 2). In an identical morphostratigraphic position with the gravel sands near Popovice were the same sediments found in the PK III parent rock beneath the tram flyover at the Central Cemetery in Brno, at the road underpass from Brno-Bohunice to Brno-Horní Hršpice, and in the mouth of the "Prague" freeway D1 from Vídeňská street. However, the superposition has never been really confirmed in the clay-pit of the Modřice brick-field.

4. Paleolitic findings

There were sporadic paleolitic artefacts found during the mining history in different positions and different places of the outcrop, which originate from the Upper, Middle and Lower Paleolite and are listed in this order. Some of them have already been published (Valoch, 1977).

An indisputable evidence of man presence in the period of early young Paleolite represents the unidirectional core (Fig. 11.1) made of horn-stone originating from Jurassic limestones. A tiny piece of the original cortex was retained on the ventral side and the impact area was modified by several facets. The dorsal side bears negatives of three blade-shaped chips broken off in parallel. In terms of culture and time the core can be classified to analogies from the nearby locality in Brno-Bohunice (Valoch et al., 1976). It is a bohunicien whose age is about 40 000 years B.P. Having fallen out of the main mining wall in 1988 the finding has no stratigraphic context. However, it must necessarily originate from the fossil soil of the Middle Würm (soil W1-2). The fragment of a large chip from the Jurassic horn-stone boulder (Fig. 11.2) shows a coarse dentation on the right side in the distal part. The black cortex was preserved on the dorsal face, the other surface being covered with white patina. The finding report indicates that it was found in 1993 in situ in the "upper brown soil" and its origin and age are apparently identical as in the previous core.

Other artefacts can be ranged in the Middle Paleolite. The first two of them originate from the basal loess position above PK II + III. A highly vaulted massiv quartz split (Fig. 11.5) had its ventral smooth area covered with sinter after the removal of which the area appears fresher than the other areas. The distal part on the left has a small transverse area reminding a graver chip with a double bulbus perspicuous at the base. The dorsal side is partly covered with the boulder cortex. The distal part on the left bears a larger split area with no particularly clear impact direction, which forms a flat edge with the ventral part. The boulder crust is peeled off by three parallel blade-shaped splits on the proximal end. The split areas are smoothed by wind. The finding originates from 1972 from the upper position of the upper black soil from the vicinity of animal bones findings (see Seitl in this text). The spongilite boulder splinter (Fig. 11.3) found in 1973 in the loess is slightly damaged on both sides of its lower end. The cortex is browny yellow with white patina on splitting areas. The dorsal left

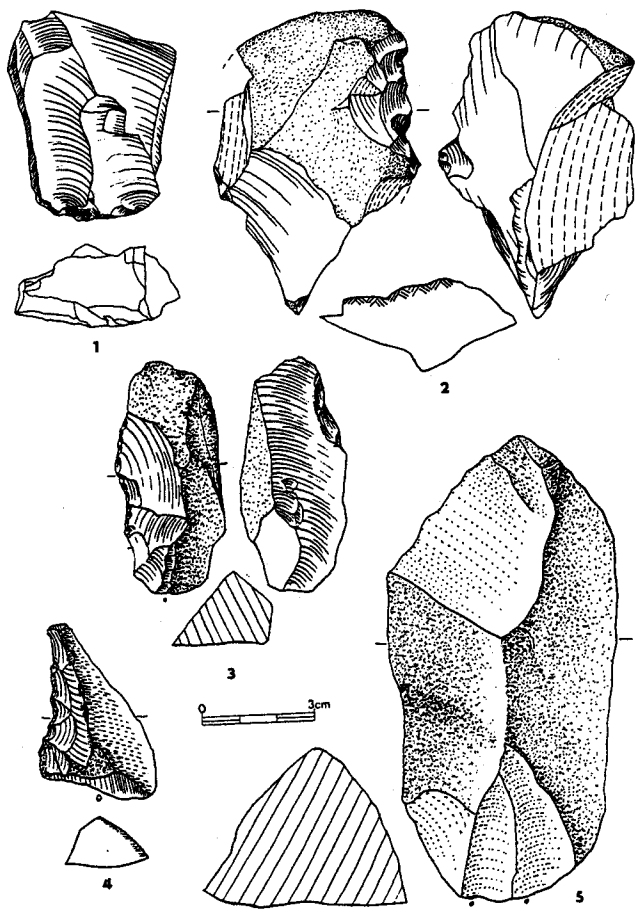

Fig. 11 The young Paleolitic and mid-Paleolitic artefacts from the brick-field loam pit in Modřice. Orig. K. Valoch

edge shows signs of marginal retouching, the ventral notch to the upper right exhibits the retouching too.

Other artefacts of the Middle Paleolite originate from the PK II+III soil complex. A larger part of the quartz boulder (Fig. 12) , chipped on both sides and protruding into a tip on its distal end was found in the upper chernozem (brörup?) in 1975. The dorsal side was covered with sinter after the removal of which the side appears to have fresher looks than the other surfaces which show a slight eolian smoothing. A concave-side scraper (Fig. 11.4) on the trihedral spongilite splinter (Valoch, 1977) was found on the horizontally outcropped area of basal brown parasoil PK III. The quartz splinter with a distal broken end (Valoch, 1977) was found (Fig. 13.2) on the base of the lower chernozem (amersfoort?). A larger quartz split (Fig. 13.4) in the form of a citrus fruit segment (Valoch, 1977) originates - according to the information of the finder - from the "lower part of the soil complex". It was the basal chernozem (?) in which a quartz splinter was found in which the talon was formed by the cortex (Fig. 13.3). The dorsal area is smooth with only another impact area formed to the right, of which two splinters were taken in the ventral direction.

The historically first artefact (Pelíšek, 1949) of this locality originates from the loess under PK II+III. It is a large diskoid core of dark grey Jurassic horn-stone (compare also Musil - Valoch - Nečesaný, 1953).

There is only one artefact that can be attributed to the Lower Paleolite with a great probability (Fig. 13.1),

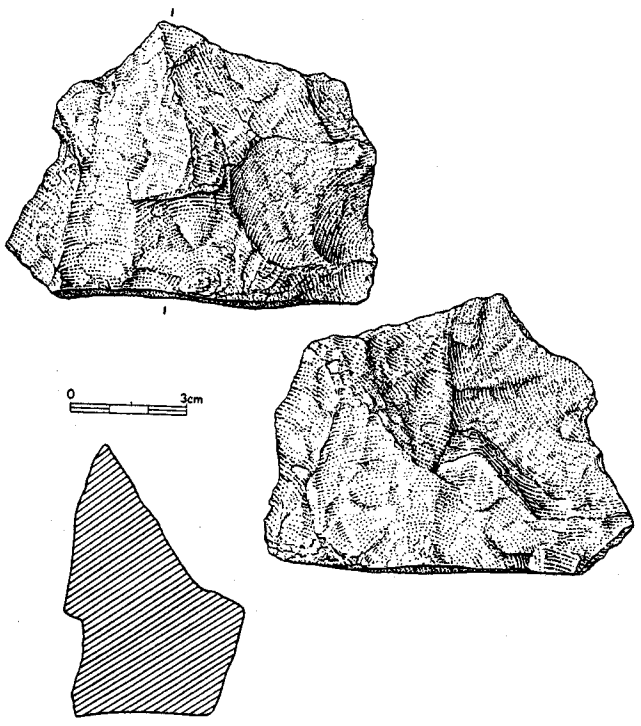

Fig. 12 The mid-Paleolitic artefact from the brick-field loam pit in Modřice. Orig. K. Valoch

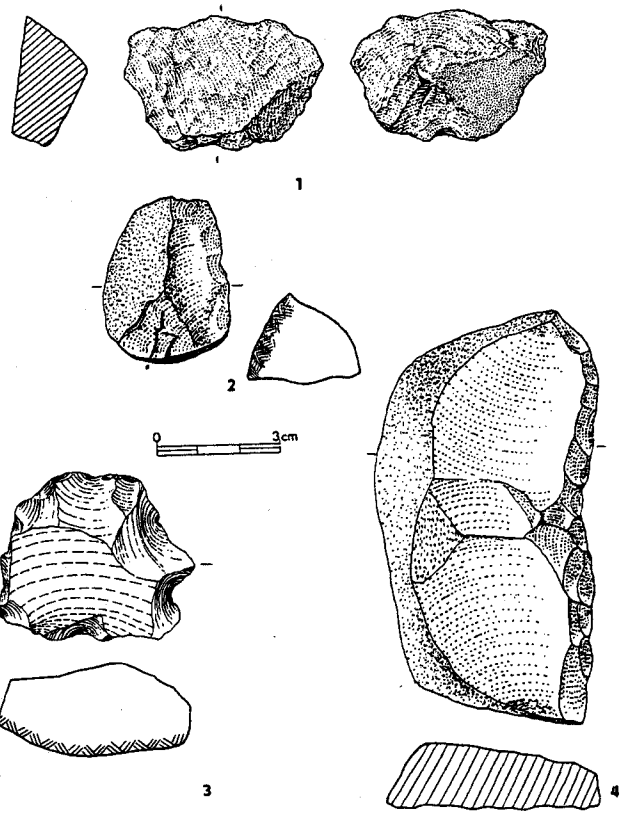

Fig. 13 The old-Paleolitic and mid-Paleolitic artefacts from the brick-field loam pit in Modřice. Orig. K. Valoch

viz a diskoid fragment of the shoulder from the brown quarcite whose cortex forms its entire ventral side. It was chipped on its dorsal side in such a way that there are obvious notches. The whole surface shows heavy eolian smoothening. It was found in the SW end of the outcrop in the loess soil originating from the rock cover of the Tuřanská terasa (Terrace).

The described collection of the paleolitic artefacts deposited in the Anthropos Institute, Moravian Regional Museum in Brno, documents the presence of people in the Brno basin during the different Pleistocene periods of time. The determination of more precise artefact age depends on the stratigraphic interpretation of the loess series, which can appear controversial with the present knowledge available (See Chapter 5). Yet, the artefacts from the loess above PK II+III most probably belong to the Lower Würm, the artefacts from the soil complex to the Eemian interglacial and Early Würm, and Pelíšek's artefact from the loess under the soil complex to the younger stage of the Rissian glacial. The two artefacts of the early Paleolite undoubtedly originate from the Middle Würm, and the latest mentioned quarcite artefact having been lacking the stratigraphic context still corresponds with its physical condition to the artefacts of the Lower Paleolite collected from the surface.

5. Discussion

The complex morphological and morphostratigraphic development of the Modřice loess series as well as a certain discrepancy of the accompanying circumstances give rise to discussion topics which can be summarized as follows:

1) There are good reasons to cast serious doubts on the existence of the pre-Eemian ("Modřice") river terrace, i.e. onto the existing morphostratigraphic equivalent of the V terrace (Musil - Valoch, 1961) within the area of the Modřice brick-field loam pit. Since the stratigraphic position of the whole loess series was derived from it (Pelíšek, 1949), the local stratigraphy had been based on a fictive morphostratigraphic level since the very beginning. It is generally known today that the syngenesis of terraces cannot be derived according to their relative altitudes in water courses belonging in different catchments (Krejčí, 1988), not even in the case of the synchronic terraces, and even less so in the case of diachronic terraces.
2) The factographic disproportions between the topographic position of the pre-Eemian "Modřice" terrace and the accompanying circumstances (comp. Valoch, 1982; Musil - Valoch - Seitl, 1996; Smolíková, 1996; Karásek, 1996) do not exclude a logical conclusion that in the case of this morphostratigraphic level it is the diachronic terrace that is in the question, and the mechanism of origination described in the interpretations about the genesis of the Tuřanská terasa (Terrace) sensu lato (Karásek, 1968). The theoretical substantiation of the diachronous principle (Ollier, 1981) was presented in this country exactly with the respect to the genesis of river terraces (Novák, 1987). Included in the application consequences this would mean that the "Modřice" terrace came into the existence earlier in the locality of Brno-Pisárky, and later on in the locality of Brno-Žabovřesky in spite of the fact that the two localities are of the same syngenetic terrace level whose relative altitude gradually increases in the direction upstream the Brno rivers.
3) The stratigraphic assessments of fossil soil complexes in the loess series most probably somewhat underestimated the possibilities of their facial modifications not only in the sense of soil catenas conditioned by the exposure (Mičian, 1965) but also in the connexion with the effects of slope modelling processes which need not necessarily manifest in all loess series of the slope localities in a uniform way. A climazonal soil type such as chernozem can originate in its typical form only in the flat terrain. And it will logically have another form on slopes where the

Fig. 14 The set of soils PK II+III on the western mining wall near the head of pre-loess elevation, heavily reduced by slope modelling and eolian deflation. Photograph L. Seitl, December .996

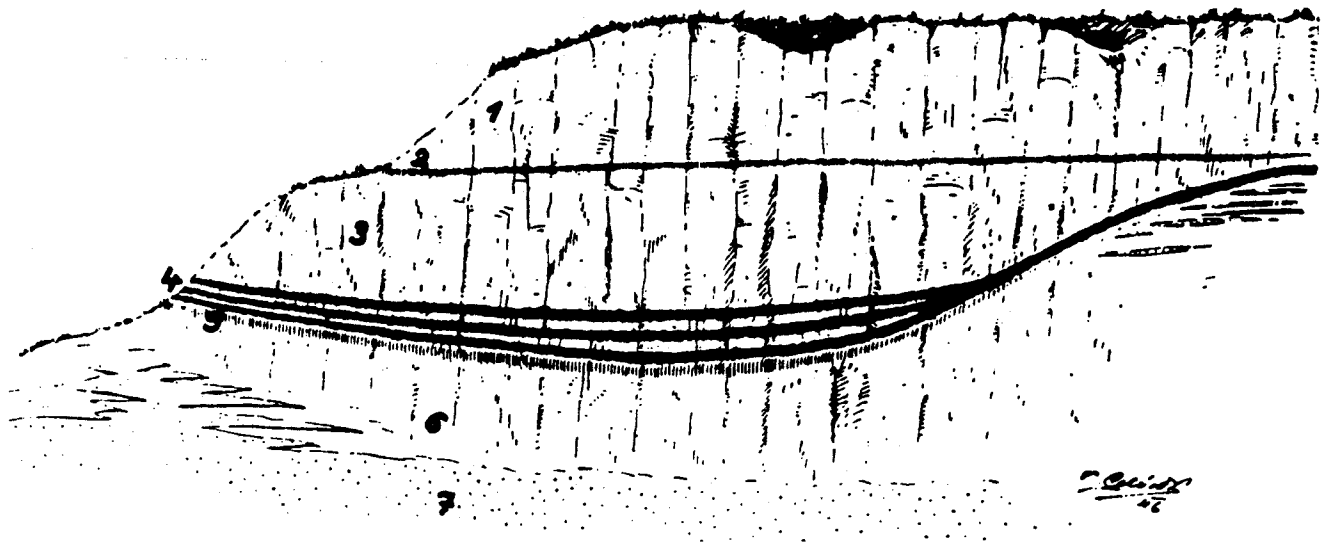

Fig. 15 A schematic profile through the loess series in Dolní Věstonice (J. Pelíšek in Knor et al., 1953)

1. Loess W_3
2. Soil W_{2-3} (PK I)
3. Loess $W_1 + W_2$
4. Fossil chernozems (PK II+III)
5. Brown parasoil (PK II+III)
6. Loess (Riss)
7. Eolian sand

Fig. 16 The lithological boundary between calcareous clay and rock cover loess, pointed out by the dislocation along the slip area. The movement of a loess series part took down also the blocks of calcareous clay (to the left from the hammer). Photograph J. Karásek, November 1995

climatically conditioned soil-forming process is entered by the slope modelling processes as well as by the epigenetic eolian deflation in the vicinity of the upper slope edges. Therefore, there is no reason to be surprised by a fact that an identical pedostratigraphic horizon shows different physical properties such as colour in the foot and slope part of the same loess series. This is also the reason why the discussed soil W 1-2 in loess series foot positions is black (Brno-Husovice, Brno-Horní Hršpice), whilst having the brown colour in the slope positions of the series (Brno-Bohunice - see Valoch et al., 1976) and macroscopically may resemble tundra brown soil PK I (Pelíšek, 1971-72; Valoch, 1996). This facial variability of the soil "W 1-2" in the Modřice loess series was schematically illustrated by Pelíšek (in Demek - Kukla, 1969). The same effect for one of black soils PK II (Fig. 14) was discussed also in our recent paper (Karásek - Seitl, 1997).

A unique published example of the naive stratigraphic interpretation of loess series in Modřice is the stratigraphy based on a simple deduction of loesses and soils from above (Letošník in Bouček - Kodym, 1963) in which the soil set PK II+III is given the age of "W 1-2". Should we disregard the objectively conditioned partial misunderstandings concerning the soil W 1-2 (comp. Musil - Valoch, 1966), practically all authors arrived at a conclusion that the only one soil complex with the typical basal brown parasoil that is represented in the Modřice profile (PK III) is the product of the Eemian ("R-W") interglacial. Taking into consideration the disputable conclusive value of the morphostratigraphic level ("Modřická terasa") from which the local stratigraphy was derived, the agreement of stratigraphic interpretations of the Modřice PK III is remarkable. Having not been yet provided any unambiguous evidence such as paleontological findings, it is supported only by regional analogies today, for example by the stratigraphy of loess series from Dolní Věstonice. It is worth mentioning in this connexion that the groundwork of the hitherto acknowledged - and later confirmed by the dating of the absolute age - stratigraphic conception of the Dolní Věstonice profile was laid also by Pelíšek (in Knor et al., 1953) as early as in 1946. Pelíšek's sketch (Fig. 15) also clearly indicates the correlation between the appearance and development of lithostratigraphic and pedostratigraphic horizons on the topographic position in the outcrop (e.g. the fusion of four soils from the foot part of the series into one oriented up the slope gradient). A telescopic settling of soil W 1-2 farther towards the slope foot, uncovered by the present outcrop, can also be coming into consideration .

Another indirect evidence of the Eemian age of the basal soil complex in Modřice is generally considered the fact that fossil brown parasoil is an indication of the genuine interglacial climatic optimum (e.g. Smolíková, 1968). However, the macroscopically traceable changes in the sequence of loesses and soils as related to the topographic position of the outcrop provide a very complicated picture, which gives rise to doubts about the hitherto recognized stratigraphic interpretation (Valoch, 1992). The considerations about a possible representation of PK IV in the Modřice series originate also from other authors (McCoy et al., 1996). The possibility certainly cannot be excluded: however, any further discussion on this theme should be based on serious factual and regional knowledge of the issue.

6. Conclusion

There is one fact that follows out of the presented analysis and discussion: a majority of the hitherto stratigraphic interpretations of the Modřice loess series is based on an erroneous morphostratigraphic conception. If we adopt an opposite work procedure and assess the age of the pre-loess form elements on the basis of loess rock cover stratigraphy, we arrive at following conclusions in the case of the Modřice loess series:

1. The post-loess smooth and flat slope area in the loam pit site is in a striking contrast with the articulation of the slope area in the loess series parent rock. With the mining wall withdrawing westwards the authors state an irregular nip-out of positions of the mined raw material whose extractable reserve is close to being exhausted.
2. The position of some blocks in the series is apparently allochthonous (Fig. 16) and therefore unfit for any deduction of stratigraphic conclusions on the basis of the momentary outcrop.
3. The existence of the pre-Eemian "Modřická terasa" (Terrace) has never been evidenced in the loam pit area and the accompanying circumstances of its morphostratigraphic position in the said-to-be syngenetic localities (Brno-Žabovřesky, Brno-Pisárky) are in such a discrepancy that they admit a hypothesis of its diachronic genesis. This hypothesis would weaken the credibility of any attempt at interaerial morphostratigraphic correlations published in the connexion with the "Modřice Terrace" (e.g. Zeman, 1982; Karásek, 1985a).
4. A considerable portion of the terrace plateau between the town centre and Modřice, which was identified with the pre-Eemian "Modřice Terrace" sensu lato (Sýkora, 1961) belongs to the Husovice Terrace sensu lato (comp. Karásek-Valoch, 1966), i.e. to the synchronic morphostratigraphic level of the Lower Würm. This can be documented by several published profiles (comp. e.g. Fig. 10) of which the profile in Brno-Husovice still exists and unofficially serves as a supporting profile.
5. The dating of basal brown parasoil PK III in Modřice into the Eemian interglacial climatic optimum is apparently justified, yet supported almost entirely by merely regional analogies. Should its greater age (Valoch, 1992; McCoy et al, 1996) be unambi-

guously denied, the possibility should be supported by decisive arguments.

