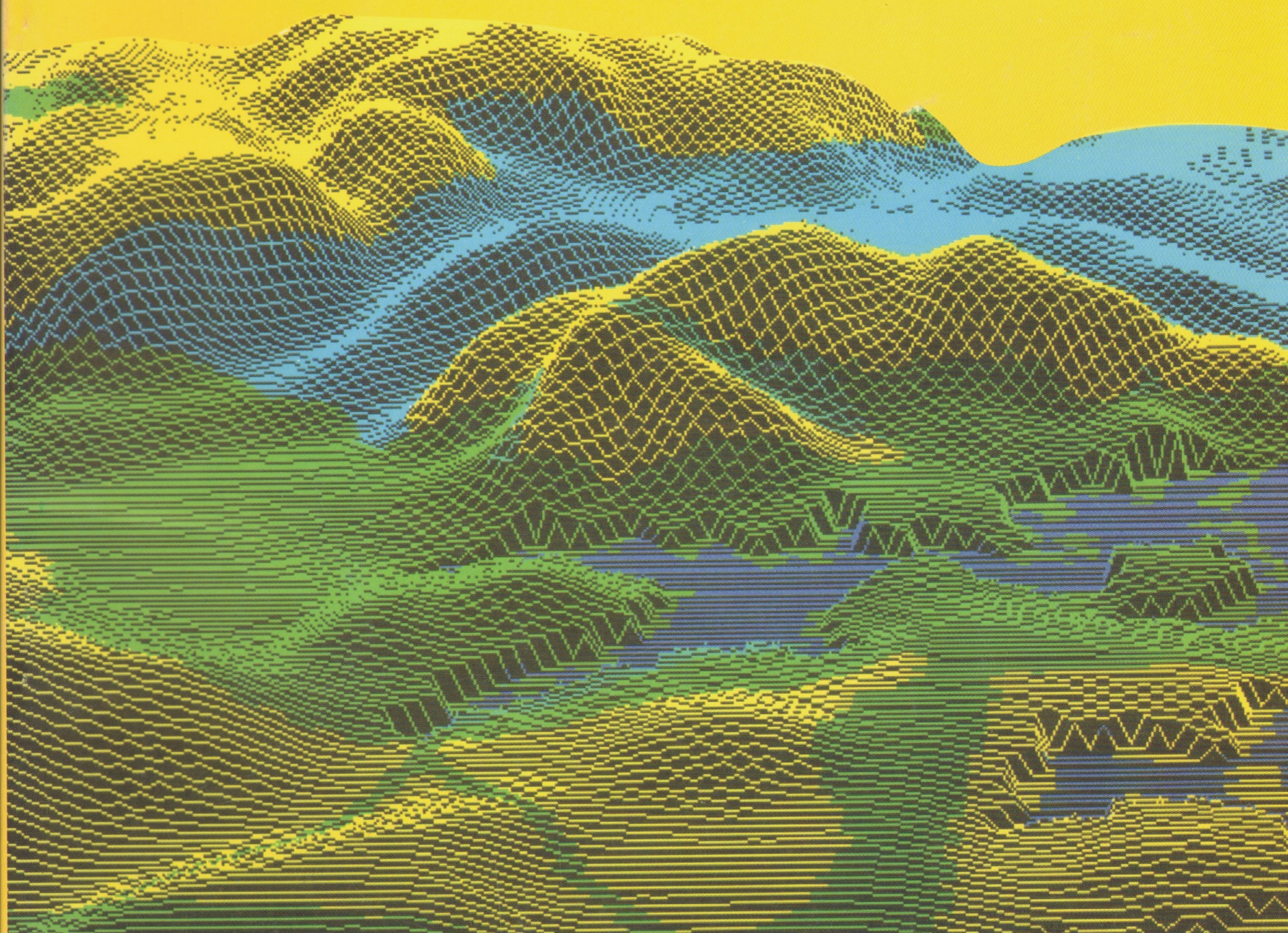
MORAVIAN GEOGRAPHICAL REPORTS

VOLUME 10 NUMBER 2 ISSN 1210 - 8812

2002



The flood affected a number of institutes of the Academy of Sciences of the Czech Republic. View of the Archives AS CR in northern outskirts of Prague at the time of Vltava (Moldau) River culmination on 14 August 2002. Flooded were all buildings, destroyed was about 1 km of archive material including library, rare prints and collection valuables.

(Photo M. Barvík)

Flooded premises of the Institute of Nuclear Research Řež, a.s., Nuclear Physics Institute AS CR, and Institute of Inorganic Chemistry AS CR in Řež north of Prague on the right bank of the Moldau River on 14 August 2002.

(Photo A. Špalek)

Illustrations to the paper of S. Ondráček et al. (p. 53 – 62).

MORAVIAN GEOGRAPHICAL REPORTS

Two numbers per year

PRICE

9 EUR
per copy plus the postage
18 EUR
per volume (two numbers per year)

PUBLISHER

Czech Academy of Sciences
Institute of Geonics, Branch Brno
Drobného 28, CZ-602 00 Brno
IČO: 68145535

MAILING ADDRESS

MGR, Institute of Geonics, ASCR
Drobného 28, 602 00 Brno
Czech Republic
(fax) 420 545 422 710
(E-mail) geonika@geonika.cz
(home page) http://www.geonika.cz

Brno, 4. 11. 2002

PRINT

PROTIS, spol. s r.o., 664 03 Podolí 393

ISSN 1210-8812

Articles

Reports

PERCEPTION OF WORK AND FUTURE EXPECTATIONS OF THE SLOVAK GUEST WORKERS IN AUSTRIA

Daniel KOLLÁR

Abstract

The paper deals with perception of work and future expectations of the Slovak guest workers in Austria. Causal circumstances concerning future expectations of the work in Austria can be sought for in perception of the work conditions in Austria. Positive perception and evaluation of the work conditions in Austria and satisfaction with work influence the ideas of the length of the stay. Migrants expressing mostly their positive and agreeable surprises related to work want to stay long in Austria, while the idea of short-time stay is rather typical for the individuals dissatisfied with their work. Highly interesting in this context though, is that dissatisfaction with work conditions in Austria does not correlate to potential change of job in Slovakia but to a considered change of job in. The quoted fact corresponds to the contemporary theories of push-and-pull models, where using the example of situation of Slovak income and employment in labour market it is necessary to stress the fact that the negative situation at the labour market in Slovakia forces even the dissatisfied Slovaks to go on looking for an adequate job in Austria, discarding the option of returning back to Slovakia.

Shrnutí

Vnímání práce a budoucí očekávání slovenských migrantů za prací do Rakouska

Článek se zabývá analýzou percepce pracovních podmínek slovenských migrantů za prací („gastarbeitrů") v Rakousku a jejich představ o budoucnosti. Charakter slovensko-rakouské migrace za prací je určen malými kvalitativními rozdíly mezi posledním pracovním místem migranta na Slovensku a relativně vysokým výdělkem za tutéž práci v Rakousku. Je zdůrazněna skutečnost, že v této migraci prevažují mladší a nadprůměrně vzdělaní lidé. Dvě třetiny z nich naposledy pracovali na Slovensku v terciální sféře, což zvyšuje jejich šance uplatnit se na rakouském trhu práce. Představy o práci v Rakousku souvisí s percepcí tamních pracovních podmínek. Jejich vnímání ovlivňuje představy o délce trvání pracovního pobytu. Migranti, kteří jsou se zaměstnáním spokojeni, chtějí v Rakousku zůstat dlouhodobě; představa krátkodobého pobytu je typická pro lidi, kteří se svým zaměstnáním v zahraničí spokojeni nejsou. Je však zajímavé, že nespokojenost s pracovními podmínkami v Rakousku nekoreluje s potenciální možností návratu na Slovensko, ale jen s uvažovanou změnou pracoviště v rámci Rakouska. To odpovídá současným teoriím modelů „Push-and-Pull-modelů", ve kterých je na příkladu slovenské příjmové situace a zaměstnanosti možné zdůraznit, že negativní stav trhu práce na Slovensku nutí i Slováky, nespokojené se zaměstnáním v Rakousku nevracet se domů, ale hledat jinou práci v této sousední zemi.

Key words: *commuter migration, labour market, guest workers, perception of work, future expectations*

Introduction

The traditional guest worker migration of the 1960s, 1970s and 1980s in Austria was the result of government regulation. The number of foreign workers and their placement on the labour market was a subject of political discussions. With the fall of the Iron Curtain the situation changed towards a supply driven migration.

In the nineties also the situation in migrating behaviour of the Slovak population changes. Especially between Slovakia and Austria the geopolitical distances diminished and transboundary migration to Austria has risen. The reasons of increased mobility of the Slovaks to Austria have besides the geopolitical and geographic factors above all economic background. Desire of higher earning and a remuneration corresponding to the work done along with insufficient opportunities in the Slovak labour market annually drives ever more Slovaks to look for the jobs either in Czechia or Austria.

Especially Austria became the „land of dreams“ for the Slovak guest workers.

The commuter migration from Slovakia into Austria occupies a special position with comparison to other East-West migrations among the labour markets in Europe. The relatively short distance between Bratislava and Vienna encourages the rapid creation of information networks and permits job-seekers to find work in line with their qualifications without too much financial outlay.

Theoretical and methodological basis of the research

The problem of transboundary migration and commuting for reasons of work is not a new phenomenon in geographic research. However, in the nineties it acquired new dimensions to which also the scientists respond. A new migration behaviour model remarkable for more frequent commuting between the place of living and place of work in contrast to a long-term emigration is in the focus of attention (De Tinguy 1994). Ever more frequent is the case of short-term earning stays abroad with the aim to preserve the original home. Some authors (Fassman, Kohlbacher Reeger 1995, Morokvasic 1994, Rudolph 1994) though, report that the present day migration processes are not qualitatively new. Novelty are only the modern information channels, social profile of the commuting labour force and „diminishing“ of distances that on the one side supports the proneness to migrate and the effort to go on living at home on other.

These are the reasons the contemporaneous geographers pay attention above all to the motives and factors causing migration of population. After the classic push-and-pull model the most important role in the actual migration are played by two economic factors:

a) employment available at the labour market,

b) earning available at the labour market.

Some authors (Treibel 1990) broaden the concept by two another factors linked to information networks and personality traits of the migrant (desire to improve the social status, ability to adapt to new environment, perception of change, etc.). The contemporary behavioural and human geography partly deals with the cited questions and several authors report in the context a „not altogether rational“ behaviour of man. For instance, Thomale (1974) distinguishes in the research of spatial behaviour of man two paradigms:

– „behaviour in space“ rather considering objectively observed behaviour and activity of man, or social groups in space while space is interpreted as a „activity area of man“.

– „spatial behaviour“ where the spatial behaviour of man is characterized rather by neutral behaviour from the point of view of activity and space is interpreted as mental or cognitive image of the spatial cognition and perception.

Relatively new is the second paradigm in the spatial behaviour of man. Its attention is not concentrated on descriptive plan of the research of spatial behaviour of man and the related activities (Schultes-Becker, 1990). It rather handles the world of images and feelings about the space that help better understanding of man with his specific needs and his decisions in space (Ira, Kollár, 1992). The theoretical concept of the presented contribution is based in the quoted paradigm, where the phenomenon of space is substituted by the indicators of labour market. From this point of view the transfer of Downs' scheme of human behaviour (Kollár, 1992) to the problem of commuting migration pursuing work would be highly interesting. Components of the quoted scheme like knowledge, experience, images, feelings and adaptation of the migrant in new environment create meawhile the indicators of migrating behaviour of man and complete the mosaics of comprehension and explanation of such a complex phenomenon like work migration abroad.

Preceding research in Austrian-Slovak boundary area confirmed (Maier 1994, Fassmann, Kollár 1996) that the work migration from Slovakia to Austria is the most frequently repeated type of the Slovak-Austrian commuting migration. One of the works of Austrian geographers (Fassmann, Kohlbacher, Reeger 1993) of the beginning of the nineties has pointed at high justification of research of the phenomenon and its effect on Austrian labour market. Slovak work migration to Austria, different from the Polish, Turkish or Yugoslavian migration, is characterized by daily and weekly migration connected with a different type of perception of the Austrian environment and with a different type of adaptation to it. At the first glance it might appear that the migrating behaviour of the Slovaks is based only in maximisation of the economic profit and minimisation of the time loss by the Slovak migrant in Austria. Nevertheless, as the behavioural geography is since long before not explaining the behaviour of man according to the model of *„homo oeconomicus“*, it is more appropriate to study also the subjective interpretation of the causes and consequences of foreign work migration on part of the Slovak guest worker himself.

It was the reason why the methodology of the research of the quoted phenomenon was built not only on analysis of official statistic data but first of all on empiric research. Two surveys were carried out and evaluated. The first of them in autumn 1994 a three days lasting inquiry at the Slovak-Austrian border crossings yielded the answers to two basic groups of questions:

1. What is the size and spatial structure of work migration of Slovakia to Austria?

2. What groups of population judged by socio-demographic and socio-geographic traits participate at the migration to Austria?

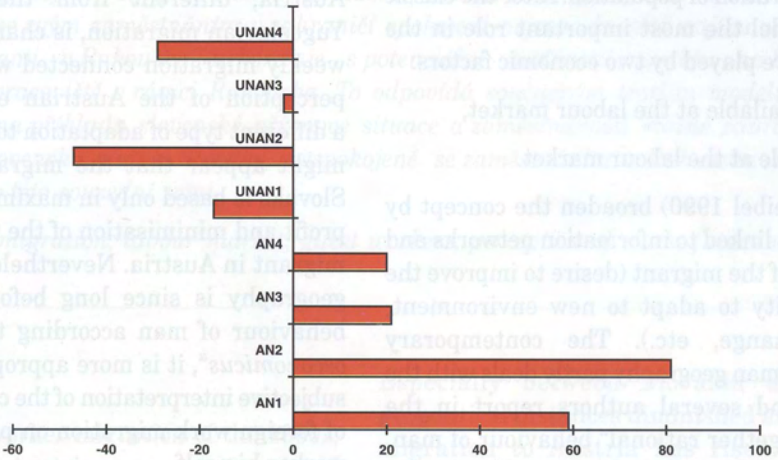
Based in the study of the Austrian statistical resources and results of the first empiric survey the second was prepared, a type of extensive interview with a representative sample (by age, sex, education and place of living) of 250 respondents.

This contribution on border commuters from Slovakia to Austria is based first of all on the second survey made among the Slovak workers in Austria, who were asked detailed questions concerning their feelings and adaptation. The questions contained in the questionnaire were oriented to chosen social and behavioural-geographic aspects of work in Austria and the spatial aspect was expanded by the subject of perception and evaluation. The evaluations of feelings and adaptability connected with the work of the Slovak guest workers in Austria are not analysed in this contribution independently. They are related to the ideas of the respondents of their future.

Perception of work and work conditions

Let us note in introduction as for the evaluation and interpretation of the results of feelings and adaptation of the Slovak guest workers in Austria that the obtained research results of professional inclusion of the Slovaks into the Austrian labour market are in contrast to the results of so far realized research in other Eastern European migrants to Austria (Fassmann, Kohlbacher, Reeger 1995). This research has demonstrated that accepting an inferior job, the one not corresponding to the qualifications of the migrant is the toll paid for his/her integration into the foreign labour market. The Slovak example of work in Austria though, proves the contrary. Rather small qualitative difference between the last job of the migrant in Slovakia and carried out activity in Austria, as well as relatively high earnings point at the special nature of the Slovak-Austrian work migration. Also the fact that among the migrants young and above-average educated people prevail must be stressed. Two third of them were working in terciary sphere in Slovakia what offered them relatively better chances to find their place at the Vienna labour market.

Another special trait of the Slovak-Austrian work migration within the European context is caused by the fact that the place of the last job in Slovakia was mostly the urban labour market (Bratislava) and the target place of job in Austrian is again mostly urban (Vienna). The commuting work migration between Slovakia and Austria gains thus the nature city-city in difference to so far prevailing types of migration rural area-city. It is also connected with a minimally different professional location between the last job done in Slovakia and the one carried out in Austria. Eventually it is necessary to include also the fact of the small geographic distance between the dominant place of living in Slovakia and the dominant place of work in Austria. The search for an adequate working place results then easier and cheaper.



AN1 - good and efficient working system
AN2 - pleasant working atmosphere, environment, relations and comradely spirit
AN3 - good technical equipment of the working place
AN4 - earning
Negative associations with a job in Austria were likewise divided into four categories:
UNAN1 - poor and little efficient working system
UNAN2 - unpleasant working atmosphere, environment, relations and poor comradely spirit
UNAN3 - inadequate technical equipment of the working place
UNAN4 - negative attitude to foreigners

Fig. 1: Spontaneous associations with a job in Austria

Actually the Slovak worker decides to migrate only after he finds an adequate employment in contrast to other guest workers (for instance from Poland) who first look for provisional lodging and for the start also provisional job. This fact explains also the low rate of „wrong" or too different professional location of the Slovaks in the labour market in Austria.

Positive or negative relation to work conditions and the work carried out in Austria, as well as satisfaction with it can be documented on example of spontaneous associations of pleasant or unpleasant experience, or dissatisfaction with employment, as the case may be, and important indicators of adaptation to working place and society, as well as a signal for potential migration behaviour and considerations on future.

Relevant from the point of view of analysis of working feelings of the Slovak guest workers are answers to the following questions:

1. What has positively surprised you in relation to your job in Austria?

2. What has negatively surprised you in relation to your job in Austria?

The individual answers have without doubt confirmed more positive than negative associations with a job in Austria. As the very diversified mosaics of answers does not allow for a statistic processing, four more general types of categories were created and to them single spontaneous associations of the respondents were aligned. In case of pleasant associations four main categories originated (Fig. 1).

In general it can be stated that the spontaneous working associations confirmed prevailingly positive nature of the surprises connected with a job (only 24.0 % of respondents were not positively surprised by anything in an Austrian place of work, while 52.6 % of respondents did not express any negative experience gained in place of work). Out of the single categories of pleasant spontaneous associations quoted above surprise of pleasant working and social atmosphere at the working place appeared most frequently (32.4 %). In the category of unpleasant spontaneous associations this answer was also comparably frequent but its number was substantially lower (18.8 %). Unpleasant surprise of negative relation to foreigners at the working place was quoted only by 11.6 % of Slovaks, what allows for a general qualification as a positive trend in Austrian society and at the Austrian labour market, though the Slovak example does not have to be necessarily (and probably is not) comparable to other nationality guest workers. Hypothetically it points at the existence of tolerance to employed Slovaks on part of Austrian employers and employees, or a positive image of the Slovaks working in Austria.

Further analysis of pleasant spontaneos associations concerning work in Austria revealed numerous statistically significant dependencies between the chosen socio-demographic and sociogeographic traits of respondents and their „agreeable surprises" in work. Sex, regarding perception of work conditions in Austria shows differences in priorities of men or women. While the Slovak men quote in this relation the feelings concerning pleasant surprise represented by well-functioning work system (37.0 % men), women appreciate pleasant work atmosphere, personal relations and comradely spirit (54.5 %). Agreeable spontaneous associations of work atmosphere are typical also for young age categories of 18 – 30 years (53.6 %). The quoted fact is to certain extent contradicting the traditional idea of the Slovak population of work conditions of guest workers abroad and roots partially in communist propaganda of „capitalist exploitation". The number of positive statement of work atmosphere, comradely spirit and personal relations increases with better mastering of German language and qualified work carried out by the Slovak migrant. On the other side longer stay in Austria allowing for better knowledge of the work conditions evokes in migrant rather pleasant associations of work system. The legal status of carried out work likewise causes differences in pleasant spontaneous associations of work in Austria. Migrants possessing work permit and health and social insurance quote most frequently a surprise over the good work system (40.5 %) and opposite, high share of spontaneous pleasant associations in category of pleasant work atmosphere, comradely spirit and positive personal relations (55.9 %) corresponds to illegal guest workers in Austria. Generally we can say that qualified, above-average educated Slovak labour force in Austria prefers in its pleasant feelings provoked by work a good and efficient work system, while less qualified labour force perceives considerably more intensely the work atmosphere.

Disagreeable spontaneous associations of work conditions in Austria do not have as much statistically significant dependencies as the agreeable ones. Negative perceptions of work conditions are connected above all with the performance of „inferior" work from the point of view of migrant's qualifications and the related lower financial remuneration and lower savings. Higher number of quoted unpleasant associations of work in Austria is typical for the medium class of migrants carrying out specialized jobs (almost 60 % of all quoted negative surprises were in this employee category) and are able to save monthly from 9 000 to 12 000 ATS. Migrants carrying out specialized jobs quote more often as compared to auxiliary workers or highly qualified experts disagreeable surprises over the work atmosphere, environment, relations and a negative relation to foreigners. Causes of the phenomena may lie in relatively shorter stay which is characteristic for the migrants carrying out less qualified activity in Austria. For instance, the quoted group of mostly auxiliary workers tends to be „satisfied with all in Austria." And the opposite, highly qualified individuals because of their longer stay in Austria got use to work conditions and identified with them. In this context also the cases of unpleasant spontaneous associations of work or work place in Austria is more sporadic.

Open declaration of satisfaction or dissatisfaction of the Slovak guest workers with the work conditions in Austria implicitly offers another possibility of explaining and subsequently better understanding of positive or negative perception of working conditions and their evaluation. Satisfaction of an individual with certain phenomenon and fact is based in bilateral relation of objective reality and its subjective interpretation. It forms one of important human feelings with high probability of influencing the individual's behaviour. In this context a distinct dominance of satisfaction of the Slovak migrants with their work place in Austria prevails (88.0 %). Although on the one side qualification of the carried out work in Austria does not affect the feeling of satisfaction or dissatisfaction there exist statistically significant differences in satisfaction of an individual with work in Austria in relation to his/her education and qualification reached in Slovakia. Education and qualification are in majority of cases not in contradiction with the quality and expertise of the carried out work in Austria, but the migrants who declare their dissatisfaction with work in Austria mostly belong to the category of commuters, carrying out „inferior" work than the one they used to carry out in Slovakia. They are mostly university graduates who are only starting to work in Austria and have not yet found an adequate job at the Austrian labour market (26.3 % of the inquired with a finished university education are dissatisfied in their work place). On the other side though, the fact that these migrants after a year or two spent in Austria find a job adequate to their qualification was confirmed. Highly significant statistic correlation (at the level of significance 0.001) between dissatisfaction and the work carried out, and considerations of changing the job indirectly confirm this tendency. Out of most frequently quoted reasons of dissatisfaction with work in Austria, besides inferiority of the job, an important role is played by the feeling of distance from home and the feeling „I am always a foreigner here". However, generally it can be said that comparably low number of „dissatisfied" migrants does not allow for correct enlightenment of the phenomenon, that can be classified only as an outline of certain tendencies.

A chance of full integration of the Slovak guest workers into the Austrian labour market is suggested by the very fact of a change of job. The main reasons of change of job by the Slovak guest workers in Austria are economic (31.3 % of migrants who changed the work place in Austria quoted as a true cause of the change the fact of „higher earning") compared to other quoted phenomena like the geographic distance of the place of work in Austria from the place of living in Slovakia or poor relations at the work place. Frequency of change of work place of the Slovak guest works in Austria statistically depends on age and sex of a respondent. For instance, 88.1 % of women have never changed their job in Austria while the interviewed men are in this sense substantially more flexible (almost every third of them has at least once changed the job in Austria). As for the single age groups, more prone to change of job is the middle age group (36 – 45 years) out of which almost 40 % had minimum two jobs in Austria. And the opposite, the least prone to change of job are the youngest (below to 25 years) and the oldest age groups (over 45). In relation to the search of new job in Austria success concerning the search itself appears interesting (39.1 % of the interviewed who changed the job in Austria quoted that they found their new job themselves).

In conclusion of this analysis we can say that perception of work conditions and feelings associated with work in Austria represent a basis for the study of future development of the Slovak migration to Austria. In the context of further adaptation, or ill adaptation of the Slovak migrants to work abroad an experiment bringing information on the imaginations of their future existence related to work in Austria is inspiring. As a matter of fact the quoted issue simulates migrating behaviour of man and to certain extent it explains the development of the labour market in the forthcoming years.

Future expectations

Analysis of future development of the Slovak work migration to Austria is on the one side based in quasi „objective characteristics" of a migrant and subjective interpretation of reality on other. Ideas of future of work in Austria are differentiated according to socio-demographic characteristics of the respondents (sex, age), socio-working traits of a migrant (carried out activity and length of stay in Austria, legal status and income) and subjective interpretation of satisfaction with work and feelings associated with it.

The majority of the inquired guest workers intend to work in Austria longer time (58.3 % of migrants even more than 10 years, or as long as possible). Statistically significant differences by sex point at different ideas of future of men and women. While women prefer short-time and limited stay abroad (more than 40 % do not want to work in Austria longer than 3 years) and only difficult economic and social situation in Slovakia has forced them to look for a job abroad, men want to stay in Austria as long as possible (answers like: until retirement or as long as possible were the most frequent ones — 60 %).

As for the rest of socio-geographic traits, the future of work in Austria correlated above all with age. The youngest migrants can be divided into two types:

1. almost half of them want to work in Austria more than 10 years,
2. for 44.1 % of the youngest migrants the job in Austria is a temporary affair.

The mentioned disproportion is connected with the level and mainly conclusion of education of the young migrants. The first type is characteristic for the young graduates of the medium level education and universities in Slovakia (they are trying to stay in Austria as long as possible) while the second type includes the university students who are only trying to improve their financial situation. In higher age categories the idea of long-term work in Austria prevails reaching the highest level (68.4 %) in group of migrants older than 45 years.

Carried out activity in Austria likewise influences the ideas on future work. Ideas of long-lasting work abroad are typical for the migrants active in specialized jobs (63.5 % of them want to stay in Austria more than 10 years, or as long as possible, though almost half of the guest workers in category of auxiliary workers want to stay in Austria maximum three years.

Statistically significant dependencies exist between the length of stay in Austria and ideas of future of the work. The longer are the Slovaks active in Austria, the more they want to stay. Of the migrants who arrived to Austria in 1995, 50.6 % express the will to stay longer. The share of „the ones who long to be employed in Austria for a long time“ is higher among the migrants who arrived in 1994 (61.4 %) and the highest value (67.2 %) was reached among the migrants who work in Austria four and more years.

The particular plans for the future work in Austria are statistically significantly dependent (similar as in case of the Polish migrants, Fassmann, Kolbacher, Reeger 1995) also on external factors active in labour market and housing available, as well as the legislation and legal status of a migrant. In case of the Slovak guest workers they correlate especially in dependence on income and work permit. While 52.8 % of migrants earning less than gross 8000 ATS monthly want to stay in Austria for a short time, the migrants belonging to higher income categories declare their wish to stay long time in Austria (67.4 %). Similar situation of different ideas is also in groups of guest workers possessing work permit and the illegally employed. While on the one side 40.8% of migrants lacking work permit consider their work in Austria a short-time affair, only one fifth of migrants with work permit declares the short-term plan of staying in Austria on other, suggesting that higher income and possession of work permit prolong the planned length of stay in Austria.

