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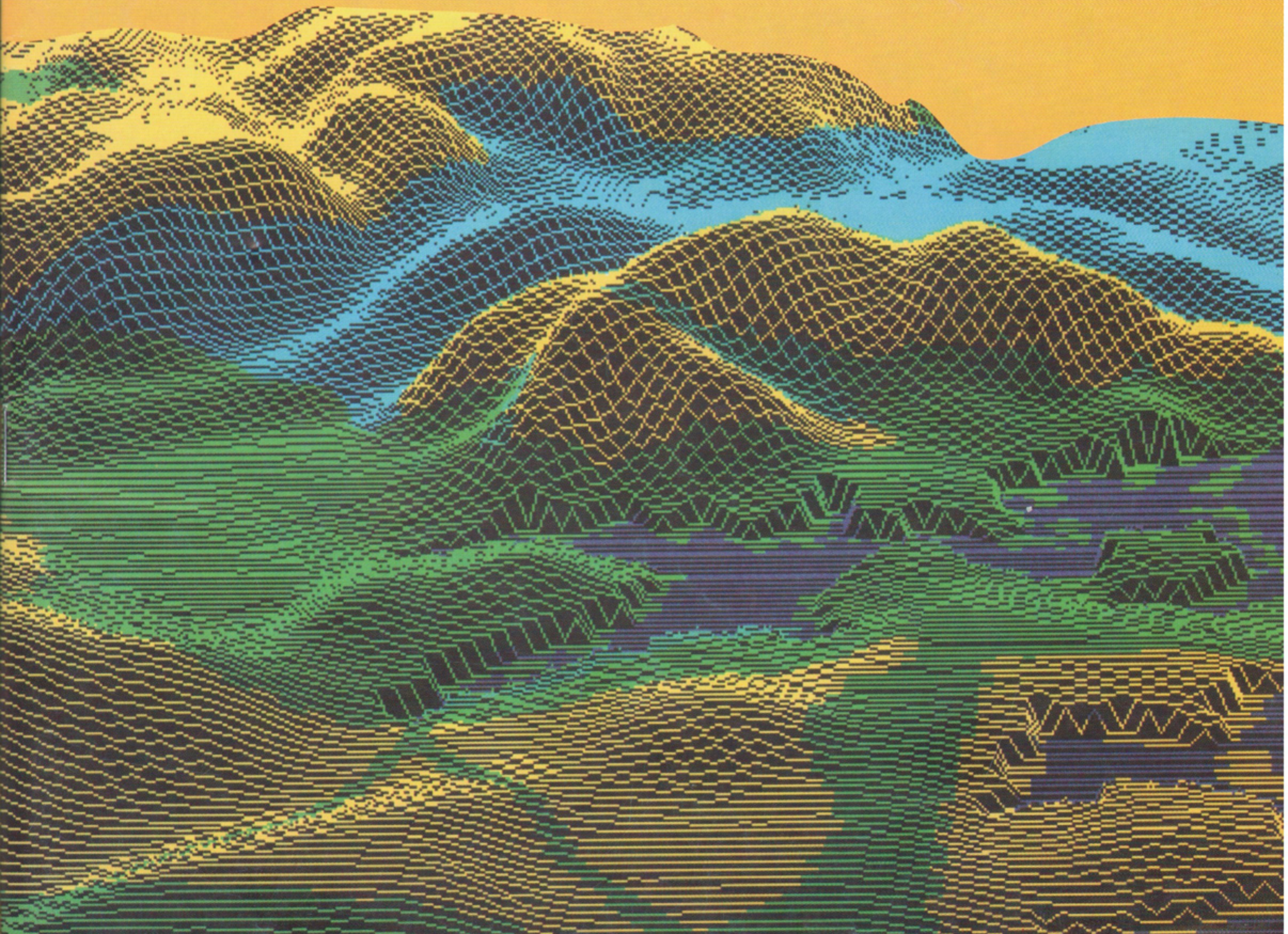

The village and chateau of Vranov nad Dyjí lie in a picturesque valley of the river

Kunštát is one of the smallest towns in Moravia

Illustrations to the paper of A. Vaishar et al.; photos: Matej GABROVEC

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Editorial

MORAVIAN GEOGRAPHICAL REPORTS, a periodical introduced by the Brno Branch of the Institute of Geonics, Czech Academy of Sciences in 1993 **enters its fifth volume this year**. The periodical is a follow-up to ZPRÁVY GEOGRAFICKÉHO ÚSTAVU ČSAV (Reports from the Institute of Geography, Czechoslovak Academy of Sciences), which ended its existence during transformation of the Academy. Its publishing has been supported by the Czech Academy of Sciences that covers a considerable part of total costs.