The most important contribution of the 60 years' history of the Modřice loess series research is the experience that the outcrop calls for a long time study to correctly grasp the local loess series formation and development, which can never be substituted by just several individual visits.

References

AMBROŽ, V. (1947): The Loess of the Hill Countries. Sborník Státního geologického ústavu 14, p. 225-280, Prague. (in Czech, English summary).

BOUČEK, B. - KODYM, O. (1963): Geologie II. Nakladatelství Československé akademie věd, Prague.

CZUDEK, T. (1997): Relief of Moravia and Silesia in Quaternary. Sursum Tišnov. (in Czech, German summary).

DEMEK, J. - KUKLA, J. ed. (1969): Periglazialzone, Löss und Paläolithikum der Tschechoslowakei. Geogr. Inst. Akademie der Wissenschaften, Brno.

FINK, J. (1964): Die Gliederung der Würmeiszeit in Österreich. Res. Of the Int. Cong. on Quaternary, p. 451-462, Warsaw.

HAVLÍČKOVÁ, M. (1966): Relief in the Loess of the Brno Surroundings. Brno (in Czech, manuscript).

KALÁŠEK, J. et al. (1963): Explanations to the Synoptic Geological Map of the ČSSR, Sheet Brno. Nakladatelství Československé akademie věd, Prague. (in Czech).

KARÁSEK, J. (1968): Bisherige Ansichten auf die geomorphologische und stratigraphische Bedeutung der Lösse Mährens und der anliegenden Gebiete. Folia Facultatis Scientiarum Naturalium Universitatis Brunensis, Geographia 4, Brno. (in Czech, German summary).

KARÁSEK, J. (1985): The Abandoned Outcrops in Brno. Zprávy Krajského vlastivědného musea 237, p. 1-6, Olomouc. (in Czech).

KARÁSEK, J. (1985a): Geomorphological Characteristic of Relief of Southern Part of Znojmo Region. Sborník Československé geografické společnosti 90, p. 177-189, Prague. (in Czech, English summary).

KARÁSEK, J. (1992): The Morphostratigraphical Position of Postbadenian Gravelsands on the Territory of Brno. Scripta (Geology 22), p. 81-86, Masaryk University Brno.

KARÁSEK, J. (1996): Pebble Association of the Gravelsands of a Low River Terrace at Brno-Pisárky. Geologické výzkumy na Moravě a ve Slezsku, III, p. 16-18, Brno. (in Czech).

KARÁSEK, J. - SEITL, L. (1997): Comments on the Morphology and Stratigraphy of the Loess-Serie in Modřice near Brno. Geologické výzkumy na Moravě a ve Slezsku, IV, p. 7-10, Brno. (in Czech).

KARÁSEK, J. - VALOCH, K. (1996): Comments to the New Outcrops of Postbadenian Gravelsands in Brno and Vicinity. Časopis Moravského musea 80, p. 57-68, Brno. (in Czech, English summary).

KNOR, A. et al. (1953): Dolní Věstonice. Monumenta archeologica 2, Prague.

KREJČÍ, J. (1988): Erwägungen zum Problem der Ursachen der Bildung der pleistozänen Flussterrassen in der Böhmischen Masse. Scripta, (Geographia 5), p. 189-204, University of J. E. Purkyně, Brno. (in Czech, German summary).

KUKLA, J. (1961): The stratigraphic Position of the Early Czech Paleolithic. Památky archeologické 52, p. 18-30, Prague. (in Czech).

KUKLA, J. (1961a): Lithologische Leithorizonte der tschechoslowakischen Lössprofile. Věstník Ústředního ústavu geologického 36, p. 369-372, Prague.

LOŽEK, V. (1973): Nature in the Quaternary. Academia, Prague. (in Czech).

McCOY, W. D. - OCHES, E. A. - CÍLEK, V. (1996): Amino-acid Chronology of Modřice Fossil Soil Complex (Brno Region). Geologické výzkumy na Moravě a ve Slezsku, III. P. 23-26, Brno. (in Czech).

MIČIAN, L. (1965): Einfluss der geomorphologischen Verhältnisse auf der Charakter der Bodendecke. Acta geol. Et geogr. Univ. Comenianeae, Nr. 5, Bratislava. (in Slovak, German summary).

MUSIL, R. - VALOCH, K. - NEČESANÝ, V. (1954): The Pleistocene Sediments in the Vicinity of Brno. Anthropozoikum IV, p. 107-168, Prague. (in Czech, English summary).

MUSIL, R. - VALOCH, K. (1961): Die unteren Terrassen der Svitava bei Brno. Práce brněnské základny Československé akademie věd, 6, p. 225-256, Brno.

MUSIL, R. - VALOCH, K. (1966): Beitrag zur Gliederung des Würms in Mitteleuropa. Eiszeitalter und Gegenwart 17, p. 131-138, Öhringen.

MUSIL, R. - VALOCH, K. - SEITL, L. (1996): Present Stratigraphic Problems of Fluvial "Modřice Terrace" at Brno-Pisárky. Geologické výzkumy na Moravě a ve Slezsku, III, p. 26-28, Brno. (in Czech).

NOVÁK, V. (1987): On the Origin of River Terraces. Sborník Československé geografické společnosti 92, p. 98-104, Prague. (in Czech, English summary).

NOVÁK, Z. et al. (1991): Geological map of ČR, 1:50 000, Sheet Brno 24-32. Český geologický ústav, Prague.

OLLIER, C. (1981): Tectonics and Landforms. Longmans Group Limited, Burndt, Mill, Harlow, Essex, UK.

PÁLENSKÝ, P. et al. (1997): Geological map of ČR, 1:50 000, Sheet Ivančice 24-34, Český geologický ústav, Prague.

PELÍŠEK, J. (1940): Studie über dilluviale Böden (in Lössen) und dilluviales Klima im Gebiet des Schwarza-Tales in Mähren. Práce Moravské přírodovědné společnosti XII, Brno. (in Czech, German summary).

PELÍŠEK, J. (1949): A Contribution to the Stratigraphy of Loess in the Svratka River Valley (Czechoslovakia). Práce Moravskoslezské akademie věd přírodních XXI, Brno. (in Czech, English summary).

PELÍŠEK, J. (1971-72): Pedogenetische Charakteristik der Fossilböden in der Lössschichtfolge bei Modřice südlich Brno (Tschechoslowakei). Časopis Moravského musea 56-57, p. 111-126, Brno.

PELÍŠEK, J. (1982): Lösse und fossile Böden des Brünner Beckens. Studia geographica 80, p. 96-106, Brno. (in Czech, German summary).

SEITL, L. (1983): News Exposures Pliocene and Pleistocene Sediments Brno Surroundings. Časopis Moravského musea 68, p. 85-100, Brno. (in Czech, English summary).

SMOLÍKOVÁ, L. (1968): Genese der jungpleistozänen Fossilböden von Modřice bei Brno auf Grund mikromorphologischen Untersuchungen. Časopis pro mineralogii a geologii 13, p. 199-209, Prague. (in Czech, German summary).

SMOLÍKOVÁ, L. (1996): Paleopedology of the Section Brno-Pisárky. Geologické výzkumy na Moravě a ve Slezsku III, p. 32-33, Brno. (in Czech).

SÝKORA, L. (1961): Report to Survey of Quaternary in Region Modřice and Chrlice. Zprávy o geologických výzkumech, p. 253-256, Prague. (in Czech).

VALOCH, K. (1977): Neue alt- und mittelpaläolitische Funde der Umgebung von Brno. Sborník geologických věd, Antropozoikum 11, p. 93-112, Prague.

VALOCH, K. (1982): Das Paläolithikum des Brünner Beckens. Studia geographica 80, p. 213-228, Brno. (in Czech, German summary).

VALOCH, K. (1992): Contribution to the Stratigraphy of the Upper Pleisticene in Moravia. Scripta (Geology 22), p. 77-80, Masaryk University Brno.

VALOCH, K. (1996): Das Mittelwürm in den Lössen Südmährens und seine paläolithischen Kulturen. Eiszeitalter und Gegenwart 46, p. 54-64, Hannover.

VALOCH, K. et al. (1976): Die altsteinzeitliche Fundstelle in Brno-Bohunice. Studie Archeologického ústavu československé akademie věd IV, 1, Brno.

VALOCH, K. et al. (1985): Das Frühaurignacien von Vedrovice II und Kupařovice I in Südmähren. Sborník geologických věd, Antropozoikum 16, p. 107-203, Prague.

ZAPLETAL, K. (1927): Geologie und Petrographie der Brünner Umbebung. Časopis Moravského zemského musea 25, p. 67-111, Brno. (in Czech, German summary).

ZÁRUBA, Q. (1942): Length-profile through the Vltava River Terraces between Kamýk and Veltrusy. Rozpravy české akademie 59, No. 9, Prague. (in Czech).

ZEMAN, A. (1982): Fluviale und fluviolakustrinne Ablagerungen des Brünner Beckens. Studia geographica 80, p. 55-84, Brno. (in Czech, German summary).

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JEMNICE: THE ROLE OF A SMALL TOWN IN THE PRESENT STAGE OF TRANSFORMATION

Antonín VAISHAR - Jana ZAPLETALOVÁ

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Abstract

The paper deals with problems of Jemnice (4 350 inhabitants) in the present stage of transformation of the economic and social system in the Czech Republic. A comparison advantage of Jemnice can be a relatively diversified economic base, a disadvantage then is the ever deepening remoteness from main centres as well as from important roads and an incompletely built up urban function. It rollows from the historical context and from the analysis of present population, housing, production, service, transport and recreational functions of the town that Jemnice does not have too bright prospects in terms of its greater development. It is rather to preserve historical and natural values of the town and its surroundings, to generate prerequisites for jobs, attendance to town inhabitants and setting, and to improve the town image for visitors. With no redistribution of mechanisms that would bring development stimuli from central resources the major wealth of the town are its inhabitants.

Shrnutí

Příspěvek se zabývá problémy města Jemnice (4 350 obyvatel) v současné etapě transformace ekonomického a sociálního systému České republiky. Srovnávací výhodou Jemnice může být poměrně diverzifikovaná ekonomická základna, nevýhodou naopak prohlubující se odlehlost od hlavních center a důležitých komunikací a neúplně vybudovaná městská funkce. Z historického kontextu a z analýzy současné populační, bytové, výrobní, obslužné, dopravní a rekreační funkce města vyplývá, že Jemnice nemá příliš velké předpoklady pro větší rozvoj. Jde spíše o to, aby byly uchovány historické a přírodní hodnoty tohoto města a jeho okolí, aby byly vytvořeny předpoklady pro zajištění pracovních příležitostí a obslužnosti pro obyvatele města a jeho zázemí, a aby se zlepšovala jeho image ve vztahu k návštěvníkům. Bez přerozdělovacích mechanismů, které by přinesly rozvojové impulsy z ústředních zdrojů jsou hlavním bohatstvím města jeho obyvatelé.

Key words: Czech Republic, small town, transformation, prosperity possibilities

1. Introduction

Small towns represent a very important part of the settlement system in the Czech Republic. They provide the contact with the urban environment for a considerable part of the countryside, particularly its peripheries, thus enabling to them access to urban ingenious contrivances such as services, jobs outside the rural sphere, social contacts, information and innovations for the rural population.

The small towns are a backbone of the Czech settlement system since historical times. In the Middle Ages, small towns were founded and built to political and power concerns of monarchs and nobility. In the period of industrialization, market principles made their way at the localization of various activities into the towns. These principles suffered a general breakage in the period of centrally planned economy when new manufacturing facilities, infrastructure and housing facilities were localized into settlement centres, i.e. also into the small towns, on the basis of the then political and social needs. From the historical point of view, the period was rather short. However, its importance for today's situation is great. Towns with a relatively developed and diversified production base and infrastructure from the

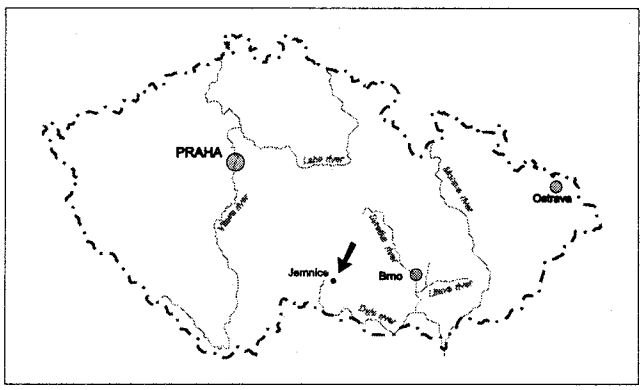

Fig. 1 The map of the Czech Republic (with the arrow pointed to the area under study)

pre-Socialist era were suddenly having an advantage while in towns in which a considerable part of manufacturing and housing facilities came into existence at the time of so called industrialization threaten with potential structural problems in the course of economic transformation.

At the present time, the enterprises and other activities established in the small towns during the Socialist period pass a check of their compatibility with the principles of market economy. We do not claim that all activities established in the small towns in the Socialist period are a potential problem. In many a case the localization was a success even from the present points of view. On the other hand, some problems may come to the surface in the cases of monostructural production base or at the localization of manufacturing activities that are not given corresponding conditions in terms of market principles, or in the case of generally incompetitive industries or trades under the given economic conditions.

The localization of companies in the Socialist period was related to the concentration of housing facilities a great deal of which were built as typical multi-storeyed panel blocks of flats. In fact, the small towns with a high percentage of activities established during the Socialist era can be told at the very first sight - by the increased numbers of multi-storeyed housing blocks. The concentration of jobs and population related also to the concentration of social infrastructure. The field of services was underestimated in the Socialist era, however (with the exception of some social services within the systems of education and health care).

The aim of our contribution is to analyze ways used by one of small towns in a highly peripheral region to cope with the present transformation situation and to find out what role can this small town play for its hinterland. The authors chose the town of Jemnice, situated near the Moravian-Bohemian borderland, as a town with the relatively continuous historical development.

2. A brief look in the history

Jemnice is situated on the Želetavka River. The town relief is rather varied the main square altitude being 450 m. The town is situated in the most remote corner of the Třebíč district, at a distance from other large towns. The Jemnice hinterland is not too big and includes the SW part of Třebíč district, overlapping with other districts of neighbouring seats - Moravské Budějovice and Dačice which also rank with the small towns but their gravitational power is higher than that of Jemnice.

Jemnice is one of the oldest Moravian fortified towns built around the original mining settlement at the place of today's neighbourhood of Podolí on the western bank of the river (Dostál et al., 1974). A cylindrical tower of the original Roman rotunda in the local cemetery is considered the oldest existing preserved structure in Moravia. A borderland castle used to stand on the opposite headland at the turn of the 11th and 12th centuries, in whose place a royal town was founded in 1227. The crossing of trade channels near the ford across the Želetavka River can be considered a localization factor as well as deposits of gold and silver discovered later.

Jemnice experienced the greatest boom under the rule of the Luxemburg kings when it enjoyed a whole range of privileges. The town's importance did not consist only in the mining of precious metals; it also became one of centres of royal power in the SW Moravia thanks to its favourable defence position. The bearer of culture was a Franciscan monastery founded in 1455 and deserted in 1558. The mining industry ceased to exist after the town was devastated by the Hungarians in 1468. The attention of town owners declined and new owners were taking turns quickly. During the Thirty Years' War

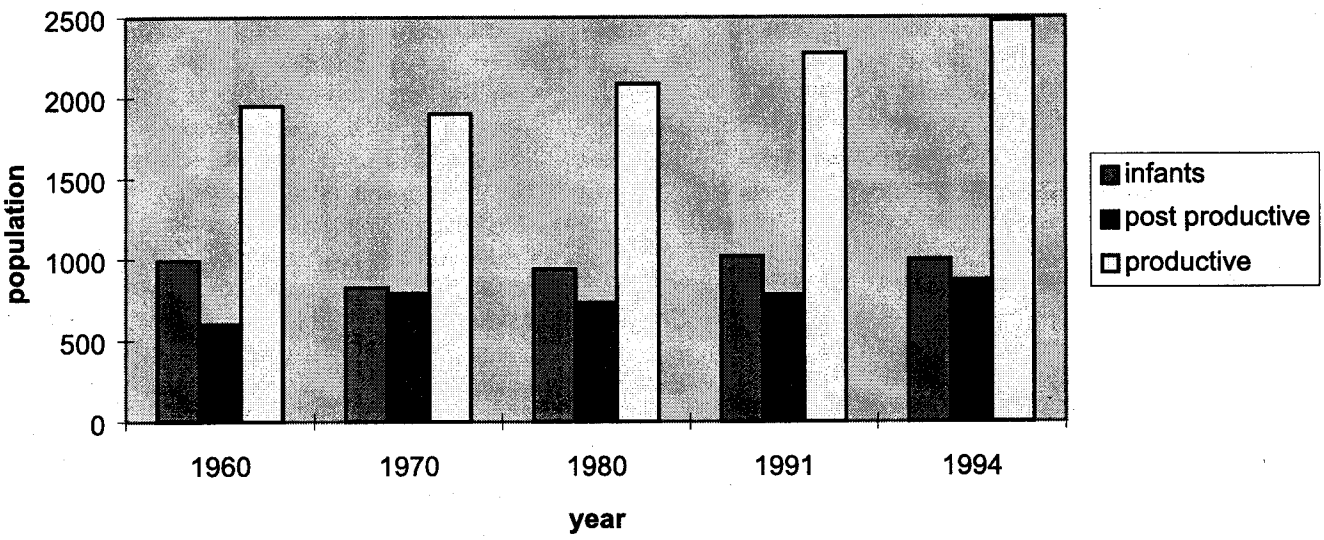

Fig. 2 Development of population age structure in Jemnice

the town was entirely devastated. The present town core came into existence after the fire in 1832.

Since times that can be documented by statistic data, Jemnice ranked with small Moravian towns. The period of 1670-1930 was analyzed by Láznička (1948). At that time, Jemnice was between position 80 and 90 in Moravia. In 1670, there were 127 houses in Jemnice, and their number was steadily decreasing to 74 in 1763. In the 70's of the 17th century, there were 35 settlers with fields and 22 tradesmen with houses in Jemnice. A hundred years later (in 1763), Jemnice had 99 burghers, 249 tradesmen, 30 peasants, 29 servants and 7 persons with non-productive professions such as clerks or churchmen.

Before the end of feudalism (1834), the Jemnice population included 1188 Christians and 304 Jews - altogether 381 households. Of these, 54 Christian households made their living by agriculture, 7 by trades, and 250 by the combination of both. All Jewish households made their living by trades and businesses. Podolí was the Jemnice suburb the size of which was nearly same as that of the town itself. It had 1118 inhabitants in 269 households of which 238 made their living by agriculture, 10 by trades and 17 by the combination of both. At that time, the suburb was of a genuine countryside character. The town population gradually increased to 2386 inhabitants in 1869, 2710 in 1880 and 3082 in 1910. This was the time when the population structure of nationalities (2907 Czechs, 159 Germans, 16 other) became to be of the specific importance.