Causal circumstances concerning ideas of future of the work in Austria can be sought for in mental or cognitive image of the work conditions in Austria. Positive perception and evaluation of the work conditions in Austria and satisfaction with work influence the ideas of the length of the stay. Migrants expressing mostly their positive and agreeable surprises related to work want to stay long in Austria, while the idea of short-time stay is rather typical for the individuals dissatisfied with their work (almost half of them quote the limit of maximum three years at the present job in Austria). Highly interesting in this context though, is

	Total abs.	Total %	below 3 years %	3 – 10 years %	more %
SEX					
men	180	72.9	20.6	17.8	61.6
women	67	27.1	41.8	9.0	49.2
AGE					
below 25	68	27.5	44.1	7.4	48.5
26 – 35	73	29.6	17.8	21.9	60.3
36 – 45	68	27.5	17.6	22.1	60.3
46 and more	38	15.4	26.3	5.3	68.4
Total	247		26.3	15.4	58.3

Source: Own research in February 1996

Tab. 1: Socio-demographic structure of migrants and the ideas of length of stay in Austria that dissatisfaction with work conditions in Austria does not correlate to potential change of job in Slovakia but to a considered change of job in Austria (66.7% of dissatisfied are planning the change of job in Austria). The quoted fact corresponds to the contemporary theories of push-and-pull models (Treibel 1990), where using the example of situation of Slovak income and employment in labour market it is necessary to stress the fact that the negative situation at the labour market in Slovakia forces even the dissatisfied Slovaks to go on looking for an adequate job in Austria, discarding the option of returning back to Slovakia.

Conclusion

Analyzed perception of work and future expectations of the Slovak guest workers in Austria also pointed at the trends in further development of work migration from Slovakia to Austria. They confirmed that the study of subjective interpretation of the causes and consequences of foreign migration by the migrant himself is justified and it explains to certain extent his/her migrating behaviour. However, it is not possible to overestimate the individual ideas of the respondents and use them as a sole source of estimations of further migration development. Prognosing of future development of the Slovak migration to Austria is at the present much more complicated. The scenarios of migration in the next few years will be based on part of the Slovaks prevailingly on economic reasons and influenced by numerous factors like:

- legal provisions concerning the granting of work permits to the foreigners on part of Austria,
- „openness“ of the frontiers
- possibilities of seasonal work in Austria,
- bilateral agreement on the quotas of the Slovak employees,
- political and economic development in Slovakia, etc.

The first four quoted conditions relate to the new Austrian trends in control of immigration. It will practically most probably mean that the Slovak migration to Austria will go on though with certain limitations. As suggested by the development of labour market the transboundary Slovak-Austrian migration will be still tolerated and accepted in future and it will create a stimulating element for the development of the Slovak-Austrian boundary area. Different consequences are expected for the Slovak labour market. Persisting high unemployment in Slovakia, insufficient remuneration of work and a slowly progressing transformation will lead to further drain of the qualified labour force out of Slovakia.

This contribution was worked out as a part of the Project no 7052/20 financed by the VEGA Grant Agency.

References

DE TINGUY, A. (1994). Die Abwanderung der Akademiker aus der „GUS“ nach Frankreich: Flucht oder Mobilität? In: MOROKVASIC M., RUDOLPH H.(Hg.) Wanderungsraum Europa: Menschen und Grenzen in Bewegung. Berlin, Sigma Verlag, p. 270-287.

FASSMANN, H., KOHLBACHER, J., REEGER, U. (1993). „Suche Arbeit“- Eine empirische Analyse über Stellensuchende aus dem Ausland. In: Forschungsbericht des Instituts für Stadt- und Regionalforschung der Österreichischen Akademie der Wissenschaften, Heft 10, Wien, 58 pp.

FASSMANN, H., KOHLBACHER, J., REEGER, U. (1995). Die „Neue Zuwanderung“ aus Ostmitteleuropa - eine empirische Analyse am Beispiel der Polen in Österreich. In: Forschungsbericht des Instituts für Stadt- und Regionalforschung der Österreichischen Akademie der Wissenschaften, Heft 13, Wien, 78 pp.

FASSMANN, H., KOLLÁR, D. (1996). Les migrations frontalieres entre le Slovaquie et l´Autriche, Migrations societe 43, p. 91-102.

IRA, V., KOLLÁR, D. (1992). Cognition of environment as part of the relationship „man-environment“, Geographica slovenica 23, p. 463-476

MAIER, G. (1994). Economic Integration in Central Europe: Cross-Border Trips in the Vienna-Bratislava Region. Wien, Manuskript, 20 p.

MOROKVASIC, M. (1994). Pendeln statt Auswandern. Das Beispiel der Polen. In: MOROKVASIC M., RUDOLPH H.(Hg.) Wanderungsraum Europa: Menschen und Grenzen in Bewegung. Berlin, Sigma Verlag, p. 166-188.

RUDOLPH, H. (1994). Grenzgängerinnen und Grenzgänger aus Tschechien in Bayern. In: MOROKVASIC M., RUDOLPH H.(Hg.) Wanderungsraum Europa: Menschen und Grenzen in Bewegung. Berlin, Sigma Verlag, p. 225-250.

SCHULTES-BECKER, I. (1990). Auswirkungen einer „partiell offenen" Grenze auf das Verhalten der Bevölkerung, Arbeitsmaterialien zur Raumordnung und Raumplanung, Heft 26, Bayreuth, p. 65-230.

TREIBEL, A. (1990). Migration in modernen Gesellschaften. Soziale Folgen von Einwanderung und Gastarbeiter. Weinheim und München: Juventa Verlag, 200 pp.

Author's address:

RNDr. Daniel KOLLÁR, CSc.

Geografický ústav SAV, Štefánikova 49, 814 73 Bratislava

e-mail:geogkoll@savba.sk

Reviewer:

RNDr. Peter MARIOT, CSc.

SLOPE DEFORMATIONS AND THEIR SIGNIFICANCE FOR RELIEF DEVELOPMENT IN THE MIDDLE PART OF THE OUTER WESTERN CARPATHIANS IN MORAVIA

Karel KIRCHNER, Oldřich KREJČÍ

Summary

The extreme precipitation in July 1997 activated slope movements in the flysch relief of the Outer Western Carpathians in eastern Moravia. The slope movements resulted in extensive landscape devastation and markedly remodelled the topography. The situation was an impulse for a detailed geological and geomorphological study of slope displacement. The paper presents detailed characteristics of six chosen localities with slope deformations. The research brought some new pieces of knowledge of slope movements, which help to better understand and appreciate the role of slope movements in the development of flysch relief.

Shrnutí

Svahové deformace a jejich význam při vývoji reliéfu střední části Vnějších Západních Karpat na Moravě

Extrémní srážky v červenci 1997 aktivovaly svahové pohyby ve flyšovém reliéfu Vnějších Západních Karpat na východní Moravě. Svahové pohyby způsobily rozsáhlé škody v krajině a výrazně přemodelovaly reliéf. Situace byla impulsem k podrobnému geologickému a geomorfologickému studiu svahových deformací. V článku je podrobně charakterizováno 6 vybraných lokalit se svahovými deformacemi. Výzkumy přinesly řadu nových poznatků, které rozšiřují a zpřesňují poznatky o svahových pohybech a umožňují lépe pochopit a docenit úlohu svahových pohybů při vývoji flyšového reliéfu.

Key words: *slope deformations, flysch relief, Outer Western Carpathians, eastern part of Czech Republic*

1. Introduction

The Outer Western Carpathians (Fig. 1) form in Moravia a mainly dissected relief of mountains and highlands which are built by complexes of flysch rocks. An important relief-forming agent are slope movements, landslides in particular, resulting in various types of slope deformations. Triggering mechanism of the development of slope movements in this region use to be extreme precipitation, intensive thawing of snow cover and human factor. Effects of these factors and the consequent – often extreme – development of slope movement help us to understand the intensity of relief remodelling and the origin of abundant relief forms. It is not only the development of many new relief

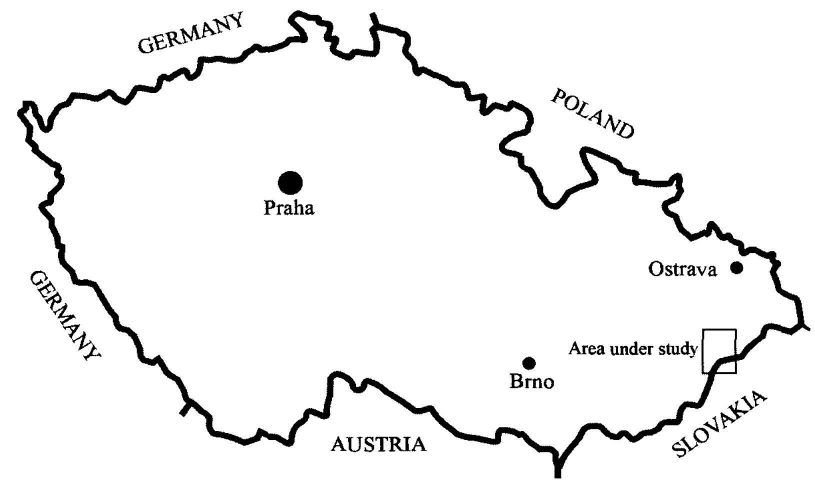


Fig. 1: Location of study area

forms that occurs during the development and activation of slope movements but also extensive damage on landscape infrastructure.

The role of slope movements in the development of the relief of Outer Western Carpathians in Moravia was not duly appreciated by geomorphologists in the past and slope deformations were not paid too much attention. In contrast, the phenomenon of slope movements has been a subject of long-term research in neighbouring countries with the similar flysch relief. Polish geomorphologists evaluated the role of slope movements as dominant in the Polish Carpathians where the slope movements are prevailing at relief development (e.g. Gil-Starkel, 1979; Kotarba, 1986; Zietara, 1988). Also in the relief of flysch ranges of mountains in Slovakia the role of slope movements has been paid deserved attention (e.g. Harčár, 1987; Nemčok, 1982). The effect of landslides in the relief of flysch Carpathians in Moravia was recently studied by Czudek (1997). The heavy rainfall in July 1997 caused an extensive activation of slope movements which were again paid appropriate attention in the neighbouring territories of Slovakia and Poland (e.g. Bajgier-Kowalska, 2000; Gorczyca, 2000; Malgot-Baliak, 2000; Mrozek-Raczkowski-Limanówka, 2000).

Information on the activation of slope movements after the extreme precipitation in eastern Moravia in July 1997 (Dostál-Řehánek, 1999) and on the first stage of research works (Kirchner-Krejčí, 1998) was brought on pages of this periodical. Slope movements caused vast damage in the landscape (Rybář, 1999) and pronounced creating of the relief. The situation triggered a detailed study of slope deformations in the most affected areas and the research got also focused on recent extensive calmed-down slope movements in which the year of origination was known. The research works brought a number of new lessons learnt, which enable a better understanding and appreciation of the role of slope movements in the development of flysch relief particularly in eastern Moravia.

The paper presents a brief information about the follow-up research of slope deformations that linked up with the first stage of studies (see Kirchner-Krejčí, 1998). It is focused namely on the characterization of some slope deformations in the middle part of the Outer Western Carpathians, eastern Moravia (Photo 1). The geological and geomorphological research of slope deformations in this region provided a number of new results which further widen and precise the existing knowledge about the role of slope movements in the geomorphological development of flysch relief.

The study of slope deformations is implemented within the geological project „Slope deformations in the Czech Republic" guarantor of the project being the Czech Geological Survey). The geomorphological research works performed by the Institute of Geonics, Branch Brno, Academy of Sciences of the Czech Republic were financially supported from the grant project of Grant Agency of the Academy of Sciences of the Czech Republic No. IAA308690 (Vaishar ed., 1999).

Localities with slope deformations characterized in the paper are as follows: the Moravian-Silesian Beskids - Kněhyně-Čertův mlýn Hill ; the Hostýnské vrchy Hills - Křížový vrch Hill; the Vsetínské vrchy Hills - Bystřička landslide, Brodská

Photo 1: Summit part of Moravian- Silesian Beskids (built by prevailing glauconitic sandstones of the middle part of Godula Formation – Silesian unit), on foreground is Kněhyně Hill (1257 m a. s. l.) and Čertův mlýn Hill (1206 m a. s. l.) with large slope deformations. Photo K. Kirchner.

landslide, Jezerné landslide; the Javorníky Mountains – Hradisko Hill (Fig. 2).

study was elaborated in 1999 of „Geological structure of Moravia as a conditioning phenomenon of landslide

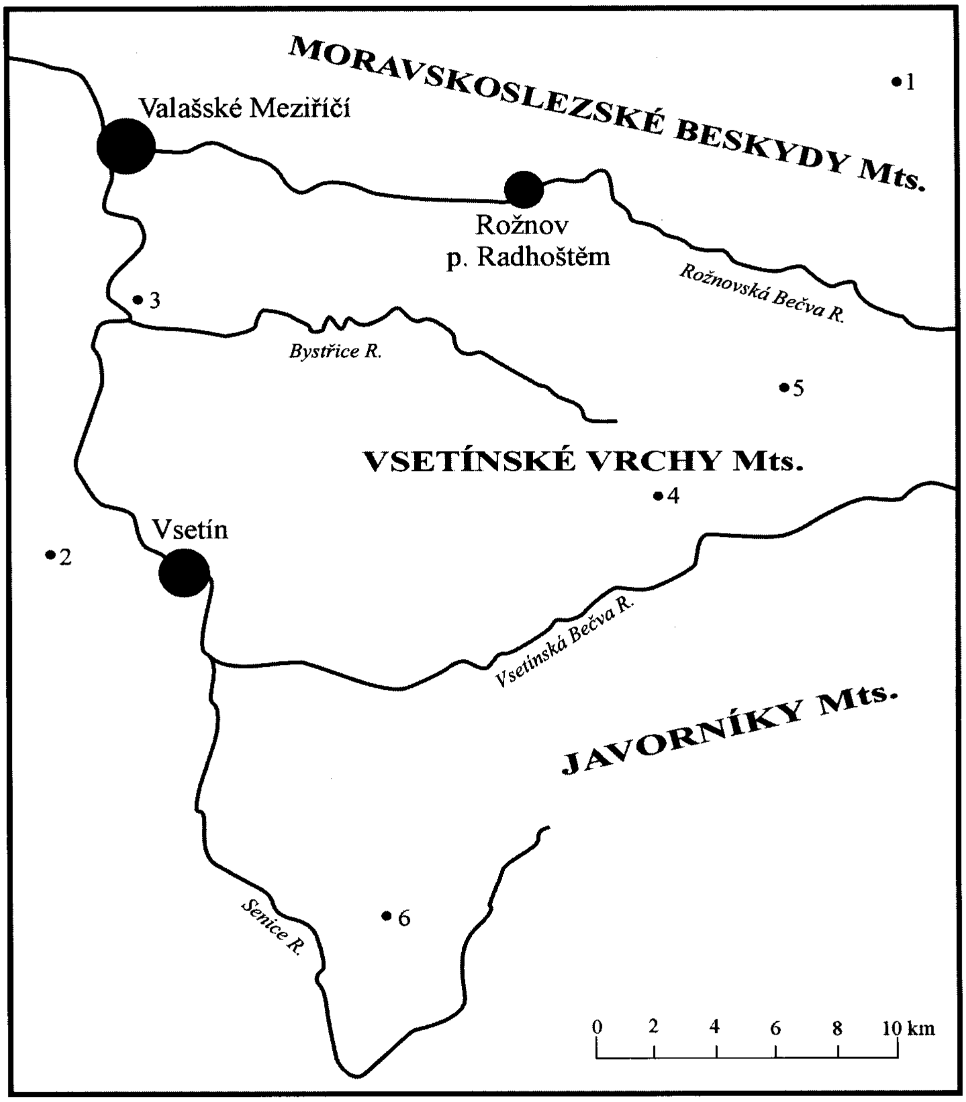


Fig. 2: Schematic map showing the selected localities of slope deformations. 1 – Kněhyně-Čertův mlýn Hill, 2 – Křížový vrch Hill, 3 – Bystřička landslide, 4 – Brodská landslide, 5 – Jezerné landslide, 6 – Hradisko Hill

2. Methodology

The stage of inventory to study new slope deformations started after their extensive activation and development from July 1997 being implemented by Czech Geological Survey Prague with many surveying organisations. In the Vsetín district for example there were more than 250 localities registered at this time with developing slope movements (see also Kirchner-Krejčí-Máčka, 2001). The inventory served as a basis for the evaluation of geological hazards and risks. Three categories were specified as those of risk due to slope movements with the most dangerous landslides being classified in Category III (details see Hroch, 1999). With respect to the extensive character of slope deformations and their further influence on the development of human activities and life in the landscape a special-purpose movements". The study was followed by a geological project „Slope deformations in the Czech Republic" which is still in progress. The project includes a detailed investigation of slope deformations and creation of „Special maps of stability conditions" provided primal basis to produce graphically simple „Prognostic maps of landslide susceptibility" sometimes called also „Landslide hazard maps". (e.g. Rybář-Stemberk-Suchý, 1998; Rybář-Stemberk, 2000). As to April 2001, there were more than 1500 landslide phenomena documented in the Vsetín district on the basis of further research works with a total number of slope deformations in the Outer Flysch Carpathians in Moravia amounting to 3700 as at this date (Krejčí et al., 2002).

The landslide research differs in dependence on individual localities and their topical situations, the basic method being geodetic alignment of the landslide and monitoring of its movements (e.g. Hradisko Hill in the Javorníky Mts.). Inclinometric measurements in boreholes are normally made in larger landslides with drilling works in the most extensive landslide areas reaching into a depth of up to 70 m. The boreholes further serve for the calibration of geophysical methods (geoelectrical, shallow seismics and georadar). The complementary research is always accompanied with a construction stability assessment of the locality and with a proposal of rescue measures which are normally quite costly works ranging between 30 000 up to over 4 million USD (landslides above the railway track near the village of Bystřička).

The most affected regions of Vsetín and Zlín have been subjected to the assessment of slope deformations with the use of engineering and geological mapping which is in progress now and including the application of methodological approaches of detailed geomorphological mapping.

3. Basic features of the relief in the region of interest

The relief of the region in question belongs in the geomorphological subprovince of Outer Western Carpathians, regions of Western Beskids (geomorphological unit of Moravian-Silesian Beskids – Locality Kněhyně-Čertův mlýn Hill, geomorphological unit of Hostýnsko-vsetínská hornatina Mountains- sub-unit Hostýnské vrchy Hills – Křížový vrch Hill, sub-unit Vsetínské vrchy Hills – Bystřička landslide, Brodská landslide, Jezerné landslide), and Slovakian-Moravian Carpathians (geomorphological unit of Javorníky Mountains – Locality Hradisko Hill) as divided by Czudek ed. (1972). It follows that the territory is generally characterized by the topography of mountains and highlands, erosion-denudational and structurally-denudational, dwelling on Mesozoic and Tertiary complexes of flysch rocks (details see Kirchner in Pavelka-Trezner eds. 2001). In geological terms the region of interest belongs in the Magura Flysch Belt) (Rača tectonic unit) while the northern part of the area in question with the Moravian-Silesian Beskids belongs in the Outer Flysch Belt (Silesian unit).

The flysch complexes are formed by alternating layers of claystones and sandstones of the Mesozoic and Tertiary age. The Flysch Belt is an allochthonous nappe system thrust during the Paleogene and Miocene tectogenesis over the West European plate. Other suitable materials for gravitational movements are superficial loamy-stone, loamy-clay, loamy-sand or debris sediments as well as thick unconsolidated residual mantles of weathered flysch rocks. The dominant claystone complexes are widespread but landslides situated on this lithology are less common and of smaller size. The weathering resistance of the rudaceous (conglomerate) and arenaceous sediments is mainly controlled by the type of cement. The most common carbonate and clay-marly cements are easily weathering when exposed to exogenic agents. Thick bedded sandstones usually weather to as deep as 20 m.

The selected slope deformations and their geomorphological significance in some geomorphological localities are characterized on the basis of state-of-the-art knowledge with their basic characteristics being based on studies published by Krejčí-Kirchner (2000), Krejčí et al. (2000), Krejčí et al. (2001), Kirchner-Krejčí-Máčka, 2001).

4. Geomorphological characteristics of some slope deformations

Locality: Kněhyně-Čertův mlýn Hill

The locality contains the summit part of Kněhyně Hill (1257 m a. s. l.) and Čertův mlýn Hill (1206 m a. s. l.) in the western part of the Moravian-Silesian Beskids. The basement is mostly built of glauconitic sandstones of the middle part of Godula Formation (Silesian unit). Structural conditioning of these plains cannot be excluded due to strike and dip of sandstone beds on the summit plain (Kněhyně 195/15°, Čertův mlýn 290/8°). In the top part of Čertův mlýn Hill there is a pronounced rock ravine (length 110 m, depth up to 4 m) on whose bottom there are entries into pseudokarst caves. The ravine developed on the tectonic line of N-S direction through deep creep and loosening of the rock massif (details see Kirchner-Krejčí, 2000b). Upper parts of the Kněhyně slopes are modelled by sizeable block slides and slides of slope sediments. Root areas of slope deformations are bound to the course of tectonic faults (W-E, N-S) being characterized by steep rock walls.The authors assume that the course of these lines also affects the character of Kněhyně top. According to the dominating tectonic lines there are rock ravines opening in the slopes, parallel to one another (locally called „zaryje"/scratches/) with a number of entries into the underground (details see Wagner et al., 1990). There is for example an extensive slope deformation beneath the root edge on the north-eastern slope of Kněhyně, which is up to 1 km long and 1 km wide. The well known Kněhyňská jeskyně (Cave) at a depth of 57.5 m also came into existence on the crossing of E-W and N-S tectonic lines. The ridge of Čertův mlýn, too is modelled by intensive slope movements along the dominant system of tectonic fissures in the N-S direction. On the south-western ridge there is for example a slope landing representing a rotated block with extensive pseudodoline – dimensions 50x20 m, depth 10 m. The block slide down along the root area formed by the tectonic fissure.

Nappe structure of the partial Godula nappe (Silesian nappe) was affected by tectonic fissures which break the original structure into partial blocks with predominating strike of the dip of layers to the South or to the West. Character of slopes in the summit portion of the Moravian-Silesian Beskids is determined by gravitational movements which are bound to N-S tectonic lines (predominant in the Godula nappe). Deep founded gravitational deformations develop along these lines, with the disintegration of summit ridges. The gravitational deformations are active also in the present time since the underground spaces are continually developing. According to speleological research, the depth of the Kněhyně cave has been reduced from 72.5 m in the 1960s (Pavlica, 1984) to 57.5 m (Wagner et al., 1990).

Locality: Křížový vrch Hill

The Křížový vrch Hill can be found in the eastern part of Hostýnské vrchy Hills at an altitude of 670 m a.s. l. The slide area is situated on the south-eastern slope of Křížový vrch Hill (scar at an altitude of 600 m a. s. l.), its length and width being 925 m and 525 m, respectively. There are several types of slope movements here (block movements, landsliding, earth flows), the rock wall of scar is modelled by rock fall. According to Wagner et al. (1990), the rock wall was in its upper portion specified as a frost-riven cliff and the adjacent plain as a cryoplanation terrace. According to research made by Kirchner and Krejčí (2000a), it is shear plane of fossil block movement, which is connected with the development of rock wall of scar and with the movement of rock blocks. The rock wall reaches to a height of 6.5-7.0 m and length of up to 300 m and is founded in sandstones of the Soláň Formation, (the Rača unit). The block movement is bound to the course of jointing plane (strike and dip – 132/85°), beds – 28/17°. The course of fissures which are approximately parallel with the rock wall of the block movement gave rise to a fissure cave called Zbojnická (total length of the cave 17 m, depth 12 m, av. width 1m, Wagner et al., 1990). The plain that was specified as cryoplanation terrace is a sizeable block of rockslide covered with sharp-edged sandstone blocks (up to 3 m). Blocks released from the scar (such as rock fall) were displaced by gravitation (probably also by solifluction). The rock wall of the block type slope deformation was given final shape by cryogenic processes in Pleistocene.

Locality: Bystřička landslide (Fig. 3)

In the western part of Vsetínské vrchy Hills an extensive slope deformation came into existence near the village of Bystřička after the extreme precipitation in July 1997 (Photo 2, 3). The lower part of the deformation put into danger the railway to Slovakia. Most pronounced were two slide phenomena of earth flow nature (details see Rybář, 1999). The north-situated landslide of stream shape (length 460 m, width up to 50 m) is very interesting from the viewpoint of slope morphology, being conditioned in its upper part by geological structure. On the basis of genesis and morphology, Rybář – Stemberk – Suchý (1998) distinguished 4 phases of slope failure development. The first phase in the upper part of landslide area is characterized by landsliding along a predetermined bedding plane (movement along syncline – slope inclination approx. 10°, movement length approx. 250 m). Continuation is a earth flow (movement at a length of nearly 200 m down the slope of up to 24°). The third phase shows in the reactivation of deep faults and in the development of block deformation in the lower part of the slope. The fourth phase is indicated by failure of railway embankment, destruction of protective dikes on adjacent river banks (bulging). The earth flows do not proceed along the slope gradient but their upper parts turn to the West, which is conditioned by the course of

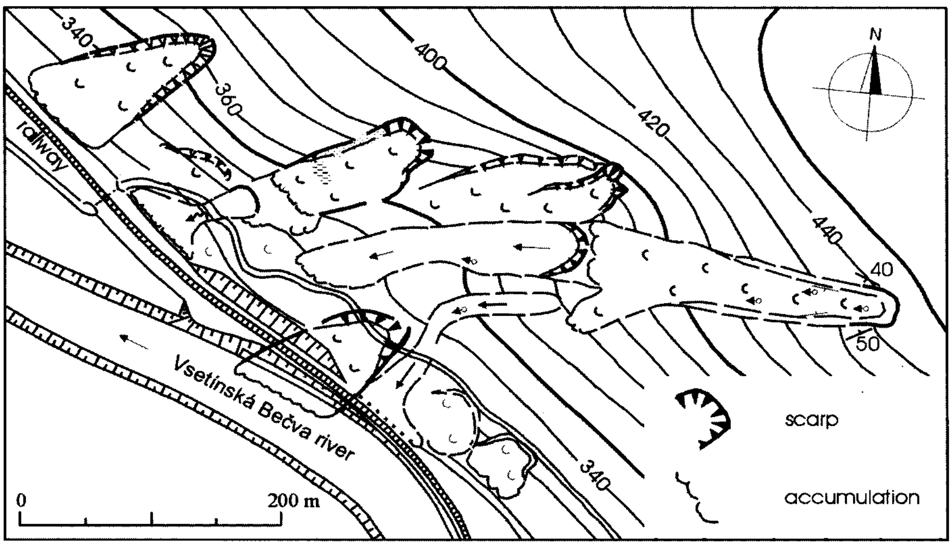


Fig. 3: Schematic map of the Bystřiška landslide (Arranged by M. Bíl after Rybář and Stemberk, 2000).

Photo 2: The Bystřička landslide - the upper part of locality is modelled by earth flow (state to July of 1997). Photo O. Krejčí.

the Rusava Member of the Zlín Formation (the Rača unit), lying along the syncline. In the upper part of the slope deformation a pronounced elongated depression developed which in morphological terms reminds a slope dell. It is well possible that it was formerly confused with it because there was a short slope graben depression already existing here as documented by maps. Slope dells can often represent upper sections of stream slope deformations (similar information see for example Dzurovčin, 1997). A pronounced sandstone ridge in the lower part of the slope is -according to the current knowledge- a part of the rock block of a deep seated slope deformation.

Locality: Brodská landslide

A large slope deformation of earth flow type (total length 690 m, width 50-70 m, elevation 170 m) developed in the central part of Vsetínské vrchy Hills, North of Nový Hrozenkov village in the upper part of the Malá Brodská Brook in July 1997. The slope deformation affected the Vsetín Member (with claystones dominating over sandstones) in the Rača unit of the Magura Flysch. The deformation is in details assessed by Rybář (1999). From the geomorphological point of view, important is the morphologically pronounced upper part of the slope deformation. Here, the ground body got into motion in a dish depression, which is limited by a flat system of layers and a fissure area. Root areas bear traces of former slope movements. In morphological terms, a slide of stream shape developed here whose front part stopped after 300 m and formed an accumulation mound of up to 10 m in height. Further movement of the landslide accumulation down the steep slope gave rise to a landslide-dammed lake in the main valley. In the final phase of the movement, slide masses oversaturated with water moved along the valley bottom along a distance of nearly 300 m, which formed a small landslide-dammed lake on a side tributary of the Malá Brodská Brook. The morphologically pronounced trough depression in the upper part of the slope deformation gets gradually silted being inserted into an older and in down the slope direction elongated depression which is of gravitational origin, too.