The past four years saw four single and two double issues. The achieved results and experience have made it possible to further improve the already good standard of the periodical in its fifth year. The editorial board of **MORAVIAN GEOGRAPHICAL REPORTS** has been extended by geographers from neighbouring countries. We presume that the experts from Central Europe can best grasp issues of the Moravian region and contribute with their experience to their solution.

MORAVIAN GEOGRAPHICAL REPORTS offer a possibility of publication also to non-geographical authors. We encourage all experts involved in the regional issues concerning the Moravian space with no regard to their specialization or country in which they work. Another change will concern distribution of the periodical. From Issue 1/1997, all individual issues will be made available also in electronic form with complete issues or separate papers available on floppy-discs for just running costs or by means of electronic mail. We have now an Internet page of our own, which facilitates current information of the periodical, composition of individual issues, conditions for publishing and circulation.

The Editorial Board of **MORAVIAN GEOGRAPHICAL REPORTS** would like to thank all who participated at the publication of the first four issues and will be looking forward to cooperation with future authors, reviewers and readers.

TOPOGRAPHY OF THE MARGINAL SUDETIC FAULT IN THE RYCHLEBSKÉ HORY (MTS.) AND GEOMORPHOLOGICAL ASPECTS OF EPIPLATFORM OROGENESIS IN THE NE PART OF THE BOHEMIAN MASSIF

Antonín IVAN

Abstract

The varying morphology along the Marginal Sudetic Fault in the Rychlebské hory (Mts.) is an evidence of weak Tertiary and Quaternary neotectonic epiplatform orogenesis. The fault scarp of the Marginal Sudetic Fault splits into three sections of different heights and cross profiles, which - in addition to the different intensity of tectonic movements - reflect petrographic differences of the Variscan crystalline basement in the contact area of the Lugicum and Silesicum.

Shrnutí

Proměnlivá morfologie podél jv. ukončení okrajového sudetského zlomu v Rychlebských horách je projevem slabé terciérní a kvartérní neotektonické epiplatformní orogeneze. Zlomový svah na okrajovém sudetském zlomu se člení ve tři úseky o různé výšce a sklonu, které vedle rozdílné intenzity zlomových pohybů odrážejí petrografické rozdíly varisky konsolidovaného fundamentu na styku silezika a lugika.

Key words: tectonic geomorphology, fault scarp on Marginal Sudetic Fault, NE part of the Bohemian Massif

1. Introduction and brief topography

The northeastern front of the Rychlebské hory (Mts.) in the Javorník promontory in Silesia belongs to the most instructive geomorphological features of young fault tectonics in the Bohemian Massif. It came into existence by tectonic movements on the Marginal Sudetic Fault (MSF), newly designated also as a marginal fault of Lugicum (Mísař et al., 1984; Skácel, 1989). The mountain front separates the contrasting topographies of Sudetic and Fore-Sudetic blocks (Badura-Przybylski, 1995) and its morphology was studied in detail particularly in the Góry Sowie (Mts.) in Poland (Dumanowski, 1961; Kryzskowski - Pijet, 1993; Migoń, 1993).

The fault section located in the CR territory is 30 km long, stretching from Bílá Voda to Dolní Lipová, its morphological features gradually changing from marginal fault scarp into fault valley or fault-line valley. A change of MSF topographical feature can be seen on the Lugicum-Silesicum boundary. In the Silesicum fracture ramifies and continues towards SE as a very complicated fault valley crossing the Hrubý Jeseník (Mts.), designated there as the Bělá fault (Pouba - Mísař, 1961; Demek, 1971; Karásek, 1990; but see Cháb et al., 1994).

The Rychlebské hory (Mts.) are block mountains (Smrk, 1125 m) whose partial blocks form sub-units of the Travenská and Hornolipovská hornatina (Mts.), and Sokolský hřbet (Ridge) on the Sudetic and Foresudetic blocks, respectively (Fig. 2). The Fore-Sudetic block also includes the hilly lands of Javornická pahorkatina (200-350 m) and Žulovská pahorkatina (Boží hora, 525 m).

Current geological research in the territory concentrates mainly on the Variscan collision plate tectonics