The period of industrial revolution did not see any industrial enterprise of importance coming into existence and the construction of a railway from Moravské Budějovice in 1896 did not help too much either. The town kept its rural character before World War I as well as after the war. In the 20's of the 20th century, the town has a cooperative, a factory making farming machinery, whip-handles, paper goods, a coffee roasting plant, a distillery, a liqueur shop, a soda water plant, two mills, two steam sawmills, two brickworks, two cement works, a brewery (founded in 1800), a saving house, a trade-

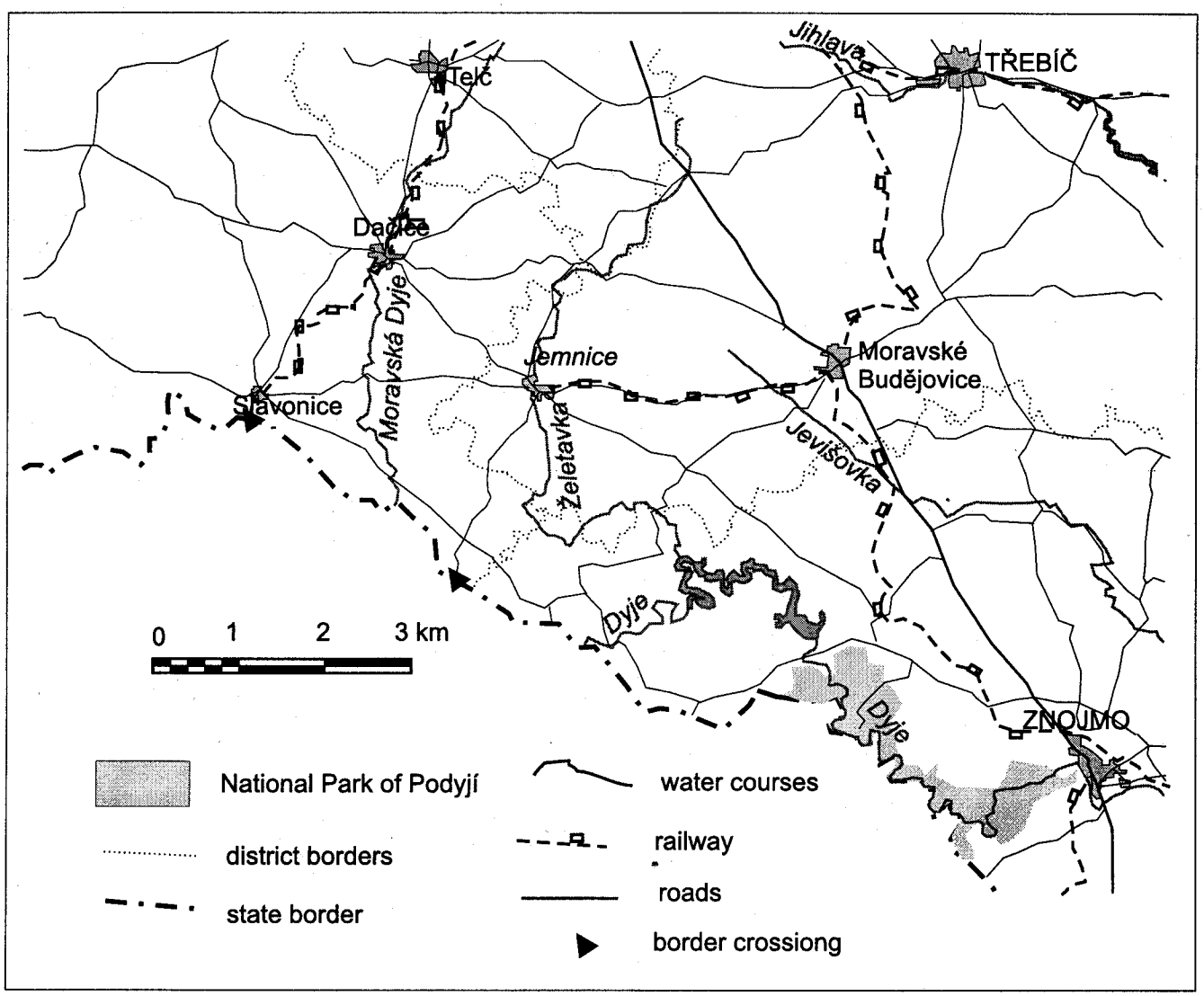

Fig. 3 The regional context of Jemnice

peasant small loan company, and an extension secondary polytechnical school (Kuča, 1997). The electrification of the town in 1926 and the location of a garrison in 1937 were considered certain economic stimuli.

A couple years after the War, in 1949, Jemnice lost its administrative function as a seat of the judicial district and became the most remote town in the Třebíč district. Several manufacturing facilities were established within the industrialization plan, linked up with the building of housing facilities.

The history of Jemnice is a history of the continuous solution of the objective disproportion between the remote location and the effort to build a fully functioning town as a centre of the region. We can say today that the significance of Jemnice declined after its major medieval localization factors had been exhausted: the defence function and gold extraction. Jemnice was too late to catch the growth in the period of industrial revolution and too late again to launch the development of services a century later. The loss of judicial function was just an administrative expression of the trend. At the present, the most important function of the town consists in the provision of jobs to the population of its setting, particularly in various industries. Yet, a considerable portion of agricultural activities in the economic structure of the town has been retained. In terms of services, Jemnice plays the function of a hierarchic by-stage between its rural setting and better equipped small towns of Dačice and Moravské Budějovice. The restoration of its cultural function is a subject of present efforts.

3. The demographic development and housing

In 1994, Jemnice had 4344 inhabitants of whom 23 %, 57 % and 20 % were of pre-productive, productive and post-productive age, respectively. The population balance for 1991-1995 indicates that 374 inhabitants were born and 290 died, which represents a natural gain of 84 inhabitants, i.e. 1.6 % of total population. The development differs from national figures, the reason being seen in the progressive age structure of the population. However, the balance of migration for the period is negative. There were 559 inhabitants leaving the town in this period of time, and only 521 inhabitants moving in, i.e. migration loss of 38 inhabitants. The total increase of population for the mentioned period of five years is 9 per mille. The future trend in Jemnice is expected to follow national trends: the population will gradually show slight ageing, newly born will be less, and both natural and total balance of migration will worsen.

In the 1991 census, the town of Jemnice (including Louka and Panenská) had 1438 flats in 936 houses. Of these, 918 flats (63.8 %) were in privately owned houses. The historical core of the town had 243 houses with 370 flats. The model of "Socialist housing" is represented by the town district "Za léčebnou". Between the wars, the house-building was concentrated particularly in the town district "U sokolovny". Podolí is an old suburban part of the town, more or less of a rural character. Mixed housing including new blocks of flats can be seen especially in the town district "Na větrném kopci". Other town districts fulfil mainly other functions and have only a negligible number of dwelling houses.

Urban district	Houses	Flats	In private houses
Historical core	243	370	67.6 %
U sokolovny	148	235	63.4 %
Za léčebnou	215	468	39.5 %
Na větrném kopci	100	163	60.7 %
Podolí	125	151	81.5 %

The town does not want to win a larger population. Its efforts are aimed at maintaining such a population structure that could be a guarantee to a sound functioning of its organism. A priority for this achievement in present conditions is the housing issue. Actual needs of flats grow the cause being seen in decreasing numbers of family dependents in an average household, which logically results in more flats with the same population. A very serious problem is also the loss of housing resources both due to technical reasons and due to changing flats into offices, shops and the like. Sales of communal flats helped the town to get rid of a heavy financial load normally connected with the expensive maintenance of municipal housing resources. On the other hand, the concern of new house and flat owners in the condition of their facilities was increased by this way. A problem may appear in the future with the conserved present situation: the inhabitants will age together with their flats and houses, the released flats then often becoming a subject of speculative leasing.

Within a reorganization plan, the town council of Jemnice took over 330 flats from the former House Management Enterprise, so called state flats. Of these, 140 were sold within the privatization schedule and 50 more are to be sold. The town plans to keep 140 so called municipal flats for service and social purposes. There are also 4 single-room flats for various emergencies that can be rented for max. 1 year. At the present, the realistic needs speak of some 30 flats. At the allocation of any released flat, the main criterion is the real need of the applicant. The number of uninhabited flats is very low and these flats can mostly be found in privately owned houses. The town council is not too inclined to the change of flats in private houses into recreational cottages (summer houses).

At the present economic situation with the house building nearly paralyzed the town attempts at rivate house building at least by taking its share in land investments. In addition, it is also prepared to preserve certain municipal housing resources. The need is especially ur-

gent before a realistic market with flats comes into existence in the Czech Republic. And even then, there will always be social needs of the town and of its inhabitants.

4. Transformation of economy

The economic structure of Jemnice at the end of the Socialist era was as follows: Agricultural Cooperative Jemnice, established in 1958 and gradually fused with cooperatives neighbouring seats had some 2.5 thous. hectares of agricultural lands and more than 250 workers. Industrial companies such as Motorpal Jihlava (formerly Czechoslovak National Automobile Repair Shops), the clothing company Otavan Třeboň (formerly Slavona Slavonice and originally Pánek Carpet Factory), the manufacturing cooperative Stavba (construction works) and the packaging works Balírny obchodu had nearly 400, 240, 230, 50 to 70 employees, respectively. Cancelled businesses gave rise to Communal Services of the Town of Jemnice in 1960. Apart from the garrison there was also a frontier guard regiment in the town. Schools and the educational system in general were losing importance. At the last census in 1991, which in fact reflected the situation at the end of the Socialist economic structure, the town of Jemnice (within

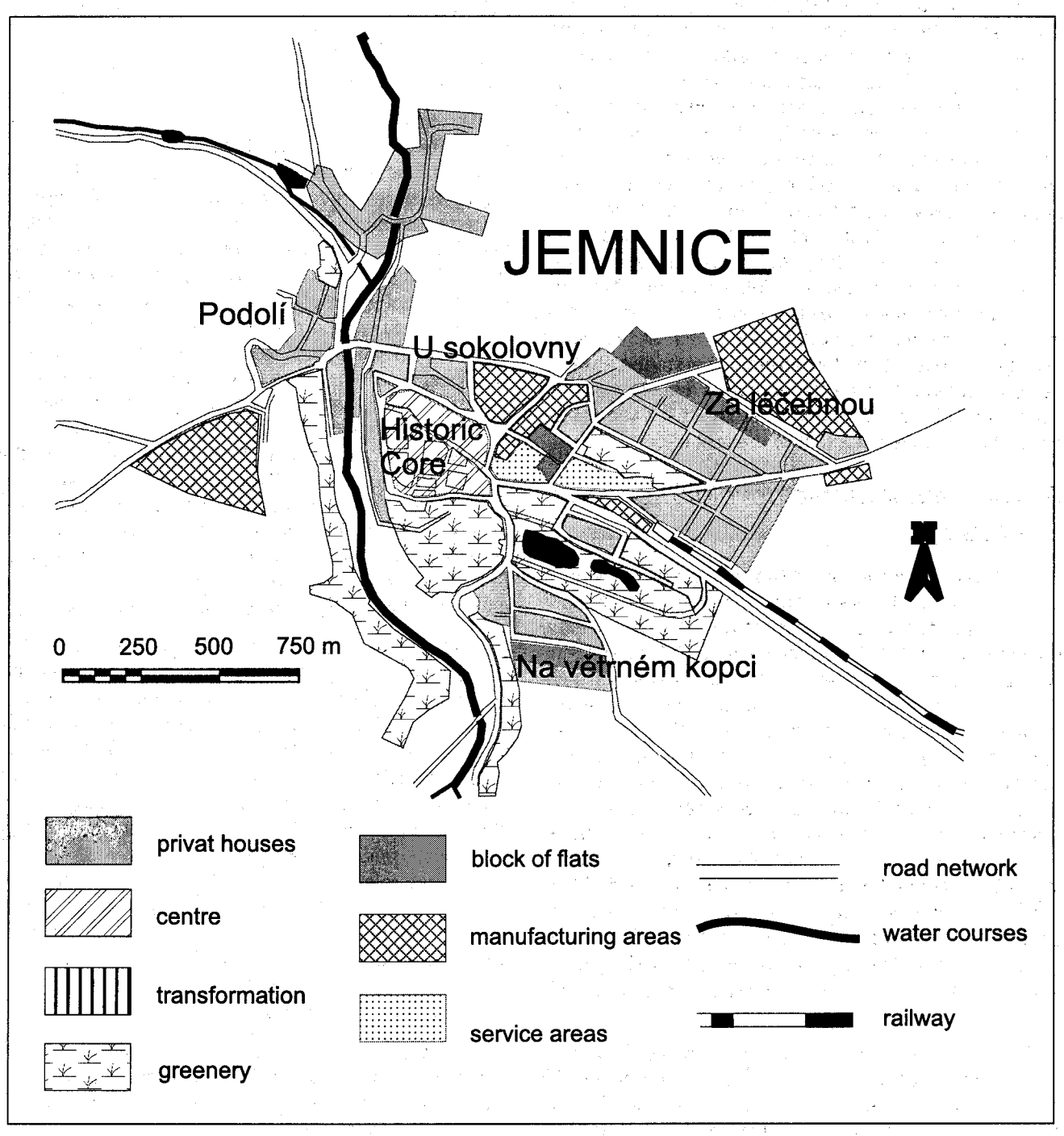

Fig. 4 The area-functional structure of Jemnice

its today's limits, i.e. including Louka and Panenská) had 2680 economically active inhabitants of whom 630 (23.5 %) worked in agriculture, forestry and water management, and 907 (33.8 %) in industries. The remaining 42.7 % were employed in services. In the end of the Socialist era, Jemnice can be characterized as a centre of a importance for its setting, with a relatively high percentage of agricultural population and a not too strong industrial base.

At the present, the Agricultural Cooperative of Jemnice is in the process of liquidation. The former management privatized a great deal of assets and founded ZEOPS Company Limited. The number of independent peasants does reach twenty with their arable lands ranging between 15 and 20 hectares. This means that the management of these properties is most probably below the minimum tolerable efficiency. It is deduced therefore that the majority of these independent farmers work to satisfy their own consumption.

The most important industrial companies in Jemnice were transformed into corporations by means of coupon privatization. These were particularly subsidiaries of MOTORPAL Jihlava a. s. (engineering) and OTAVAN Třeboň, a. s. (clothing). The most popular company in Jemnice are tea packaging works JEMČA, a. s. (formerly Balírny obchodu Jihlava). The manufacturing cooperative STAVBA was transformed into an owner cooperative. A new electrotechnical company EGSTON, s.r.o. is a company with foreign capital (Austrian), which employes approximately 200 persons. Other establishments worth mentioning are the mechanization centre of Czech Forests Velké Meziříčí, the timber processing company TARO located in the urban part of Podolí, and several small private companies with up to ten employees, for example in building industry.

There are 550 private entrepreneurs-natural persons registered in Jemnice of whom the major part (47 %) is involved in trading, artisan trades (38 %), and services (10 %). The number of entrepreneurs amounts to 25.6 % of economically active persons. However, quantitative data on their results and success of their businesses are missing. It is obvious that the entire sphere of trade and services depends on the small entrepreneurs. The number of small and medium-size businesses changes continually. At the end of 1997, there were 26 retail facilities, 6 companies providing services to motorists, 8 workshops with locksmith's, plumber's trades and electrical installations, 7 wood-processing shops (traditional in the region), 6 restaurants, 5 repair shops of different kinds, and 3 companies providing construction services.

5. Technical infrastructure

Technical infrastructure of a corresponding standard was a subject of attention for the town council in the recent period of time. The condition of local road network is relatively good; 3 mil. CZK were spent to its maintenance in 1996. It is important that the whole town will be connected to telephone shortly; a new digital telephone switchboard was put into operation last year. The improvement of telecommunication services can be considered one of basic conditions for the development of businesses and it will also enable the development of advanced information technologies.

The original municipal water supply system dates back to 1529 and was functional until recently. A remote water feeder from Štítary (the Vranov Dam Lake) was finished in 1997. Some 70 % of households are connected to the sewage disposal plant. The remaining housing facilities to be connected are to be found mainly in the right bank of the Podolí town district. Up to now, there are no funds to finish the town sewage system.

The households are heated by different systems: gas, electricity, solid fuels. Gasification of the town has been made to some 60 % and the last localities to be connected include the square and the town district of Podolí. A necessary pre-condition for connecting the whole town to gas is the completion of a medium-pressure gas distribution system. Solid communal waste is not being sorted up to now and is taken to the dump at Borek near Dačice by A.S.A. Dačice.

The technical infrastructure shows a considerable improvement at present, thus reflecting both the improved housing standard in Jemnice and the improved conditions for the development of enterprise. It is necessary to accomplish the sewage disposal and gas systems and to maintain the technical infrastructure in an appropriate technical condition. A problem to be resolved soon in the connexion with the new waste law (Law No. 125/97 in force since January 1, 1998) concerns the sorting of solid communal waste and related issues.

6. Social services

Social services include schools and health care institutions, social care facilities, cultural facilities and other activities of similar character. In terms of educational institutions, Jemnice has a kindergarten, a complete basic school with about 650 pupils and a gymnasium.

The first secondary school in Jemnice was established in 1907: the Czech Provincial Forestry School became a counter-balance to a similar German school located in Hranice na Moravě. After the constitution of Czechoslovakia in 1921, the school was moved from Jemnice to Hranice, fused with the local school, and instead, Jemnice was given a school for forest wardens that was originally in Beroun. This facility was transformed into a forestry polytechnical school in 1951 and later became a forestry apprentice centre which ceased to exist in 1970. After 1990, the town originally attempted at the establishment of an integrated secon-

dary school for entrepreneurs in agriculture but the idea appeared irrealistic. The local gymnasium does not have all classes and apparently due to this reason ranks with the smallest secondary schools in the district.

A question was raised some time ago by the town council whether the local gymnasium should not be closed in connexion with savings in the field of education. The information published in daily press such as PRÁVO, 8 January 1998 indicate that the issue of existence or non-existence of the gymnasium in Jemnice has been often reduced both by the public and by mass media to a possible future commutation of local students to a secondary school in another town. Yet, the existence of such a secondary school in a small town should be rather understood as a facility which contributes to the intellectual environment of the town, increases jobs for graduated persons and last but not least is one of bearers of the social life in the town. Another factor is an improvement of complex functions of Jemnice with regard to its setting.

Health services in Jemnice are ensured by a dislocated facility of Polyclinic in Moravské Budějovice. There are 8 physicians in the town, a pharmacy and a functioning first-aid service. Special examinations are provided by the Polyclinic in Moravské Budějovice and hospital care by the hospital in Třebíč. In addition to these health services which are provided to local inhabitants and people from the hinterland, Jemnice has a complete psychiatric department dislocated here from the district hospital in Třebíč. The department is one of much discussed facilities in the town since it is specialized in the treatment of drug addictions and local citizens fear that the use of drugs might infiltrate into the town.

Cultural and educational facilities in Jemnice include a House of Children and Youth, which partially compensates for a missing basic school of arts. The town inhabitants can make use of a cultural centre, municipal library and cinema. An old people's house with 24 flats and permanent nurse attendance as well as a children home can also be considered facilities providing social services.

The social services make a very important branch in small towns. As early as today they provide a significant percentage of relatively stable jobs including positions for people with the secondary education and university graduates, which not only helps to improve the situation on the labour market, but also the social structure of the town population. The needed capacities derive to a certain extent from the anticipated demographic development which suggests that the population will age in general. This would mean that the share of preproductive age population will be decreasing in comparison with the increasing number of retired people. At the same time, the present trends bring a fast deepening of social differences that will have to be compensated by social measures. It is to be expected therefore that the existing capacities of schools will have to be reduced and there will have to be -in contrast- greater needs of old people's facilities as well as of medical care facilities whose character will be permanent rather than intensive or that of classical social care.

7. Transport

Jemnice is situated off the major national highways and railways. Three roads of Class 2 cross in the town, which have further three extensions as roads of Class 3. These communications link Jemnice with neighbouring seats. The local railway connecting Jemnice with Moravské Budějovice has been existing since 1896. It should be pointed out that the technical condition of public roads in the Jemnice area is bad. And the situation with the local railway is very similar. Czech Railways Headquarters classify the railway line as non-profitable and this is why it is to be either cancelled or privatized. Two local entities are interested in the privatization of the railway line.