Locality: Jezerné landslide

At the right bank of the Jezerný potok Brook some 3.5 km to North of Velké Karlovice village there is an extensive slide area. The slide front reached as far as to the opposite slope of the valley damming the brook and giving rise to a natural landslide-dammed lake. The lake began to extinguish in the 19th century. A dike was added at the beginning of the 20th century and the reservoir was given its existing shape in 1942 (Kříž, 1993). Total size of the slide amounts to 650 m length and max. 450 m width. It is a complex type of slide based on deep weathered bedrock built of lithostratigraphical units of the Magura Flysch, mainly characterized by block disintegration of bedrock supported by lithological changes (sandstone bodies inside rythmic flysch sediments) and tectonic failures. Depth of the main slide surface can be estimated to be more than 20 m. Bedrock is built by rythmic flysch with thick positions of sandstones (the Beloveža Formation) and the Zlín Formation (the Rača unit). Upper part of the slope deformation have a character of sizeable slope rock steps (height 20-30 m). At the foot of rock walls and steep rocky slopes there are waterlogged sites, spring areas and a number of pseudodolines. Inside the block slide area, some

250 m to West of Jezero lake, there are solitary rock outcrops high 2-3 m, shifted by gravitation. The largest block inside the boulder field have a size of ca. 10x5 m. In the debris accumulation there are also several small debris caves (max. dimensions: depth 1 m, width 1.5 m, height 0.5 m). The block slide is lying on a tectonically complicated contact between the Upper Cretaceous Ráztoka Member of the Soláň Formation), Beloveža Formation (Paleocene - Eocene) and the Zlín Formation (Eocene). The block material of the slide area itself was derived mainly from the Beloveža Formation.

Locality: Hradisko Hill (Fig. 4)

The Hradisko Hill (773 m a. s. l.) is situated in the south-western part of Javorníky Mountains. Thanks to extensive sandstone rock forms in the summit position and in the upper parts of slopes, these are the largest castellated rocks in the flysch belt of the Outer Western Carpathians in Moravia. Bedrock is built mainly of sandstones and conglomerates of the Luhačovice Member of the Zlín Formation - the Rača unit. The top of Hradisko Hill is formed of a mighty anticline at front of the partial scale and dissected by both longitudinal and transversal fissures (Kirchner-Krejčí, 1996). Weathering occurred along the fissures with elongated depressions, pseudodoline depressions and rock towers on the summit plateau. Small rock cities formed in the upper part of the Hradisko Hill north-western and south-eastern slopes. The southern anticlinal limb binds the structurally conditioned southern and south-eastern slopes of Hradisko Hill. The sizeable rock wall (height 18 m) on the north-western slope of Hradisko Hill was in former works interpreted as a frost-riven cliff with the development of cryoplanation terraces. At the foot, there are fissure caves (Demek, 1963) bound to fissures of N-S and WNW-ESE directions (of which the largest one is up to 50 m long). Our investigations and subsequent geophysical measurements (Hubatka et al., 2000) revealed an extensive slope deformation in this part

Photo 3: Reclamation in upper and middle part of the Bystřička landslide (state to April of 2000). Photo O. Krejčí.

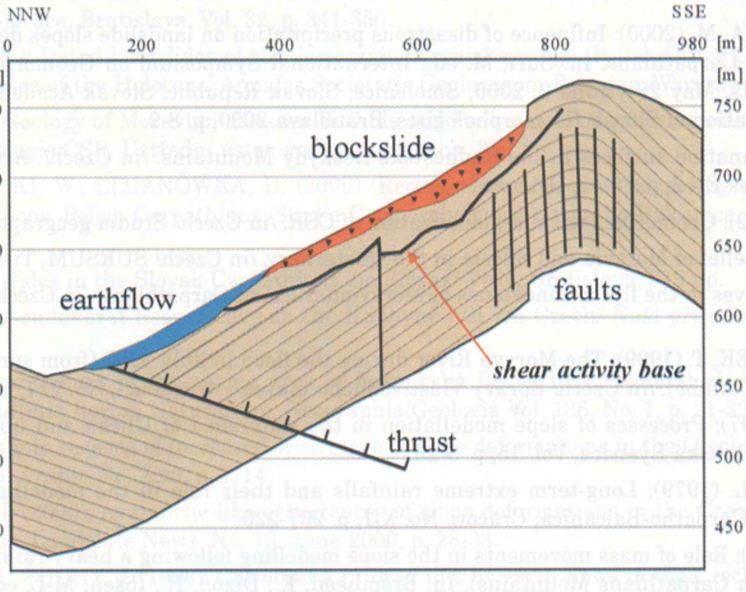


Fig. 4: Schematic cross- section through NW part of Hradisko Hill (after O. Krejčí et al. 2002)

of Hradisko Hill. The frost-riven cliff is root rock wall of an extensive block type slope deformation which reaches as far as to the valley of the Pulčínský potok Brook (slide length 635 m). The shear plane is to be found at a depth of about 20 m; under the main shear plane there is a zone which is most probably faulted by gravitational movements (thickness at some places of up to 20 m). Total thickness of the slide amounts to 36 m. Under the base of slide activities there are further interfaces (potential shear planes) that can be detected by geophysical measurement, which reach down to a depth of 70 m. In its upper part the slope deformation has a character of block slide, locally a character of block displacements (displacement of block which is 40 m long and 10 m thick). In the middle and lower parts of the slope the slope deformation melts into a flow like slide (movement of sizeable boulder taluses). The massif of Hradisko Hill is characterized by typical structurally-denudational forms on sandstones that were further faulted by severe slope deformations along tectonic fissures; only later the forms were modelled by cryogenic processes. It is also the genesis of the Hradisko Hill summit plateau that appears to be a problem having been generally considered a remainder of the Tertiary planation surface. Its structural conditioning is rather obvious thanks to the position on the top of an anticline of resistant sandstones of the Luhačovice Member, which is dissected by both axial and transversal fissures. The whole area is loosened by a deep slope deformation. In these conditions, it is hardly possible to consider a possibility of preserving planation surface remainders in this locality. And the same viewpoint will have to be taken into account at studying other summit plains in the region of Javorníky Mountains and Vizovická vrchovina Highland and determination of their structural contingency.

5. Conclusion

Some pronounced slope deformations modelling both high ridges of mountains and lower ridges of highlands were described within detailed geological and geomorphological research of slope deformations in eastern Moravia. It has been demonstrated that slope movements have significantly modelled flysch relief in the region under study. Coming into existence and further development of these deformations are given by features of bedrock (position of layers, fracturing). Research of slope deformations uncovers a novel view of form genesis (slope depressions, rock walls, slope ridges on studied localities, remainders of planation surfaces).

Problematic still remains dating of beginnings and individual periods of slope movement activation. It is considered useful to link up with the experience from dating of these movements in the Polish Flysch Carpathians (e.g. Margielewski, 1997; Starkel, 1994) where the slope movements were dated in a number of localities and the movement activation put into relation with humid periods of the Holocene.

References

BAJGIER-KOWALSKA, M. (2000): Influence of disastrous precipitation on landslide slopes development and their use in the Polish Flysch Carpathians. In: Šúri, M. ed.: International Symposium on Geomorphic Response to Land Use Changes. Abstracts. May 29 - June 2, 2000, Smolenice, Slovak Republic. Slovak Academy of Sciences, Institute of Geography, Association of Slovak Geomorphologists, Bratislava 2000, p. 8-9.

BUZEK, L., 1972: Planation surfaces in the Radhošťské Beskydy Mountains. /in Czech/. Acta Facultatis Paedagogicae Ostraviensis. Series E - 2, p. 28-42, Ostrava

CZUDEK, T., ed. (1972): Geomorphological regionalization of CSR. /in Czech/ Studia geographica, Brno, No. 23, p. 1-140.

CZUDEK, T. (1997): Relief of Moravia and Silesia in the Quaternary. /in Czech/ SURSUM, Tišnov 1997, 164 pp.

DEMEK, J. (1963): Caves in the flysch sandstones of Moravian-Silesian Carpathians. /in Czech/ Československý kras, No. 15, p. 127-130.

DOSTÁL, I., ŘEHÁNEK, T. (1999): The Morava River during the flood in July 1997 (from spring area up to river mouth opening into the Danube). /in Czech/ Zprávy Vlastivědného muzea v Olomouci, No. 227, p. 1-26.

DZUROVČIN, L. (1997): Processes of slope modellation in the watershed of Ulička and upper Cirocha R. /in Slovak/ Ochrana prírody, Banská Bystrica, Vol. 15, p. 5-28.

GIL, E., STARKEL, L. (1979): Long-term extreme rainfalls and their role in the modelling of flysch slopes. Studia Geomorphologica Carpatho-Balcanica, Cracow, No. XII, p. 207-220.

GORCZYCA, E. (2000): Role of mass movements in the slope modelling following a heavy rainfall in the Beskid Wyspowy Mountains (Flysch Carpathians Mountains). In: Bromhead, E., Dixon, N., Ibsen, M-L. eds. Landslides in research, theory and practice Vol. 1. Proceedings of the 8 th International Symposium on Landslides held in Cardiff on 26-30 June 2000. Thomas Telford, London, p. 654-658.

HUBATKA, F. et al. (2000): Slope deformations in the Czech Republic. Geophysical works in the locality Pulčín-Hradisko. /in Czech/ Research report, Geofyzika a.s. Brno, 17 pp.

HARČÁR, J. (1978): Slides in the Lower Beskids, their relation to geological structure and morphology. /in Slovak/ Geografický časopis, Bratislava, Vol. 30, No. 1, p. 57-74.

HROCH, Z. (1999): Slope movements after floods in 1997 and the role of state geological survey. /in Czech/ Geotechnika, Praha, No. 2, p. 2-4.

KIRCHNER, K. (2001): Geomorphology. /in Czech/ In: PAVELKA, J., TREZNER, J. eds. et al. (2001): Příroda Valašska (okres Vsetín). Český svaz ochrany přírody Vsetín, Okresní úřad Vsetín, Školský úřad Vsetín, p. 39-44.

KIRCHNER, K., KREJČÍ, O. (1996): Geological and geomorphological inventory of significant rock forms in the sandstones of Magura Flysch. /in Czech/ In: STÁRKA, L., BÍLKOVÁ, D. eds. Sborník příspěvků ze semináře Pseudokrasové jevy v horninách české křídové pánve. Teplice nad Metují 4-6 Oct. 1996. Správa chráněných krajinných oblastí ČR, Agentura ochrany přírody a krajiny ČR, Česká speleologická společnost Praha, p. 25-29.

KIRCHNER, K., KREJČÍ, O. (1998): Slope movements in the Flysch Carpathians of Eastern Moravia (Vsetín District), triggered by extreme rainfalls in 1997. Moravian Geographical Reports, Vol. 6, No. 1, p. 43-52.

KIRCHNER, K., KREJČÍ, O.(2000a): Slide area on the Křížový vrch (Hill) near Semetín (the Hostýnské vrchy Hills). /in Czech/ Geografie-Sborník České geografické společnosti, Vol. 105, No. 3, p. 286-288.

KIRCHNER, K., KREJČÍ, O. (2000b): To the geomorphology of summit part of Kněhyně and Čertův mlýn (the Moravian-Silesian Beskids). /in Czech/ In: PRÁŠEK, J. ed.: Současný stav geomorfologických výzkumů. Sborník referátů z mezinárodního semináře 13-14 April 2000, Nýdek. Ostrava University Ostrava, p. 11-13.

KIRCHNER, K., KREJČÍ, O., MÁČKA, Z. (2001): Geomorphological aspects of pronounced slope deformations in eastern Moravia. /in Czech/ Geomorphologia Slovaka, Bratislava, Vol. 1, No. 1, p. 78-83.

KOTARBA, A. (1986): Role of landslides in creating of the foothill and Beskids relief, /in Polish/ Przeglad Geograficzny, Warszawa, Vol. 58, No. 1-2, p. 119-129.

KREJČÍ, O., KIRCHNER, K. (2000): Morphological changes connected with extreme landsliding in Moravian Carpathians. In: Andrzejewski, L., Molewski, P., Wysota W. red. (2000): Dorobek i Pozycja Polskiej Geomorfologii u Progu XXI. Wieku. Streszcznia referatów, komunikatów i posterów. V. Zjazd geomorfologów polskich. IG UMK,Torun, p. 66-67.

KREJČÍ, O., KIRCHNER, K., HUBATKA, F. (2000): Slope movements in the Flysch Carpathians of Eastern Czech Republic triggered by extreme rainfalls in 1997 (an example from Vsetín District). In: Bromhead, E., Dixon, N. and. Ibsen, M-L eds. Landslides in research, theory and practice, Vol. 2. Proceedings of the 8 th International Symposium on Landslides held in Cardiff on 26-30 June 2000. Thomas Telford, London, p. 849- 854.

KREJČÍ, O. et al. (2001): Slope movements in the Flysch Carpathians of eastern Czech Republic triggered by extreme rainfals in 1997: a case study. Geophysical Research. Abstracts, Vol. 3, 2001, Abstracts of the Contributions of the 26 th General Assembly of the European Geophysical Society, Nice, France, European Geophysical Society. p. 315.

KREJČÍ, O. et al. (2002): Some examples of deep-seated landslides in the Flysch belt of the Western Carpathians. In: Rybář, J., Stemberk, J., Wagner, P.: Landslides. A.A. Balkema Publishers, Netherlands, p. 373-380.

KŘÍŽ, V. (1993): The Jezero water formation in the Vsetínské vrchy (Hills). /in Czech/ Sborník prací přírodovědecké fakulty Ostravské univerzity, geografie, geologie, Vol. 136, No. 1, p. 47-53.

MALGOT, J, BALIAK, F. (2000): Landslides in Slovakia, their effects on the environment and on important engineerig structures. Mineralia Slovaca, Bratislava, Vol. 32, p. 341-350.

MARGIELEWSKI, W. (1997): Dated landslides of the Jaworzyna Krynicka range (Polish Outer Carpathians) and their relation to climatic phases of the Holocene. Annales Societatis Geologorum Poloniae, Warszawa, Vol. 67, p. 83-92.

MENČÍK, E. et al. (1983): Geology of Moravian-Silesian Beskids and Podbeskydská pahorkatina (Hilly land). /in Czech/ Oblastní regionální geologie ČSR. Ústřední ústav geologický, Praha, 300 pp.

MROZEK, T., RACZKOWSKI, W., LIMANÓWKA, D. (2000): Recent landslides and triggering climatic condotions in laskowa and Plesna regions, Polish Carpathians. Studia Geomorphologica Carpatho-Balcanica, Cracow, Vol. XXXIV, p. 89-112.

NEMČOK, A. (1982): Landslides in the Slovak Carpathians. /in Slovak/ Veda, Bratislava, 319 pp.

PAVLICA, J. (1984): The pseudokarst fissure cave on the Kněhyně hill. /in Czech/ Naší přírodou, Praha, 1984, No. 2, p. 8-11.

PRÁŠEK, J. (1993): Geomorphology of the spring area of Rožnovská Bečva River watershed. /in Czech/ Universitas Ostraviensis, Acta Facultatis Rerum Naturalium, Geographia/Geologia Vol. 136, No. 1, p. 21-32.

RYBÁŘ, J. (1999): Analysis into reasons of increased occurrence of slope deformations in the Czech Republic in July 1997. /in Czech/ Geotechnika, Praha, No. 2/99, p. 7-14.

RYBÁŘ, J., STEMBERK, J. (2000): Avalanche-like occurrences of slope deformations in the Czech Republic and coping with their consequences. Landslide News, No. 13, June 2000, p. 28-33.

RYBÁŘ, J., STEMBERK, J., SUCHÝ, J. (1998): Cut-off of a railway line by earth flows in the Czech Republic during July 1997. In: The 8th International IAEG Congress. Balkema, Rotterdam, p. 2083-2089.

STARKEL, L. (1994): Frequency of floods during the Holocene in the Upper Vistula Basin. Studia Geomorphologica Carpatho-Balcanica, Cracow, No. XXVII-XXVIII, p. 3-13.

WAGNER, J. et al. (1990): Caves of the Moravian-Silesian Beskids and surroundings. /in Czech/ Knihovna České speleologické společnosti, Vol. 17, P raha, 130 pp.

ZIETARA, T. (1988): Landslides areas in the Polish Flysch Carpathians. Folia Geographica, ser. Geographica-Physica, Vol. 20, p. 21-31.

Authors' addresses:

RNDr. Karel KIRCHNER, CSc.
Academy of Sciences of the Czech Republic, Branch Brno
Institute of Geonics
Drobného 28, 602 00 Brno, Czech Republic
e-mail: kirchner@geonika.cz

RNDr. Oldřich KREJČÍ
Czech Geological Survey, Branch Brno
Leitnerova 22, Brno, Czech Republic
e-mail: okrejci@cgu.cz

Reviewer:

Doc. RNDr. Ladislav Buzek, CSc.

THE MORPHOTECTONICS OF THE EASTERN MARGINAL SLOPE OF THE ROPICE-RANGE (THE MORAVSKOSLEZSKÉ BESKYDY MTS.)

Tomáš PÁNEK – Roman DURAS

Abstract

The article evaluates morphotectonic situation in the area of the Ropice-range in the Moravskoslezské Beskydy Mts. Special attention is paid to the eastern marginal parts of the area alongside the border with a tectonic depression of the Jablunkovská brázda Furrow where chosen tectonic landforms are studied by geomorphological and geophysical methods. On the base of detailed geomorphological and geophysical analysis the presence of Quaternary tectonic movements within the area is stated.

Shrnutí

Morfotektonika východního okrajového svahu Ropického hřebene (Moravskoslezské Beskydy)

Příspěvek hodnotí morfotektonické poměry oblasti Ropického hřebene v Moravskoslezských Beskydech. Zvláštní pozornost je věnována východní okrajové části území při hranici s tektonickou sníženinou Jablunkovské brázdy, kde jsou geomorfologickými a geofyzikálními metodami studovány vybrané tektonické tvary reliéfu. Na základě podrobné geomorfologické a geofyzikální analýzy je konstatována přítomnost kvartérních tektonických pohybů v území.

Key words: *Moravskoslezské Beskydy Mts., Ropice-range, Jablunkovská brázda Furrow, morphostructural analysis, morphotectonics, neotectonics, fault scarps.*

1. Introduction

The Ropice-range represents the northeast geomorphological part of the Moravskoslezské Beskydy Mts (Fig. 1). The area culminates with the elevation point of Ropice (1082 m) and takes up the area of about 128 sqm. The area of the Ropice-range and adjacent geomorphological parts were under quite a close geological research during the past. Results of the research have not properly been appraised in a geomorphological way. Geomorphological research carried out in 50s and 60s of the last century outlined some problems but the area has practically been paid no attention since (Stehlík, 1956, 1960).

The aim of the article is to point at particularly specific morphology of the eastern margin of the studied area which is on the base of available geological, geomorphological and geophysical data interpreted as a consequence of young Quaternary tectonics. This hypothesis is discussed in relation with morphostructural features of the whole area of the

Fig. 1: Location of the studied area in the Czech Republic

Ropice- range and the Jablunkovská brázda Furrow and tries to make use of relevant information about the relief of other parts of the Western Beskydy Mts.

2. Overall morphostructural features of the Ropice-range

To value basic morphostructural features of the area all geological information, analysis of valley network and terrain geomorphological mapping have been used. Matter of the highland is represented by formation of the Silesian Unit within the development of the Godula partial nappe (Menčík et al., 1983; Menčík, Tyráček, 1985). The largest area is represented by outcrops of the Godula Formation (Cenomanian-Senonian stages) whose inclination towards the south does not participate in the formation of monoclinal ridges and cuestas, unlike other parts of the Moravskoslezské Beskydy Mts. It rather seems that lithological displays and influence of older tectonics disappeared with the rise of planation surface which today is present in the form of flat and wide central ridge in the altitude of 800 – 1000 m a.s.l (Fig. 2). On the base of contemporary knowledge of the development of the Western Carpathians in Neogene we can express a hypothesis that we have much to do with the rest of the midmountain level which originated in the Panonian stage (Bizubová, Minár, 1992; Lacika 2000; Mazúr, 1963). Flat forms of the relief are preserved in the Ropice-range on the largest areas of the Moravskoslezské Beskydy Mts. Structurally conditioned monoclinal ridges and cuestas well preserved in other parts of the Moravskoslezské Beskydy Mts. (particularly in western and southern parts) are represented only by a compact monoclinal ridge Slavíč (1055 m) in the southest part of the Ropice-range. Older lithological complexes of the Silesian nappe occur in the studied area only alongside the eastern marginal slope where resistant layers of Ostravice sandstone (Cenomanian-Turon stages) display well from the morphological point of view. Conspicuous conical monadnocks developed on the Ostravice sandstone by the eastern foothill of the Ostrý Mt. (1044 m). A stretch of Istebna Formation (Campanian-Maastrichtian stages) rises along the contact with the Jablunkovská brázda Furrow in the eastern part. Although the formation lies in the roof of Godula Formation during its contact with the Jablunkovská brázda Furrow it tectonically clinched under hypsometric level of older formations. With some exceptions there is a slight influence of lithology and older nappe tectonics in contemporary relief. Borders of lithological formations and landforms do not usually correspond.

Morphostructural analysis helped us to make the following statements:

- The Ropice-range represents strongly tectonicly and erosionally transformed part of the Silesian nappe. After last displays of fold and nappe deformations finished in the Badenian stage a horst in the WNW-ESE direction arose in consequence of neotectonic movements. Present morphostructural elements of the horst are in distinct discordance with old nappe deformations and the direction of layers (W-E).

Fig. 2: Planation surface in the southern part of the Ropice-range in the altitude of 950-1000 m a.s. l. Photo T. Pánek.

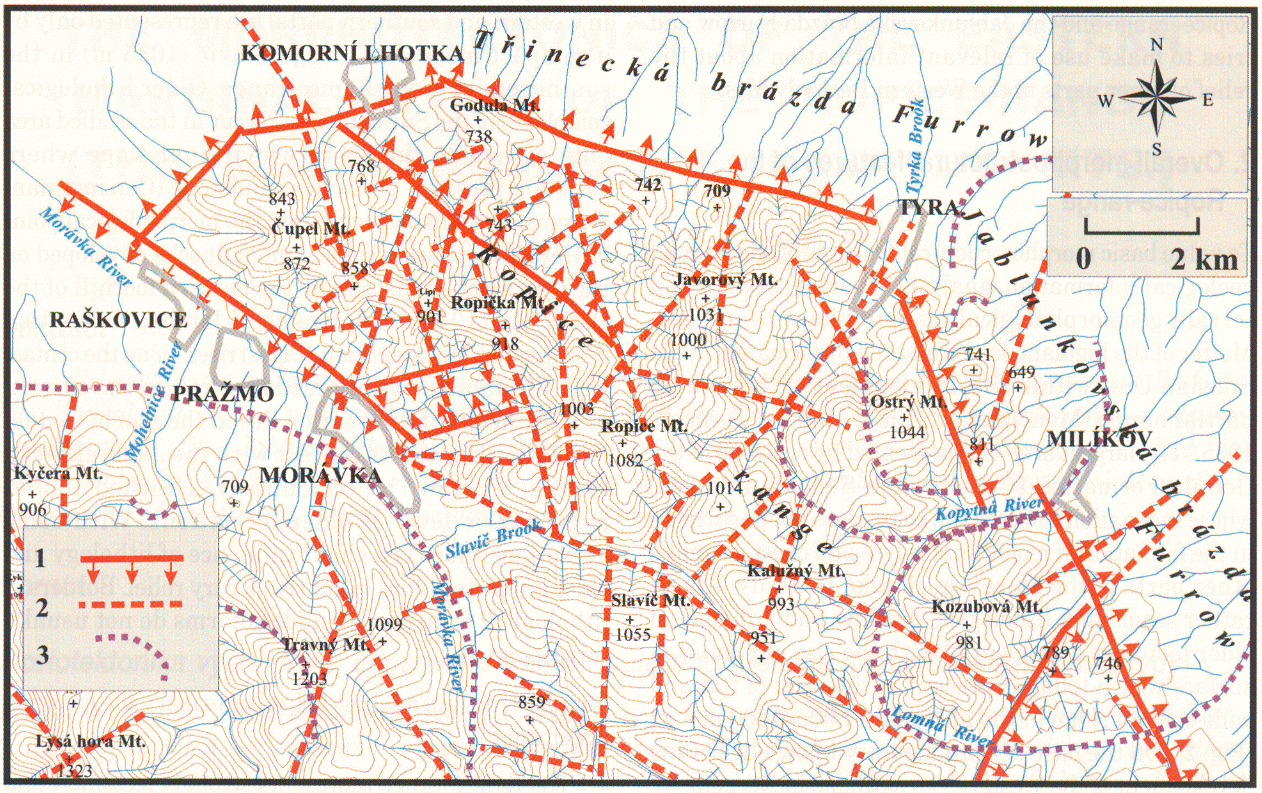


Fig. 3: Morphotectonic features of the Ropice-range and surrounding area. Legend: 1 – neotectonically active faults (arrows indicate the direction of the subsidence of morphostructures), 2 – morphotectonically conspicuous fissures and faults without neotectonic display, 3 – circular structures (borders of domes and ring morphostructures).

- Faults which became active during neotectonic period (probably after the rise of Panonian planation surface) can be observed in contemporary relief in the form of fault scarps and steps on ridges. The faults are especially of the WNW-ESE direction and they represent northern and southern limitation of the Ropická rozsocha Mts.; towards graben of the Jablunkovská brázda Furrow the area is limited by faults of the NNW-SSE direction (Fig. 3).

Fig. 4: Eastern marginal slope of the Ropice-range. Photo T. Pánek

- Northern limitation is represented by a fault scarp which was divided into a system of triangular facets elevation of which ranges between 150-400 m. Fault which passes through a broad valley of the Morávka River by the southern limitation of the mountain range displays in a similar way. There is a strongly tectonic limitation of the Ropice-range towards the graben of the Jablunkovská brázda Furrow on the east (Fig. 4). Here the limitation creates a border of the system of several faults which caused the rise of a slope with a step-like morphology. Distinct tectonic limitation is not present only in the southern part within the contact with the geomorphological area of the Zadní hory Mts.
- Faults with passive function in the relief can be observed in the course of valleys, dells and as the case may be in linearly spreaded saddles. They are often represented only by a course of a valley network and pass through the central broad ridge without surface displays. This system of faults was active especially during the rise of nappe formations in the Badenian stage and its activity finished before planation surface of probably the Panonian age arose.
- Besides frequent linear boundaries also nonlinear boundaries were identified by means of analysis of the valley network shape given on topographic maps. They can be found particularly around the Ostrý Mt. (1044 m) and the Kozubová Mt. (982 m) in the eastern part of the area. Nonlinear boundaries are represented by annular arrangement of the valley network and, in advance, they can be considered as displays of neotectonic dome-like deformations. Similar morphostructures were identified also in other parts of the Moravskoslezské Beskydy Mts. and, if there are any, in farther parts of the Western and Eastern Carpathians (Kvitkovič, Feranec, 1986).
- Generally, the Ropice-range can be characterized as a wedge-shaped horst which was neotectonically uplifted in the northeastern part where a concentration of highest elevation points (Ostrý, Javorový, Ropice) and fault slopes (over 400 m high) can be found. Towards the west summit level and elevation a.s.l. of the planation surface decrease. The elevation of marginal fault scarps also falls down to about 150 m.