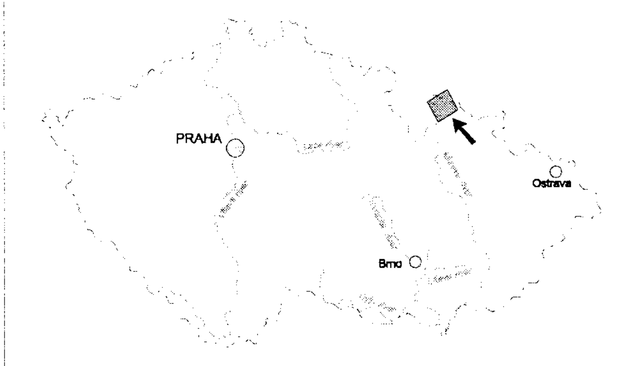

Fig. 1 Map of the Czech Republik with marked area under study

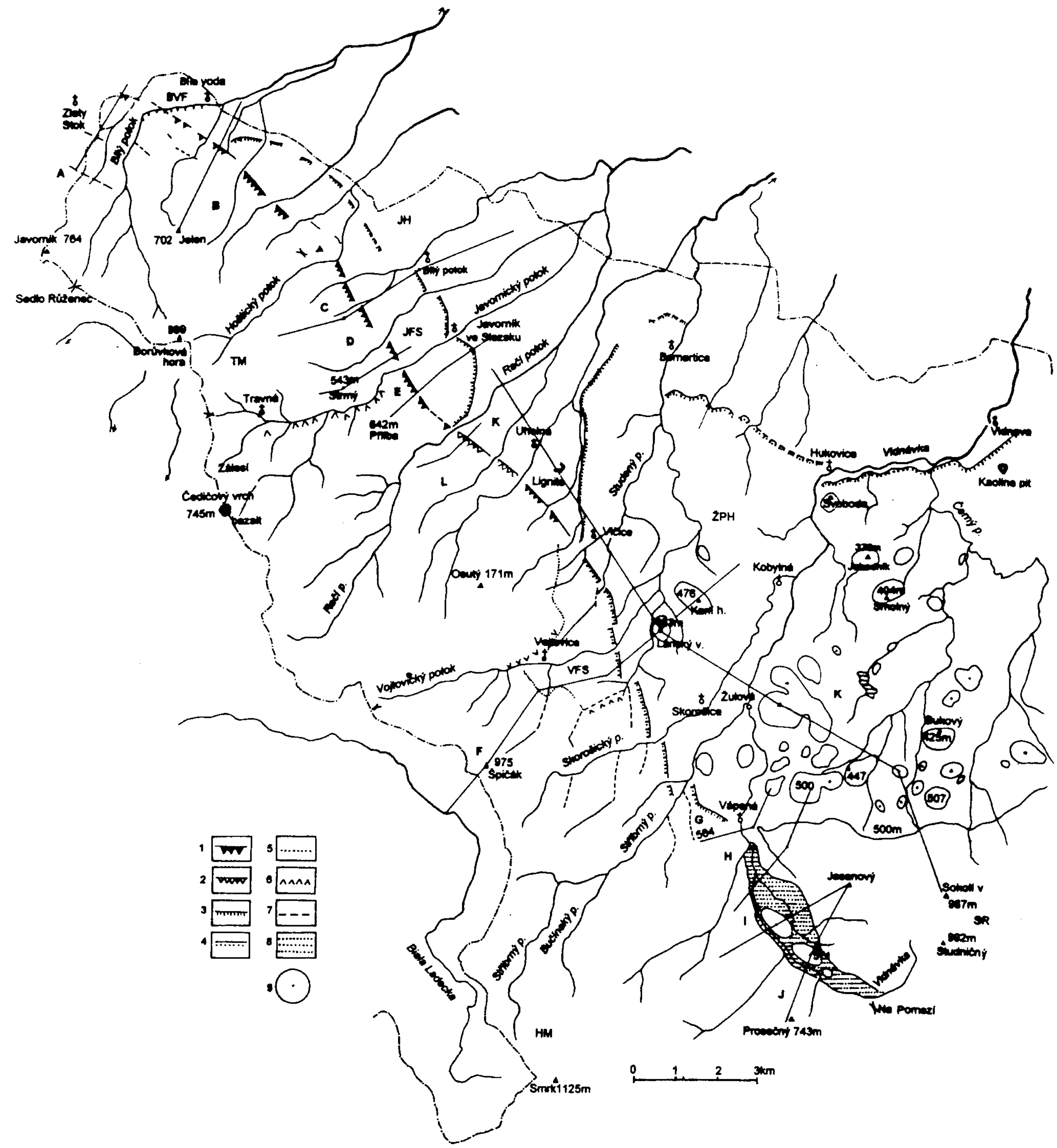

Fig. 2 Northwestern part of the Rychlebské hory (Mts.). Main topographical features along the Marginal Sudetic Fault.

1 - high segmented scarps
2 - low steep scarp
3 - low tectonic scarps of the foot steps (partly en echelon) and in the Žulovská pahorkatina (Hilly land)
4 - western margin of Žulovská pahorkatina (Hilly land)
5 - inner edge of the Vojtovice foot step
6 - higher slope of assymetric valleys
7 - supposed faults
8 - the fault valley or fault-line valley of the uppermost Vidnávka between Vápenná and col of Na Pomezí
9 - inselbergs and other isolated hills

TM - Travenská hornatina (Mts.); HM - Hornolipovská hornatina (Mts.); SR - Sokolský hřbet (Ridge); JH - Javornická pahorkatina (Hilly land); ŽPH - Žulovská pahorkatina (Hilly land); BVF - Bílá Voda Fault and foot step; JFS - Javorník foot step; VFS - Vojtovice foot step.