The frequency of motorcar traffic in Jemnice and its setting can be called a copy of national trends. This means that the road traffic becomes ever busier. However, the composition of traffic flow in Jemnice and its setting has been heavily changing to the benefit of passenger cars and light lorries of up to 3 tons carrying capacity, while the representation of heavy trucks and lorries has been decreasing similarly as that of coaches. This is considered to be the consequence of transformation processes in Czech economy after 1990 when economic subjects -especially in peripheral regions- show lower performance and some are even being closed. Another factor to condition changes in the composition of traffic flow is an ever worsening transport attendance of the area, which makes the inhabitants use their own means of transport not only to travel after services and culture, but very often also to commute for work, to visit a doctor or to do shopping. The problems deepen as the increased use of passenger cars results in losses of other means of public transport and hence in the pressure on their cancellation.

There are 16 bus lines attending Jemnice, of which only two can be considered regional or long-distance lines: Znojmo-Jemnice-Jindřichův Hradec-České Budějovice, and Dačice-Jemnice-Moravské Budějovice-Brno. The remaining bus lines ensure the connection between the rural setting and local seats of settlement, mainly with Jemnice, Moravské Budějovice and Dačice and the mutual connection of these centres.

The best traffic connection of Jemnice is that with Moravské Budějovice - a town some 20 km distant. There are 18 or 20 (the first figure being the number of lines from Jemnice to Moravské Budějovice, and the second figure in the opposite direction) lines on week days. Of these, 7 are railway line pairs. On Saturdays

and Sundays, the two centres have 9 or 8 line pairs. The second centre with a good traffic connection to Jemnice is Dačice (district of Jindřichův Hradec). There are 16 pairs of bus lines between Jemnice and Dačice on week days and 3 pairs on Saturdays and Sundays. One bus line to Jemnice is from Slavonice (4 pairs of lines on week days), and another line from Jihlava and Telč, passes Třešť and Jemnice to Bítov.

There are as many as nearly 50 pairs of bus and railway connections ensuring the passenger transport in Jemnice on working days. However, the situation differs on Saturdays, Sundays and holidays. The majority of bus lines are operated only on working days or on school days. On non-working days, the number of lines is limited to 11 pairs. On these days, you can travel from Jemnice to Dačice, Moravské Budějovice, Brno, Jihlava, Třešť, Telč, Bítov, Třebíč, as well as to centres on the route Znojmo-Jemnice-České Budějovice. Rural villages in the nearer and farther surroundings of Jemnice are practically out of reach by the means of public transport on these days.

Should the plans of Czech Railways be implemented, which essentially concern the cancellation of all railway lines on local tracks on working days and on Saturdays, Sundays and national holidays (this applying to the traffic connection between Jemnice and Moravské Budějovice) from the date of May 24, 1998 when a new time table comes in force, the town of Jemnice with four thousand inhabitants would only have 5 and 6 pairs of lines on Saturdays and Sundays, resp. This plan also includes proposals for a reduction of some train lines on working days. (A general reduction of 4% train connections is proposed on a national scale.) This solution would mean just a further confirmation of town remoteness with all possible consequences for its future.

8. The potential of Jemnice for tourism

Regarding its today's importance, Jemnice has an unusual number of construction monuments. Up to these days the town is circled with a double stone wall with four fortifications and two gates. In the town district Podolí we shall find the oldest church in Jemnice - the Church of James the Greater, whilst the main town church of St. Stanislaus dominates the town square. The St. Vitus's Church is situated on the northern edge of the town; the former hospital church of St. Elisabeth in Podolí was preserved but reconstructed into a flat. The original castle was rebuilt into a highly Baroque Mansion with a natural landscape type garden of 21 hectares. The mansion is under reconstruction at the present. A cemetery was preserved of one of the oldest

Fig. 5 Center of Jemnice: aerial view. Postcard

Jewish communities in Moravia, while the synagogue was taken down during World War II. A medieval water supply system leading to the town from the St. Vitus's Church is protected as a monument. North of the town, there is a tomb of the Pallavicini noble family. The town core is a rectangular market place, somewhat shifted to the West and not of exactly regular shape, skirted with houses built in the classical style. An oblique line of the northern square front is again directed by the course of an old road from South Bohemia to the Znojmo district. The blocks of houses between the square and the church clearly suggest an ortogonal foundation. The original suburbs were situated in the northern direction.

The above list indicates that the town of Jemnice has a number of historical monuments attractive even in the European context, which could be a good reason for tourists to visit these places. The size and location of the town are good pre-requisites for the creation of the pleasant atmosphere of the small town with no extreme stressing factors. Relatively close to Jemnice there are other very attractive small towns of the SW Moravia with historically valuable architecture such as Telč whose historical core was enlisted with UNESCO historical monument reserves, Dačice, Slavonice, Moravské Budějovice, Jaroměřice nad Rokytnou with a Baroque castle, a Baroque castle in Vranov nad Dyjí, the Bítov Castle, and the recreational area of the Vranov Dam Lake.

However, the potential is used very little. In spite of having three accommodation facilities (hotel, guesthouse and hostel), Jemnice cannot offer services which would correspond to at least a very bottom limit of European standard. The above mentioned towns still do not cooperate in order to offer their sights to tourists. Visits to places attractive in terms of their historical, cultural or natural values might well combine with the recreation at the Vranov Dam Lake. And at the present boom of cyclotourism, there are countless possibilities for marked tracks for cyclists with appropriate infrastructure. This might be one of ideas for the future province of Jihlava in the case that the mentioned attractive localities succeed in being included into one administration unit.

9. Town administration and federal life

Eight considerably distant neighbouring seats were annexed to Jemnice within the so called settlement concentration during the 70's and 80's. After 1990, the majority of them became independent again with the exception of two: Louka and Panenská. All mayors of newly separated municipalities consider the step as highly positive. Their standpoint is reasoned by the fact that although their budgets are very modest the decision-making is made by the municipality itself. Some of them admit, however, that the provision might be of a temporary character because after the revolution extempore the administration of Czech municipalities will necessarily be directed towards concentration once again.

After the neighbouring villages became independent, the situation of Jemnice seemingly improved. The newly independent municipalities are very small with very low own tax income and insufficient technical infrastructure (without sewage systems, sewage treatment plants, gas distribution system and at some places even with no public water supply system). Just to build this infrastructure is expensive and the town of Jemnice would not have funds enough for the investments. The administration of Louka and Panenská whose cadaster area does not even neighbour with that of Jemnice represents a certain economic problem for the town.

In fact, however, the fate of Jemnice is closely bound with the fate of its setting and vice versa. It is only logical that a kind of future integration is anticipated again. The question is whether the process of integration will respect the interests of the town as well as the interests of its setting. A possible basis for such an integration can be the fact that the Jemnice town council performs the function of a so called authorized bureau for 18 municipalities in the SW part of the Třebíč district. This means that it ensures technical services for them of professional standard such as the register of births, marriages and deaths and the surveyor's office with the small communities still enjoying their legal independence. Jemnice has also a branch office of revenue department and a subsidiary of Labour Exchange. This means that the town of Jemnice will most certainly keep some importance even in the new administration structure.

The position of Jemnice in the new administration structure of the Czech Republic remains a question for the nearest future. The town should be included in the future Jihlava county. However, should limits of the existing districts be retained, the town's position would again be very peripheral - on the dividing line of three counties. In our opinion, it would be logical to annex to the Jihlava county the Dačice area as well (from the county of České Budějovice) and the western part of Vranov area (from the Brno county). The integration of NW Moravia into a sole regional administration unit could very significantly contribute for example to the coordinated development of recreation and tourism. In the case that peripheral parts of Znojmo and Jindřichův Hradec districts can also be annexed to the future Jihlava county, the engagement of Jemnice as an administration centre could be even extended.

10. The area-functional structure and environment

The area-functional structure of Jemnice links up with the medieval location. The town district of Podolí on the right bank of the Želetavka River and on the above slope is an old seat formation. The town of Jemnice itself was founded on a headland on the other river bank.

Its groundplan was adapted to the shape of the headland groundplan which was fortified from the very beginning. Most exposed to danger was the SE edge of the town, which was protected by a castle built in the middle of the 13th century. The original town of Jemnice consisted most probably of a large and slightly irregular square and several short lanes leading to town gates. A considerable portion of the square was secondarily filled with a house block. The space between the town and the castle was later filled by a Jewish quarter (probably from 1336). It is unusual that it was as late as in the 2nd half of the 14th century that the town church of St. Stanislaus came into existence. The situation of the town and its fortifications did not long allow any extension of outskirts. In contrast, the town district of Podolí on the right bank with the hospital and church of St. Elisabeth enjoyed a long-term importance. The monastery with the St. Vitus's Church were built some 500 metres to the north-east of Jemnice.

After the defence and mining functions of Jemnice declined, the castle was rebuilt into a mansion in 1578 and complemented with a generous park and two lakes. The building of Jemnice was interrupted during the Thirty Years' War and again by a huge fire in 1832. The new-age development of Jemnice was not too expressive. At the turn of 19th and 20th centuries, the uniform sight of the town was disturbed by the construction of a school in the NW corner of the town core. It was particularly Podolí that showed signs of spatial development. Only in the 20's and 30's of the 20th century, the centre of gravity of construction works was shifted to advantageous areas eastwards of the centre, where a consistently ortogonal quarter of private houses grew up between the St. Vitus's Church and the mansion park, at the final station of railway from Moravské Budějovice. The rectangular built-up area was cut across by a road to Moravské Budějovice.

The building in this area continued also at the beginning of the second half of the 20th century when a small industrial zone came into existence eastwards of the St. Vitus's Church. This was the place on the edge of which a neighbourhood of panel blocks of flats were built during the Socialist era. At other places around the town and along the main traffic veins the house-building development was much lesser. The Podolí intravillan was just refurbished with a new agricultural production facility being built in the south-western direction, however. Except for the school building, the historical core was saved from insensitive interventions and is one of the most preserved ones in SW Moravia. In 1990, the historical town core was proclaimed a municipal historical monument reserve. The individual buildings have mainly Baroque and Renaissance (exceptionally medieval) cores. The facades originate from the 19th cen-

Fig. 6 Jemnice: St. Stanislas Church. Photo A. Vaishar

tury, and many of them became a subject of insensitive modernization in the 70's of this century. Some buildings of the Jewish quarter were also preserved. Yet, the synagogue was taken down in 1942.

One of the most pressing environmental problems in Jemnice is the passing traffic, especially the busy passage from Moravské Budějovice through the housing zone and along the centre circumference to Podolí where several other branches form leading to Slavonice, Dačice and Želetava. Important are also the issues of aur pollution, noise and the danger of meeting with pedestrians. The artery to Znojmo is less busy.

Yet another problem consists in the heating of a certain percentage of households with solid fuels, namely in Podolí which is situated in a basin. In this part of the town there are some additional problems with incompleted technical infrastructure facilities. These issues will most probably be resolved soon by a gradual shift to other fuels and by gradual complementation with technical networks. Separation and elimination of solid communal wastes is another topical problem which relates to the Waste Law in force since the beginning of 1998.

In contrast, the mansion park and lakes represent a very pleasant and quiet zone which is situated practically right in the town centre. After the mansion has been properly refurbished, the zone may become a very attractive and cultural environment with valuable natural elements and thus a very suitable counter-balance to the urbanized historical town core in order to form together an attractive atmosphere for both town inhabitants and visitors.

11. Conclusion

Similarly as many other towns, Jemnice finds itself at a certain crossing of its further development. The question is whether it can be adapted to the conditions of market economy. Its relatively diversified economic base can be a certain advantage. On the other hand, the ever persisting remoteness from the national centres as well as the insufficiently built urban functions can be serious disadvantages.

The whole history of Jemnice reflects the disadvantages of its remoteness and the interests of subjects which were to build the motivation, maintain and develop the town. Jemnice apparently does not have any pre-requisites for the development of greater extent in terms of inhabitants, jobs etc. Yet, the town should become a place where its inhabitants can make their decent living, a place that would be capable of satisfying the requirements of its inhabitants and visitors, and a place whose reputation in general awareness would be positive.

Starting with monarchs of the Luxemburg family, Jemnice experiences its greatest boom at times when the town was supported from the centre. Since the beginning of the 90's of this century, when the processes of funds re-distribution ceased in the Czech Republic, the town inhabitant are left to themselves. In the conditions of non-existing realistic regional policy it would be a fond hope to expect any support from central resources. The inhabitants of Jemnice are therefore the greatest wealth of the town and at the same time the factor on which the town future depends.

References

DOSTÁL, O. et al. (1974): Československá historická města. (Czechoslovak historical towns.) Orbis Prague, 565 pp.

KUČA, K. (1997): Města a městečka v Čechách, na Moravě a ve Slezsku. (Towns and small townships in Bohemia, Moravia and Silesia.) Volume II, Libri Prague, 938 pp.

LÁZNIČKA, Z. (1948): Moravská města. (Moravian towns.) Spisy odboru čes. společnosti zeměpisné, Brno. 151 pp.

NEKUDA, V. (1997): Moravskobudějovicko. Jemnicko. (The district of Moravské Budějovice. The district of Jemnice.) Vlastivěda moravská. Muzejní a vlastivědná společnost Brno. 863 pp.

VAISHAR, A. - KOUTNÝ, R. - MIKULÍK, O. - NOVÁČEK, V. - ZAPLETALOVÁ, J. (1997): The Courses of Transformation in Marginal Rural Regions: The Basin of Middle Dyje River. A Case Study. In: Rural Geography and Environment, eds. J. MUNZAR - A. VAISHAR, p. 135-143. REGIOGRAPH Brno.

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SLOPE MOVEMENTS IN THE FLYSCH CARPATHIANS OF EASTERN MORAVIA (VSETÍN DISTRICT), TRIGGERED BY EXTREME RAINFALLS IN 1997

Karel KIRCHNER - Oldřich KREJČÍ

Abstract

The paper deals with slope movements triggered by extreme rainfalls in July 1997. Authors concentrated on slope failures in the district of Vsetín, eastern Moravia, in area belonging to the System of Outer Western Carpathians. The Vsetín district was one of most affected by the slope movements with so far records on more than 250 localities of activated slope failures. As to the character of slope movements, landslides seem prevailing, together with mudflows and rockfalls. The slope failures disturbed the landscape infrastructure to a considerable extent and both stabilisation and reclamation of landslide areas are going to be a matter of long-term solutions. The hitherto investigations brought new knowledge which also made it possible to take a novel view of the studied area geological structure and geomorphological development of slope relief forms.

Shrnutí

Příspěvek se zabývá svahovými pohyby, které byly aktivizovány extrémními srážkami v červenci 1997. Podává charakteristiku svahových deformací v okrese Vsetín na východní Moravě ve Vnějších Západních Karpatech. Okres Vsetín byl nejvíce postižen svahovými pohyby a doposud bylo evidováno více než 250 lokalit aktivovaných svahových pohybů. V rámci svahových pohybů nejvýrazněji působí sesouvání, méně stékání a skalní řícení. Svahové deformace výrazným způsobem narušily infrastrukturu krajiny; stabilizace a sanace sesuvných území bude dlouhodobá záležitost. Doposud provedené průzkumy přinesly nové poznatky umožňující i nový pohled na geologickou stavbu zájmové oblasti a geomorfologický vývoj svahových tvarů reliéfu.

Key words: present slope movements, landslides, Outer Western Carpathians, Vsetín District, Czech Republic

1. Introduction

The slope movements belong to ones of the present modelling processes in our conditions, which transform the relief with the great intensity. The slope movements result in a whole spectrum of slope failures as depending on the type of the movement (details see e.g. Nemčok - Pašek - Rybář, 1974; Nemčok, 1982; Dikau - Brunsden - Schrott - Ibsen eds. 1996; Rybář - Stemberk - Suchý, 1997). Landsliding is one of the most frequently occurring and pronounced slope movement. Activation of these gravitational movements is caused by geological and climatic conditions, relief morphology and human activities. In our conditions, the land slides arise under characteristic meteorological situations such as heavy rains, intensive snow thaw, etc. Any time prediction of these situations is rather complex, and this is why the extent and intensity of slope movements are being realized as late as at their occurrence and development of slope movements which can entirely change the relief, give rise to new landscape forms and result in considerable damages in the landscape infrastructure.

The severe rainfalls in northern and central Moravia and eastern Bohemia in July 1997, triggered slope movements recorded particularly in the flysch rocks of northern and eastern Moravia. Based on the order and in the close co-operation with Departments of environment and regional development at the District Council

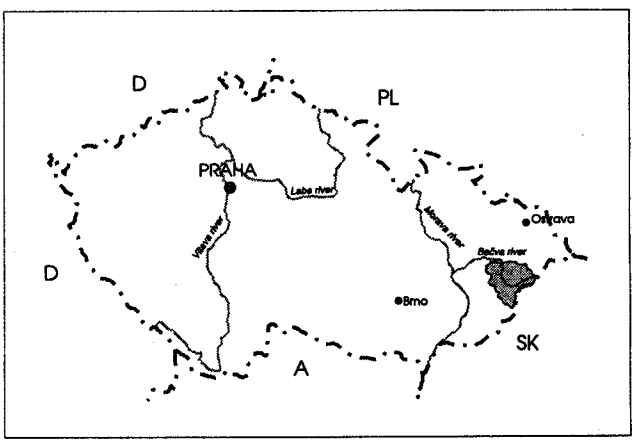

Fig. 1 Position of the Vsetín District in the Czech Republic

of Vsetín we focused our geomorphological and geological investigations on this East Moravian district in which the slope movements began to develop to such an extent that peoples lives and properties were considerably jeopardised. It is possible to state that the district of Vsetín was the one most affected by slope movements. In this area, the rainfall values in the period from 5 to 8 July were extremely high. A less severe rainfall situation occurred between 18 and 20 July. For example, 380 mm and 388.5 mm were gauged respectively in the town of Valašské Meziříčí and in Rožnov pod Radhoštěm during the first four critical days. These values are as much as four times higher than the total value for July. The total July precipitation in the Valašské Meziříčí station were 497.6 mm (70 % of long-term annual average) and 549.6 mm in Rožnov pod Radhoštěm (60 % of long-term annual average). More details about the rainfall situation can be found in papers of Květoň - Srněnský - Veselý (1997), basic information about the floods was published in this journal by Munzar - Ondráček - Táborská (1997). The presented paper will discuss the history and the present situation of slope movements research in the Vsetín district, describing the most distinguished examples of activated slope failures types and proposals of further solution.