3. Problematics of a step-like topography along the contact of the Ropice-range and the Jablunkovská brázda Furrow

Contact zone between the Ropice-range and the Jablunkovská brázda Furrow is characterized as a step-like marginal slope which is rimmed with a system of geologically documented faults by the foothill (Fig. 5). The step-like character best developed on the eastern slopes of the mountain group of the Kozubová Mt. (981 m). Elevation of individual steps ranges from several metres to several tens of metres here. The steps occur with some exceptions in the NNW-SSE direction. The lowest step reaches the height of 2 m and the highest step reaches as many as 40 m. Individual steps divide slightly inclined slopes and plateaus. From the morphological point of view topographic steps can be best perceptible in the foothill location of the marginal slope where steps are developed in two or three levels one above the other. The foot of the lowest step runs in the elevation of 465-470 m a.s.l. and is characterized with strong wetness and local occurance of springs. Studies of terrain steps have brought the following knowledge:

- The most probable cause of the rise of step-like topography lies with young (Pliocene-Pleistocene) tectonic movements. Tectonic origin si supported by the presence of geologically documented faults mentioned above which run in a short distance from the individual steps. Faults of the NNW-SSE and NW-SE direction which predisposed the course of the steps cross with faults of the NE-SW direction and they thus create a specific mosaic of tectonic blocks of small dimensions.
- Quaternary tectonic movements are characterized with conspicuous morphological freshness of individual terrain steps and with the fact that they dislocate originally constant level of the foothill planation surface of the type of pediment. Pediment of a similar type and conforming in a relative elevation has been studied properly within a Slovak part of the Western Carpathians where it has been characterized as a river level. On the base of its morphological location, correlate sediments and the age of cut formations the rise of the pediment has been dated at the turn of the Pliocene and Pleistocene (Bizubová, Minár, 1992; Mazúr, 1963). Another research has proved a continuous development of the river level until the Mindel (Činčura, 1967). There are some features in the studied area which show that the development of pediment continued also in the Pleistocene. Pediment with a small thickness of superficial deposits merges fluently and without a striking elevation gradient into a lower parts of alluvial cones of the Riss age (Macoun et al., 1965). Therefore, there could not be any considerable hiatus between the rise of the pediment and alluvial cones and it is more probable that the development of the pediment was gradually replaced with a sedimentation of alluvial cones.

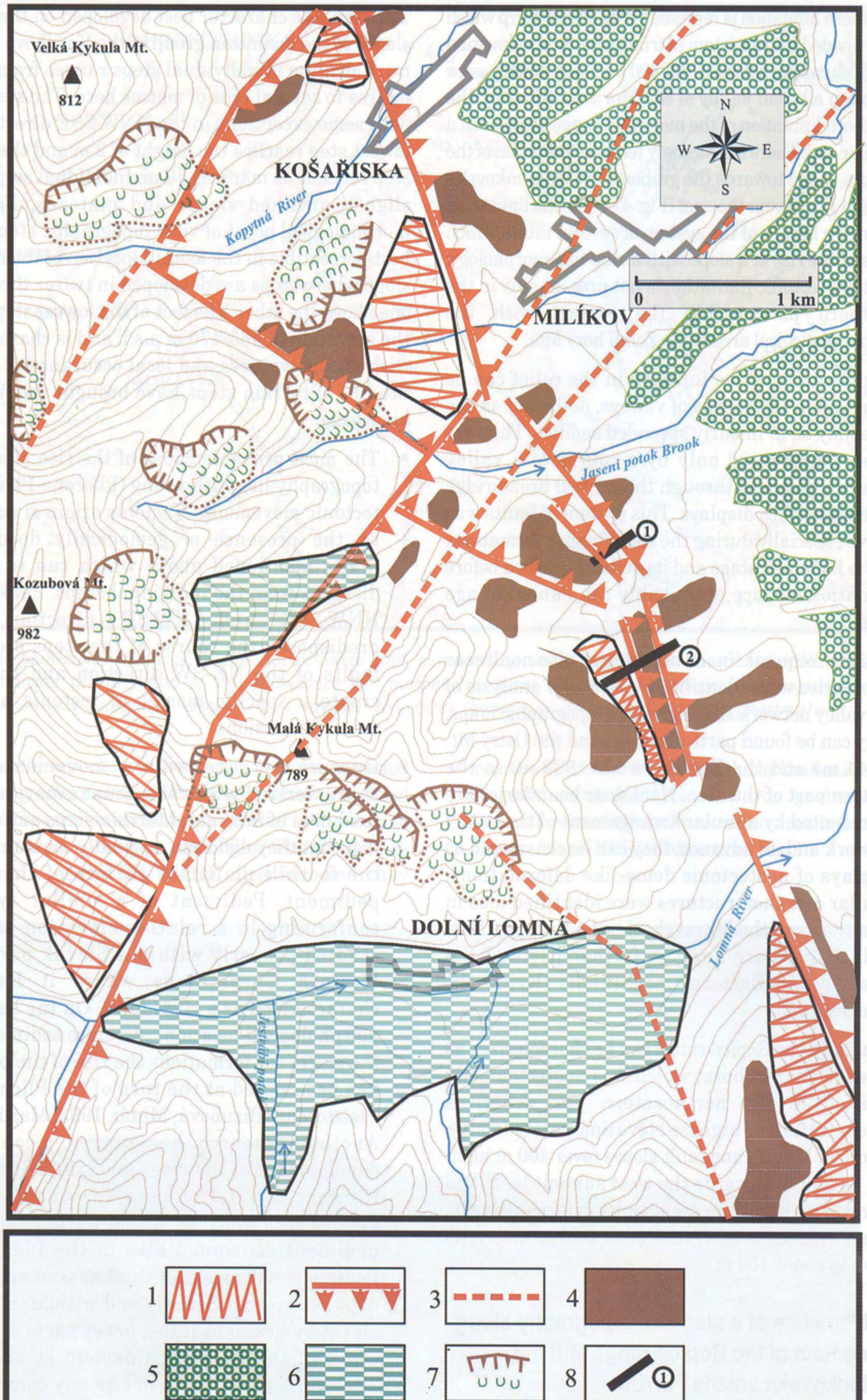


Fig. 5: Morphotectonics of the southeastern part of the Ropice-range. Legend: 1 – fault scarps, 2 – neotectonically active faults, 3 – fissures and faults without neotectonic display, 4 – tectonically disturbed foothill pediment, 5 – alluvial cones of the Riss age, 6 – structural depressions on less resistant outcrops, 7 – landslides, 8 – geophysical profiles.

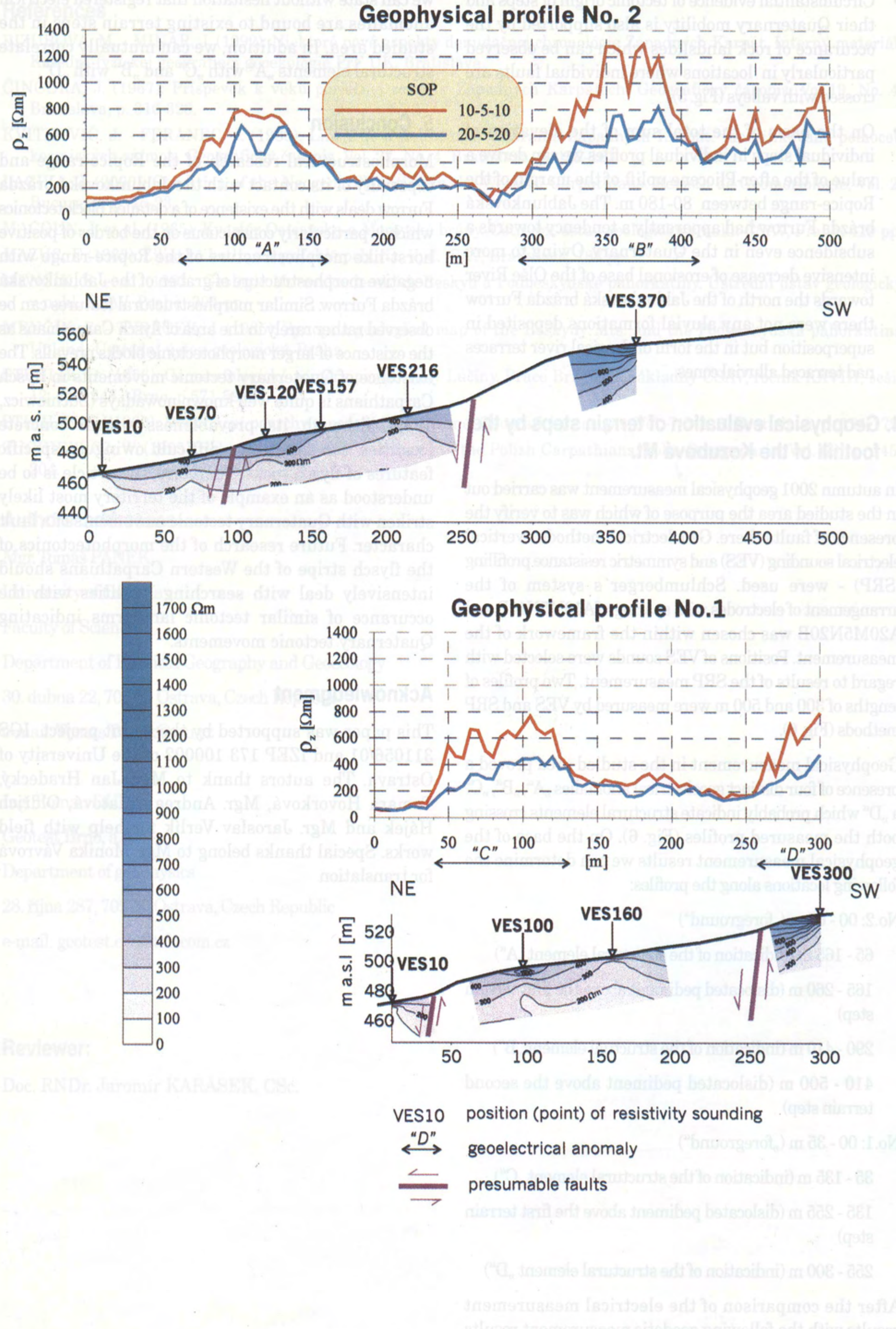


Fig. 6: Foothill geophysical profiles of the southeastern part of the Ropice-range.

- Circumstantial evidence of tectonic origin of steps and their Quaternary mobility is also supported by the occurance of rock landslides which can be observed particularly in locations where individual faults are crossed with valleys (Fig. 5).
- On the basis of the total sum of the elevation of individual steps in individual profiles we can derive a value of the after-Pliocene uplift of the margin of the Ropice-range between 80-180 m. The Jablunkovská brázda Furrow had apparently a tendency towards a subsidence even in the Quaternary. Owing to more intensive decrease of erosional base of the Olše River towards the north of the Jablunkovská brázda Furrow there were not any aluvial formations deposited in superposition but in the form of classical river terraces nad terraced alluvial cones.

4. Geophysical evaluation of terrain steps by the foothill of the Kozubová Mt.

In autumn 2001 geophysical measurement was carried out in the studied area the purpose of which was to verify the presence of faults there. Geoelectrical methods - vertical electrical sounding (VES) and symmetric resistance profilling (SRP) - were used. Schlumberger´s system of the arrangement of electrodes with spacing of A10M5N10B and A20M5N20B was chosen within the framework of the measurement. Positions of VES sounds were selected with regard to results of the SRP measurement. Two profiles of lengths of 300 and 500 m were measured by VES and SRP methods (Fig. 6).

Geophysical measurement in the studied area proved a presence of four distinct geoelectrical anomalies „A", „B", „C" a „D" which probably indicate structural elements crossing both the measured profiles (Fig. 6). On the base of the geophysical measurement results we can determine the following locations along the profiles:

No.2: 00 - 65 m („foreground")

65 - 165 m (indication of the structural element „A")

165 - 260 m (dislocated pediment above the first terrain step)

290 - 410 m (indication of the structual element „B")

410 - 500 m (dislocated pediment above the second terrain step)

No.1: 00 - 35 m („foreground")

35 - 135 m (indication of the structural element „C")

135 - 255 m (dislocated pediment above the first terrain step)

255 - 300 m (indication of the structural element „D")

After the comparison of the electrical measurement results with the following geodetic measurement results we can state without hesitation that registered electrical anomalies are bound to existing terrain steps in the studied area. In addition, we can mutually correlate structural elements „A" with „C" and „B" with „D".

5. Conclusion

Morphostructural research of the Ropice-range and especially of its contact with the Jablunkovská brázda Furrow deals with the existence of a detailed block tectonics which is particularly conspicuous on the border of positive horst-like morphostructure of the Ropice-range with negative morphostructure of graben of the Jablunkovská brázda Furrow. Similar morphostructural features can be observed rather rarely in the area of flysch Carpathians as the existence of larger morphotectonic blocks prevails. The existence of Quaternary tectonic movements in flysch Carpathians is quite well known nowadays (Zuchiewicz, 1995) although its provableness within concrete localities can be rather difficult owing to specific features of flysch rocks. Therefore, the article is to be understood as an example of the territory most likely striken with Quaternary tectonic movements of a fault character. Future research of the morphotectonics of the flysch stripe of the Western Carpathians should intensively deal with searching localities with the occurance of similar tectonic landforms indicating Quaternary tectonic movements.

Acknowledgment

This paper was supported by the Grant project IGS 311056/01 and IZEP 173 100002 of the University of Ostrava. The autors thank to Mgr. Jan Hradecký, Tamara Hovorková, Mgr. Andrea Milatová, Oldřich Hájek and Mgr. Jaroslav Verlík for help with field works. Special thanks belong to Mgr. Monika Vávrová for translation

References

BIZUBOVÁ, M. - MINÁR, J. (1992): Niektoré nové aspekty denudačnej chronológie Západných Karpát. Interný materiál. Katedra fyzickej geografie a geoekológie PrF UK, Bratislava.

ČINČURA, J. (1967): Príspevok k veku poriečnej rovne v Západných Karpatoch. Geografický časopis, Vol.19, No. 4, Bratislava, p. 316-326.

KVITKOVIČ, J. - FERANEC, J. (1986): Lineárne a nelineárne rozhrania Západných Karpát. Identifikované pomocou kozmických snímok. Geografický časopis, Vol. 27, No. 4, Bratislava, p. 152-163.

LACIKA, J. (2000): Condition of the Neogene Planation in the Western Carpathians. Revista de Geomorfologie, Vol. 2, București, p. 15-23.

MACOUN, J. et al. (1965): Kvartér Ostravska a Moravské brány. Ústřední ústav geologický v nakl. ČSAV, Praha, 419 pp.

MAZÚR, E.(1963): Žilinská kotlina a priľahlé pohoria. Vyd. SAV, Bratislava, 188 pp.

MENČÍK, E. et al. (1983): Geologie Moravskoslezských Beskyd a Podbeskydské pahorkatiny. Ústřední ústav geologický v nakl. ČSAV, Praha, 304 pp.

MENČÍK, E. - TYRÁČEK, J. (1985): Synoptic geological map of the Beskydy Mts. and the Podbeskydská pahorkatina Upland. Ústřední ústav geologický, Praha.

STEHLÍK, O. (1956): Geomorfologické poměry povodí řeky Lučiny. Práce Brněnské základny ČSAV, ročník XXVIII, sešit 12, spis 348, Brno, p.571-590.

STEHLÍK, O. (1960): Denudační povrchy v povodí řeky Lomné. Geografický časopis, Vol. 7, No. 3, Bratislava, p. 174-179.

ZUCHIEWICZ, W. (1995): Selected Aspect of Neotectonics of the Polish Carpathians. Folia Quaternaria, Vol. 66, p. 145-204.

Authors' addresses:

Mgr. Tomáš PÁNEK

University of Ostrava

Faculty of Sciences

Department of Physical Geography and Geoecology

30. dubna 22, 701 03 Ostrava, Czech Republic

e-mail: Tomas.Panek@osu.cz

Ing. Roman DURAS

Geotest Brno, a.s.

Department of geophysics

28. října 287, 709 00 Ostrava, Czech Republic

e-mail: geotest.ova@telecom.cz

Reviewer:

Doc. RNDr. Jaromír KARÁSEK, CSc.

POPULATION DEVELOPMENT IN THE OSTRAVA REGION: SOME ASPECTS AND CURRENT TRENDS

Antonín VAISHAR

Abstract

The Ostrava region recorded a rapid growth of population in the period 1870 – 1970 with peaks in 1890 –1910 and 1950 – 1970. In this period of time, a great accumulation of population occurred in the coal basin districts of Ostrava-City and Karviná. The growth got stopped at the present time due to the down-scaling of coal extraction, restructuring of industry and general demographic climate, and the population is seen to move from regional centres to small towns and rural municipalities. Prognoses expect a population shrinkage and continuing disurbanization tendencies.

Shrnutí

Některé aspekty populačního vývoje Ostravska a jeho současné trendy

Ostravsko zaznamenávalo prudký růst počtu obyvatel v období 1870 – 1970 s vrcholy v letech 1890 – 1910 a 1950 – 1970. Během této doby došlo ke koncentraci obyvatelstva do pánevních okresů Ostrava-město a Karviná. V současné době se v důsledku útlumu těžby, restrukturalizace průmyslu a celkového demografického klimatu růst zastavil a dochází k přesunům obyvatelstva z center regionu do malých měst a venkovských obcí. Prognóza předpokládá úbytek počtu obyvatel a pokračování dezurbanizačních tendencí.

Key words: *population development, industrial restructuring, Ostrava agglomeration, Czech Republic*

1. Introduction

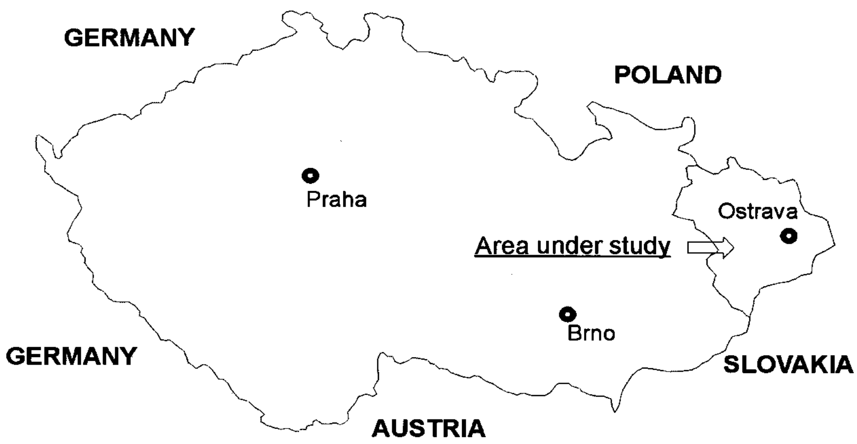


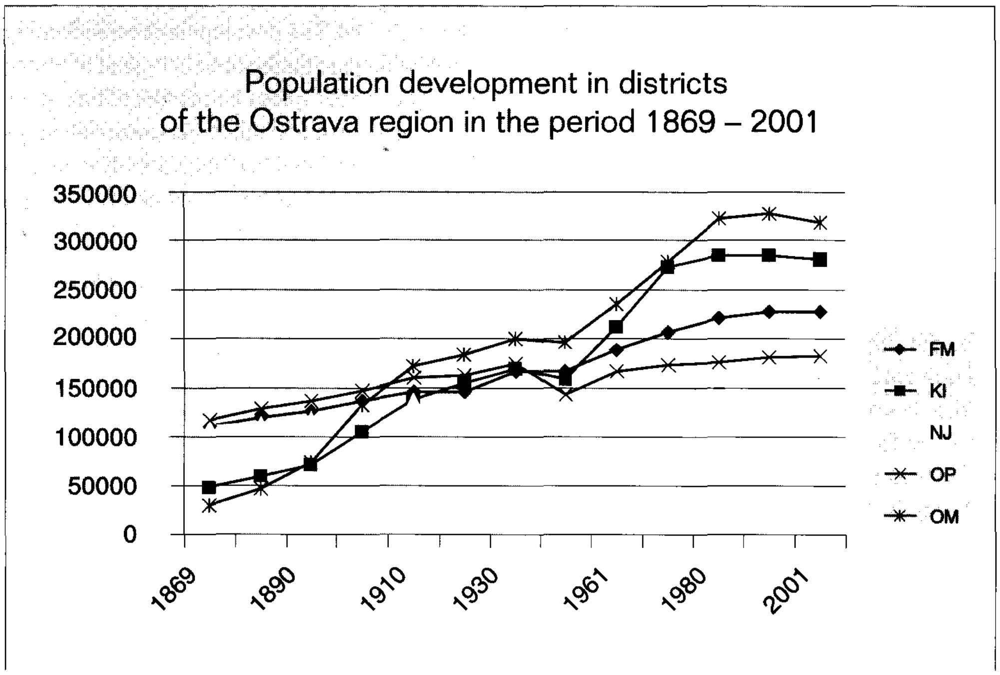
Fig. 1: Area under study

The Ostrava agglomeration (Fig. 1) passed through unusually stormy changes in the last two centuries. From a scarcely populated marginal region situated on the Czech-Polish-Hungarian borderline it made its way after having had launched intensive coal mining among the most densely populated and highly preferred regions of the country. The fact suggests a predominating immigration character of the population with all consequences for deformation of the demographic and social structure of the population and impaired stability of the social system. The last ten years could witness a down-scaling of coal mining and great problems with restructuring the most important corporations in the region, which resulted in the start of certain demographic processes. The issue has been studied by projects resolved at the Institute of Geonics, Academy of Sciences of the Czech Republic (AS CR)[1].

[1] Grant Project funded by the Grant Agency, Academy of Sciences of the Czech Republic, No. S3086005 Influence of underground mining damp-down on processes in litosphere and environment, and the key project of scholarly research at the Academy of Sciences of the Czech Republic No. K3046108.

2. Development in the period 1869-2001

Development of population in individual districts (Fig. 2) of the agglomeration: Frýdek-Místek (FM), Karviná (KI), Nový Jičín (NJ), Opava (OP), Ostrava City (OM), according to administrative situation in 2002, is illustrated in the diagram:



The diagram clearly shows both the general trend of population development in the Ostrava region and the shifts to the benefit of core parts of the region. At the beginning of the period under study, the region as a whole could be characterized by increasing population thanks to the general demographic development and rapidly proceeding industrialization. From 1869 to 1900, total population increased from 417 thous. to 648 thous., i.e. by 55 %. The greatest growth was recorded in the decenium 1890 – 1900 when the region's population increased by about 120 thousand inhabitants.

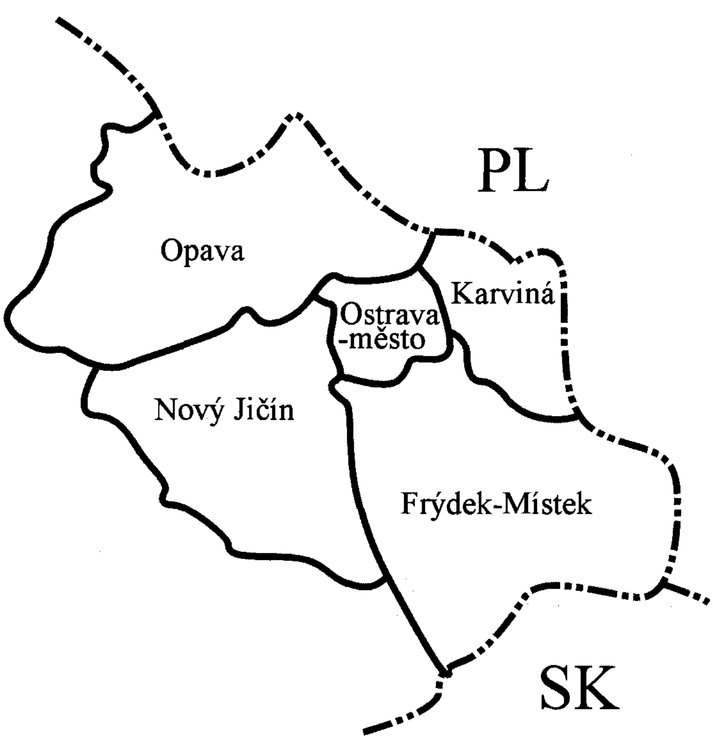


Fig. 2: Districts of the Ostrava agglomeration

In 1869, the territory of the existing districts Karviná and Ostrava-City had 78 thousand inhabitants, i.e. not even 19 % of the region's population. In contrast, the existing territories of the today's districts of Frýdek-Místek, Nový Jičín and Opava had the populations of 110 thous. and 120 thousand at that time. However, the population number in the Ostrava agglomeration and Karviná district increased more than three times before 1900 and the two districts accumulated nearly 37 % of the region's population.

The population number continued increasing also in the first third of the 20[th] century although the growth was somewhat slower. The last census before World War II in 1930 indicated that the population of five districts in the Ostrava region was about 852 thousand inhabitants with the share of Ostrava and Karviná districts exceeding 40 %. Regarding the fact that an essential portion of the territory is situated in borderland, the Ostrava region recorded in general a population loss due to World War II and its results. In 1950, the whole region had only about 92 % of the pre-war population.

The following twenty years are characterized by an extremely rapid growth of population with respect to the fact that the Ostrava region was generally preferred for the recruitment of labour force and for the construction of housing facilities. Thanks to massive immigration and great population potential of young people, the Ostrava agglomeration exhibited a population increase of some 290 thousand inhabitants in this period, which represents some 37 % of the situation in 1950. In 1970, the region could boast of about more than a million inhabitants of whom over 51 % lived in the two core districts.

The immigration character of the region reflected at that time also in the occurrence of unfavourable social or social-pathological phenomena. An analysis from the end of the 1970s (Vaishar, 1983) showed that in the parameters such as divorce rate, rate of abortions to request, suicides or emigration the districts and towns of the Ostrava industrial agglomeration were in situation which was worse than average values for the then Czech Republic. A worse situation could be found only in the districts and towns of north-western Bohemia with an even more intensive exchange of population after 1945.

The pace of population increment started to rapidly fall down after 1970. Yet, the Ostrava region's population amounted to nearly 1.179 million in 1991. Ostrava and the district of Karviná shared in this figure by nearly 52 % which means that the proportion of their population in fact stopped to increase.

Therefore a statement can be made that the most rapid increase of population in the Ostrava region occurred in the period from 1890 to 1910 due to demographic revolution and industrialization, and also in the period from 1950 to 1970 due to political and social preference of the region which was oriented onto heavy industries. In between, however, in the period 1938-1950, the region's population decreased and partially exchanged due to events of World War II. After 1970, the population increase started to slow down and its recent development relates already to problems of the present time.

In the whole period of time, population density in the region increased from the average of 107 persons per square kilometer to 301 inhabitants per square kilometer. The proportion of Ostrava-City and Karviná core districts, which was in 1869 only a little higher than the share of the districts in the country's area (11.2 %), exceeded 50 % in the course of the historical development. Population density in these two districts increased from 140 persons per square kilometer in 1869 to an extreme of 1071 inhabitants per square kilometer.

3. Current national trends

Demographic development in the Ostrava region is reflecting demographic development in the whole country, which was characterized in the 1990s particularly by a dramatic decrease of fertility rate down to the value of 1.144 in 2000, and by a gradual increase of life expectancy at birth, which is however still far away from reaching values common in western Europe (Kučera, Šimek, 2000). The development considerably differs from worldwide parameters and is typical of some post-socialist and south-European countries (Champion, 2001). It is probably no coincidence that countries in question in the both cases returned to democracy after years of totalitarian regime without reaching parameters of the standard of life usual in western Europe.