2. The history of research of slope movements in the studied area

The numerous slope movements and their activation by heavy rainfalls have been known since times immemorial. In the past centuries, extreme precipitation resulted in huge slope movements with extensive losses on properties and human lives. A survey of the events in the territory of the Czech Republic can be

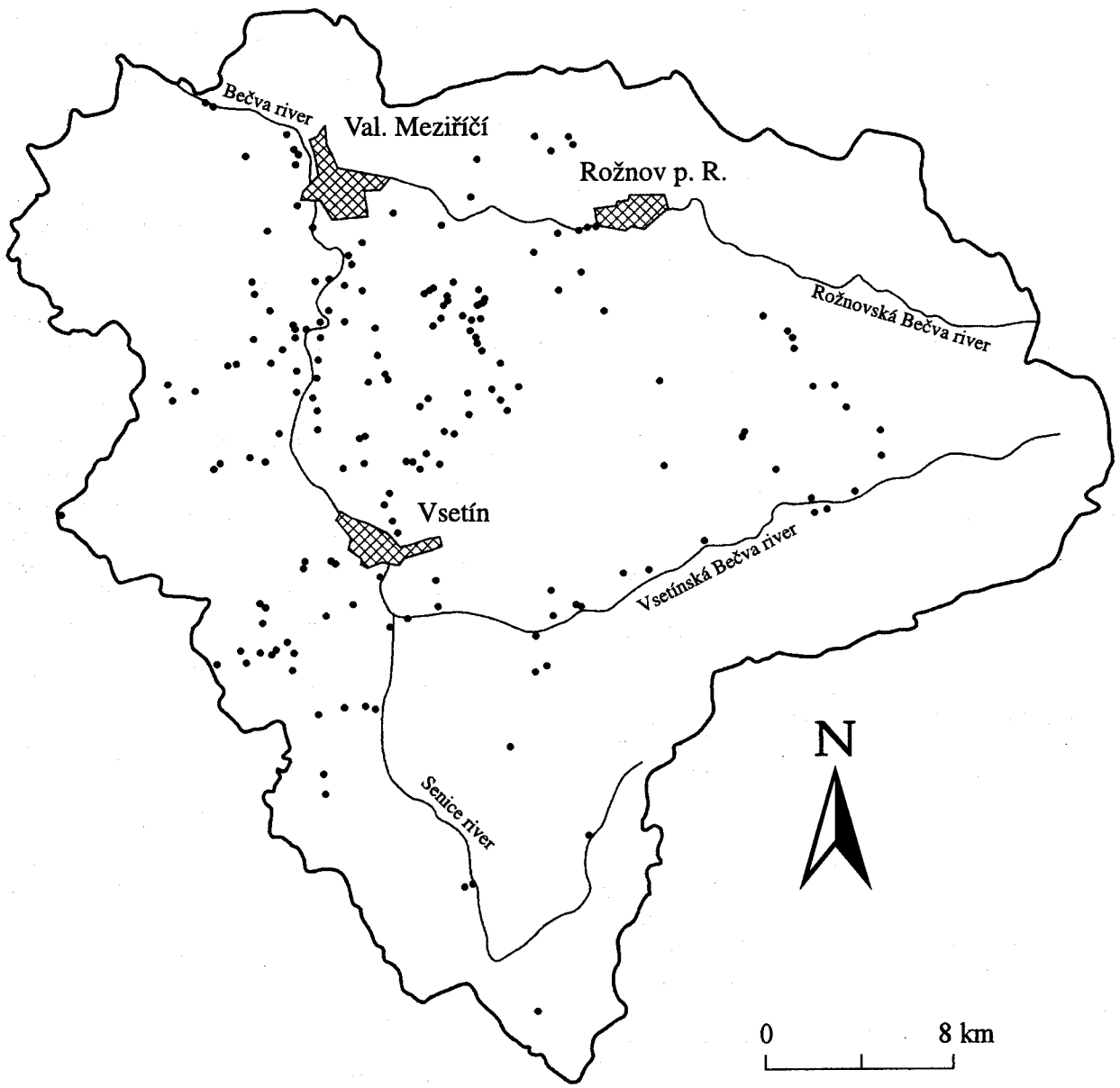

Fig. 2 Distribution of slope deformations in the Vsetín District

found for example in a historical catalogue of land slide phenomena was given by Špůrek et al. (1972) and in the paper by Rybář et al. (1997). It is a matter of course that the historically well documented landslide disasters are known particularly from permanently and densely inhabited areas such as Prague and its surroundings, western and northern Bohemia.

The area of Vsetín district as well as that of the entire flysch Carpathians was situated a bit aside of the densely populated areas and starting industrial activities such as railway building, which would call for a certain territorial survey. The first scientifically documented landslide in the Vsetín district, which occurred in Hošťálková in 1919, was recorded by Záruba (1922-23). It was a large-scale slide of slope talus of the Soláň Layers of 750 m in length and 200 to 350 m in width. The rate of slide movement - recorded by eye witnesses - was 710 m per hour. The land slide destroyed 6 farmer houses and a small lake came into existence at a point where the landslide front blocked the local brook.

Other slope movement localities in the Vsetín district include Lidečko (Burkhardt - Plička, 1967) and Oznice (Burkhardt - Liškutínová - Plička, 1972). In the first case, the extensive area (300 x 200 m) with blocks of sandstone of the Luhačovice Layers is situated to the north of the Hill Kopec in the very central part of the Vizovická vrchovina (Highland). It is a deeply founded block slide with occurring pseudokarst phenomena, particularly fissure caves. The landslide near the village of Oznice in the Hostýnské vrchy (Hills) occurred in the Újezd Layers of the Zlín Group of layers in 1967 and was controlled by the geological structure. Its length was 450 m and width up to 200 m. An eye witness - inhabitant of the village Na pasekách - who found himself on the landslide body at the most critical time claims that the rate of slide movement was reaching the pace of normal walking. The landslide arised on a brachysynclinal closure of bedding planes of the Újezd Layers.

Actual danger from the slope movements in the Moravian Flysch Carpathians was recognised in the course of extensive building of water dams. The constructions of water reservoirs called for a geological research of unusual extent. This applies mainly to the dam on the Stanovnice Brook (a tributary of Vsetínská Bečva River from the Javorníky Mts.) at the village of Karolinka, and to the Šance Dam on the Ostravice River in the Moravian-Silesian Beskidy Mts. (the Frýdek-Místek District). The geophysical research and borings in the landslide area above glassworks at Karolinka where water infiltration from the Stanovnice Water Reservoir might be expected revealed an absolutely exceptional depth of the slope movements. Three huge blocks were find out and the landslide shear plane is situated deep in the bedrock, reaching up to 70 m deep in the frontal part of the landslide (e.g. Woznica, 1977; Woznica in Bláha, 1993). The landslide originated in the Vsetín Layers of the Zlín Group of layers and is controlled by layer bedding corresponding to the slope gradient. Another extensive research was made in the flooding area of the Šance Dam with several great landslides, especially in the bay on the right side - Řečice Locality (Bůžková - Müller - Novosad, 1969; Fekeč - Mahút - Novosad, 1970). The slides in both localities were reclaimed at considerable money costs. In the case of Karolinka, the extreme rainfalls of July 1997 resulted in a considerable increase of water table in the observation wells, any slope movements were not activated, however. In the Řečice Locality - water reservoir Šance only a low landslide activation occurred in spite of the fact that some of the slides are permanently exposed to water from the reservoir. These examples provide a good evidence of existing efficient reclaiming measures which are capable to resist to natural hazards of large extent. Nevertheless, the measures are very expensive and can be applied only in localities with the highest general jeopardy.

The basic registration of slope failures was made in the whole territory of the country in the period between 1956-1962. The list which is being permanently updated is a part of the Slope Failures Register in Geofond Prague. A number of landslides occurring in the Vsetín district were recorded at the detailed geological mapping and plotted on map scales 1:25,000 and 1:50,000 (e.g. Pesl 1990, 1991; Stráník, 1996). Complex geomorphological research of landslides was carried out only in smaller areas. For example, Obdržálková (1992) made an assessment of the distribution of 94 landslides in the Hostýnské vrchy (Hills) founding out that the total landslide area in the range of hills was 3.17 square km, i.e. 1.1 % of its area. According to Obdržálková, the main cause to the landslides were precipitation greater than 55 mm per 24 hours and the side erosion of water courses. The most endangered are slopes of SE and E orientation. The majority of slope failures in the given area were processed in more general surveys on relief development and slope processes in flysch areas (e.g. Czudek, 1997; Hrádek - Kolejka - Švehlík, 1995; Záruba - Mencl, 1969).

At studying geology and geomorphology of distinguished natural localities in the Vsetín district in 1995-1997 authors focused on investigation of gravitational movements as related to the development of pseudokarst phenomena. Sizeable slope failures - mostly of block displacement type - (according to Rybář - Stemberk - Suchý 1997) originate by deep - seated creep and affect top areas of the Hostýnské vrchy (Hills), Vsetínské vrchy (Hills), Javorníky Mts. and Vizovická vrchovina (Highland). Let us mention only the most interesting localities: In the Vsetínské vrchy (Hills), the slope failures concentrate in the belt of Beloveža Group of layers with the most significant localities being Jezerné (near the village of Velké Karlovice), Kobylská (Karolinka), and area of Vaculov-Sedlo to the north of Vsetín. At the Locality of Jezerné, extensive slope

movements resulted in blocking a local brook and a lake came into existence at the point of sealing the natural dike. In the Locality of Kobylská, the slope movements affect both the mountain ridge and the valley slopes. Fissure caves and pseudodolines originated between partial rock blocks. The area of Vaculov-Sedlo represents the most extensive area with slope movements in the Vsetín district, total length of the landslide area along the Bystřička Brook from the village of Bošová up to the top of Hill Ptáčnice being 4 000 m and the max. width of the area over 1 200 m. In July 1997, nearly the whole area got activated to different intensities. The most important locality of the Javorníky Mts. is Hill Hradisko near Pulčín. The territory is structurally controlled (the anticline of sandstone of the Luhačovice Layers of the Magura Flysch Nappe) with numerous forms of frost weathering. There is a big rock town here with rock pillars, fissure caves, and a huge landslide of sandstone blocks 500 m in length and 250 m in width. The height of the overhanging rock wall that forms a shear plane amounts to 17-18 m. The rock wall consists of a single board of sandstone (Kirchner - Krejčí - Roupec, 1996) and was only consequently remodelled by cryogenic Pleistocene processes to acquire the character of a frost-riven cliff at the present. It means that this is an old Pleistocene landslide. The authors assume that a number of other rock walls of frost-riven cliffs originated as shear planes of extensive rock slides. No pronounced changes were observed in slope failures situated at top position after the extreme rainfalls in July 1997.

3. Slope movements activated in the studied area in July 1997

The Vsetín District is characterised by mountain and highland relief of mainly erosion and structurally - denudation nature on the Mesozoic and Tertiary complexes of flysch rocks which belong to mountain ridges of the Outer Western Carpathians (Czudek ed., 1972). In geological terms, the southern and central parts of the district belong in the Magura Flysch Belt (the White Carpathians Mts., the Vizovická vrchovina (Highland), the Javorníky Mts., the Hostýnské vrchy (Hills), the Vsetínské vrchy (Hills). The northern part of the district consist of the Outer Flysch Belt (the Moravian-Silesian Beskidy Mts., the Podbeskydská pahorkatina (Hilly land). The flysch complexes are formed by alternating layers of claystones and sandstones. These kinds of rocks are little permeable, which means that their surface zone gets water saturated quickly. The layer bedding and tectonic fracturing also cause formation of shear zones controlling slope movements. Other suitable materials for gravitational movements are loamy-stone, loamy-clay and loamy-sand sediments as well as thick unconsolidated residual mantles of weathered

Fig. 3 Accumulation part of the large debris flow in the woody area of Brodská near Karolinka village

flysch rocks. The extreme precipitations in July 1997 resulted in both new slope failures and the activation of slope movements of earlier origin. Many localities exhibited landslides of enormous destruction force, groundflows being less frequent (rockflows or mudflows), and rockfalls sporadic.

Various research organisations registered altogether over 250 localities with developing slope failures in the Vsetín District. A great number of landslides which are often quite extensive occurred in the cadastral areas of villages: Mikulůvka, Růžďka, Malá Bystřice, Bystřička, Velká Lhota as well as in the cadasters of towns of Vsetín and Valašské Meziříčí. All slope movement localities have not been recorded yet and their number is supposed to be higher. For example, Rybář et al. (1997) found a total of 120 landslides between the southern limits of town of Valašské Meziříčí and the confluence of Vsetínská Bečva R. and Bystřička R. during geological mapping on a scale of 1:10,000, of which 60 % were newly activated. The landslide areas in the Vsetín District being gradually registered in the future can be estimated to be more than 500.

In the majority of cases, the slope movements were activated as early as on Monday, 7 July 1997. Our research confirming that the fastest slides occurred between 7-8 July. Less intensive movements occurred due to increased rainfalls in the period between 18-20 of July. The movements on extensive landslide areas were recorded until the Autumn 1997. The slope movements (mainly landslides) in some areas considerably damaged the landscape infrastructure. At some places, the landslides endangered and damaged peoples' homes, particularly so in the villages of Mikulůvka, Růžďka, individual weekend houses and entire recreational areas, highways and roads, local railway, the Bystřička Water Reservoir, local sources of drinking water, telephone cables, electrical supplies, high pressure gas line, forest stands, gardens, orchards and pastures. The mudflows occurred in many a case within the lower accumulation parts of landslides as a consequence of water oversaturation of clay-loam grounds (destruction affects identical to those at landslides). The rock fall put into jeopardy a children camp and recreational facilities (Kirchner - Krejčí, 1997).

Let us mention examples of slope failures that were typical and at the same time the most extensive in the Vsetín District. Rockfalls are considered very dangerous and fast slope movements. One of the cases occurred in the right lower part of the slope below the Bystřička Dam. Several sandstone blocks were released in a steep rocky section of the slope along fissures from the weathered and thin conglomerate layer, the largest 3 boulders reaching the size of 5x3 m. As early as on Sunday, 6 July 1997, a smaller sandstone

Fig. 4 Escarpment part of the large debris flow to the railway near Bystřička village. The land slide is structurally determined (a syncline). Both photos: O. Krejčí

boulder of 270x150 cm got loose due to heavy rainfalls and fell down to the valley bottom right onto a children holiday camp. According to eye witnesses the boulder was falling along the steep slope at a rate of 10-15 sec. As there was a further risk of other blocks falling, the camp was closed. There is also a recreational summer house within the reach of rockfall and it is therefore necessary to quickly stabilise the loose blocks as well as the root area.

Landslides occur in the absolute majority of the registered localities in the studied area. Due to oversaturating, mudflows and groundflows originated in lower parts of landslides. A partial type of landslides was possible to determine in smaller localities. While in larger localities the landslide types are complex with shear planes being of different shapes and occurring in different depths. We can therefore speak of the landslide area; other data on landslide types are going to be precised in detailed geological and geophysical investigations. We can often meet with large slides of slope sediments in river and brook cut-banks. The movement begins as a bank breakage and continues by either sliding or mudflow. If the movement goes along an already existing shear-plane such as the clayey layer of floodplain loams, the displacements are defined by Záruba and Mencl (1969) as bank slides. A number of these slope failures occurred on smaller water courses in the town of Valašské Meziříčí - Locality Křivé and on the Mšadlý Brook on the village of Horní Bečva. The most extensive landslide area which is partially affected by lateral fluvial erosion can be found eastwards of the village of Zubří on the steep leftbank slope of the Rožnovská Bečva River, where a moving landslide of 250x400 m in size damaged the forest stand and forest road, reaching with its accumulation part the river bed. In the case of further movements, there is a danger that the river bed would be narrowed or the water course totally blocked since the present movement of slide accumulation was min. 20 m towards the river. In the motion were also the sizeable sandstone benches in the lower part of the slope. This landslide is one of a very large fossil landslide area whose total length is about 900 m and which reaches the very upper parts of the mountain ridge, thus representing a great potential danger in the future because the river bed of Rožnovská Bečva might once get blocked.

The most extensive landslide areas where dwelling houses were put in danger are the villages of Mikulůvka and Růžďka. At least five houses in Mikulůvka were endangered by an extensive landslide. The length of the activated landslide area amounted to about 600 m, its width being 300 m. Although the movement in the landslide front was originally considerably fast (1 to 2 metres per hour), the motion was gradually stopped and the landslide calmed down. The geophysical research and drillings indicate that the phenomenon included the

Fig. 5 Damaged road in the escarpment part of the large band slide on the Dušná Hill (732 m) near Vsetín town. Photo: O. Krejčí

movement of talus (colluvial) loams and clays up to 10 m in thickness. Also the landslide area on the left valley slope in the village of Růžďka amounted to 800 m in length with its width ranging between 100-200 m. The landslide damaged five farm buildings, local roads, gardens and the adjacent forest stand. The landslide that is still active and very deeply founded is most destructive in the whole Vsetín District and most probably in whole Moravia. In it, a 20 m thick layer of sandstones of the Beloveža Group of layers forces outward the underlying bedrock claystones. The accumulation part of the landslide reaches the thickness of up to 30 m. The landslide front is situated right in the housing zone and its extremely destructive affect results from the structurally conditioned constriction of the landslide body.

Two large landslides broke the railway between the town of Valašské Meziříčí and Vsetín near the village of Bystřička on Monday, 7 July. The accumulation front of one of them directly hit the railway track embankment, damaged rails, with the electrical mains trolley wires being taken down by falling trees. The second flow landslide did not reach as far as the railway track, but the huge rock mass in motion partially leaned against a little sandstone ridge that was slowly displaced towards the rails and caused their heavy deformation. This landslide was structurally geologically controlled (movement of syncline core of the Rusava Layers). Lower parts of both landslides experienced a severe water oversaturation of accumulated materials and origination of earth and mud flows with tiny runoffless depression. The movement of these flows down the steep slope heavily damaged the forest stand and raised a chaotic tangle of broken spruce trees in the accumulation part, thus forming an impervious barrier. The reclamation of the railway track will however require extensive technical works since the landslide front forces the lower part of the slope together with the railway track into the river bed of Vsetínská Bečva River.

The landslides affected to a certain extent also the banks and adjacent slopes of the Bystřička Water Reservoir where large landslides originated on the slopes, whose final accumulation parts of mostly mud and earth flow character reached as far as the reservoir and put out of operation roads around the dam lake for a certain period of time. The leftbank road of Bystřička dam where entirely blocked by the huge landslide that ended in the lake together with he forest stand. On the right bank of the dam lake, near the restaurant U Bušů at village of Malá Bystřice, 4 large flow-type slides (max. length up to 250 m) covered the road body with accumulation tongues of muddy soil with broken tree stems. The fine-grained material partly contaminated the water reservoir.

A landslide area with highly destructive effects in the landscape occurs in the valley of Brodská Brook in the village of Nový Hrozenkov where a structurally controlled flow-type slide originated of about 450 m in length and some 80 m in width. The slip blocked a forest road and destroyed a large grown-up forest its impressive root area which is structurally geologically controlled amounting to the height of 6-15 m. Flysch sediments got into motion along the bedding planes and fissure up to the distance of at least 100 m. The accumulation part of the landslide is long about 100 m and its height is nearly 10 m. The lower part of the slip reached the brook bottom where it further proceeded along the stream bed some 150 m. The landslide resulted in the extensive damage to forest stands whose reclamation is practically irrealistic from the viewpoint of area size and technical demanding.

The most extensive activated landslide area in the Flysch Carpathians in Moravia at the present can be found in the valley of Bystřička Brook, locality Vaculov - Sedlo (see chapter 2). Length of the landslide area is 4 km, width 1.2 km. There are various types of slope failures which affect both colluvial (slope) sediments and bedrock. Thick landslide accumulations alternate with water logged depressions (existence of a small lake). The open parent rock links up with fissure caves and pseudokarst dolines. Many lonely houses and special-purpose roads were damaged and particular losses were seen on the soil cover in meadows, pastures and forests. The sizeable blocks of bedrock proceed into the streambed of Bystřička Brook and the name-less brook, which are gradually being blocked. Possibilities of protection in such an extensive landslide area are limited.

4. The solution to reclaim landslide losses

Research works in the landslide areas are organised and funded by the Department of Rock Environment Protection, CR Ministry of Environment. The first stage of research works in the Czech Republic consumed as much as 20 mil. CZK. These were, however, only finance spent on the research works with no road or railway constructions included. Research works and initial rescue measures concerning the damaged road and railway sections required a multiplied sum. Basic reconnaissance in the field as well as expert assessments of all research projects and final reports are made by Czech Geological Institutes in Prague and Brno.

For the purpose of research the landslides were classified in three categories: Category III includes active landslides with damage to permanently inhabited houses, communications, large lands, etc. The mere classification in this category establishes the right for drawing funds from the CR Ministry of Environment allocated to the research and consequent rescue of the area. In the Vsetín district, there were 74 landslides registered in Category III (altogether 80 incl. broken main roads and railway tracks); 70 were recorded in the other territory of the Czech Republic. Some localities still

keep records on up to 6 separate partial landslides. Only 15 landslides of Category III were registered outside the sediments of the flysch belt of Western Carpathians, the fact indicating an extraordinary predisposition of flysch sediments to the occurrence of dangerous geodynamic phenomena. There were more than 30 demolition actions issued for individual houses located in the landslide areas. It is obvious that the majority of landslide areas with the damage of lesser extent but with small farms, summer houses, less busy local roads, fruit trees, fields and forests will be not rescued in the near future at all. The total number of landslides in all categories, activated in the Vsetín District - as documented to the date of April 1998 - amounts to over 250.

The research works themselves were split into two stages and are still carried out by specialised firms. Stage 1 included detailed mapping of landslide areas (scales 1:2,000 and 1:10,000) and registration of all partial landslide elements. Detailed descriptions were made of the origination and course of the phenomenon, geological and hydrogeological situations found and damaged objects recorded. The registration card of Geofond Prague was filled and photographic documentation supplied. In the end, a proposal for further research or simple and technically less demanding reclamation measures was worked out.

The complementary research differs as related to individual localities and their topical situations the basic method being the geodetic alignment of the landslide and monitoring of its movements. Inclinometric measurements in bores are normally made in larger landslides with drilling works in the most extensive landslide areas reaching into the depth of up to 40 m (Růžďka). The bores further serve to the calibration of geophysical methods and the most commonly used complex of these methods is as follows: georadar with depth engagement of 50 to 80 m, shallow refraction seismics, vertical electrical scanning (VES) and dipole electromagnetic profiling (DEMP). The complementary research is always accompanied by a geotechnical assessment of the locality and a proposal of rescue measures which are normally quite costly works ranging between 1 to 60 mil. CZK (landslides above the railway track near the village of Bystřička) or even more expensive works (the village of Růžďka). Alternative solutions will come into consideration in the most extensive landslides with rescue works costs over ten million CZK. The alternative solution should consist of an assessment of necessary changes in the area plans of affected villages, prospects of their future habitability, displacements of engineering networks and roads. Another possibility comes in view to leave the extensive landslide areas entirely to their own natural evolution or to convert the affected meadows and pastures into a forest land and to technically stabilise only the landslide areas which represent a real jeopardy to peoples homes and important infrastructural landscape elements.

5. CONCLUSION

The activity of slope movements (mainly landslides) in the Vsetín District is given by the geological control as well as by the character of relief in this Carpathian part of Moravia. The impact of area by landsliding is of the character of small natural hazards. The main impulse were heavy rainfalls in July 1997. To stabilise the slope movements and recover the losses will take a long time. However, each landslide locality has its own specific features which apart from the natural prerequisites also include factors caused by human activities. A number of buildings were erected on old landslide terrains and often it was inadequate house extensions that loaded the landslide area. In other cases, one-sided incisions relieved the slope foot and resulted in landslidings. Other causes of slope movement activation in the past are considered to be human activities resulting in the increased surface runoff into critical points such as insensitive deforestation, liquidation of anti-erosion measures on agricultural land and -in contrast- insufficient maintenance of forest reclamation rills draining water off the landslide areas. And it was also some ground formations at road construction works such as one-sided deep undercuts or embankments, or furrows made for telephone cables - improperly situated in the landsliding areas and affecting the landslide movement activity.

The registration of landslides will be finished in 1998. The extensive landslide localities will be studied in details in order to bring into life rescue measures that would correspond with the extent of damaged houses and landscape losses. After the analysis of all available records from the landslide areas, district area maps on a scale of 1:25,000 are going to be set up with marked areas of the possible occurrence of landslide phenomena. The areas will be classified in categories by the degree of landslide danger and intensity of its occurrence. In terms of the future development of geology as a science, the achieved results are expected to enable a certain adjustment of present geological maps in some cases as well as to change conceptions of building some geological units in the studied area. From the viewpoint of further development of geomorphological knowledge, the research of activated slope movements and their ways of manifestation in the present relief resulted in our statement that the significance of slope failures at the solution of slope development in mountain ridges of the Carpathian Flysch Belt in Pleistocene and Holocene was underestimated. The slope movements are supposed to have played an important role at the development of some relief formations such as slope inclines, structural ridges or rock cliffs where a modelling role of cryogenic weathering processes used to be preferred some time ago.

References

BLÁHA, P. (1993): Geofyzikální metody při výzkumu svahových deformací. Díl I: textová část. Geotest, Brno a.s., NIS ČR - středisko Geofond, Praha, 71 pp.

BURKHARDT, R. - PLIČKA, M. (1967): Dva význačné sesuvy ve Vizovické vrchovině (Zwei Ausgeprägte Rutschungen in den Gebirge Vizovická vrchovina (Ost-Mähren). Sborník Československé společnosti zeměpisné, 4, 72, Praha, p. 305-311.

BURKHARDT, R. - LIŠKUTÍNOVÁ, D. - PLIČKA, M. (1972): Význačný sesuv u Oznice v Hostýnských vrších (Extensive Landslide near Oznice, Hostýnské vrchy (Hills). Sborník Československé společnosti zeměpisné, 3, 77, Praha, p. 219-225.

BŮŽKOVÁ, H. - MÜLLER, K. - NOVOSAD, S. (1969): K metodice průzkumu skalních vrstevních sesuvů v Moravsko-slezských Beskydech. Geologický průzkum, 2, Praha, p. 43-46.

CZUDEK, T. ed. (1972): Geomorfologické členění ČSR (Geomorphological division of the Czech Republic). Studia geographica, 23, Brno, 140 pp.

CZUDEK, T. (1997): Reliéf Moravy a Slezska v kvartéru (Das Relief Mährens und Tschechischen Schlesiens im Quartär). Sursum, Tišnov, 213 pp.

DEMEK, J. (ed.) a kol. (1987): Zeměpisný lexikon ČSR, Hory a nížiny. Academia, Praha, 584 pp.

DIKAU, R. - BRUNSDEN, D. - SCHROTT, L. - IBSEN, M.-L. (eds.) (1996): Landslide recognition, Identification, Movements, and Causes. John Wiley & Sons, Chichester, 251 pp.

FEKEČ, J. - MAHÚT, P. - NOVOSAD, S. (1970): Inženiersko-geologický prieskum vrstevných zosuvov v zátopnej oblasti priehrady Šance. Mineralia slovaca, 2, 8, Bratislava, p. 269-282.

HRÁDEK, M. - KOLEJKA, J. - ŠVEHLÍK, R. (1995): Natural Hazards in the Czech and Slovac republics. In: M. Hrádek (ed.): Natural Hazards in the Czech Republic. Studia geographica, 98, Brno, p. 7-56.

JONES, D. (1993): Landslide hazard assessment. Landslide Hazard Mitigation. Conf. Proc., The Royal Ac. of England, London, p. 96-113.

KIRCHNER, K. - KREJČÍ, O. - ROUPEC, P. (1996): Geomorfologický a geologický výzkum některých lokalit v magurském flyši (Geomorphological and geological research of some localities in the Magura Flysch). Geologické výzkumy na Moravě a ve Slezsku v roce 1995, Brno, p. 65-68.

KIRCHNER, K. - KREJČÍ, O. (1997): Svahové pohyby na Vsetínsku (Slope movements in the Vsetín Region). Veronica 9, 3, Brno. p. 19-20.

KVĚTOŇ, V. - SRNĚNSKÝ, R. - VESELÝ, R. (1997): Rozložení srážek při povodních v červenci 1997 (Synoptic assessment of weather situations during the July 1997 floods). Meteorologické zprávy, 50, č. 6, p.172-177.

MATULA, M. - PAŠEK, J. (1986): Regionálna inžinierska geológia ČSSR. (Regional engineerig geology). ALFA, Bratislava - SNTL, Praha, 295 pp.

MENČÍK, E. - TYRÁČEK, J. (1985): Přehledná geologická mapa Beskyd a Podbeskydské pahorkatiny, měřítko1:100 000. Ústřední ústav geologický, Praha.

MENČÍK, E. a kol. (1983): Geologie Moravskoslezských Beskyd a Podbeskydské pahorkatiny (Geology of the Moravskoslezské Beskydy Mts. and the Podbeskydská pahorkatina Hilly land). Ústřední ústav geologický, Praha, 300 pp.

MUNZAR, J. - ONDRÁČEK, S. - TÁBORSKÁ, J. (1997): Disastrous floods in Moravia and Silesia in July 1997 (A preliminary report on their causes, course and losses). Moravian Geographical Reports, Vol. 5, No. 2, Brno, p. 44-59.

NEMČOK, A. - PAŠEK, J. - RYBÁŘ, J. (1974): Dělení svahových pohybů (Classification of slope movements). Sborník geologických věd - hydrogeologie, inženýrská geologie, 11, Praha, p. 77-97.

NEMČOK, A. (1982): Zosuvy v slovenských Karpatoch (Landslides in the Slovakian Carpathians). Veda, Bratislava, 320 pp.

OBDRŽÁLKOVÁ, J. (1992): Landslides in the Hostýnské vrchy Mountains (Moravia). Acta Universitatis Palackianae Olomoucensis, Fac. Rer. Natur., Geographica-Geologica, XXXI, vol.109, Olomouc, p.75-84.

ONDRÁŠIK, R. - RYBÁŘ, J. (eds.) (1991): Dynamická inžinierska geológia. SPN, Bratislava.

PESL, V. (red.) (1990): Geologická mapa ČR, 25-24 Turzovka, 1:50 000. Český geologický ústav, Praha.

PESL, V. (red.) (1991): Geologická mapa ČR, 25-23 Rožnov p. R., 1:50 000. Český geologický ústav, Praha.

RYBÁŘ, J. (1994): Engineering - geological evaluation of climatic effects in the cyclic character of slope movements activity. Acta montana, ser. AB, 1, Praha, p. 5-14.

RYBÁŘ, J. a kol. (1997): Zpráva o inženýrskogeologickém mapování svahových deformací podél toku Vsetínské Bečvy v úseku Bystřička-Valašské Meziříčí. - MS Archiv, Český geologický ústav, Praha.

RYBÁŘ, J. - STEMBERK, J. - SUCHÝ, J. (1997): Zpráva o inženýrskogeologickém mapování svahových pohybů ve vybraných modelových oblastech údolí Labe. Projekt Ministerstva životního prostředí ČR, 630/1/97, Praha, 34 pp.

STRÁNÍK, Z. (1996): Vysvětlivky ke geologické mapě 1:50 000, list 25-14 Valašské Meziříčí. Český geologický ústav, Brno.

ŠPŮREK, M. (1974): Historical catalogue of slide phenomena. Studia geographica, 19, Brno, 179 pp.

WOZNICA, L. (1977): Engineering geological investigations of the Karolinka reservoir Landslide. In: Geotest and Landslides, Special Publication of yearbook of the geological-geodetical service on the occasion of the I.A.E.G. Symposium Landslides and other mass movements, September 1977, Prague. p. 51- 63.

ZÁRUBA, Q. (1922-23): Studie o sesuvných terénech na Vsatsku a Valašsku. Časopis Moravského musea zemského, 20-21, Brno, p. 170-180.

ZÁRUBA, Q., MENCL, V. (1969): Sesuvy a zabezpečování svahů (Landslides and their control). Academia, Praha, 221 pp.

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Reviewer

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GREGOR MENDEL AND THE TORNADO IN BRNO ON 13th OCTOBER, 1870

Jan MUNZAR

Abstract

The occurrence of tornadoes and/or spouts was discussed in connexion with the study of dangerous weather phenomena in the territory of the Czech Republic. The historico-geographical investigations succeeded in providing evidence to over 30 cases of tornadoes of various intensities in the period from the 12th century up to the present times. One of the most detailed descriptions on the incidence of this destructive atmospheric whirl is the article on the tornado that occurred in Brno on 13th October 1870 . The article was written in German [orig. Windhose] by an eye witness: the founder of genetics and meteorologist Gregor Mendel (1822-1884). The paper aims at a closer information about important sections of this significant but nearly forgotten contribution. Mendel´s essay includes both a colourful description of the course and losses, and an original physical analysis of the phenomenon. This tornado was most probably the first one in Europe with the evidenced documentation of its funnel column rotation. On the top of this, it was a rarely occurring clock-wise rotation, ie. the so called anticyclonal tornado.

Shrnutí

V souvislosti se studiem nebezpečných povětrnostních jevů na území České republiky byla také věnována pozornost otázce výskytu velkých tromb - tornád. Při historicko-geografickém průzkumu se podařilo doložit více než 30 případů tromb různé intenzity za období od 12. století do současnosti. K nejpodrobnějším popisům výskytu tohoto ničivého atmosférického víru patří německy psané pojednání o větrné smršti - trombě [v orig. Windhose] v Brně 13. října 1870 z pera očitého svědka - zakladatele genetiky a meteorologa Gregora Mendla (1822-1884). Cílem článku je podrobně seznámit s významnějšími pasážemi jeho pozoruhodné, ale pozapomenuté publikace. Mendlovo pojednání obsahuje jak barvitý popis průběhu a škod, tak především originální fyzikální rozbor jevu. Uvedená tromba byla patrně první v Evropě, u níž byla průkazně dokumentována rotace jejího oblačného sloupce - chobotu. Navíc se jednalo o vzácně se vyskytující otáčení ve směru pohybu hodinových ručiček, tedy o tzv. anticyklonální trombu.

Key words: tornado, Gregor Mendel, Brno, Czech Republic

1. Introduction

It is only recently that J. T. Snow and A. L. Wyatt (1997) summarized on the pages of magazine Weather the present knowledge about tornadoes, their worldwide occurrence and categorization including equivalent names for this destructive atmospheric whirl in 15 languages. Although the strong and violent tornadoes occur most frequently on the Great Plains of North America, they are in fact an international phenomenon. Therefore the American authors aimed at the territories outside of the contiguous U.S.A.

In Europe, the tornadoes are best documented in Great Britain thanks to systematic research since the 70s (Meaden, 1976). The authors summarize the data on their occurrence in Baltics, France and in the territory of the former Soviet Union. The occurrence of tornadoes in Italy is acknowledged but with no quantitative data. As the area of Central Europe, ie. territories of Germany, Austria and Czech Republic are not mentioned in this work, it might seemingly indicate that the dangerous meteorological phenomenon does not occur here.

In the case of Germany and Austria, the erroneous impression could have been caused by paying not enough attention to the literature on tornadoes in German language. The most circumstantial German publication dealing with the issue still remains a monograph by A. Wegener (1917). Austria has a self-contained catalogue for the period between 1910-1971 issued recently (Pühringer, 1973).

There is no wonder in the case of the Czech Republic that tornadoes are not much known in this territory since the first national handbook of meteorology which mentions their occurrence originates from the 80s of this century (Munzar et al., 1989). The first comprehensive article on the topic was published three years ago within a project of studying natural hazards in the Czech Republic (Munzar, 1995).

Of more than 30 so far documented cases of tornadoes or wind-spouts occurring in the Czech Republic, the one best described thanks to Gregor Mendel as an eye witness occurred in Brno on 13th October 1870 (Fig. 1).

Fig. 1 Gregor Mendel (1822-1884)

2. Mendel - meteorologist

The name of the great natural scientist Gregor Mendel (1822-1884) who lived and worked in Brno is justly connected with his genetic discoveries that secured for him a permanent place in the history of science after his death. Some of his other activities, especially those in the field of meteorology, have been wrongfully neglected. Mendel's genuine interest in the scientific discipline was most probably based on his awareness of weather and its importance for the growth of plants.

Mendel was a foundation member of the Austrian Meteorological Society in 1865. When the Association of Natural Scientists in Brno set forth a proposal for the establishment - de facto restoration - of the University in Moravia in 1870, he is mentioned as a meteorologist in the enclosed petition. He contributed to the development of the discipline as a careful observer at the Brno station within a network of the C.k. Central Institute for Meteorology and Earth Magnetism in Vienna, as an organizer and editor of meteorological observations in Moravia and as a propagator of scientific progress in meteorology. In the list of his 13 signed publications, nine are devoted to the meteorological topics.

It is assumed that Mendel became closer acquainted with the meteorological issues in 1850, three years after having been admitted to holy orders, when he registered as a 28-year-old supply-teacher at a gymnasium in Znojmo for teachers' examinations at the University of Vienna to acquire qualifications for teaching natural science and physics. His home written work in physics was given a following theme: To show mechanical and chemical properties of atmospheric air and to explain the origin of winds from them (Munzar, 1971).

It is not much known that as early as in 1863, i.e. three years before the publication of his famous work about experiments with cross-breeding of peas, this scientist from Brno described the heat island of the town of Brno with the correct explanation of its causes on the basis of his own measurements. In this context he also mentions the "town smoke-fog" ["Rauchnebel" in German original - note by J. M.]. The today common term of "smog" was first used as late as in 1905 (Munzar, 1994).

The most important one of the meteorological publications signed by Mendel in his full name seems to be a study about the tornado in Brno on 13th October 1870, written in German language [at this time, he had been performing the function of the abbot in the Augustinian monastery of Staré Brno already for several years]. The Brno public was informed about his observations, other acquired knowledge and conclusions at the workshop of the Association of Natural Scientists in Brno hardly a month later, on 9th November 1870. His lecture was then published in German language at the beginning of the next year (Mendel, 1871).

3. The "infernal symphony" over the monastery of Staré Brno

"On the 13th of previous month we had an opportunity to observe a very rare phenomenon of tornado [orig. Windhose or Trombe] in Brno and were given evidence at the same time of losses that the malicious meteor can cause. The more impressive the stormy drama appears from a certain distance, the more dangerous and unpleasant it is for all those who experienced an immediate contact with it. The latter statement can be confirmed by my own experience because the tornado of 13th October blew over my flat in the monasterial prelatery at Staré Brno, and I can thank to a lucky coincidence to have paid for the meeting with only a dismay." - writes Mendel in the introduction to his study (Fig. 2) and continues as follows:

"It happened on the mentioned day a couple of minutes before 2.00 PM when the day suddenly darkened and only a dim twilight remained. At the same time, the monastery building shook heavily and began to tremble in such a way that the doors closed by handles got wide open, heavy furniture was displaced and the plaster from ceilings and walls was falling down at some

Die Windhose vom 13. October 1870

von

Gregor Mendel,

vorgetragen in der Sitzung am 9. November 1870.

(Sonderabdruck aus dem IX. Bande der Verhandlungen des naturforschenden Vereins.)

Am 13. des vorigen Monates hatten wir in Brünn Gelegenheit, die sehr seltene Erscheinung einer Windhose oder Trombe zu beobachten und uns zugleich von den Verwüstungen zu überzeugen, welche dieses äusserst bösartige Meteor anzurichten im Stande ist. So imposant sich das vorüber sausende Schauspiel in einiger Entfernung ausnehmen mag, so ungemüthlich und gefährlich gestaltet sich dasselbe für alle, die damit in unmittelbare Berührung kommen. Das letztere kann ich aus eigener Erfahrung bestätigen, da die Windhose vom 13. Oktober über meine Wohnung in der Stifts-Prälatur in Altbrünn wegzog, und ich es wohl nur einem glücklichen Zufalle zu danken habe, dass ich mit dem blossen Schrecken davon kam.

Es war an dem genannten Tage einige Minuten vor 2 Uhr Nachmittags, als plötzlich die Luft so sehr verdunkelt wurde, dass nur ein mattes Dämmerlicht übrig blieb. Gleichzeitig wurde das Gebäude in allen Theilen heftig erschüttert und in Schwingungen versetzt, so dass eingeklinkte Thüren aufsprangen, schwere Einrichtungsstücke verschoben wurden und der Anwurf stellenweis von Decken und Wänden fiel. Dazu gesellte sich ein ganz unbeschreibliches Getöse, eine wahrhaft infernalische Symphonie, begleitet von dem Geklirre der Fensterscheiben, dem Gepolter von Dachziegeln und Schieferplatten, welche durch die zerschmetterten Fenster zum Theile bis an die gegenüberliegenden Zimmerwände geschleudert wurden.

In solcher Weise überrumpelt und betäubt, konnte auch der Muthigste eines peinlichen Eindruckes sich nicht erwehren. Zum Glücke war das Höllenspektakel nach wenigen Augenblicken zu Ende. Ich schätze die Dauer auf 4 oder höchstens 5 Sekunden, und bemerke dabei, dass die Windhose, wie es sich nachträglich herausstellte, in ihrer grössten

Fig. 2 The front page of Mendel's essay about the tornado in Brno on 13th October 1870

places. All this was accompanied by an entirely indescribable noise, a true infernal symphony with clattering window panes, rattling roofing tiles that were shot through the broken windows as far as the opposite wall of the room.

Taken by the surprise and deafened in this way, not even the boldest man could prevent anxiety. Fortunately, the infernal performance ended in a few moments, my estimate being 4 or 5 seconds at the most...

As soon as the dust settled down a little bit, a look from my window helped me to reveal the enemy: it was a tornado [orig. Windhose] of such a shape that I knew from pictures and descriptions. When I first saw it, it was proceeding at a great speed over gardens on the southern side of Špilberk, crossed the Pekařská street in the direction of Petrov and dashed further up its slopes. The lowest part of the phenomenon was soon hidden for me by St. Peter's Cathedral ..." (Mendel 1871).