Apparent consequence is a rapidly worsening age structure of the population, which has become regressive. In the period 1996 – 2000, the number of newly born children was maintained at 90 – 91 thousand with the increasing number of young women. In the period 1998 – 1999, the number of deceased fell below the boundary of 110 thousand although the number of persons over 65 years of age was increasing (Kučera, Šimek, 2000). In 2000, the life expectancy at birth increased to 71.7 and 78.4 years in males and females, respectively.

The number of persons at the age category of 0 – 14 years fell from 20.6 % in 1991 to 16.2 % in 2001 while the share of persons over 60 years of age increased in the same period of time from 17.9 % to 18.4 %. The result to be expected in a not too distant future and in spite of the fact that the age of retirement has been steadily increasing is an increasing share of population at post-productive age, who will have to be given bread by the steadily decreasing share of population at productive age. Up to now, however, it is mostly the middle-aged population which is increasing and the problem is not felt therefore to be politically urgent. Since 1995, the pace of the population loss in Czechia has been about 10 thousand per year.

Another consequence of the worsening population age structure is natural loss of population, main reason being the fact that the numbers of live-born children are deep below the level of natural reproduction. In 1999, gross rate of reproduction was 0.552 while it was 0.902 in 1991. There are disputes among experts whether the fact should be attributed to the relative worsening of social situation for young families (Rychtaříková, 1996) or the deep changes of life style offering young people considerably more life alternatives than the early foundation of the family (Rabušic, 1996), and whether the deep drop of fertility rate is only a question of postponing the entry into the process of reproduction or the issue is of permanent character. It is more or less obvious that birth-rate is not to be expected to return soon to its level before 1990. The natural loss of population will most probably be partly compensated for by immigration notwithstanding the fact that the absolute number of foreign immigrants has been decreasing since 1997 similarly as the balance of foreign migration which amounted only to 8 774 persons in 1999 and could not even replace the natural population loss.

4. Projection of national trends in the Ostrava districts

Experts agree that the trends of natural migration are similar across the whole territory of the country, being slightly modified by the size of population base, degree of urbanization and proportion of Romany population which still keeps a somewhat higher degree of fertility rate. Therefore, differences should be sought mainly in the mechanical movement.

The natural movement of population is nevertheless still partly affected by particularities of the former historical development. After the post-war loss of population at the end of the 1940s, the Ostrava region became destination of massive immigration that continued through the 1950s and culminated in the 1960s (Jiřík, Prokop, 1997). This immigration was triggered by the unambiguous preference of the region as a coal and steel heart of the republic. Sources of migration to Ostrava were mainly neighbouring districts, some other Moravian regions and the then districts of Čadca and Žilina in Slovakia. In the 1970s, the centre of economic preference was moved to Prague and northern Bohemia and the population increment in the Ostrava region followed out of the young population base arisen here due to the previous immigration. It should be pointed out however that the immigrants were mostly males, which made the population base not that much pronounced as could have been expected from absolute gains in the number of inhabitants and that the female component of the population got stabilized as late as in the 1980s.

Current total fertility rate in the Moravian-Silesian region[2] is 1.128, i.e. lower than national birth-rate. The lowest and highest average birth-rates in the period 1998 – 2000 were those of the districts of Ostrava-City (1.12) and Nový Jičín (1.19), resp.

In 2000, the balance of natural movement of population was negative in all districts of the Ostrava region (most in the district of Ostrava-City: - 1.53 ‰). The order of other districts by relative balance of natural movement of population was as follows: Karviná (-1.47 ‰), Frýdek-Místek (-1.46 ‰), Opava (- 1.35 ‰) and Nový Jičín (- 0.68 ‰). Monitoring the 5-year period from 1995 – 1999 we arrive at similar conclusions although the highest natural population loss (- 8.17 ‰) was in this case exhibited by the district of Ostrava-City which was followed by Frýdek-Místek (- 7.74 ‰) and Karviná (- 5.17 ‰). The situation in other two districts was not so dramatic: Opava (- 2.53 ‰), Nový Jičín (- 2.48 ‰).

The above data are in variance with the general presumption that the agglomeration core districts of until recently strongly immigration character with the young population base will resist for a certain time the national trends. It follows from a comparison of the five-year period and its last year that the situation is worsening particularly in marginal districts an exception being the town of Ostrava itself.

In 2000, the two districts of the Ostrava region with the greatest environmental load recorded a marked population

Photo 1: Pedestrian zone in the historical downtown of Opava. Photo O. Mikulík 2001

[2] The Moravian-Silesian region consists of five districts under study plus the Bruntál district.

loss due to migration: Karviná (- 3.43 ‰) and Ostrava-City (- 2.29 ‰). The districts of Nový Jičín (- 0.24 ‰) and Opava (- 0.21 ‰) had the migration more or less balanced while the district of Frýdek-Místek which reaches most into the recreational area of the Beskids Mts. exhibited a slight population gain (+ 0.69 ‰). Clear population loss due to migration in the five-year period 1995 – 1999 recorded the districts of Ostrava (- 5.45 ‰) and Karviná (- 4.50 ‰) while the other districts still showed medium-term immigration: Opava (+ 1.43 ‰), Frýdek-Místek (+ 3.31 ‰) and Nový Jičín (+ 3.50 ‰).

The above figures indicate that four districts in the Ostrava region recorded in general a population loss and it is only the district of Nový Jičín which exhibited a slight increase of population in the last five years. The greatest migration turnover for this period of time (9.83 %) recorded the regional centre of Ostrava-City, which is however quite understandable regarding the fact that in the case of Ostrava the migration between the centre and surroundings is considered to be migration between districts while in the case of other districts the part of migration between centres and their hinterland occurs as migration within the district. Most stable in terms of mechanical movement of population is the district of Opava (6.54 %).

5. Population development in municipalities of the Ostrava region in 1995 – 1999

The population trends in the Ostrava region can be expected to record considerable changes recently. The reason is seen both in the new national trends after 1990 and in the restructuring of the Ostrava region, which necessarily results in changed residential preferences of the local population. The author is aware of the fact that a 5-year series cannot be considered too representative in normal situation; however, with respect to the changes of trends, a longer series could result in averaging of empirical values.

The following data were gained from the municipal population balances. With no regard to a not entirely demonstrable 100% creditability of the data, the figures can be considered relatively unambiguous. From the viewpoint of their relations between the natural and mechanical movement of population the individual municipalities can be classified into four types[3] as follows:

- Municipalities with both natural and mechanical population increment;
- Municipalities with the natural increment and mechanical loss of population;
- Municipalities with the natural loss and mechanical increment of population;
- Municipalities with both natural and mechanical population loss.

DISTRICT	PP/MP	PP/MU	PU/MP	PU/MU	CP	CU
Frýdek-Místek	15	8	45	7	48	27
Karviná	1	1	9	4	9	6
Nový Jičín	11	7	29	7	33	21
Opava	35	12	28	4	61	18
Ostrava-City				1		1
TOTAL	62	28	111	23	151	73

Tab. 1: Types of municipalities by districts[4] [numbers of municipalities]

Another differentiation is naturally that of municipalities with total gain or total loss of population and differences graded by relative magnitudes of respective balances. The last parameter to be taken into account was turnover of mechanical movement.

By relation between natural and mechanical population movement the Ostrava region municipalities were classified into four categories. A nearly half of all municipalities could be characterized by natural loss and mechanical gain of population in the last five years. Here a comment should probably be added that the population development like this was formerly typical of municipalities in which inhabitants of old people's homes formed a not exactly negligible part of population. On the next place there are municipalities with both natural and mechanical increment of population (28 % of the set). Relatively small shares fall to municipalities with natural population gain and mechanical loss of population (which was in the past rather typical of rural regions that were the source of population migration into towns) and municipalities with both natural and mechanical population loss.

Summarized results indicate that more than two thirds of municipalities recorded population gain in the period from 1995-1999 and nearly a third of municipalities exhibited population loss. Apart from the district of Ostrava-City, a greater part of the municipalities with population increase can be seen in all districts, i.e. also in those which recorded population loss on a district scale in the same period. It follows rather clearly that the loss of population can be expected first of all in municipalities with the largest population, i.e. in the town of Ostrava itself and in the majority of medium-sized towns.

The municipalities with both natural and mechanical population loss include a majority of large towns in the Ostrava region such as Ostrava[5], Karviná, Bohumín, Český

---

[3] In the case that resulting balance was 0 in some of the movements, we took off one or more years until arriving on either positive or negative value.

[4] PP=natural gain; PU=natural loss; MP=migration gain; MU=migration loss; CP=total gain; CU=total loss;

[5] See the above data on the Ostrava-City district;

Photo 2: Frýdek-Místek: the unfinished and forsaken building of public utilities (on the left) in housing estate Slezská with more than 2 500 inhabitants. Photo E. Kallabová 2001.

Těšín, Havířov, Třinec, Nový Jičín, Opava and Jablunkov of which the greatest relative natural loss values were recorded in the towns of Bohumín (9.4 ‰), Karviná (8.3 ‰), Ostrava, Nový Jičín (6.4 ‰) and the greatest relative mechanical loss values in Opava (24.2‰), Karviná (19.1 ‰), Český Těšín (11.7 ‰) and Třinec (8.4 ‰). In absolute figures, Ostrava lost 4 407 residents in the five years, Karviná 1 827, Opava 1 547, Havířov 590, etc.

As far as the other large towns in the Ostrava region are concerned, Frýdek-Místek recorded a slight natural gain but a great migration loss of 28.7 ‰, which represented a total loss of 1 614 residents. A similar situation could be seen in Orlová which kept a natural gain of 12.9 ‰ but exhibited a migration loss of 21.6 ‰, and Kopřivnice with a natural population increment of 17.7 ‰ and a mechanical population loss of 22.0 ‰.

The largest town with positive demographic development is Hlučín. Apart from it, the positive natural and migration gains are exhibited by Studénka and Vítkov, and the positive balance also by other small towns in the Opava district Hradec nad Moravicí and Kravaře. It also follows from the Table that the Opava district has the most favourable ratio between municipalities with general increase and general loss of population.

An entirely different situation can be seen in rural municipalities where the most frequent type are municipalities with natural population loss, migration gain and positive general balance of population movement. A relatively considerable number of rural municipalities have both natural and migration population gains. As to municipalities with population loss, their pattern cannot be told to have markedly geographical aspects. A number of them are situated on the periphery of the studied region (Jablunkov, Fulnek-Odry, Budišov nad Budišovkou, Polish border in the Opava district, Hlučín district), while some other can be found right in the outskirts of Ostrava. However, none of micro-regions contains a greater concentration of these municipalities.

The positive balance of small and very small municipalities has been recently seen as a national-scale trend (Andrle, 1997). As to the statistic reasons of migration into small seats, a fact of the greatest weight is that it is much easier to get a flat in the countryside than in the town. This of course does not answer the question why people seek flats in the countryside. On the other hand, there are still reasons persisting for people leaving the countryside to study in towns, to get closer to their working place, to marry, to divorce and there are also health reasons.

Since it is not to be expected in conditions of the decreasing volume of internal migration that rural municipalities in the Ostrava region would be immigrated to mainly by inhabitants from other parts of the country, we have to consider it probable that the immigration has its source in large towns of the same region. According to information obtained in the field a considerable part of the migration process in the Ostrava region can look so that towards the end of their economic activity people leave housing estates of prefabricated blocks of flats in the large towns in order to move into houses in rural seats, which they either inherited from their parents or which they formerly used for recreation. The process can also have an ecological aspect – i.e. a return to the less devaluated nature; nevertheless, the social aspect is more important, i.e. leaving the dehumanized anonymous environment of large cities to return to some traditions of to-be-rural style of living but without farming activities and at a higher level of technical equipment. Also, there are some sporadic but rather visible tendences on the part of nouveaux riches from Ostrava to build new above-standard residences in the countryside with the recreational hinterland of the Beskids Mts behind the back.

This trend can have its impacts on the rural seats in the region. If it is people at the beginning of their retired age that immigrate, they will not bring any great tax yield and their contribution to prosperity of rural municipalities is usually not great either. Retired people usually show tendencies of refusing new activities that could disturb their peace. And because it rather young qualified and educated people who leave the countryside to find better self-determination, the age and qualification structure of population in rural municipalities may logically be impaired in spite of the increasing number. On the other hand, the population loss in large towns of the Ostrava region - although corroborating the assumption about the reduced attractiveness of their environment- does not need necessarily to signal a worsening population structure.

6. Prognosis of population development

Prognosis of population development in the Ostrava region derives from the general projection of the Czech population, which was worked out in three variants: low, medium and high of which the medium one is considered most likely to occur (Kretschmerová, Šimek, 2000). With respect to the historical development in the 1990s, the prognosis has several very disputable points, though. One of them is the level of fertility rate which is the third lowest in Europe (and apparently in the world, too) and is not sufficient any longer to guarantee even the mere reproduction of population. The question is when the falling fertility stops, if and at what pace it will then be increasing, and to what age of women its highest intensity is going to be shifted. The medium projection variant counts with a fertility of 1.50 in 2030 and with a shift of its peak to 29.1 year of age of mothers.

Another problem – although not so uncertain – is the prolongation of the life expectancy at birth. As compared with north- and west-European countries the Czech population has considerable reserves in this direction and at the same time good pre-requisites for further positive development. The medium projection variant anticipates for the year 2030 a hope of survival at 75.2 years and 81.5 years for men and women, respectively. A consequence of this development will be ageing of the population.

The third and very speculative problem is the issue of the development of mechanical movement. All variants expect a positive balance of anticipated migration with the main immigration stream being expected from the East. However, there are too many aspects of political character in the game, among other the entry of the Czech Republic into the European Union, development of the situation in Balkan, in eastern Europe, etc. The medium variant of projection expects migration gains of about 9.5 – 15 thousand persons per year, which will most probably not be enough to compensate for the natural loss of population.

YEAR	LOW	MEDIUM	HIGH
2000	10266	10268	10271
2005	10196	10247	10297
2010	10098	10244	10383
2015	9959	10200	10442
2020	9764	10098	10443
2025	9488	9927	10364
2030	9136	9691	10212

Tab. 2: Numbers of Czech population according to respective projection variants (thous.)

Migration may reflect back on the natural movement of population. Current data (Srb, 1999) suggest that while the Czech population and all „domestic" minorities (Slovaks, Ukrainians, Russians, Poles, Hungarians and Germans) have been recently recording a natural loss of population, other and undetected nationals can rather be characterized by mild gains.

Result of existing trends and with a great probability also of the future trends of population development will be the worsening of the population's age structure, which is going to be felt at the beginning mainly as a reduction of its children component. In about 2007, there will be a steep increase of population at retired age and hence a further load on social budgeting.

The mere fact that according to respective variants the numbers of Czech population should differ in thirty years by more than a million indicates how speculative any projections in this direction can be.

Another question is how the national trends show in the Ostrava region. In terms of natural movement, the Ostrava region can boast of figures slightly better than the national standard. Reason can be the effect of younger population base as well as the location at the very east of the country. Nevertheless, the differences between the national situation and the situation in the Ostrava region were gradually swept away in 1993 – 1999, and the Ostrava region is slowly catching up with the national averages. An example can be fertility rate. Any pronounced specific features of the region within Czechia can therefore not be expected from the viewpoint of the natural movement of population. As to the population ageing, the phenomenon shows on a greater part of the Ostrava region's territory with exceptions from the rule being Orlová and Frýdek-Místek, which is a specific result of the housing policy in the 1970s and 1980s (Vencálek, 1997).

Speculations can be made about migrations. Intensity of internal migration in Czechia decreased in the 1990s. Regarding the structural problems of economy it is not to be expected that the Ostrava region would become a busy destination of migrants from other parts of the country or from abroad. Apart from the general disurbanization trends, it is well possible that a certain role is also played by not exactly favourable perception of the industrial region similarly as in the neighbouring Upper Silesia in Poland (Gwosdz, 2001). On the other hand, however, an extreme emigration from the Ostrava region is not likely to happen either. As we could see in a detailed view, the region has been rather experiencing internal movement and exchange between large and small towns and between towns and countryside, from the region's core toward the agglomeration margins. It is therefore to be expected that the demographic situation in the Ostrava region will not differ too much from results of national trends. Should we consider the medium projection variant most probable, the population will be shrinking at an accelerating pace mainly due to the negative balance of the natural movement.

7. Conclusion

Reflection of down-scaling coal mining and restructuring industries in the Ostrava region into the demographic development of the region is an open issue at the moment. All prognoses applied on the level of municipalities and districts are of a considerably speculative character Although there are some analogical situations to be seen for example in the Ruhrgebiet, Alsathia-Lotharingia or Middle England, changes in these regions occurred in different time horizons and social contexts. Even the issue of Upper Silesia varies because within Poland the region is not the most remote one from the main centres of the country and from the western border.

It will be useful therefore to study the issue also in the intracensal period and to extend the methodological apparatus with a behaviorally geographical approach.

References

ANDRLE, A. (1997): Is the population coming back to countryside? /in Czech/ Státní správa a samospráva 8, No. 22, p. 24.

GWOSDZ, K. (2001): Postrzeganie regionu tradycyjnego przemyslu w okresie transformacji: przypadek Górnego Śląska. Czasopismo geograficzne 72, No. 3-4, p. 283-299.

CHAMPION, T. (2001): Demographic transformations. In: Daniels, P. et al.: Human Geography. Prentice Hall Harlow, p. 183-215.

JIŘÍK, K.-PROKOP, R. (1997): Specific features of Ostrava population development and composition on the background of economic and social transformations after 1945. /in Czech/ In: Příspěvky k dějinám a současnosti Ostravy a Ostravska. Tilia Šenov, p. 46-87.

KRETSCHMEROVÁ, T.-ŠIMEK, M. (2000): Population prognosis for Czech Republic until 2030. /in Czech/ Demografie, 42, No. 3, p. 183-192.

KUČERA, M.-ŠIMEK, M. (2000): Development of population in Czech Republic in 1999. /in Czech/ Demografie, 42, No. 3, p. 169-182.

RABUŠIC, L. (1996): On present development of matrimonial and parental behaviour in Czech Republic. /in Czech/ Demografie, 38, No. 2, p. 173-180.

Retrospective encyclopaedia of municipalities in the CSSR 1850-1970 (1978). /in Czech/ Part 2, Volume 1, FSÚ Prague, 678 pp.

RYCHTAŘÍKOVÁ, J. (1996): Current changes of reproduction character in Czech Republic and the international situation. /in Czech/ Demografie, 38, No. 2, p. 77-89.

SRB, V. (1999): Natural exchange and balance of population by nationalities in Czechia 1990-1994. /in Czech/ Demografie, 41, No. 4, p. 297-302.

VAISHAR, A. (1983): Geographical difference of some social factors of environment in selected towns and districts of the CSR. /in Czech/ Územní plánování a urbanismus 10, No. 3, p. 181-184.

VENCÁLEK, J. (1997): Changes of demographic potential in the Ostrava industrial agglomeration. /in Czech/ In: Změny geografického prostředí v pohraničních oblastech Ostravského a Hornoslezského regionu. University of Ostrava, p. 177-182.

Author's address:

RNDr. Antonín VAISHAR, CSc.
Academy of Sciences of the Czech Republic
Institute of Geonics, Branch Brno
Drobného 28, 602 00 Brno, Czech Republic
e-mail: vaishar@geonika.cz

Reviewer:

Prof. PhDr. Petr CHALUPA, CSc.

ENVIRONMENTAL HISTORY OF CENTRAL EUROPE IN THE FIRST HALF OF THE 18TH CENTURY

(ACCORDING TO THE SO CALLED WROCLAW COLLECTION)

Jan MUNZAR

Abstract

An important source of information about the historical environment in Central Europe in the period from 1717 – 1730, primarily about its atmospheric component, is a today half-forgotten collection of publications of international character connecting to the Silesian metropolis of Wroclaw (Breslau in German, Vratislav in Czech), and later on also relating to the town of Erfurt. From the territory of Czech Lands the meteorological activity was joined by the station in Zákupy (Reichstadt in German) in northern Bohemia for the period from 1718 – 1720 or by the Těšín (Teschen) station in the Czech part of Silesia for the years 1717 and 1727 – 1729. The paper summarizes basic data on the so called Breslauer Sammlung (Wroclaw Collection) with a particular attention being paid to weather and / or other environmental conditions in the today's Czech Republic and in the neighbouring countries.

Shrnutí

Environmentální historie střední Evropy v 1. polovině 18. století (podle tzv. vratislavské sbírky)

Významným zdrojem informací o historickém životním prostředí střední Evropy v letech 1717 – 1730, především jeho atmosférické složky, je dnes pozapomenutý soubor encyklopedických publikací mezinárodního charakteru, spjatých se slezskou metropolí Wroclaw (německy Breslau, česky Vratislav) a později i s Erfurtem. Z českých zemí se do tehdejších meteorologických pozorování zapojila stanice Zákupy (německy Reichstadt) v severních Čechách v letech 1718 – 1720, popřípadě stanice Těšín (Teschen) v české části Slezska v letech 1717 a l727 – 1729. V článku jsou shrnuty základní informace o tzv. vratislavské sbírce (Breslauer Sammlung) a pozornost je věnována povětrnostním a jiným environmentálnm poznatkům z území dnešní České republiky a ze sousedních zemí.

Key words: *historical environment, historical weather, 18th century, Bohemia, Silesia, Central Europe*

---

1. Introduction

There cannot be any doubt that the atmosphere is one of the most vitally important factors of human environment because its impacts are permanently affecting the man either in the form of immediate situation (weather) or over a long term (climate). Atmospheric factors are diverse, their effects are complex both in their quality and quantity, and their impacting components are of physical, chemical and biological nature.

In order to be able to adopt at least partial measures of protection against the impacts of weather and climate and/or to use them in a suitable way, people were forced to observe the atmosphere in an ever greater detail. The observation of relations between the atmospheric environment and man proceeded in the course of its historical development from random records of smart observers of the nature to the systematic investigation, description and gradual quantification of processes and situations within the atmosphere.

The historical environment in Czech Lands can be documented more minutely only since the 16th century, both on the basis of partial, episodic informations originating from the most diverse written sources and on the basis of the first systematic qualitative observations of some components of the atmosphere. The very first attempts at their qantification were made in the 1st half of the 18th century. A significant source of the information on Central Europe's environment of supra-regional importance for the period of 1717 – 1730 is a today half-forgotten collection of publications connected at first with the Silesian metropolis of Wroclaw (Breslau in German), and later on with the town of Erfurt. Meterological and/or other observations or records from the territory of the now existing Czech Republic from that period have been preserved only thanks to the fact that they were published in the mentioned collection of publications.

2. The so called „Wroclaw collection"

A remarkable project was started and carried out on the accord of the Wroclaw's physician Johann Kanold (1679 – 1729) in order to obtain a picture of simultaneous weather and/or other environmental conditions in a large territory. Kanold and his followers published results of meterological observations recorded by their collaborators in Silesia and in other European countries in a magnificent series of encyclopaedias, the so called Breslauer Sammlungen for the period 1717 – 1730. (Hellmann 1883).

The full name of the first volume reads „Sammlung von Natur- und Medizin, wie auch hierzu gehörigen Kunst- und Literatur-Geschichten, so sich An. 1717 in der 3 Sommer-Monaten in Schlesien und Andern Ländern begeben" (A collection of events having to do with nature and medicine as well as arts and literature in connection with them, as mentioned herein for the year 1717 in its three summer months in Silesia and other lands).

Daily weather observation records for the first of these months – July 1717 were published from three stations: Wroclaw, Olawa (Olau) in Silesia and Prešov (Eperies) in Slovakia. In the period 1718 – 1719, the Kanold international network marked a considerable expansion and included both stations with the visual observation and stations with the meteorological measurement – e.g. in Nurnberg and Zurich. The Wroclaw encyclopaedias (yearbooks appearing in the intervals of year quarters) however contain also other valuable data from various European regions concerning not only the weather extremes but also their influence on farm production, incidence of diseases, etc.

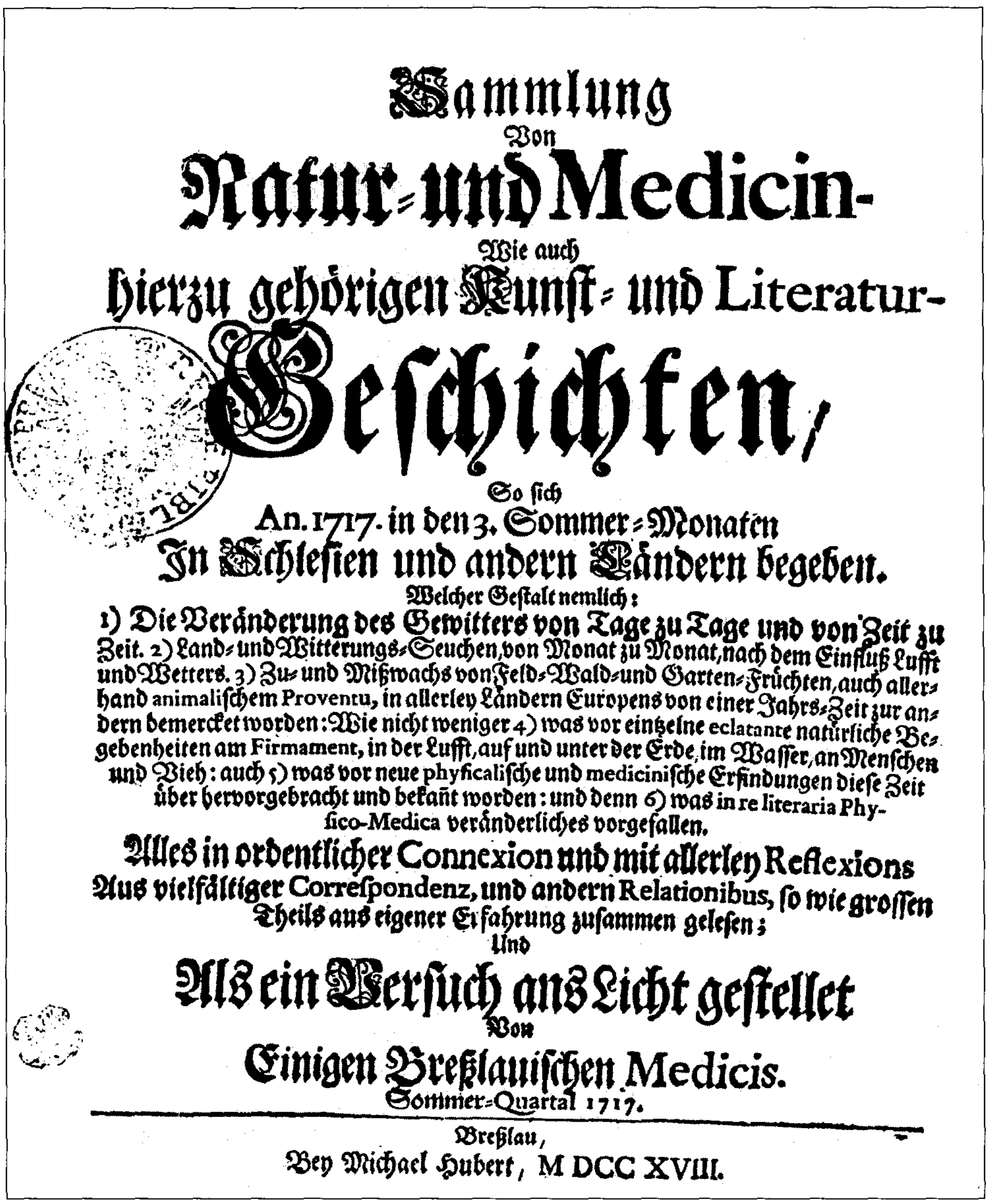
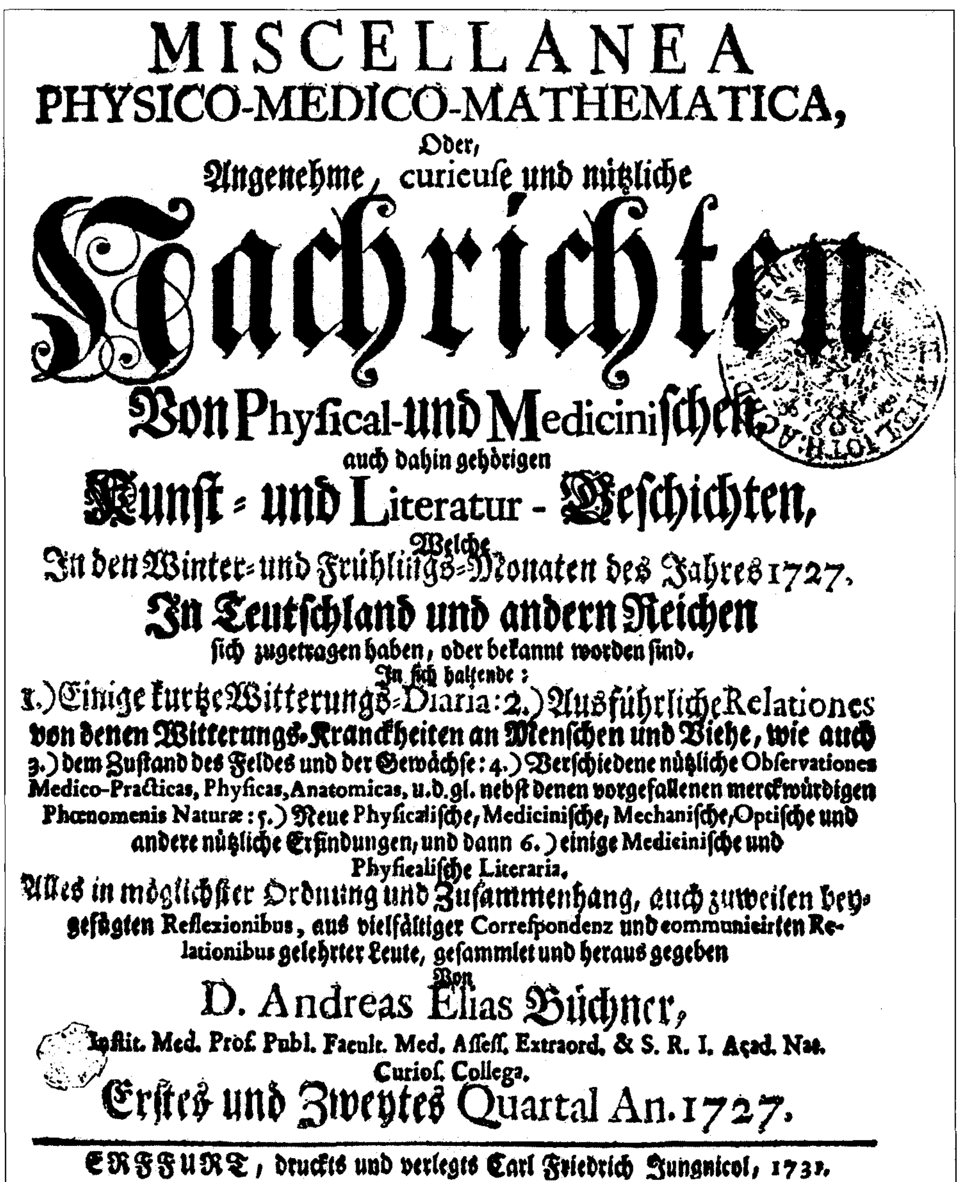

Sammlung
Von
Natur- und Medicin-
Wie auch
hierzu gehörigen Kunst- und Literatur-
Geschichten,
So sich
An. 1717. in den 3. Sommer-Monaten
In Schlesien und andern Ländern begeben.
Welcher Gestalt nemlich:
1) Die Veränderung des Gewitters von Tage zu Tage und von Zeit zu Zeit. 2) Land- und Witterungs-Seuchen, von Monat zu Monat, nach dem Einfluß Lufft und Wetters. 3) Zu- und Mißwachs von Feld-, Wald- und Garten-Früchten, auch allerhand animalischem Proventu, in allerley Ländern Europens von einer Jahrs-Zeit zur andern bemercket worden: Wie nicht weniger 4) was vor eintzelne eclatante natürliche Begebenheiten am Firmament, in der Lufft, auf und unter der Erde, im Wasser, an Menschen und Vieh: auch 5) was vor neue physicalische und medicinische Erfindungen diese Zeit über hervorgebracht und bekañt worden: und denn 6) was in re literaria Physico-Medica veränderliches vorgefallen.
Alles in ordentlicher Connexion und mit allerley Reflexions
Aus vielfältiger Correspondenz, und andern Relationibus, so wie grossen Theils aus eigener Erfahrung zusammen gelesen;
Und
Als ein Versuch ans Licht gestellet
Von
Einigen Breßlauischen Medicis.
Sommer-Quartal 1717.
Breßlau,
Bey Michael Hubert, M DCC XVIII.

Fig. 1: Front page of the first volume of so called Wroclaw Collection (Breslauer Sammlung) for 1717 from 1718.

The editor's name on the front page is missing; only the bottom lines read as follows: „onto the light issued by several Wroclaw physicians as the first experiment" (Fig. 1). The main editor, Johann Kanold was supported by two his local colleague-physicians – J. Ch. Kundmann (1684 – 1751) and J. G. Brunschwitz. They succeeded in publishing a total of 37 quarterlies in Wroclaw, which are called „experiments". The last of them was the 38th quarterly for the end of the year 1726, issued already by A. E. Büchner (1701 – 1769), local professor of medicine. It was himself who continued publishing of the hitherto encyclopaedical series in bulletins called „Miscellaea physico-medico-mathematica..." for the period 1727 – 1730 (Fig. 2 a, b).

Contents of the bulletins for individual months were divided into six sections called classes (Classis). The first of them, referred to as the history of weather, was first bringing available every-day weather observations and then the so called fragmenta with details on „weather metamorphoses" from different European countries. These were added a survey of opinions to the etiological aspects of weather in the particular month and to the consequences of weather changes. The second class was focused on the occurrence of diseases which were put into connexion with weather. The third class concerned reports on good or bad growth of various field and garden crops or harvest. The fourth class was called the history of nature and contained communications of reporters on unusual, irregular mainly meteorological phenomena with frequent sketches. The fifth class was devoted to physical and medical discoveries which were publicized together with the information on new machines and instruments. The last sixth class was bringing records on newly appearing books, essays, scientific disputations, etc.

There was a number of meteorological stations from the territory of today's Poland, which took part in the



MISCELLANEA
PHYSICO-MEDICO-MATHEMATICA,
Oder,
Angenehme, curieuse und nützliche
Nachrichten
Von Physical- und Medicinischen,
auch dahin gehörigen
Kunst- und Literatur-Geschichten,
Welche
In den Winter- und Frühlings-Monaten des Jahres 1727.
In Teutschland und andern Reichen
sich zugetragen haben, oder bekannt worden sind.
In sich haltende:
1.) Einige kurtze Witterungs-Diaria: 2.) Ausführliche Relationes von denen Witterungs-Kranckheiten an Menschen und Viehe, wie auch 3.) dem Zustand des Feldes und der Gewächse: 4.) Verschiedene nützliche Observationes Medico-Practicas, Physicas, Anatomicas, u.d.gl. nebst denen vorgefallenen merckwürdigen Phaenomenis Naturae: 5.) Neue Physicalische, Medicinische, Mechanische, Optische und andere nützliche Erfindungen, und dann 6.) einige Medicinische und Physicalische Literaria,
Alles in möglichster Ordnung und Zusammenhang, auch zuweilen beygefügten Reflexionibus, aus vielfältiger Correspondenz und communicirten Relationibus gelehrter Leute, gesammlet und heraus gegeben
Von
D. Andreas Elias Büchner,
Instit. Med. Prof. Publ. Facult. Med. Assess. Extraord. & S. R. I. Acad. Nat. Curios. Collega.
Erstes und Zweytes Quartal An. 1727.
ERFFURT, druckts und verlegts Carl Friedrich Jungnicol, 1731.

Fig. 2 a, b: Front page (a) and frontispiece (b) of the first volume of Büchner's continuation for 1727 from 1731.

Fig. 2b

observations for the period 1717 – 1726. It was mainly the Wroclaw station from where daily measurements were published of air pressure and temperature taken three times a day together with records on wind direction and weather. These were gradually added results from the observation of atmospherical precipitation (whose totals were expressed in units weight) and hydrological measurements of „superficial and ground“ water on the Odra River (Fig. 3). Although the observer's name is not mentioned, it seems most probable that observer was editor himself – J. Kanold. Kanold's findings linked up with the meteorological bequest of David von Grebner, which comprises two publications written in Latin with his meteorological diary from Wroclaw for the period 1692 – 1699 and for the year 1710, with the last mentioned year already with the „notes“ on air pressure and temperature. However, J. Kanold mentioned an inspiration for his event to be the experiment made by David Algöwer (1678 – 1737) from Ulm, who published in 1714 a paper „Specimen Meteorologiae Parallelae...“ (Examples of meteorological similarities...) which contained -in addition to the observations from Ulm - from September 1710 to March 1714 – also the weather reports from other localities. Another station worth mentioning is for example that of Luczyny (Luzin) – or Kurow (Kauer) – which was the second locality measuring precipitation. Frequent are also the data reported from the stations of Gdańsk (Danzig) and Legnica (Lignitz).

Since January 1727 when the editing of the collections was took up by A. E. Büchner the proportion of records and information from Erfurt and its surroundings increased with the respect to the working place of the editor at the account of Silesia (Büchner 1731 – 1733). The daily weather observations are arriving only from three stations now: Nurnberg, Löbau and Zurich. Although there was a drop-out in the observations from Nurnberg between April and July 1728, the records from measurements and observations at the Wroclaw station returned into the bulletins for as long as four months their author being apparently again J. Kanold who contributed also e.g. with a comprehensive information on the course of flood on the Odra River in Wroclaw in the spring 1728 and resulting damage. From January 1729 to June 1730 the daily weather observations from Zurich were replaced by measurements of air pressure with accompanying weather characteristics from the hospice of St. Gotthard, recorded at this first montane station in Europe located at an altitude over 2000 masl. by the Capuchin Joseph Da Sessa at an instance of J. J. Scheuzer.

Irregular phenomena worth mentioning to have occurred in the territory of Silesia are for example the attack of grasshoppers in the summers of 1727 and 1728 (also in Thuringia), and in the spring and summer of 1729 according to records by Daniel Sinapius, vicar in Luczyna. Partial reports on weather, diseases or „situation in the fields“ originated for example from correspondents residing in Warsaw, Wroclaw, Luczyna or Gdańsk.

From the territory of Czech Lands the international activity was joined by the station in Zákupy (Reichstadt) in northern Bohemia for the period 1718 – 1720 or by the station in Těšín (Teschen) for the years 1717 and 1727 – 1729. It is not important for environmental history that the town of Těšín which was a part of the Czech Crown from the mid-17th century split in 1920 into two parts: the Czech part (Český Těšín) and the Polish part (Cieszyn), the natural border line between the two parts being the Olše (Olza) River, the historical part of the town being situated on the right (Polish) bank (Fig. 4).

3. Meteorological observations from Bohemia 1718 – 1720

The station in Zákupy near Česká Lípa ($\varphi = 50° 42' N, \lambda = 14° 39' E$) participated in the weather observation both qualitatively and quantitatively by having assessed the weather character in the given month by visual observations made from October 1718 to November 1719 and from April to December 1720, and by having measured air pressure and temperature, wind direction and accompanying weather three times daily from the end of December to March 1720

158 ANNO 1717. OCTOBER.

22	27	1	4	25	-	-	10	9	-	-	6	15	Vollkommen helle. S.
23	-	-	3	-	27	1	3	8	27	1	3	14	Wie gestern.
24	-	-	-	19	-	-	8	2	-	-	6	20	Wie gestern, Abends gelinder NW.
25	-	-	2	25	26	12	-	4	26	12	4	13	Wie gestern.
26	26	12	9	23	-	-	-	5	-	-	-	17	Dergleichen nur etwas mehr windig aus NW.
27	27	1	2	-	27	1	2	9	-	-	9	20	Dicker Nebel, helle.
28	-	1	7	28	27	1	7	15	27	1	5	25	Vollkömmlich helle.
29	-	-	10	32	-	-	9	-	-	-	7	24	Wie gestern, Abends starcker Nebel, gelinder SO.
30	-	-	9	24	-	-	-	21	-	-	4	22	Den gantzen Tag dicker Nebel, so sehr naß machte, Windstille.
31	-	-	4	26	-	-	4	-	-	-	-	23	Eben wie gestern den gantzen Tag Nebel.

Lufft- Regen- und Fluß-Messung in Breßlau.

	Barometr.			Thermometr.			Regen-Maaß.			Fluß-Maaß.
1	16	16	16	66	61	63	″	″	″	fällt 1. Zoll.
2	16	″	″	66	61½.	63½.	″	″	″	″ ″
3	15	″	″	65	61	60	3ß.	Gran. 8.		″ ″
4	17	″	18	65	63	71	″	Gran. 4.		fällt ½. Elle.
5	15	″	″	60	60	60	3ß.	″	″	wächst ½. Viertel.
6	16	″	16	65	62	63	″	″	″	fällt 1. Zoll.
7	16	″	15	62	62	60	″	″	″	fällt 1. Viertel.
8	15	″	14	61	56	62	℈j.	″	″	fällt ½. Viertel.
9	14	″	″	59	56	61	″	″	″	wächst 2. Zoll.
10	14	11	9	63	57	60	″	″	″	steht.
11	6	7	9	60	61	63	3ß.	″	″	wächst 1. Viert.
12	10	″	13	65	63	70	3j.	″	″	fällt 1. Viertel.
13	15	16	14	72	59	73	″	″	″	wächst 2. Zoll.
14	11	10	″	66	62	60	3j.	Gran 20.		fällt 3. Zoll.
15	10	″	″	62	60	60	3iß.	″	″	wächst 3. Zoll.
16	10	″	″	65	60	60	314.	″	″	steht.
17	12	″	″	67	62	62	32.	″	″	wächst 3. Zoll
18	13	″	″	59	56	55	″	″	″	wächst 2. Zoll.
19	16	″	″	63	60	60	Früh Gran 8. Abends 35½.			wächst ½. Elle.
20	20	19	18	70	64	61	″	″	″	wächst ½. Viertel.
21	18	″	″	63	55	57	″	″	″	wächst ½. Viertel.
22	18	″	″	65	60	58	″	″	″	fällt 1. Viertel.

23.

Fig. 3: Specimen from the published measurements in Wroclaw (Breslau in German) for 1-22 October 1717: air pressure, temperature, precipitation and water stage in Odra(Oder)River once a day.

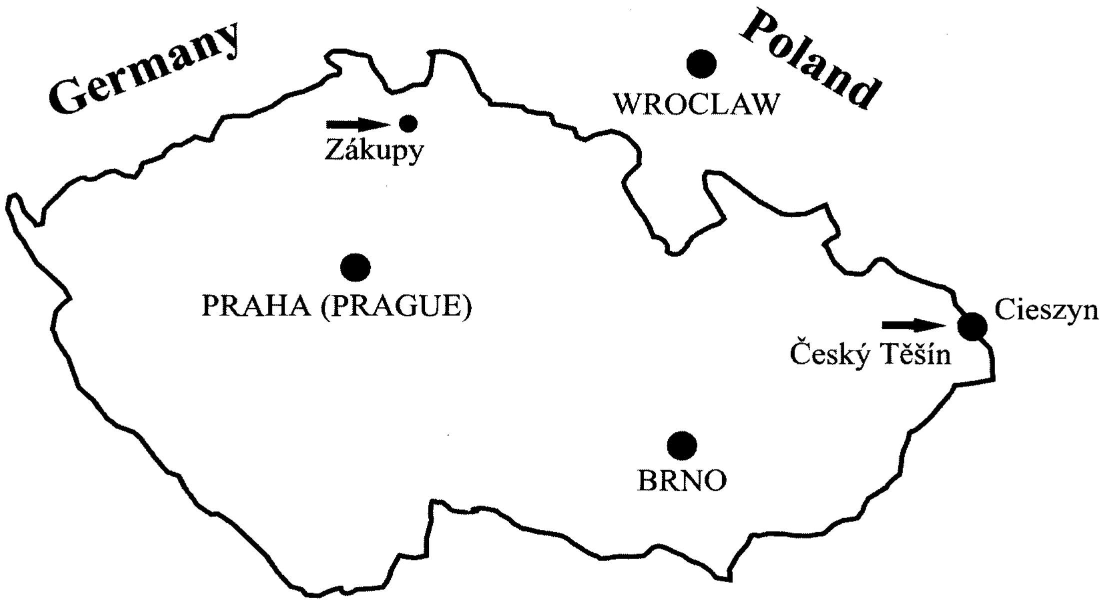


Fig. 4 : Localization of two meteorological stations from the Czech Lands cooperating with Wroclaw and/or Erfurt: Zákupy in northern Bohemia and Těšín (this Silesian town was split in 1920 into a Czech part – Český Těšín – and a Polish part – Cieszyn).

inclusive. The observer was Johann Carl Rost (1690 – 1731) – physician and astronomer temporarily in services of the lady-owner of the local manor.

The measurements made by Rost in Zákupy and published in the „Sammlungen" are elucidated in his extensive foreword about the historical context and methodology. Although his daily measurements continued until June 1720 at the least, they have not been published since April already the reason being a fact that type-setting of such an enormous number of tables became unfulfillable. The presentation of daily measurements in the Kanold series was therefore reduced to 4 stations: Wroclaw, Löbau (23 km WSW of Görlitz), Nürnberg and Zurich.

The data on air pressure and temperature measured by J. C. Rost in northern Bohemia are the first documented systematic meteorological measurements made in the territory of the Czech Republic and will call for a further analysis.because daily air temperatures in the period between 21 December 1719 and 31 March 1720 cannot be converted into the present usage as we still do not know what reference temperature (Puncto Temperati) was on the observer's mind. We can only state from historical analogies that 0° of the thermometer scale in Zákupy could range approximately within an interval of 8 – 12°C (Fig. 5).

Pioneer are also Rost's observations of wind direction. It followed from an orientation analysis that he used a 16-segment scale to express the wind direction and his determinations were based on the direction of cloud flows. For example – in January 1720, the most frequent winds were those from the West (33 %), South-West (16 %) and North-West (14 % of all cases). Notwithstanding the fact that up to that time – and long after it – the weather records in northern Bohemia spoke of dominating „northern" winds.

It follows from Rost's foreword to his results that the barometer and thermometer for his measurements were obtained from the Prague Jesuit „Father Löwald" who visited the residence of his employer, Grand Duchess of Tuscany. Along with the barometer he gave dr. Rost also the notes with his Prague measurements of average and extreme values of air pressure and weather occurring with them. Rost's meteorological „instructor" was successfully identifed: it was Jan (Joannes) Lewaldt (1686 – 1769). Unfortunately, he did not published any of his Prague measurements and we learn about his apparently first systematic air pressure measurements taken in Czech Lands before 1719 only thanks to Rost's information in the Wroclaw Collection.

By coincidence, J. C. Rost was contributing to the „Sammlungen" once again from March 1727 to December 1730 with observations from his birth city of Nurnberg where he continued in the meteorological measurements carried out by his deceased brother Johann Leonhard Rost (1688 – 1727).

4. Meteorological observations from Silesia (Těšín region)

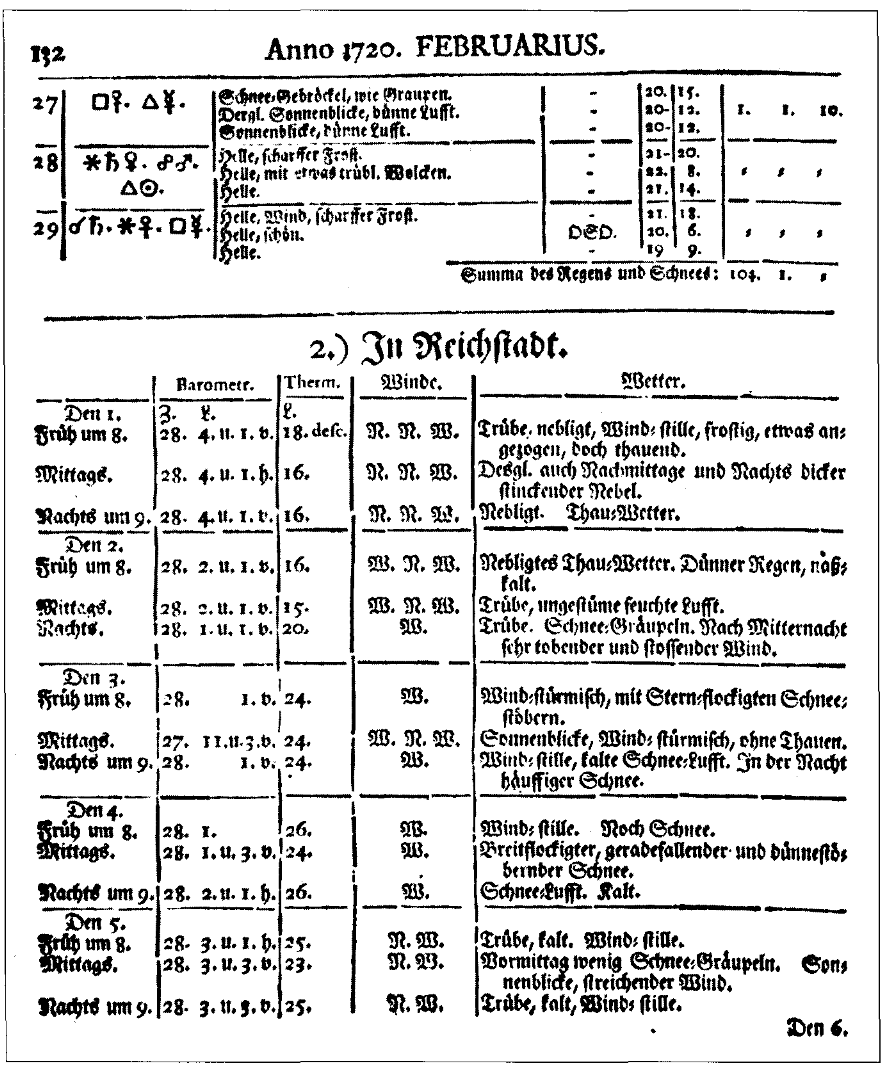
The only station cooperating in the territory of Moravia and Czech part of Silesia was that in Těšín (Teschen). It was only the daily weather observation from August to October 1717 without instruments; unlike in Zákupy these were only very brief statements. Těšín appeared once again in the publication series with its information for the period from January 1727 to August 1729 where the section of „Fragmenta" presents summaries on the course of weather in individual months with exceptional data on the occurrence of diseases in the town. Up to now it has not been found out who was the local observer; neither it is clear if the observer was one and the same person in the above mentioned period of thirteen years.

Nevertheless, there is a relatively considerable variance in the meteorological records from Těšín before the year 1720 and at the end of the 1720s as to detailed weather characteristics during the day. Individual days of September 1717 are depicted as follows: 1st Nice weather – hot and brightness; 2nd Hot and bright; 3rd Cloudy weather; 4th Similar; 5th Some rain in the morning, cloudy, cold; 6th Cloudy and cold; 7th Similar; 8th Coasy or in other words bright and warm; 9th As well; 10th Brightness and hot as around John (the Baptist – 24 June?); 11th As well; 12th Similar; Since now until the end of this month the weather was unpleasant, i.e. rainy and windy.

Ten years later, we can find more detailed weather records; for example in January 1727: We had mainly windy weather between 1st and 5th, but at the same time there was a mild thaw; 6th It was colder; 7th Snow arrived; 8 – 10th Mild weather again but on the last day a true hurricane arrived between 4 – 5 o'clock in the afternoon from the southern mountains from Hungary (today's Slovakia), which caused a lot of damage particularly where the Wisla River flows from the mountains...

There are sporadic entries with the specification of wind direction; the record of 21 April 1727 indicates that the new snow cover was a quarter of ell (ca. 15 cm) thick. And there are also some records on optical phenomena occurring in the atmosphere (e.g. a large halo around the Sun on 14 May 1727 between 10 – 11 o'clock in the morning). A survey originating from July 1727 says among other that on 19th and 20th There was a nice weather that made harvest possible. Such a big harvest has not been seen for years. (The good harvest of grain is also documented in chronicles from southern Moravia, in Bzenec and Čejkovice). On the other hand, the rainy weather in July 1728 spoiled the harvest.

Records from December 1727 bring a lot of details on a flood. There were „big waters" on the Olše (Olza) River and particularly on the Wisla River also towards the end of August and in September 1728. Interesting is also the weather account of 9th June 1729 when there was a cold rain in the morning and snowing in the mountains.



132 Anno 1720. FEBRUARIUS.

27	□♀. △☿.	Schnee-Gebröckel, wie Grauppen. Dergl. Sonnenblicke, dünne Lufft. Sonnenblicke, dünne Lufft.	- - -	20. 20- 20-	15. 12. 12.	1.	1.	10.
28	✱♄♀. ☍♂. △☉.	Helle, scharffer Frost. Helle, mit etwas trübl. Wolcken. Helle.	- - -	21- 22. 21.	20. 8. 14.	,	,	,
29	☌♄. ✱♀. □☿.	Helle, Wind, scharffer Frost. Helle, schön. Helle.	- DSD. -	21. 20. 19	18. 6. 9.	,	,	,

Summa des Regens und Schnees: 104. 1. ,

2.) In Reichstadt.

	Barometr.	Therm.	Winde.	Wetter.
Den 1.	Z. L.	L.		
Früh um 8.	28. 4. u. 1. v.	18. desc.	N. N. W.	Trübe, nebligt, Wind-stille, frostig, etwas angezogen, doch thauend.
Mittags.	28. 4. u. 1. h.	16.	N. N. W.	Desgl. auch Nachmittage und Nachts dicker stinckender Nebel.
Nachts um 9.	28. 4. u. 1. v.	16.	N. N. W.	Nebligt. Thau-Wetter.
Den 2.				
Früh um 8.	28. 2. u. 1. v.	16.	W. N. W.	Nebligtes Thau-Wetter. Dünner Regen, näß-kalt.
Mittags.	28. 2. u. 1. v.	15.	W. N. W.	Trübe, ungestüme feuchte Lufft.
Nachts.	28. 1. u. 1. v.	20.	W.	Trübe. Schnee-Gräupeln. Nach Mitternacht sehr tobender und stossender Wind.
Den 3.				
Früh um 8.	28. 1. v.	24.	W.	Wind-stürmisch, mit Stern-flockigten Schnee-stöbern.
Mittags.	27. 11. u. 3. v.	24.	W. N. W.	Sonnenblicke, Wind-stürmisch, ohne Thauen.
Nachts um 9.	28. 1. v.	24.	W.	Wind-stille, kalte Schnee-Lufft. In der Nacht häuffiger Schnee.
Den 4.				
Früh um 8.	28. 1.	26.	W.	Wind-stille. Noch Schnee.
Mittags.	28. 1. u. 3. v.	24.	W.	Breitflockigter, geradefallender und dünnestöbernder Schnee.
Nachts um 9.	28. 2. u. 1. h.	26.	W.	Schnee-Lufft. Kalt.
Den 5.				
Früh um 8.	28. 3. u. 1. h.	25.	N. W.	Trübe, kalt. Wind-stille.
Mittags.	28. 3. u. 3. v.	23.	N. W.	Vormittag wenig Schnee-Gräupeln. Sonnenblicke, streichender Wind.
Nachts um 9.	28. 3. u. 3. v.	25.	N. W.	Trübe, kalt, Wind-stille.