In spite of the fact that Mendel's essay does not include a single illustration, the description of the phenomenon is so colourful that it is possible to make a good picture of the tornado as well as of the losses:

"The losses caused by the tornado [Trombe] are very considerable ... A belt of some 3 Klafters [approx. 6 m] in width exhibited the most severe impact and clearly shows the tornado trail. Loose objects laying on the ground within the belt were shot up by an irresistible force in the direction of rotation tangents. This explains the considerable losses on windows ...

There were 1300 broken window panes only in the monasterial church of Staré Brno, an approximately same amount being broken in the monastery building. The effects of this aerial mitrailleuse were really crushing. In the mentioned belt of six meters stretching over my flat, not a single roofing tile remained at its place, all battens were taken down and away with some damage even on the truss. The upper part of a chimney, 9 feet [about 3 meters] in length and many centers [several hundred kilogrammes] of weight was torn away, rotated in the height and was thrown down again in a certain distance. Empty barrels, logs, planks etc. were flying in the air as straws ..." (Mendel, 1871).

4. Estimated parameters of the tornado in Brno

More than a half of the eighteen-page essay is devoted not only to a precise description of the tornado, an entirely exceptional phenomenon in this region of Central Europe. Based on his own observations as well as on the information of other eye witnesses, Mendel carried out a strictly logical reconstruction of the course of this atmospheric whirl and estimated its parameters as follows:

"The sky was mostly covered with clouds of light grey colour, particularly so its westward section. The light background was in a sharp contrast with a huge tornado funnel column. The trunk consisted of two enormous cones of which the upper one was pointing its tip

downwards while seeming as if hanging on an isolated cumuliform cloud of not large size, on which it was possible to observe a great disturbance showing in the form of intense waving to and fro. The lower cone has its base on the ground and was raising vertically up in such a way that the blunt tips of both cones were connected.

The upper cone, similarly as the clouds surrounding its base was of a very dark to black colour, resembling a smoke trail as we can see it sometimes rising from the chimneys of our factories at the entirely calm and moist atmosphere, which shows a regular widening pattern with the increasing height. The lower cone had a grey-brown colour which gradually darkened towards the bottom. It was possible to observe clearly the rotation of the column around its vertical axis.

Also, it was possible to see regular ignitions of the cloud forming the base of the upper cone with electric light in short intervals. A gymnasium student claimed to have seen a flash of lightning running down from the upper cone into the lower one with the accompanying thunder. The two phenomena escaped my observations...

The determination of the vertical extent of a tornado is not an easy task since the angle estimates were very vague. It can be stated only very approximately that the lower cone height was some 120 Klafters [230 m] and the height of the upper cone was some 160 Klafters [300 m]. No less difficult was the estimate of diameters of cone bases because the lower base could not be clearly visible due to the great amount of dust that was shot into the height of some 5-6 Klafters [approx. 10 m], and the base of the upper cone was covered by the impetuously moving cloud in a similar way. The lower cone diameter could have been 6-8 Klafters [11 to 15 m] at its base, and the diameter of the upper cone base could have been larger by approximately a half..." assumes Mendel.

Lenght and width of the trail

"Towards the West of Brno, the demonstrable losses corresponding to a real tornado can first be found on the slopes of the hills between Pisárky and Kamenný mlýn near the Svratka River. From here its trail can be traced across the river and the mill-race towards the vineyards on the southern slope of the Žlutý kopec (Hill). When the tornado reached up to its very top, it dashed through the gardens above the Hlinky Street from where it broke onto the monastery building having passed across the brewery of Staré Brno (Figs. 3 and 4). The registered losses indicate that the tornado originated closely before its entering the town and ceased again soon after leaving it after an approxi-

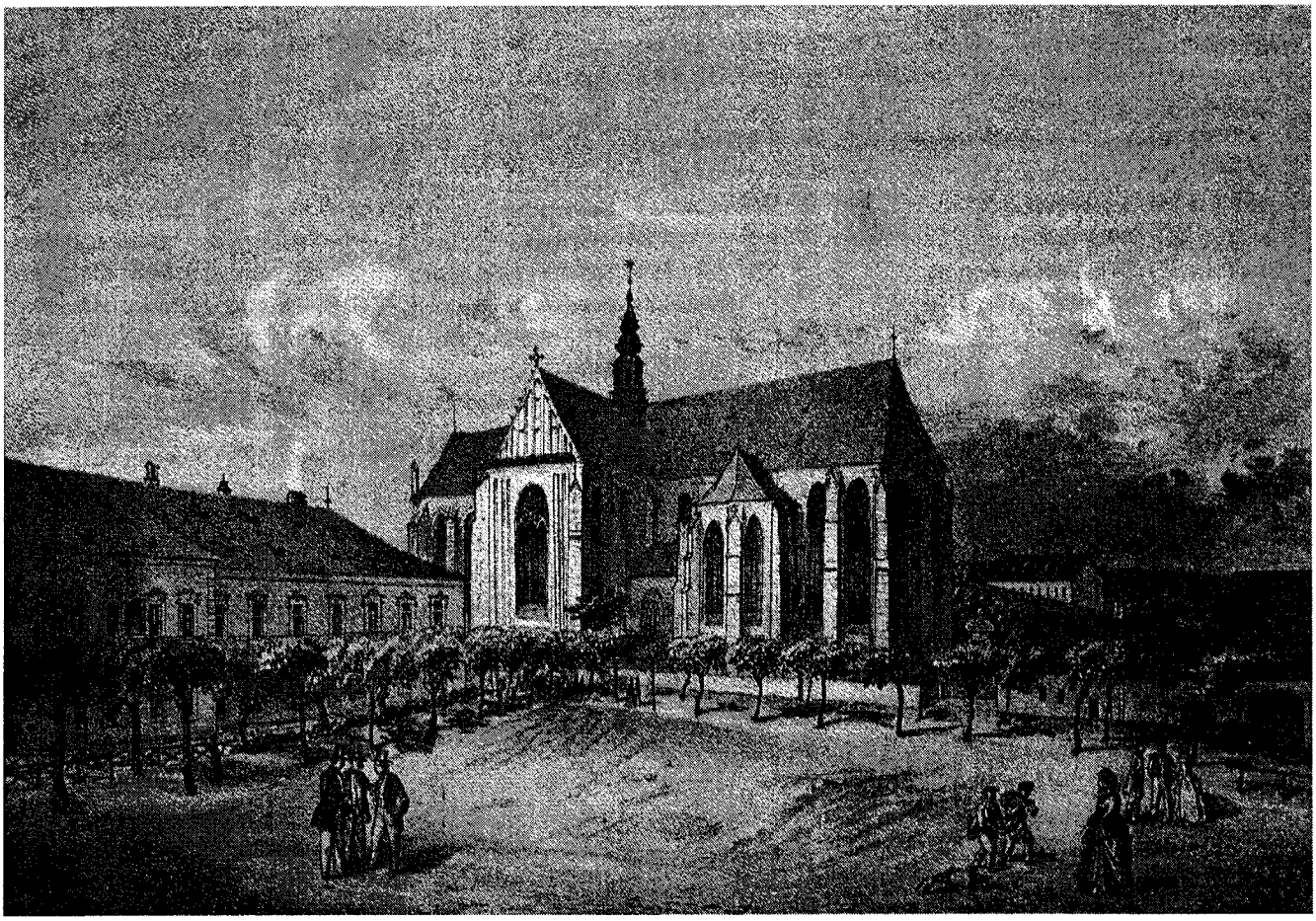

Fig. 3 The church and monastery of Staré Brno in the 19th century

mately 1 mile travel [apparently the Austrian post mile, i.e. 7.5 km] ...

The width of the tornado trail can be quite well estimated by the losses. It is interesting that the width - or in other words the proper diameter of the tornado - was gradually increasing. Some 50 Klafters [about 100 m] from the mill-race at Pisárky the tornado left its first traces from which its width can easily be told because it proceeded forward across the avenues which skirt the both banks of the river [Svratka]. Its average width at this place was about 90 Klafters [170 m]. However, near the monastery of Staré Brno the average width amounted to over 100 Klafters [190-200 m] and yet further increased up to 110-115 Klafters [210-220 m] at the railway station ... The above mentioned belt of 3 Klafters [the 6 meter broad strip above Mendel's flat] was situated exactly in the middle of the trail."

Course speed and rotations

"The speed of the tornado course over the monastery building can be given an approximate estimate. As its average at this place was about 100 Klafters and the duration estimated at 4 to 5 seconds it follows that the tornado was progressing at a speed of about 20-25 Klafters per second, i.e. 18 to 22 miles per hour [40 to 45 m per sec or 135 to 170 km per hour], i.e. at a speed that was nearly three times greater than the speed of our railways and equal to the speed of our most violent windstorms ...

I am missing a reliable guideline to determine the tornado rotations. It is for sure, however, that they were not too great in its visible part since it was evident that the objects shot up into the lower cone got out in very elongated spirals. This could be seen very clearly from the alternating light and dark masses of dust which were pulled up to its very top. In the comparison with the edge, the rotations must have been very high, however, since the objects that were lifted into the height by this whirl were flung away by a great force. Taking into account the circumstance I assume that the tornado rotations were lower than the speed of the tornado course, my estimate being some 10 to 14 Klafters [per second = 20 to 27 m per sec] for its marginal parts."

Sense of rotation - an exception from the meteorological law?

"In contrast, the sense of rotation of the tromba can be determined with certainty. The tromba rotated in the same sense as is the movement of an arm in the clock put down, ie from the East over the South to the West. This means that our tornado made an exception from the rule that was set up by the meteorology of the New

Fig. 4 The Staré Brno Augustinian monastery today. At the background, the brewery chimney on the left and in the middle the Žlutý kopec (Hill) whose southern slopes together with the monastery were passed by the tornado 130 years ago. Mendel viewed the tornado moving away from the first floor of the building, most probably from the second window from the right.

Age for the rotation of the atmospheric whirls on the northern hemisphere according to which the rotation should always occur in an opposite direction to the clock-wise sense as it is observed in the case of huricans and typhoons.

I consider any mistake for hardly possible. When I first could see the tornado at a distance of some 150 Klafters [280 m], the sense of rotation could be distinguished easily and precisely ...

All possible objects from the SSE, SE and ESE were thrown into the windows of my flat facing the East, one roofing tile having even flown over my desk through the opened doors into the neighbouring northern room. As the thrown objects all flew through the double window glazing, it was easy to tell the direction from where they arrived from the position of holes broken in the outer and inner window panes. Any local disturbance [deviation] in the throw direction can hardly be assumed because there is a free space in front of my windows of 37 Klafters [70 m] in width. According to the set up law of rotation [of the tornado] the throw had to arrive from the NNE, NE and ENE.

Another, and as I believe a very important evidence of our tornado having broken the law of rotation consists in the fact that its northern half was much more harmful and dangerous than the southern half. This means that the forward progressing and rotating motions on the northern end must have occurred in the identical sense so that their effects were summed up whilst an exact opposite occurred on the southern end. The fact can be evidenced along the whole trail of the tornado even today [9th November 1870] ...

It is possible to assume from the circumstance that the trees fallen on the southern end were also facing the East with their crowns that the speed of the tornado course was considerably higher than the speed of its rotation which was exceeded by approximately one degree of wind force [apparently by 1 degree Beaufort]. The southern end exhibited opposite effects of the two forces. Yet, the surplus of intensity that remained to the forward progressing motion after paralyzing [suppressing] the rotating motion was still great enough to uproot trees which had resisted numerous windstorms in the past."

5. Mendel's knowledge in the time context

In the second part of his essay Mendel made an analysis of the course of weather on that critical day and explained the circumstances of the origin of this atmospheric whirl that had identical properties as the tornadoes of Northern America. The fact that it was a clash of two air flows of different directions and features was corroborated both by his own observations of the different directions of cloud flows at various heights above the ground, and additionally by a comparison of data on the direction and speed of the wind on meteorological stations in Prague, Vienna and Krakow - these were acquired by him within hardly 4 weeks.

The natural scientist from Brno assumed that the phenomenon was a manifestation of a deviated equatorial [rather tropical] flux that exceptionally reached as far as Central Europe by moving over the air matter in the lower atmosphere layers [which certainly cannot be agreed with today]. The local influences finally contributed to the labile stratification of the atmosphere, which was manifested both by typical optical and acoustic signs of the thunderstorm and by the mild shower and hailstorm. The end of the essay discusses in details electrical phenomena at the condensation of water vapours as a precondition of storm phenomena related to the inception of the tornado.

In his article Mendel referred to several names (Dellmann and Palmiere, Whitfield, Ambschell) which shows his routine and competence in the contemporary meteorological and physical literature. The careful monitoring of the progress of the time even in other aspects can be documented by his mentioning the mitrailleuse, a predecessor of the machine-gun, invented in France in 1867, i.e. some three years before the observation of the tornado. It is improbable that Mendel could really hear its "machine-gun" shooting. It is much more probable that he read about the new weapon in the press of the time, comparing readily his impressions from the rattle of falling roof tiles and broken window panes to the sound of the weapon just thanks to his good imaginative powers.

Interesting are also other small details of this Mendel's essay. They give evidence both for varefullness and rational attitude of the author, and for his dry humour. The latter can be learnt from the section devoted to news of eye witnesses about the whirlwind or from the "airy" conclusion of the whole article. He pointed out of the received witnesses what attracted his attention by more than naive conception and description: his lady reported together with a small company on the vintage in the vicinity of the monastery took the fiery coloured column reaching high into the clouds first for the smoke of a forest fire. However, when the smoke column was moving on towards the vineyards with the ever more alarming roar, they believed that it was the devil himself who came to disclose his identity to them [in original expressed indirectly as Feared - Gefürchtete]. In the end of the story told by this lady witness he made a regardful remark that the people had never any chance to deal with physical or meteorological studies.

The tornado in Brno and tornadoes in Europe

Gregor Mendel ends his article with the following words: "This is the end of the essay about our danger-

ous guest of 13th October. Having exhausted a number of speculations about this guest, we nevertheless have to admit in the end that with our will at our best we have not got farther than to an airy hypothesis which has been built from the airy material and on a very airy foundation." (Mendel, 1871).

He was too modest, however, since there are no doubts today about his work ranking with the best ones written to the issue of these atmospheric whirls until 1870. Mendel was apparently ahead his times even in meteorology, not only within the then Austria-Hungary. Because the essay was published in the provincial magazine of the Brno Association, it could not find its way into the contemporary meteorological or geographical literature. Unlike his famous work on plant hybrids, however, this essay remained unknown to these disciplines practically until today (even after its republication in the same magazine in Brno in 1911, when Mendel had already been "discovered" as a genetic and a monument for him was erected in Brno).

Theodor Reye, professor of natural sciences at the University of Strassbourg, did not mentioned the article of the the scientist from Brno in his monograph about the atmospheric whirls including tornadoes from 1872 although theoretically he could have made it before the deadline. A much more interesting is the fact that Reye (1872) did not even mention a single one of four authorities referred to by Mendel in his essay.

A much later published monograph about tornadoes in Europe, issued by the German geophysicist and meteorologist Alfred Wegener (1880-1930) toward the end of World War I also did not mention the comprehensive study of the great natural scientist from Brno in spite of the fact that its part was a catalogue of 258 stronger or weaker tornadoes and/or spouts observed in Europe so far (Wegener, 1917). And the Mendelian tornado could have found a decent place in this prominent companion:

1) The tornado trail was found only in 15 % of the cases in Wegener's catalogue, with only seven of them having the trace longer than 7 km. The trace in Brno was about 7.5 km long.
2) The speed was estimated in hardly 12 % of tornadoes, of which only 15 cases dated back before 1870. Of these, the tornado in Uppsala from 1st December 1887 had a record speed of 86.4 km per hour. Yet, seventeen years before this record the tornado in Brno was nearly twice as fast as it was moving across the town at a speed that was estimated to 135-170 km per hour.
3) The speed of the wind in the atmospheric whirl itself was estimated for a single case before 1870: over 110 km per hour in the tornado from the southern outskirts of Paris in 1839. The "Brno" tornado had the wind speed - more precisely the speed of rotation - somewhat lower, between 70 and 100 km per hour.
4) The sense of funnel column rotation around its axis was determined in only about a tenth of registered tornadoes until 1917 and it was only a single one before the article of the scientist from Brno was published. This was the case of the tornado recorded in the area of the Mediterranean Sea on 20th August 1855, in which, however, a much more frequent cyclonal rotation was observed, i.e. the anti-clock-wise rotation. The report on its occurrence was published as late as in 1895, which makes Mendel in fact the first one in Europe to publicize the valuable information about the sense of rotation of these atmospheric whirls. By a mere co-incidence his rotation was anticyclonal, which he considered to be the "exception from the law". (Today we know that the law does not apply for the atmospheric whirls of small sizes - see Fujita (1977), Pühringer (1971)). According to Wegener (1917) the first occurrence of anticyclonal rotation in Europe was described in the tornado on the Geneva Lake in 1887, i.e. 17 years after the tornado in Brno.

6. Conclusion

If we summarize the hitherto knowledge it comes up that there are many reasons for which the tornado in Brno from 13th October 1870 can be considered a very rare weather phenomenon. The tornado was special by not only the fact that it occurred in this part of Central Europe, but also by the fact that it was recorded here in the latest autumn and no other records on later in the year occurring tornadoes are available today. (It is interesting that according to Lamb (1964) a tornado occurred in the same month and year - 19th October 1870 - in southern England.) Also, the tornado from Brno was unusual in terms of its shape resembling the hour-glass (which originated from the known funnel coming out from the base of the mother thundercloud-Cumulonimbus and from the whirling dust that set off the usually unvisible lower part of this small atmospheric whirl.) Finally, the tornado observed by Mendel was exceptional by the anticyclonal (clock-wise) rotation of its air particles.

God knows what would have been the response to the essay by Gregor Mendel should it not have been published in the provincial magazine but in the first specialized magazine for the German speaking area "Zeitschrift der österreichischen Gesellschaft für Meteorologie", issued in Vienna since 1866. (At the time, the "Zeitschrift" informed about the tornado in Brno by merely reprinting two short news from the Brno newspaper "Brünner Zeitung", and "Mährischer Correspondent" under a common name of "Windhose in Brünn am 13. Oktober" (1870). It is well possible that its author would have also got into the monographs of this discipline.

It is quite surprising for our present time what interesting conclusions Mendel arrived at nearly 130 years ago mainly just through his logical thinking when it is still difficult sometimes for Czech experts from the end of

the 20th century to bring evidence to the occurrence of tornadoes or spouts of various intensities even with the advanced meteorological technique (Šálek, 1994; Setvák et al., 1996). Yet, the famous natural scientist from Brno had an invaluable advantage of being an eye witness.

What is there to be added? As to the causes of the rise of the described tornado in the given region and time of the year from the viewpoint of the present knowledge it is possible to make a statement with nearly a hundred per cent certainty according to Kakos (1998) and taking into account the observations in Prague-Klementinum from 12th to 14th October 1870, that the phenomenon was related to the transition of a rapidly moving cold front from the western quadrant. This we can claim in spite of the fact that the synoptic maps for every day were available in the Austrian-Hungarian monarchy as late as from 1st January 1877 and the atmospheric fronts first appeared in the weather maps only after World War I thanks to the Norwegian meteorological school (Munzar, 1989).

From 12th to 13th October 1870, a pronounced warm spell was recorded with the average daily air temperature increasing from 7.0 degree Celsius up to 13.7 degree Celsius and the maximum temperature reached nearly 17 degree Celsius during the day. It was apparently the warm air that for some time broke through into Bohemia and Moravia at the rapid pressure decrease from 742.6 torr down to 731.5 torr and the change in the wind direction from NW to W. After a cold front passed over Prague and later over Brno the weather got colder again with the average air temperature and maximum temperature decreased by 4.6 and 4.1 degree Celsius, respectively on 14th October. The pressure went soon up again to 740.0 torr and the wind changed its direction toward NW, which most probably indicated a rapid passage of a cold front on which storms accompanied by a rare phenomenon - tornado were generated due to the atmosphere labilization in the afternoon hours.