Den 6.

Fig. 5: Specimen from the published measurements by J. C. Rost in Zákupy (Reichstadt in German) for 1-5 February 1720: air pressure, temperature,wind direction and weather three times per day.

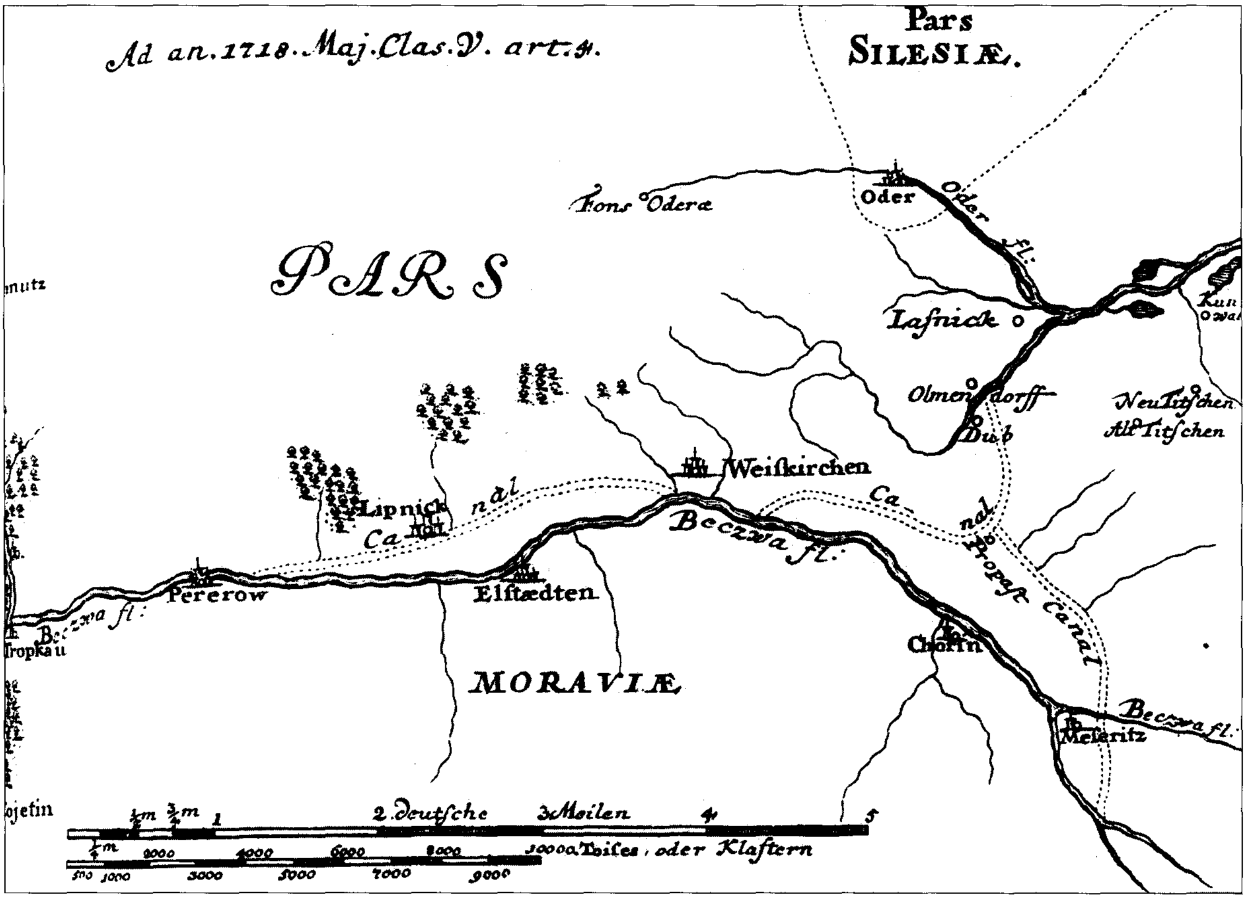


Fig. 6: The proposition of Lothar Vogemonte for naval connection the Danube and Odra (Oder) Rivers via Morava (March) River and Bečva (Beczwa) River by means of three channels on the Bečva River, sinistral tributary of Morava River (Wroclaw Collection, May 1718).
Explanations: Pars Moraviae = territory of Moravia, Pars Silesiae = territory of Silesia. On the left: Morava (March)River with the settlements Olmütz = Olomouc, Tropkau = Troubky (the Moravian village, a symbol of flood disaster in July 1997 with 9 life casualties) and Kojetín. Beczwa Fl. = Bečva River with settlements Pererow = Přerov, Weisskirchen = Hranice, Meseritz = Valašské Meziříčí. Oder Fl.= Odra (Oder) River with settlements Dub and Iasnick = Jeseník nad Odrou. Scale above: German miles, below fathoms.

From the viewpoint of the history of natural environment, Těšín enjoys a primacy also in the measurement of atmospheric precipitation in the eastern part of Czech Lands from January 1777 until February 1778. In this case we know the observer who was the Jezuit Leopold J. Szersznik (1747 – 1813), graduate from the Olomouc University and later from the Prague University. Originating from Těšín, he returned to his native town at the end of the year 1775. His meteorological measurements in this town were most probably stimulated by the Prague astronomer and meteorologist Josef Stepling (1716 – 1778) with whom Szersznik met during his studies in Prague in 1774, i.e. a year before his comeback to Těšín.

(It is not so important for environmental history that the town of Těšín was split in 1920 into a Czech part (Český Těšín) and a Polish part (Cieszyn) the division line being made the Olše (Olza) River, and that its historical core in which L. J. Szersznik lived and worked is on the right -today Polish-river bank.)

The weather reports for Moravia are otherwise rather modest. A survey for June 1718 includes for example a remark that in Lanškroun behind Klodzko (viewed from Wroclaw) a storm with hails caused a great damage on the first day of Whitsun, i.e. 5 June 1718. At the same time there was a severe torrential rain in Moravia during which water took away a lot of linen sheets from bleaching grounds. The fact is that the flash flood was not recorded in the historical literature of Moravian provenance.

Nevertheless, Moravia was a subject of interesting information about a plan to build canal between the Danube and Odra Rivers, published in collection in May 1718. The two rivers were about to have a naval connection via the Morava (March in German) River and Bečva (Beczwa) River. Author of the design was Dutch builder of hydrotechnical works Lothar Vogemonte who was granted a privilege by Emperor Joseph to design canals in the Austrian monarchy in 1711. The Vogemonte's draft design on a copper-engraving made by M. Pfeiffer is illustrated in (Fig. 6). The builder proposed a construction of three channels on the Bečva R. from Přerov around Hranice na Moravě to the village of Dub and to the town of Valašské Meziříčí, whose total length was 22 500 fathoms (ca. 40 km).

5. Conclusion

The collection of weather data and/or other environmental components from Central Europe in the period 1717 – 1730, published within the „Wroclaw" initiative constitutes one of important sources for learning about the historical environment in the first half of the 18th century, its conditions and/or variability, which preceded by more than sixty years the collection of weather data in the yearbooks of the Societas Meteorologica Palatina (Meteorological Society of Mannheim) for the period 1781 – 1792.

It should be added that from the viewpoint of the history of the Czech meteorology, the measurements made by J. C. Rost in the northern Bohemia preceded by more than thirty years those made by astronomer and meteorologist Josef Stepling in Prague-Klementinum in 1752.

Acknowledgement

The author thank the Academy Sciences of the Czech Republic for the financial support of the key project No. K3046108, within the framework of which the paper is originated.

Selected references

BRÁZDIL, R. – VALÁŠEK, H. (2002) : Meteorological measurements and observations at Zákupy 1718 – 1720 (in Czech – English summary). Geografie – Sborník České geografické společnosti, Vol.107, No.1, p.1-22.

BÜCHNER, A.E. (1731-1733): Miscellanea physico-medico-mathematica etc. An.1727-1730. Erfurt 1731 – 1733

ČORNEJOVÁ, I.- FECHTNEROVÁ, A.(1986): Životopisný slovník pražské univerzity. Filosofická a teologická fakulta 1654-1773. Praha,p. 257-258.

HELLMANN, G. (1883): Repertorium der deutschen Meteorologie.Leipzig, 995 pp.

MEMORIA D. D. Joh. Car. Rostii... In: Commercium Liter. Ad Rei Medicae et Sci. Natur. Incrementum Instituti. Norimbergae 1731, p.377-379.

MUNZAR, J. (1990) : The beginnings of regular meteorological observations in the Czech Lands from the 16th to the 18th centuries. In:Climatic change in the historical and the instrumental periods, ed. R.Brázdil, p.153-155. Masaryk University Brno.

MUNZAR, J. (1993): Early meteorological instrumental records in Bohemia. In: Early meteorological instrumental records in Europe - Methods and results, ed. B.Obrebska-Starklowa, p. 75-79. UJ Cracow

MUNZAR, J. (1999): Beginnings of quantification of natural elements of the evironment in Bohemia in the 18th century on the example of air (in Czech - English summary). In: Historická geografie - Historical geography, Vol. 30, p.119- 134. Praha

MUNZAR, J. (2000): Early meteorological measurements in the Czech Lands. In: Giuseppe Toaldo e il suo tempo, eds. L.Pigatto - P.Casini, p.721-729. Padova

MUNZAR, J. (2002): Contribution of the Wroclaw (Breslau) meteorological network from the years 1717-1730 to a better knowledge of weather conditions in Central Europe. In: Man and climate in the 20th century.International conference Wroclaw, 13-15 June 2002, abstract book, p.68-69. Wroclaw

MUNZAR, J. (2003): Johann Carl Rost (1690-1731) and his meteorological observations in northern Bohemia and in Nuremberg (In Czech - English summary). Meteorologické zprávy, Vol.56, No.1 (in print)

SAMMLUNG von Natur- und Medicin-, wie auch hiezu gehörigen Kunst u. Literatur-Geschichten, so sich An.1717 in den 3 Sommer-Monaten (bis An.1726 in den 3.Herbst-Monaten) in Schlesien u. andern Ländern begeben... von einigen Breslauischen Medicis. Breslau 1718 (- Erfurt 1730).

Author's address:

RNDr. Jan MUNZAR, CSc.

Academy of Sciences of the Czech Republic

Institute of Geonics, Branch Brno

Drobného 28, 602 00 Brno, Czech Republic

e-mail: munzar@geonika.cz

Reviewer:

RNDr. Karel KRŠKA, CSc.

THE 20TH ANNIVERSARY OF THE INSTITUTE OF GEONICS, ACADEMY OF SCIENCES OF THE CZECH REPUBLIC IN OSTRAVA

Richard ŠŇUPÁREK, Petr KONEČNÝ

It will be exactly 20 years that the scientific workplace of Institute of Geonics, Academy of Sciences of the Czech Republic (former Institute of Mining) was founded in Ostrava on 1 July 1982, which is at the present time the one of the kind in the Moravian-Silesian region.

History of the workplace started in 1978 when a decision was made in the second half of the 1970s to dislocate some workplaces of the then Czechoslovak Academy of Sciences (CSAV) in Prague to industrial centres in order to bring them closer to industrial practice. The decision concerned among other also the Institute of Mining in Prague, which was to be moved to Ostrava. It is worth mentioning that at that time the Czechoslovak Academy of Sciences was to establish two other workplaces in Ostrava at the same time viz. the Institute of Theory of Metallurgical Processes, and the Institute of Industrial Landscape Ecology. The traditional Silesian Institute of CSAV had been already operating in the near town of Opava.

Fig. 1: The building of the Institute of Geonics AS CR in Ostrava (Photo: O. Mikulík)

The branch office of the Prague Institute of Mining, CSAV in Ostrava launched its activities in March 1978 with just six employees. It resided in Hladnovská Street on premises which were previously in the possessions of the University of Mining, later gained and reconstructed by CSAV. The material and staff development of the workplace was planned so that a scientific workplace with 140 employees and newly built premises for this special purpose would come into existence in the Ostrava-Poruba scientific and paedagogical area of the university campus.

Activities of the new scientific workplace in Ostrava were originally focused on the issue of underground mining at ever more difficult technical circumstances for mining, particularly great mining depths and critical conditions. The concept of mining was worked out in such a way that the scientific research was focused on the physical substance of processes occurring in the rock massif during coal mining. Main scientific disciplines were therefore geomechanics of mining and aerology. Because the research concept was interdisciplinary, the Institute was organized in a way that could provide for cultivation of mining sciences such as underground mining, geology, geomechanics, geophysics, geochemistry, mathematics (mathematic modelling), physics, etc. In contrast to other workplaces of applied mining research, however, problems of technology and economics of deposit mining were not subject of research in this institute since the disciplines were dealth with only as a necessary general frame of investigated issues.

The Prague Institute of Mining was at that time steered by Ing. Gustav Šebor, DrSc. – a corresponding member of CSAV; having been appointed with a task to built the CSAV workplace in Ostrava, the Institute supported its development only in terms of material but except for a merely one single technician there were no people from Prague coming to Ostrava and all staff for the Ostrava subsidiary had to be recruited in the Ostrava conurbation. Prof. Ing. Lubomír Šiška, DrSc. – a corresponding member of CSAV was appointed managing director of the branch office. Experienced researchers came from the Scientific Coal Research Institute (VVUÚ) in Ostrava-Radvanice and from the University of Mining (VŠB), people with experience and skills in mine operation and research and development were recruited from the Coal Mining Company (OKD) in Ostrava-Karviná. From the very beginning of existence of the Institute a good part of its personnel policy was extension education of young scientific workers and university graduates from the whole country.

Organizational structure of the workplace was developing accordingly. In 1979, the Institute of Mining in Prague was reconstructed into the Institute of Geology and Geotechnics, CSAV having incorporated the former Geological Institute, CSAV. The concept was adjusted in such a way that the so called Ostrava section of the Institute of mining was primarily appointed to deal with the issue of underground coal mining. A self-standing separate Institute of Mining, CSAV in Ostrava was founded on 1 July 1982 its foundation being based on the resolution of the CSAV presiding committee. The Institute had 59 employees.

A systematic transformation of the entire Czecho-Slovak Academy of Sciences and its institutions was initiated in 1990 in new political and economic conditions. At that time, the Institute in Ostrava employed 120 persons. After a detailed assessment of scientific work performed by CSAV institutions, the Institute of Mining with its 125 employees was classified as the one with good prospects but with a need of down-scaling the research of coal mining and transforming its programme in accordance with the development of economic requirements in the Czech Republic as well as with current global trends. The Institute's management together with the Institute's Scientific Board prepared a conception in cooperation with all creative employees, which made it possible to utilize the hitherto knowledge and experience but rather extended the area of interest beyond the boundaries of mining. Basic idea of the new concept was that while the main object of research (Earth crust) remains the same, the subject of research would be the physical substance of processes taking place in it, being induced by anthropogenic activities in general – not only by the exploitation of deposits. In contrast to classical scientific disciplines such as geology, geophysics, geomechanics etc., which are focused mainly on the description of nature and natural processes, this was how the groundworks of a new scientific discipline (geonics) were laid. Geonics was defined as a science which studies the substance of processes occurring in the Earth crust due to anthropogenic activities including environmental impacts. Substance of this transformation consists in the fact that some parts of the issue of mining can be considered a part of geonics and this is how the research of mining at the Czecho-Slovak Academy of Sciences could be saved from liquidation.

The transformation concept structured in this way was accepted and approved by the convention of the Academy of Sciences of the Czech Republic (AS CR) in February 1993 and the Institute of Mining was renamed to the Institute of Geonics as at 1 April 1993. The transformation was naturally connected with budget and staff reductions (institutes of the Academy of Sciences having still been state-budget depending or subsidized organizations). The staff of the Ostrava branch office was reduced to 75 persons. Research in the sphere of mining aerology was considerably restricted in harmony with the new concept and down-scaling measures. On the other hand, the Institute of Geonics merged with the geographic workplace of the Academy in Brno with 25 employees of the former Institute of Geography, AS CR.

Today, the Institute of Geonics, Academy of Sciences of the Czech Republic can be considered a workplace that has gone through the most complicated period of transformation and stabilized its programme and position within the system of AS CR institutions and within the hierarchy of geological sciences. The Institute resides in Ostrava-Poruba, Studentská 1798; its branch office in Brno can be found at the address: Drobného ulice 28, 602 00 Brno.

The Institute of Geonics cooperates with both Czech and other European scientific workplaces. In this connexion, a special role is played by its collaboration with universities, namely with the VŠB Technical University in Ostrava, with the Ostrava University, Masaryk University in Brno, Palacký University in Olomouc, and Charles University in Prague. In the case of VŠB-Technical University in Ostrava and Ostrava University, the Institute of Geonics was accredited -in accordance with the existing legislation-a training workplace for selected subjects of doctoral study such as rock engineering, mining and underground constructions, geomechanics of mining, mining industry, applied mathematics and mathematic modelling.

Current scientific issues resolved at the Institute of Ostrava concern the following groups of problems:

- Research of Earth crust materials (their composition and properties) and their environmental interactions;
- Research of some processes occurring in rock massif induced by anthropogenic activities (e.g. stability of underground constructions, reinforcement of rock massif parts, excavation of underground spaces, propagation and insulation of contaminants, etc.);
- Research of mathematic methods with application for mathematic modelling of processes in rock massif (method of finite elements, method of boundary elements, etc.) and research of other technological methods and their management;
- Non-conventional methods of Earth crust exploitation (geotechnologies, special methods of waste disposal, etc.) and their impact on environment.

Attempts are also focused on the revival of the sphere of aerology and mine ventilation.

Primary activities of the Brno Branch office are concentrated onto the following groups of problems:

- Evaluation of the impact of current changes in various types of regions taking into account the effect of technical activities on environment;
- Studies of living environment in town conurbations and residential systems;
- Regional differentiation of life quality as a consequence of environmental impact.

Similarly as a number of other institutes of the Academy of Sciences of the Czech Republic, the Institute of Geonics successfully passed through two regular international classifications in 1995 and 2000; it represents today a well consolidated scientific workplace with stabilized links to cooperating Czech and foreign scientific institutions, universities and research centres.

In the course of its existence, the Institute participated in a number of research projects of which we can mention the extensive programme of measuring primary stresses in the rock massif of the Carpathian Foredeep and Bohemian Massif by using hydrofracturing of borehole walls, the international research project focused on materials cutting by high-pressure abrasive water jets, monitoring of natural or induced seismicity in northern Moravia, development of GEM software for mathematic modelling of extensive problems of geomechanics or the research of structure and development of regions from the viewpoint of living environment.

The Institute currently runs about 25 scientific grant projects ordered by the Czech government and participates in about 4 or 5 large international projects. An important activity of the Institute of Geonics is application of scientific results in practice as based on the requirements of industrial and administration spheres. Recent projects to be mentioned are for example the Prognosis of rock bursts, causes of their development and methods of prevention, or Temperature and humidity changes of mine air in underground environment, which serve to legislative needs of the Czech Bureau of

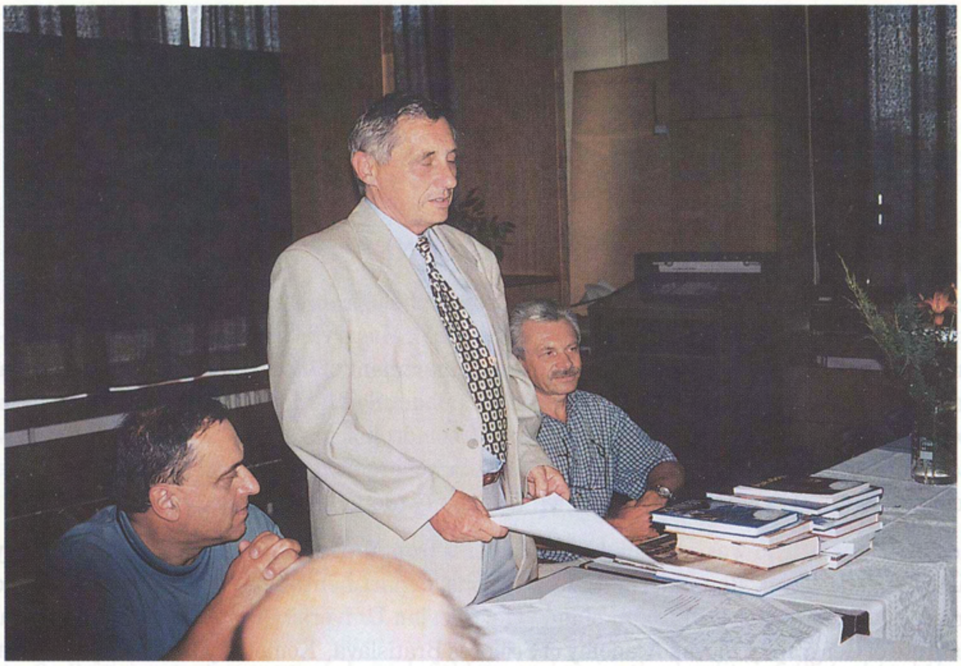


Fig. 2: The director of the Institute, Doc. Ing. Richard Šňupárek, CSc., during his speech at the festive meeting on the occasion of 20th anniversary of the workplace. (Photo: O. Mikulík)

Mining, cooperation in the extensive project of sanitation of the Kateřina burning waste bank in the municipality of Radvanice in Bohemia, the project study and geotechnical research and monitoring for underground storage of burnt-out nuclear fuel at the Skalka site, mathematic modelling of stress conditions in rock massif during exploitation of uranium deposition in Dolní Rožínka, etc.

Further development of the workplace certainly depends on the place and financial position the science is going to take up in the Czech society; results of scientific work are the most essential aspect, however. Last but not least, a reality should be taken into consideration that the Institute of Geonics has remained the only and single workplace of the Academy of Sciences of the Czech Republic in the region of northern Moravia and Silesia this being a good reason to appoint it with the tasks of extension education and education of public. The current status and facilities of the Institute as well as the hitherto results of its scientific work provide the best pre-requisites for its further development and success in the field of scientific research.

GEOMORPHOLOGICAL RESEARCH IN 2002 – INTERNATIONAL SEMINAR IN BRNO (CZECH REPUBLIC)

Karel KIRCHNER

An international geomorphological seminar „Geomorphological research in 2002" was held at the Department of Geography, Faculty of Natural Sciences, Masaryk University in Brno from 10 – 11 June 2002. The Seminar was organized by the Department of Geography, Institute of Geonics, Branch Brno (Academy of Sciences of the Czech Republic), South-Moravian subsidiary of the Czech Geographical Society, and Czech Association of Geomorphologists. The Seminar linked up with international workshops held in 2000 and 2001 being organized by geomorphologists from the Faculty of Natural Sciences at the Ostrava University (details see Prášek, Kirchner, 2001).

The Seminar in Brno was attended by 47 experts from universities, institutes of Academy of Sciences of the Czech Republic, state institutions, departmental and application workplaces. Foreign participants arrived from Poland (The Silesian University in Sosnowiec) and Slovakia (Institute of Geography, Slovak Academy of Sciences Bratislava, Komenský University Bratislava, University of J. P. Šafárik Košice, University of M. Bell Banská Bystrica). The Seminar aimed at a presentation of results from geomorphological research in both Czech Republic and abroad and particularly at a presentation of new lessons and methods learnt with a subsequent discussion.

The first Seminar day (10 June 2002) was devoted to the presentation of papers. As there were as many as 32 papers, organizers had to divide the Seminar into two parallel sections of which Section 1 dealt with geomorphological processes, morphotectonic and morphostructural issues and regional geomorphology, and Section 2 included contributions concerning the problems of GIS in geomorphology with the demonstration of new methodological approaches and information on regional research in Slovakia and Nicaragua. Speakers in Section 1 paid a considerable attention to slope processes such as landslides, deep slope deformations, and to fluvial processes occurring in floodplains with pointing out their geomorphological significance. Within the morphotectonic and morphostructural problems the speakers addressed particularly the role and features of neotectonics in topography, e.g. in the regions of České středohoří (Middle Mountains) Western Beskids, Little Carpathians, Rychlebské hory (Mountains). Geomorphological information of regional significance was presented about the morphostructural features of the eastern margin of the Bohemian Massif, former south-Moravian lakes, fluvial gravels occurring in the territory of Brno. Attention was raised by papers concerning the

Photo 1: Participants to geomorphological field excursion during the account given by RNDr. T. Czudek, DrSc in the Pouzdřany locality, southern Moravia, on 11 June 2002. Photo: K. Kirchner

Photo 2: Participants to geomorphological field excursion in the locality of Stránská skála in Brno on 11 June 2002. Photo: K. Kirchner

attractive issue of karst processes in southern Poland, eolian processes in the Barguzin Basin near the Lake Baikal and slope processes occurring on Machu Picchu in Peru. Speakers in Section 2 discussed possibilities for the application of modelling at investigating slope deformation, morphometric methods, development of digital legends to geomorphological maps, creation of geomorphological information system, and geomorphological value of rocks. Regional geomorphological lessons learnt were presented from geomorphologically interesting areas of Slovakia (e.g. Rožňavská kotlina Basin, Slovak Karst, the Žiar Mountains), Czech Republic (Javoří hory Mountains., upper stream of the Sázava River, Czech Paradise) and Nicaragua (development of volcanic relief). The presented papers will be published in revised proceedings from the Seminar to be issued by the Masaryk University in Brno.

The second day of the Seminar (11 June 2002) was reserved for a field excursion. Doc. RNDr. J. Karásek, CSc. informed participants about the relief development of Brno area in the localities of Stránská skála and Žuráň. The issue of morphological structure and development of the eastern margin of Bohemian Massif with the valley of Jihlava River were introduced by RNDr. M. Hrádek, CSc. in two localities near Ivančice. The field excursion ended in southern Moravia where RNDr. T. Czudek, DrSc informed about the relief modelling in the Quaternary and about the development of Pleistocene planation surfaces of cryopediment type in the localities of Pouzdřany and Popice.

High attendance at the Seminar, the amount of presented papers and the following discussion provided a true picture of the geomorphological research not only at geographic workplaces but also in geological and departmental institutions. The research works are in harmony with the current trend as well as with the existing requirements of practice which call for assessment of geomorphological processes occurring at the present time in different relief types. Attention is also paid to morphostructural problems and use of GIS in geomorphology. Czech experts successfully participate at some geomorphological studies in foreign countries. The Seminar had a surprisingly high attendance of young experts another positive fact being the participation of not only geomorphologists themselves but also engineering and quaternary geologists, i.e. specialists who are connected by the same issue of relief research (geomorphology). The next geomorphological seminar will be held in Pilsen in 2003.

References

PRÁŠEK, J., KIRCHNER, K. (2001): International seminar „Geomorphological research at the present time". /in Czech/ Geografie – Sborník ČGS, Vol. 106, 2001, No. 2, p. 129-130.

DOC. ING. PETR MARTINEC, CSc. (60)

Member of the Editorial Board of the Moravian Geographical Reports – Doc. Ing. Petr Martinec, CSc. will celebrate his important life anniversary on 29 August 2002.

Doc. Martinec agraduated from the Faculty of Mining and Geology at the University of Mining and Metallurgy in Ostrava in 1965. He started working in the exploration company Geologický průzkum Ostrava as a geologist. Hereafter he worked at the Faculty of Mining and Geology at the University of Mining and Metallurgy in Ostrava, at the Coal Research Institute in Ostrava - Radvanice and from 1990 at the Institute of Geonics, AS CR in Ostrava as a scientific worker. At present he is the head of the Department of Earth materials research at the Institute of Geonics.

Areas of his research interest include geology and sedimentology of coal basins, mineralogy, petrology and physical properties of rock and geocomposites. He published more than 300 publications.

We wish Doc. Ing. Petr Martinec, CSc. good health, forever the same enthusiasm, vitality and successful scientific work.

DOC. DR. JAROMÍR KARÁSEK, CSc. (60)

Doc. dr. Jaromír Karásek, CSc. – graduate from the Faculty of Natural Sciences, Masaryk University in Brno, scholar and follower of Prof. J. Krejčí-founder of the Brno geomorphological school, and member of the Editorial board of our periodical – celebrated his 60th birthday on 21 July 2002.

As a prominent expert in the relief of Moravia he devoted a major part of his scientific career to its research the result being about 75 technical papers, reviews and geomorphological maps. Works most valued by himself are the university textbook „Rudiments of general geomorphology“ (2001) and clear and well arranged geomorphological maps of Moravia on a scale of 1:500 000 (2001). Dr. Karásek worked for many years as an assistant to Prof. Krejčí. At the beginning of the 1970s, he was first deprived of the possibility to teach students at the political screening (so called „normalization“) after the occupation of Czechoslovakia in August 1968 and then dismissed from the university in 1976. Being allowed to return back to the university as late as after the political changes of November 1989, he first defended his Ph.D. thesis within a short time (1990) and then his second doctorate in 1992.

The Editorial Board of Moravian Geographical Reports wishes Doc. dr. Jaromír Karásek, CSc. good health and a lot of success at his further scientific work.

Editorial Board

CZECH REPUBLIC – AUGUST 2002: ANOTHER FLOOD DISASTER OF CENTURY AFTER FIVE YEARS

Stanislav ONDRÁČEK, Petr KLUSÁČEK, Jan MUNZAR

Merely five years had passed since the disastrous floods severely affected the Czech Republic in July 1997 and the country suffered another hard blow of floods in August 2002, whose extent and damage can be compared with the year 1997. While it was mainly the eastern part of the Czech territory that was affected by floods in July 1997, i.e. river basins of Morava and Odra, in 2002 it was rather the western part of the country, i.e. watershed of the Labe (Elbe) River. The most severe floods were now recorded on the Vltava (Moldau) River and on the Labe (Elbe) River below its confluence with the Moldau R. and on the largest tributaries of the Moldau R.: Berounka, Otava, Lužnice, etc. However, it was also numerous small water courses in the watersheds of Moldau and Elbe that experienced disastrous floods. An extraordinarily severe flood was also recorded in the south-western part of the Morava River basin on the Dyje River (Fig. 1, 2). The above facts indicate that within a period of merely five years the whole territory of the Czech Republic was affected by natural disaster that appears on average once in a hunder to thousand years.

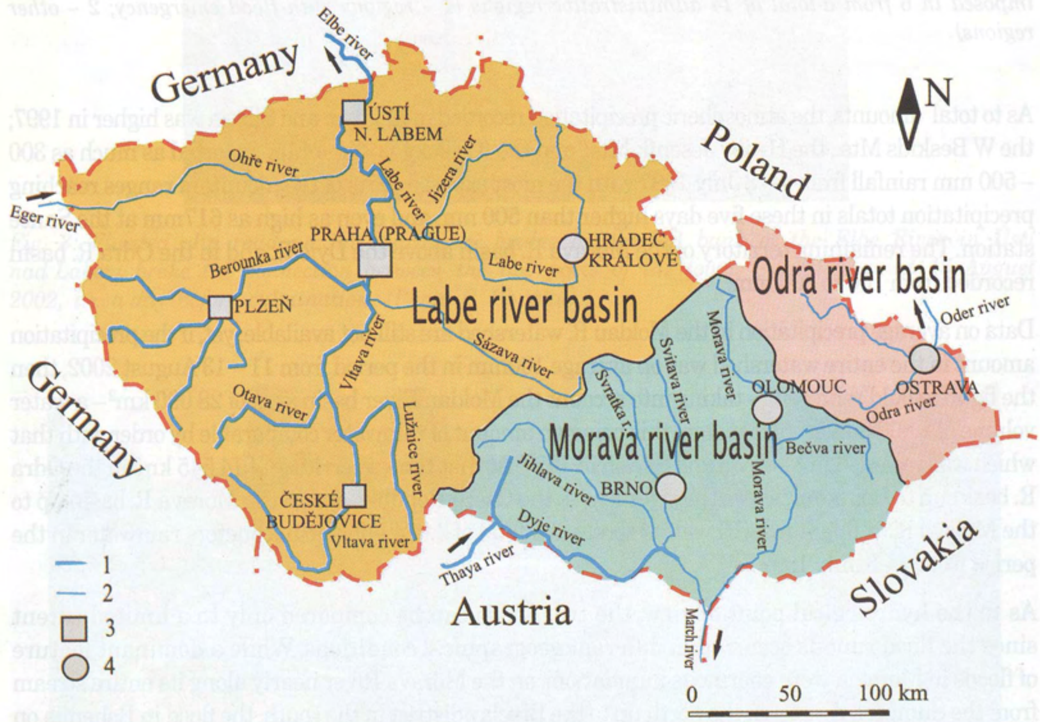


Fig. 1: Main water courses in the Czech Republic and their watersheds; the flood in August 2002 affected the capital of Prague, three regional capitals and hundreds of other towns and villages. (1 – rivers with the greatest floods in August 2002; 2 – other rivers; 3 – regional capitals affected by the disaster; 4 – other large cities)

Similarly as in July 1997, the floods of August 2002 were caused by long-lasting rains afflecting a vast territory (the entire Moldau R. basin and some other watersheds) at the same time. A greater part of the Moldau watershed area received 90 – 130 mm precipitation in the period from 11 – 13 August 2002. In the same period of time, the Šumava (Bohemian Forest) Mts. and the Novohradské hory Mts. (southern Bohemia) recorded from 130 – 190 mm rainfall and at some places even over 200 mm (Prachatice, Slavkov).

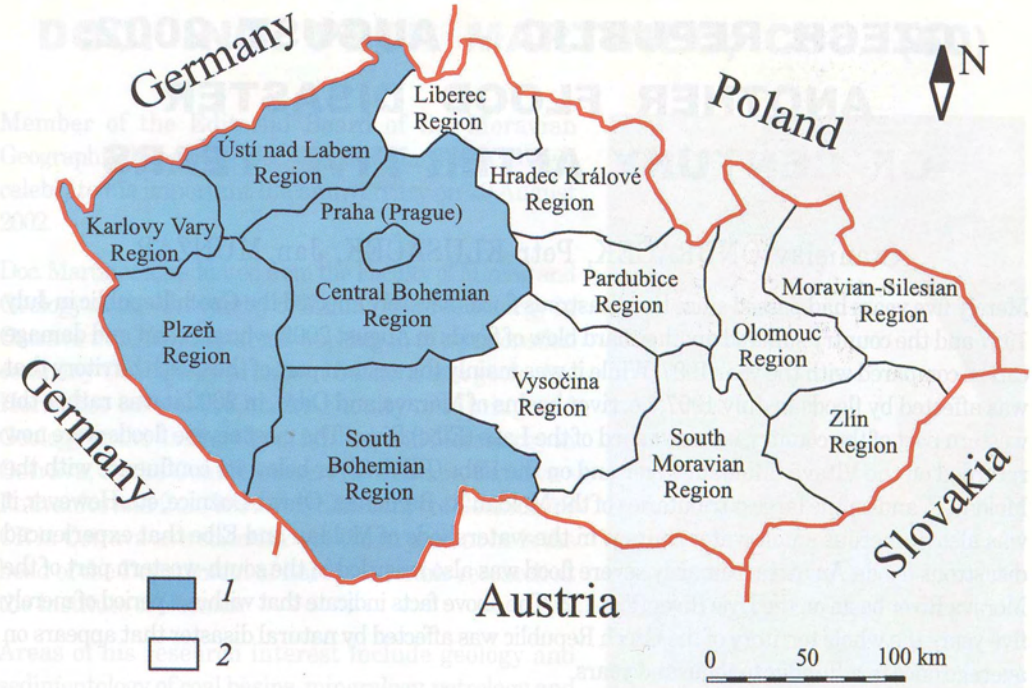


Fig. 2: Regions of Czech Republic, in which the government imposed flood emergency in August 2002. The extremely large territorial extent of the disaster is illustrated by the fact that flood emergency was imposed in 6 from a total of 14 administrative regions (1 – regions with flood emergency; 2 – other regions)

As to total amounts, the atmospheric precipitation recorded in Moravia and Silesia was higher in 1997; the W Beskids Mts., the Hrubý Jeseník Mts., and the Králický Sněžník Mts. reported as much as 300 – 500 mm rainfall from 4 – 8 July 1997 with the most exposed parts of the mountain ranges reaching precipitation totals in these five days higher than 500 mm and even as high as 617mm at the Šance station. The remaining territory of the Morava R. basin above the Dyje R. and in the Odra R. basin recorded from 100 to 300 mm.

Data on average precipitation in the Moldau R. watershed are still not available; yet, if the precipitation amount in the entire watershed was on average 100mm in the period from 11 – 13 August 2002, then the figure would represent – taking into account the Moldau River basin area of 28 090 km^2 – a water volume of 2.809 billion cubic meters this being an amount of rainwater comparable by order with that which was recorded in Moravia and Silesia in 1997. At that time, a territory of 14 545 km^2 in the Odra R. basin up to Bohumín where the river leaves the Czech Republic and in the Morava R. basin up to the Myjava R. (affluent from Slovakia) received a total of 3.024 billion cubic meters rainwater in the period from 4 – 8 July 1997.

As to the hydrological point of view, the two floods can be compared only to a limited extent since the flood runoffs occurred in different geographical conditions. While a dominant feature of floods in Moravia were enormous inundations on the Morava River nearly along its entire stream from the Šumperk district in the north up to the Břeclav district in the south, the flood in Bohemia on the Moldau and Berounka Rivers and on the lower reach of Elbe R. took place mostly in a relatively narrow valley (Fig. 3). Although there were some large inundations in 2002, too (e.g. in the plain of lower Elbe, particularly in the Litoměřice district (Fig. 4) at the confluence of Elbe with Ohře), their size was much less than in Moravia in 1997. Another difference was the fact that the flood on the Moldau River went through a system of water reservoirs while there are no water reservoirs on the Morava River. Whatever was the variance between the two floods in hydrological terms, there is no doubt that the both cases brought floods irregular and entirely extraordinary which occur on average once in more than a hundred years.

Floods like these were not experienced in the Czech Republic nearly in the whole 20th century and it is well possible that several following generations are not going to face them at all. Similar floods were reported to occur in this territory in the past but the contemporary Czech society had had no experience

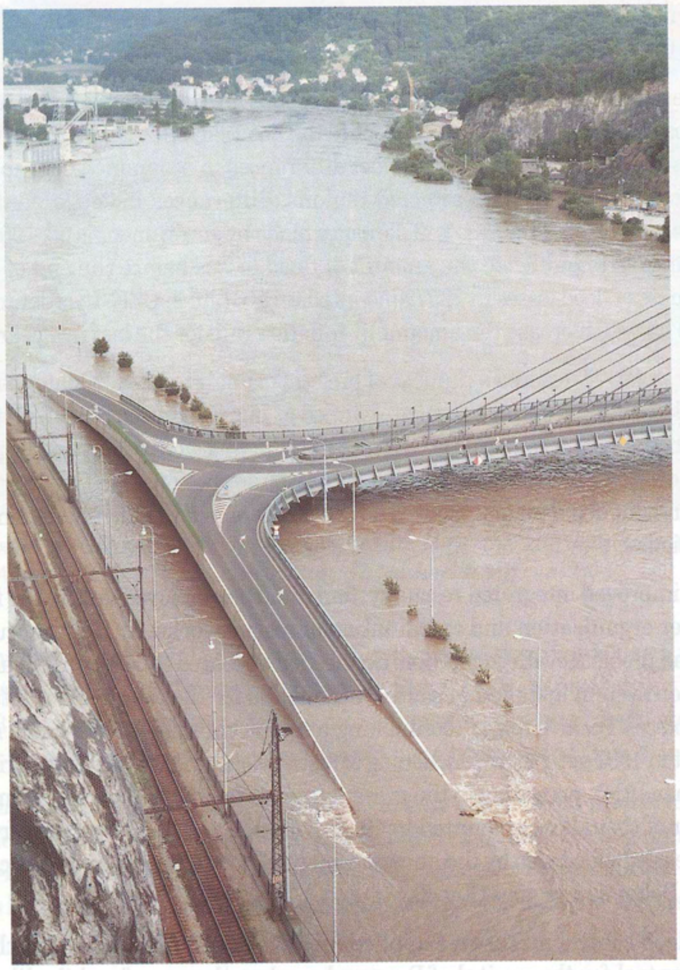


Fig. 3: Flooded slip road on the Mariánský bridge on the left bank of the Elbe River in Ústí nad Labem broke the connection between the two parts of the town. Situation as at 15 August 2002, i.e. a day before culmination. (Photo P. Chvátal)

Fig. 4: Landscape in the Litoměřice district in the lowland along the Elbe River; one of the most fertile regions in the Czech Republic (called garden of Bohemia) after the flood in August 2002. (Photo A. Vaishar)

disastrous floods at all until those of 1997. One of major differences between the floods in 2002 and 1997 is exactly the fact that in 2002 people could make use of lessons learnt and experience from 1997.

As far as consequences and impact of the flood in August 2002 are concerned, detailed records are needed to disclose total losses and to show to what measure the flood can be compared with that of 1997. It is a matter of course that the analysis will reflect differences in economic-geographical, and socio-geographical conditions in the two affected regions, differences in settlement, differences in infrastructure, etc. The very first estimate of damages made by government is 60 – 90 billion CZK. The Ministry of Finance is to publicize the amount of flood losses before the end of September. The government estimate of flood losses in 1997 amounted to 62.6 billion CZK. In order to be able to make a comparison, we have to increase the amount by inflation rate for the last five years.

The flood disaster in 1997 triggered a number of projects to analyze and evaluate reasons, course and consequences of floods and to propose measures aimed at improved flood control systems. A Strategy of flood protection for the territory of the Czech Republic was worked out and approved by Czech government. The document was followed by concrete programmes proposed and partly implemented by relevant government departments, focused on the development of individual items of flood control and flood prevention.

This was why an improved integrated rescue system could be employed during the floods in 2002. It showed in a better organization and coordination of rescue works. In 1997, rescue teams rather improvised and had problems with connection. Connection appeared to be a problem also in 2002 when the communication system installed in southern Bohemia for the case of crisis situations stopped working at some places. Positive role at coordinating rescue actions played individual regional councils which did not exist in 1997 yet. Better functioning of rescue works in 2002 is being attributed a fact that there were less casualties -according to the present knowledge there were 17 victims- than in 1997 when the number of casualties amounted to 49. Evacuation of 220 000 persons from endangered areas was doubtlessly helped also by the announcement of flood emergency for the capital of Prague and for other five Bohemian regions (Fig. 2).

One of the new flood control mezasures applied in 2002 was for example a partly implemented system of flood control for the capital of Prague, based on the use of mobile dike walls (Fig. 5). Implementation of this flood control system was launched in 1999. Unfortunately, before the flood arrived in 2002, Prague succeeded in realization of just Stage 1 of the system – protection

Fig. 5: Mobile dike walls in the lowest part of Smetanovo nábřeží (embankment) on the right bank of the Moldau R. near the Charles Bridge in Prague. (Photo H. Váňová)

Fig. 6: The flooded Křižíkova street in Prague-Karlín with the entrance into the metro station Florenc on 14 August 2002. (Photo URL: http://www.karlin.mff.cuni.cz)

of the Old Town. The line of mobile dike walls built along the river bank was a very helpfull and efficient protection for the Old Town from flooding. Stage 2 was to protect the Lesser Town and Kampa, Stage 3 was meant to provide for the protection of Karlín and Libeň, etc. Construction of the system was planned in seven stages and should have been accomplished in 2004.

In 2002, citizens were better informed by media while in 1997, media informed about the floods with a certain delay. Flood news in 2002 were very detailed right from the beginning and there were even several on-line Internet addresses with continual flood news. A question can be asked whether a reason for this better flow of information was not the fact that the flood hit also the capital of Prague in 2002.

Fig. 7: Aerial photograph of the flooded Prague town quarter Karlín on the right bank of the Moldau River (lower part) on 14 August 2002. The Štvanice island in the middle of the river was flooded, too. In water happened to be also the Hotel Hilton (in the middle between the railway track and arterial road) and the Ministry of Transport and Communications of the Czech Republic, former headquarters of the Central Committee of the Czechoslovak Communist Party (left from the hotel on the embankment). Photo URL: http://www.karlin.mff.cuni.cz

It seems that the after-flood experience from restoring Moravia in 1997 will be used for the situation in 2002. The government for example considers to repeatedly open the programme of Reconstructions, designed to assist firms after floods in 1997. The 1997 programme of Reconstructions was based on state guarantees for bank loans and on government subsidies to the interest for affected companies. The programme prepared now should in fact copy the terms of 1997. Similarly, programmes of assistance to affected citizens will most probably be also based on the experience from 1997.

In spite of all experience from the floods in 1997 employed in 2002 there are still some regions in which the man remains incorrigible. There are again construction works in inundation areas after the floods which neither made the local population insure their properties at a greater extent, etc.

Similarly as in 1997, there were some cases in 2002 of increased flood damage due to human hesitation, indolence, dilatoriness, negligence, irresponsibility, and the like. Some losses probably could have been prevented if the threatening danger was taken seriously from the beginning and responded to adequately in due time provided that the man would have behaved in accordance with the principles of preliminary carefulness and has not hesitated in some situations to take into account that the further development of events could have led to a disaster.

An example from 1997 in this connexion can be the flooding of expensive mobile corps machinery and equipment in barracks located in Uherské Hradiště. An example from 2002 can be flooding of the Prague metro which is obviously going to be the most costly item in the list of flood damages. The metro would have probably been flooded to a much lesser extent and many damages could have thus been prevented if people could have responded to the threatening danger in time (Fig. 6).

Another example from 2002 can be flooding of the Prague town quarter of Karlín (Fig. 7). Responsible authorities did not give this Prague town quarter a timely flood warning although there was a so called Flood Model of Prague elaborated as early as in 1996 in collaboration with the City Council, providing information about the course of water levels when the flood was to pass through the existing housing quarters of the town. It follows from the Model that Prague is flooded from Karlín on the right bank of Moldau R. and that the towns quarters of Libeň and Karlín represent an area with extensive inundations in the case of big floods. The local population, firms and authorities had a little chance to save their properties from destruction.

Fig. 8: Water is falling. The Kampa near the Charles Bridge in Prague on 15 August 2002 (a day after culmination) with maximum height of flood water still apparent on houses refurbished after political changes in 1989. (Photo H. Váňová)

Fig. 9: Premises of the Archaeological Institute AS CR in the Prague Lesser Town were flooded up to a height of two meters (including library and archives of technical plans) as illustrated by this photograph of 19 August 2002. (Photo Archaeological Institute AS CR)

The flooding of some Prague neighbourhoods took the people by surprise and caught them unawares which documents a loss of historical memory (Fig. 8, 9). In the past, and in the 19th century in particular, the local population used to have more knowledge about and experience with big water (and big floods in particular). It can be documented by reactions of the then town administration. The oldest preserved flood control instruction was published on 28 January 1799 during a severe winter. It was

Fig. 10: A house on the left embankment of the Moldau River on the Kampa near the Charles Bridge in Prague with culmination marks of two big historical floods. The flood in August 2002 surmounted the culmination from March 1845 by 75 cm and that from February 1784 by 55 cm. (Photo J. Kubát)

Fig. 11: Bridge across Čertovka (a canal separating the Kampa from the Prague's Lesser Town) with a small culmination mark of the flood in September 1890 above the handrail. In August 2002, the height was surmounted by 140 cm. (Photo H. Váňová)

bilingual (German and Czech) and its name was „On established attention for ensurance of Prague citizens in the event of some overflowing". It concerned namely floods caused by rapid melting of snow and passage of ice at the end of winter. Analogical decrees were then issued with no great alterations until 1900. A more detailed demarcation of inundation areas in Prague was stimulated by big floods in March 1845 and in September 1890 (Fig. 10, 11).

The town quarter of Karlín (annexed to Prague in 1922) strived to force flood control measures after the experience from years 1845, 1862 and 1872. The municipal council in Karlín issued for example a directive in 1886 for the evacuation of inhabitants from the Štvanice island in the case of flood danger. Yet, the local people refused to leave the island during the flood in September 1890 although the water raised as high as up to the first floors of buildings.

The latest instruction for inhabitants of Prague includes instructions contained in a detailed handbook „A Centenary Water" and was issued by Municipal Council of Prague 1 with the Old Town, Lesser Town and Charles Bridge in 1998 (a year after the experience with floods in Moravia). The instruction was updated and republished and became a basic source of information on flood control measures in August 2002.

In August 2002, the flood passed through the cascade of water reservoirs on the Moldau River and through reservoirs on other water courses. The actual importance of reservoirs in flood control of the territory at big floods showed much more clearly than during the floods in Moravia in 1997. Although the water reservoir of Slezská harta on the Moravice River ensured protection of the territory below the reservoir and the town of Ostrava saving them from a much greater a disaster in 1997, it was only thanks to the fact that the reservoir was not fully filled yet and could take a much larger water volume. Similarly, the reservoir of Vír could better modify the flood wave on the Svratka River becase it was half-empty due to repair works on the dam.

The situation in 2002 was different. Water reservoirs on the Moldau R. but other ones, too, such as Nýrsko on the Úhlava R. or Vranov on the Dyje R. got quickly filled and overflowing. The fact that the Moldau cascade does not provide a sufficient protection from big water for Prague and other seats on the lower Moldau and Elbe was well known to experts. Nevertheless, the general public was to a certain extent taken by surprise. „We were long trying to controvert the opinion that the cascade is a sufficient protection for Prague. It is not true and the flood showed it," said Jan Kubát, deputy for hydrology at the Czech Hydrometeorological Institute (MF Dnes, 22 Aug. 2002, article The myth named Moldau Cascade). Not even the largest water reservoirs can offer so large a protective volume that would be required for the case of so severe floods. The reservoirs play a number of other roles and it is only a relatively small portion of their total volume that is reserved for retention of flood water.

Fig. 12: The chapel of Saint Teresa in Vojan's municipal park (Prague Lesser Town) 17 August 2002, three days after culmination with maximum height of flood water still apparent on her walls. (Photo H. Váňová)

The hitherto records indicate that the number of towns and villages affected by flood in 2002 was 446; in 1997 it was 538. A precise number of houses destroyed in 2002 is not known yet because the works of structural engineers to decide on demolitions have not been finished yet; preliminary data speak of some thousand houses. The Moravian experience of 1997 shows, however, that it will be only the first winter after the floods that will show the actual situation of individual buildings. As in 1997, also in 2002 the least resistance to floods was exhibited by houses built of unburnt (cob) bricks. This was probably the main reason to the fact that the flood of 2002 „had its Troubky", too (the Moravian village of this name became a symbol of disaster in 1997 with 9 life casualties and over 300 houses either directly destroyed by the flood or decided for demolition). The name of the Bohemian village is Zálezlice, situated in the Mělník district. Zálezlice was affected by a flood wave from the Moldau River and recorded some 100 houses either directly destroyed or decided for demolition.

The flood of 1997 was given an attribute of being the flood of the 20th century as it was the most severe flood and at the same time the greatest natural disaster in the Czech territory occurring in this period of time. The flood of 2002 may be once called the flood of the 21st century out of the same reason. But this is up to our descendants because they will know for certain only as late as at the beginning of 2101. While the 19th century was relatively rich in big waters in the territory of the present Czech Republic (e.g. on the Moldau River in 1845, 1862 and 1890), there were hardly any such floods here in the 20th century. The current level of scientific knowledge does not make it possible to claim that we stand on a threshold of the period with increased occurrence of floods once again. Noteable is the fact, however, that the extreme floods of 1997 and 2002 occurred within such a short time.

Acknowledgements

The authors would like to thank ing. Jaroslav Antoš, Ph.D. (Regional Authority of Plzeň Region), Mgr. Hana Barvíková (Archives AS CR Prague), Dr. Petr Chvátal (Agency for Nature and Landscape Protection of the Czech Republic, branch Ústí nad Labem), ing. Jan Kubát (Czech Hydrometeorological Institute Prague), ing. Antonín Špalek, CSc. (Nuclear Physics Institute AS CR Řež), Dr. Hana Váňová and Dr. Jan Uxa (Municipality of Prague 1), Dr. Antonín Vaishar, CSc. (Institute of Geonics AS CR, branch Brno) and Dr. Natalie Venclová, DrSc. (Archeological Institute AS CR Prague) for photos.

References

KUBÁT, J. et al. (2002): Preliminary comprehensive report about hydrometeorological situation during the flood in August 2002. /in Czech/ Version 2. Czech Hydrometeorological Institute Prague, 29 Aug. 2002.

MATĚJÍČEK, J.–HLADNÝ, J. (1999): The flood disaster of the 20th century in the territory of the Czech Republic. /in Czech/ Ministry of Environment of the Czech Republic, Prague, 60 pp.

MUNZAR, J. (2001): Flood instructions on Czech Lands in the past (in Czech – English summary). Historická geografie, 31, p. 163–189. Praha

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

MUNZAR, J. – ONDRÁČEK, S. (2000): Floods in July 1997 – the most destructive natural disaster in the territory of the Czech Republic not only in the 20th century. In: Erfurter Geographische Studien, Bd. 9, p. 67–82.

MUNZAR, J. – ONDRÁČEK, S. (2001): Paradoxies of natural disasters (with examples from the Czech Republic). Moravian Geographical Reports, Vol. 9, No. 2, p. 41–47.

Stoletá voda (1998). Městská část Praha 1, 16 pp. + map (2nd revised edition 2001).

VRÁNA, K.–MATES, J.–ŠÁLEK,M. (2002): Floods in Kocourkov (Gotham). Flood shortcomings: Information flow and excessive bureaucracy. /in Czech/ Týden., Vol. 2002, No. 35.

URL:

http://www.infopovodne.cz

http://zpravy.idnes.cz/zaplavy.asp

http://www.flashnews.cz/index.php3?iid=10900&idtema=43&idrubrika=7000

http://www.lidovky.cz/zaplavy.asp

Panorama of regional capital Plzeň (Pilsen) with the cathedral of St. Bartholomew in the historical core; in front a large flood "lake". The town is situated on the confluence of four rivers and was considerably damaged by the flood in August 2002.

(Photo URL: http://www.kr-plzensky.cz)

Kaufland department store in Pilsen with a big "Welcome" sign above the entrance could hardly invite anybody on 13 August 2002.

(Photo URL: http://www.kr-plzensky.cz)

Illustrations to the paper of S. Ondráček et al. (p. 53 – 62).

Typical structurally conditioned southern slope of the locality Hradisko Hill is built by southern anticlinal limb of flysch layers (sandstones and conglomerates of Luhačovice Member – the Zlín Formation).

Photo O. Krejčí

Southern slope of Kněhyně Hill modelled by block sliding with entry to the Kněhyňská jeskyně (Cave).

Photo: K. Kirchner

Illustrations to the paper of K. Kirchner, O. Krejčí (p. 10 – 19).