References

FUJITA, T. T. (1997): Anticyclonic tornadoes. Weatherwise, Vol. 30, No. 2, p. 51-64.

KAKOS, V. (1998): personal communication.

LAMB, H. H. (1964): The English climate. London, English Universities Press, p. 35-38.

MEADEN, G. T. (1976): Tornados in Britain: their intensities and distribution in space and time. Journal of Meteorology, Vol. 1, No. 8, p. 242-251.

MENDEL, G. (1871): Die Windhose vom 13. October 1870. Verhandlungen des Naturforschenden Vereines in Brünn, Vol. 9, 1870, Abhandlungen, p. 229-245.

MUNZAR, J. (1971): G. Mendel's erste, bis jetzt unveröffentlichte Abhandlung über Meteorologie. In: Folia Mendeliana, Proceedings of the Gregor Mendel Colloquium Brno 1970, Brno, Moravian Museum. p. 185-187.

MUNZAR, J. et al. (1989): Malý průvodce meteorologií. Praha, Mladá fronta, 247 pp.

MUNZAR, J. (1994): Gregor Mendel and urban environment. Moravian Geographical Reports, Vol. 2, No. 2, p. 49-51.

MUNZAR, J. (1995): Atmospheric hazards in the Czech Reublic: Tornadoes (spouts) as a case study. In: Studia Geographica 98, Natural hazards in the Czech Republic, ed. M. HRÁDEK, Brno, Institute of Geonics ASCR, p. 57-84.

PÜHRINGER, A. (1971): Ein Orientierungsgesetz für Tromben. Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A, Vol. 20, p. 67-77.

PÜHRINGER, A. (1973): Windhosen in Österreich. Wetter und Leben, Vol. 25, No. 1, p. 15-22.

REYE, T. (1872): Die Wirbelstürme, Tornados und Wettersäulen in der Erdatmosphäre. Hannover, C. Rümpler, 248 pp.

SETVÁK, M. - ŽÍDEK, D. - HRADIL, M. (1996): Tornadoes in the northeastern Moravia and in Silesia on 8 July 1969? (in Czech, English summary). Meteorologické zprávy, Vol. 49, No. 5, p. 143-146.

SNOW, J. T. - WYATT, A. L. (1997): Back to basics - Part 1: The tornado, nature's most violent wind: world-wide occurrence and categorisation. Weather, Vol. 52, No. 10, p. 298-304.

ŠÁLEK, M. (1994). Strong thunderstorms in Moravia connected with the occurrence of spout in the locality Lanžhot on May 25, 1994. (In Czech, English summary). Meteorologické zprávy, Vol. 47, No. 6, p. 172-177.

WEGENER, A. (1917): Wind- und Wasserhosen in Europa. Braunschweig, F. Viewegh, 301 pp.

Windhose in Brünn am 13. October. Zeitschrift d. österreichischen Gesellschaft für Meteorologie, Vol. 5, 1870, p. 584-586.

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Reviewer

RNDr. Vilibald KAKOS

Danube Pollution Reduction Programme

Antonín Vaishar

The Danube Programme launched its activities in 1991. It is steered by its execution committee (Task Force) and up to now includes 11 countries of the Danube catchment area with the exception of Yugoslavia and Bosnia with Herzegovina. The Agreement on Cooperation at Protection and Sustainable Use of Danube was signed in Sophia, Bulgaria in 1994 and ratified so far by six of necessary nine member countries. Before the desired cooperation reaches its contractual extent, a so called Interim International Commission was appointed to operate, whose Secretariat is in Vienna, Austria.

A strategic action plan for the Danube catchment area (Danube SAP) was adopted by ministers of environment from countries of the Danube Basin and the responsible representative of the EU Committee for Environment in Bucharest in December 1994. The SAP was worked out by a group of chosen experts with participating international financial institutions, and its approval was preceded by two rounds of meetings with representatives of non-governmental organizations (NGOs), industrial companies, utilities, governmental authorities, local administration and self-governments.

The SAP was made by experts in 1992-1996 its main objectives being as follows:

- to reduce the unfavourable impacts in the Danube catchment area as related to aquatic geosystems and to the Black Sea
- to preserve and improve availability and quality of water in the Danube catchment area
- to provide the control of accidental noxious leakages
- to develop international cooperation in water management.

The ongoing works on the international analysis of water management conditions in the Black Sea confirmed that the major source of pollution to the Black Sea is the Danube River with bringing over 80 % of all nutrients in it. This represented for example more than 300 thousand MT nitrogen and 40 thousand MT phosphorus in 1990. The load shows in intensive eutrophication effects and a direct impact on economies of Black Sea coast countries. The Danube ecosystems have a great economic, social and environmental value themselves. The main stream is 2 857 km long its catchment area being 817 000 square km and the population about 85 million. The flow at the point of Danube entering the delta fluctuates between 1 610 and 15 540 $m^3.sec^{-1}$. The catchment area includes following countries: Hungary (full size), Romania, Austria, Slovenia, Croatia and Slovakia (great portion), Bulgaria, Germany, Czech Republic, Moldavia, Ukraine, Bosnia and Herzegovina, Yugoslavia (small portion). In the Czech Republic, the Danube catchment area is represented mainly by the Morava River catchment which takes a greater part of Moravian territory with only some exceptions of which the most important one is the Vlára River.

A follow-up to the former activities is the programme GEF/UNDP Danube Pollution Reduction Programme. The Global Environmental Fund is a UN body. The project costs will amount to 7.5 mil. US dollars of which the GEF will cover 3.9 mil. while other expenses are going to be settled from PHARE and TACIS funds. It is also expected that the member countries will also contribute financially and with their extra efforts. A long-term GEF objective is to support reasonable institutional and financial measures for efficient environmental management in the Danube catchment area in agreement with the GEF strategy to protect international waters. Immediate objectives then consist in preparing and generating funds needed to restore environment in the Danube catchment area and to protect the Black Sea. Main outputs should be projects focused on reduced pollution and the funding of these projects should be shared by both domestic and international financial

sources. The works will take 16 months and the chief project manager is Joachim Bendow, a geographer from Vienna.

Four main project objectives are as follows:

1. To complete the existing knowledge and define priorities. This will include among other the up-dating of national reports from 1992/93, which have to be further complemented with analyses of socio-economic and financial aspects related to the issue.
2. To reassess the strategy of protecting the Danube catchment area and the Black Sea on the basis of a strategic action plan. It is necessary to start technical discussions between involved countries about agreements which would be focused on the reduction in pollution concentration and monitoring of key pollution sources.
3. To improve awareness and concern of the public.
4. To ensure programme funding. A pre-condition consists in the preparation of good and fundable projects which would be capable of attracting the interest of international financial institutions (the Danube portfolio).

The up-dated strategic action plan should be submitted to the conference of environmental ministers from the Danube catchment area countries for approval. At the same time, a conference of donor institutions should be organized where all Danube portfolio projects would be presented.

After the preparatory stage of works the programme implementation was started with a workshop organized by the Danube University in Krems, Austria in November 1997. The workshop succeeded in defining the general methodological approach of the project. The individual countries involved were represented by their country Programme Coordinators (CPCs). The Czech CPC is Ing. Bedřich from the Morava River Catchment, a. s. Brno. National teams for up-dating of the so called National Reports were nominated by GEF bodies in December 1997. Members of the Czech team are as follows: CPC (Ing. Bedřich from the Morava River Catchment Area Co. Brno), Ing. Pavlovský (Morava River Catchment Area Co. Brno), Ing. Bernardová (T. G. Masaryk Water Management Research Institute, Branch Office Brno), Dr. Vaishar (Institute of Geonics, CR Academy of Sciences, Branch Office Brno), and Ing. Hájek (CR Ministry of Finance Prague).

The national teams attended the National Review Workshop in Budapest in January 1998, where contents lay-outs, methodological approaches and time-schedules were unified for the National Reports which are to be worked out in the period from February-April 1998 and the dates for National Workshops were set up. The Czech National Workshop will be the very first of the whole series and will be held in October 1998.

The National Reports consist of four sections as follows:

- significant pollution sources (an analysis of the so called hot spots as an entry into the information system,
- socio-economic consequences,
- financial analysis,
- technical provisions.

A promising development of cooperation between academic geographical workplaces in Czech and Slovak Republics

Peter MARIOT - Oldřich MIKULÍK

The cooperation between Czech and Slovak geographers from Academies of Sciences has a long-term tradition. It became of international character after January 1, 1993 with the foundation of independent countries while partially losing intensity. Yet, the two parties were interested in further contacts and exchange of scientific results.

The 1st Slovako-Czech Geographical Academic Seminar "Similarities and Differences in the Development of Czech and Slovak Republics after the Split of the Czechoslovak Federal Republic" was organized by the Geographical Institute of Slovak Academy of Sciences (GÚ SAV) in Bratislava jointly with the Institute of Geonics, Czech Academy of Sciences (ÚGN AV CR), Branch Office Brno as a concrete event to contribute to make the resolves true. The Seminar was held in the Geographical Institute, Slovak Academy of Sciences in Bratislava on November 6, 1996, its technical guarantor being P. Mariot. The main objective of the Seminar was to inform scientists from both workplaces of the present development of socio-economic systems in the two countries, particularly after their split.

There were 11 papers presented at the Seminar, devoted to the development of Czech population in 1990-1995, employment of Slovak citizens in the Czech Republic, development of traffic between the two countries, changes in the Czech system of traffic, development of political scene in the Czech Republic after 1990, distribution of Czech nationals living in Slovakia, basic features of political orientation of population from the Slovako-Czech borderland and their religious structure, regional aspects of developing criminality in Slovakia during the period 1990-1994, similarities and differences of the population development in both countries, and geographical aspects of transforming the power generation and distribution system of the former Czechoslovak Federation Republic into independent Czech and Slovak systems.

The papers and the following discussion confirmed that the monitoring of the development of geographically relevant aspects of the socio-economic systems in both countries brings a lot of interesting results and hints. In this context, the parties agreed on similar seminars organized once a year in the future.

As agreed, the 2nd Czecho-Slovak Academic Geographical Seminar took place in the Institute of Geonics, Czech Academy of Sciences, Branch Office Brno on November 12, 1997. It concerned "Similarities and Differences in the Development of Czech and Slovak Towns after 1990" and its expert guarantor was O. Mikulík. There were altogether 12 papers presented at the Seminar, which tackled development of the capital of Bratislava to some sustainable development identificators, the town of Bratislava as a source of labour power for Austria, specific election preferences of the population in Slovak towns, typification of some Slovak towns from the viewpoint of criminality, religious structure of population in the Slovak cities, age structure and process of ageing in the Slovak urban population, development of traffic system in the town of Brno, migration relationships of Brno in the period 1990-1995, problems of waste dumps in the territory of Brno, comparison of some statutary town characteristics in the Czech Republic, relations between urbanization and labour market in the Czech Republic, and the assessment of the prepared draft law on a new administration system in the Czech Republic.

The second Seminar was a good proof to the contribution of research exchange for both participating parties. The fact that the papers from the two seminars were published

in the proceedings had a very positive response since a whole range of data characterizing the development of newly founded countries in the very first years of their existence were made available to the broad public.

The collaboration of the academic geographical workplaces in the Czech and Slovak Republics will have a further continuation. There is no doubt that this will be contributed to by the agreement signed between the Geographical Institute in Bratislava and the Institute of Geonics in Brno for 1998-2000. The agreed topic - "Geographical features of transforming socio-economic systems in the Czech and Slovak Republics after 1990" provides enough space for mutual comparison of scientific results and their theoretical and methodological applications.

The 3rd Slovako-Czech Academic Geographical Seminar is planned to be held in Slovakia in Autumn 1998 with P. Mariot being again the expert guarantor. In order to bring the most recent information, its theme is to be set up during the first half of 1998.

3rd Moravian Geographical Conference CONGEO '99 Regional Prosperity and Sustainability Austerlitz, Czech Republic, September 6-10, 1999

We have the honour of inviting you to the CONGEO '99 conference on REGIONAL PROSPERITY AND SUSTAINABILITY. It is the 3rd of Moravian geographical conferences, which continues in the tradition of biennial international meetings of geographers and other scientists dealing with regional problems. The conference is aimed at accelerating the international collaboration in regional research, in supporting international cooperation in this field and in improving acquaintance of the scientific public with research achievements of prominent geographical workplaces. Program of the CONGEO '99 conference will consist of a block of paper (poster) presentations, bilateral discussions, excursion and social activities.

The conference will be held in the world-known town SLAVKOV near Brno (Austerlitz). The town (population 5 850) is situated about 22 km from Brno in the south-Moravian district of Vyškov. It was established on trade pathways crossings. At the end of the 12th century the Order of German Knights built a fortified residence there which was one of the richest order's estates in the Czech kingdom. At the turn of the 16th and 17th centuries, the original Gothic was replaced by Renaissance. Václav, Duke of Kounic-Rietberg (1711-1794), a representative of the ruling house of Habsburg, made the town more visible in the Central European area. Napoleon Bonaparte's stay in Slavkov Castle and his proclamation after the battle of Austerlitz in 1805 made the town famous all over the world. The conference will be held in hotel Sokolský dům.

The topic of CONGEO '99 conference includes wide issues of regional geography

- Central and Eastern Europe: regions under transition
- restructuring of old industrial regions
- new prosperity for rural regions
- regional sustainable development: prosperity and/or environment
- Europe of regions: regional cooperation in new Europe
- etc.

The conference is to be attended by all scientists dealing with regional problems, both geographers and non-geographers. Organizers are interested in wide contacts in Europe, especially in Central Europe. Working language of the conference is English. Papers in English (after linguistic proof-reading) not longer than 10 pgs. (A4 size) including graphical enclosures are expected before June 15, 1999. Proceedings will be at disposal of participants by the beginning of the conference.

Preliminary registration fee is USD 195. Reduced fee for participants from countries under transition and for persons who will pay before June 30, 1999 is supposed. More information, and 1st Circulars with preliminary registration:

CONGEO '99, Institute of Geonics ASCR
mail: PO Box 23, CZ-613 00 Brno, Czech Republic
(phone) 420 5 45211901, 420 5 576076, 425 573108
(fax) 420 5 578031, (E-mail) ugn@isibrno.cz
URL: http://www.site.cas.cz/UGN/G/congeo.HTM

Review

M. Dopita et al.: Geologie české části hornoslezské pánve. (Geology of the Czech Part of the Upper Silesian Basin). 280 pp., Prague, CR Ministry of Environment. Prague 1997.

A. Aust et al.: Odkrytá geologická mapa paleozoika české části hornoslezské pánve 1:100 000. (Uncovered geological map of the Czech part of the Upper Silesian Basin 1:100 000).

The reviewed monograph represents a comprehensive and complex geological survey of one of the most industrial part of the Czech Republic, whose economic development was based on intensive deep mining of rich black coal deposits. It is a synthesis of huge knowledge from various geological disciplines, gathered in over two hundred years of mining that began in 1782 and research that took about the same time. An exceptionally high standard of the book with colour and black-and-white photographs, maps, tables, profiles, an extensive list of references, and a relatively detailed summary in English deserve a particular attention (p. 253-278). The book includes a very well made uncovered geological map (without younger formations incl. flysh) on a scale of 1:100 000 with further cartographic enclosures. A question remains the fact that there are no references to the map in the monograph.

The work which is composed of 19 chapters puts naturally the main emphasis on the detailed geological structure of Carboniferous basin filling and on varied aspects of coal mining. Greater attention should perhaps have been paid to Quaternary sediments whose practical importance as a building raw-material is remarkable. In addition to its highly technical scope, the book provides a lot of interesting information for both physical and economic geographers and particularly for geomorphologists. The territory is a place of the repeated continent-continent type collisions with opposite vergency. The Upper Silesian Basin is one of the Upper Carboniferous basins stretching along the northern edge of the Variscan orogene. As a synorogenic basin it was severely influenced by ending Variscan fold and fault tectonics and by Postvariscan platform tectonics. During the Tertiary, the SE part of the basin was covered with flysh nappes in a consequence of Alpinotype tectonics at the time of formation of the Outer Western Karpathians. Repeated marine transgressions occurred in the Neogene, and an important Pleistocene event was a double presence of the continental glaciation. Very interesting geomorphological phenomena in the Upper Silesian Basin are both the red beds, interpreted as deep tropical (?) weathering products and the dendritic drainage pattern of paleovalleys incised into Carboniferous sediments and filled with Miocene sediments of Karpathian and Badenian ages. It is admitted that the development of complex linear depressions could have begun as early as in the Mesozoic. A part of this buried relief was covered with the flysh nappes as early as in the Miocene. Both the red beds and the burried valleys have a great practical significance for coal mining. The formation of the weathering cover which forms the uppermost part of buried relief of folded carboniferous sediments is assumed to occur in the Jurassic and Cretaceous ages. Its coming into existence resulted in the disappearance of coal seams. The red beds represent only the roots of the weathering cover, reaching 20 to 100 m below the surface of Carboniferous paleorelief (with some exceptions of 600 m!) and their thickness being over 230 m in sub-horizontal deposits. The last bits of younger weathering products of most probably the Tertiary origin are found under the Miocene sediments, whose usual thickness is 20 to 30 m (sporadically up to 60 m) and the coming into existence of which is put into connexion with the formation of the Paleogene peneplain.

A rather dissected topography of the buried Paleozoic consists of a great number of prevailingly linear elevations and depressions ("washes") with height differences up to

1 000 m. They came into existence before mainly Miocene transgressions, their genesis being explained by tectonic or erosion processes similarly as that of the red beds and being a subject of many discussions. In addition to the undoubted erosion processes, significant factors were also the predispositions by Variscan faults, particularly in the W-E direction, the formation of flexure bend of the Bohemian Massif eastern edge, bending of its individual parts to the E-SE beneath the Carpathians (accompanied by block tectonics) and the integration of Epivariscan platform into the Alpine structure (overthrusting of the flysh nappes on the forefield and the gradual shift of the foredeep towards the NW). The arrangement of elevations (of which some seem to be isolated) and depressions is illustrated on the map of Paleozoic relief (1:250 000). As it has already been stated, the eastern part of the Upper Silesian Basin including the depressions filled with Miocene sediments is covered with the flysh nappes which today partly form the mountain relief of 1 000 to 1 300 m in height. The age of the movements is dated by the overthrusting of Badenian marine sediments. At some places, the nappe includes also segments of Karpatian sediments.

Interesting for geographers is also the last chapter of the book, which tackles the impacts of coal mining on environment (production of waste rock, coal sludges, coal mining disturbed topography, etc.).

Antonín IVAN

Editorial

Dear readers,

This number is the first one of the sixth volume of MORAVIAN GEOGRAPHICAL REPORTS. Its inserting price has not been changed since the issue of the first number in 1993 although the prices in the Czech Republic have experienced a stormy development. The time has arrived when the editors have to set new prices that will better correspond to the value of the periodical as compared with other ones on the international market. The new price of our periodical (starting from No. 1/1998) is going to be 11.00 DEM per copy plus the postage (and the corresponding conversion rate in CZK), i.e. 22.00 DEM per volume.

However, this price increase will bring forth a number of reductions. The editors will appreciate the loyalty of existing subscribers by maintaining for them the existing annual subscription fee for two numbers. A pronounced reduction will be provided to new subscribers and readers from the Czech Republic and other transforming countries the annual subscription for new subscribers being 13.50 DEM and the price of the individual numbers for those interested from the Czech Republic and the transition countries being 140.00 CZK.

The editorial staff hopes that you will retain in our favour in the future. We believe that our periodical will remain for you one of interesting sources to learn about the regional scientific research in Central Europe.

Escarpment part of the large debris flow in the woody area of Brodská near Karolinka village. The land slide is structurally determined (bedding planes).

Photo O. Krejčí

Illustration to the paper on of K. Kirchner - O. Krejčí

Large debris flow in the woody area near Hutisko-Solanec village. Photo O. Krejčí

Illustration to the paper on of K. Kirchner - O. Krejčí