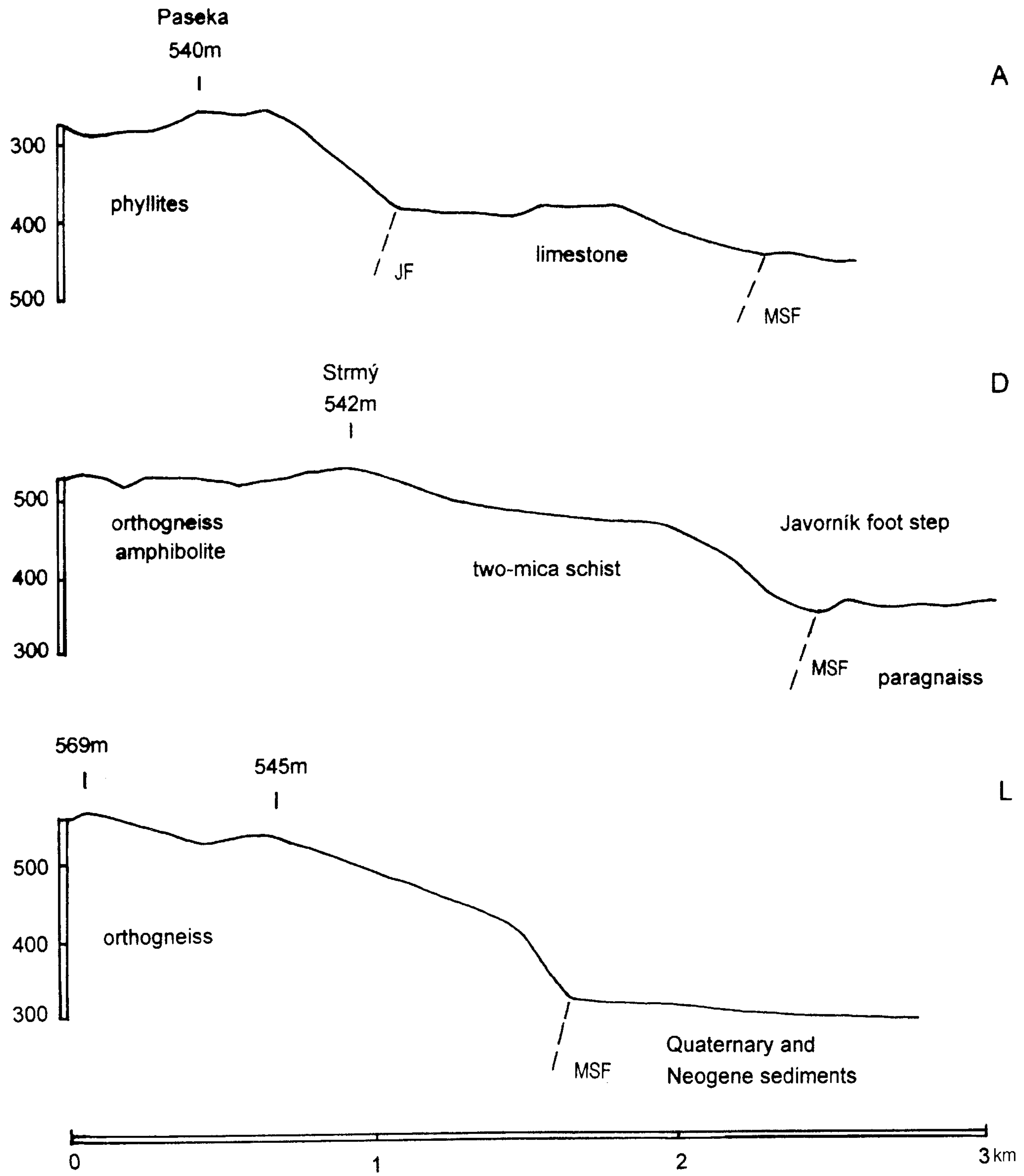

Fig. 3 Cross profiles A, D and L of the low steep fault scarps of MSF, between Bílá Voda and Vlčice.

(e.g. Cymerman - Pisecki, 1994; Grygar - Vavro, 1995; Cymerman, 1996) and possibly also on the deeper structure (Żelaźniewicz - Cwojdziński, 1994). A topic for discussion remains the Lugicum-Silesicum boundary connected with the Ramzová or Nýznerov thrusts in the Staré Město zone (Skácel, 1989; see also Cymerman, 1993; Grygar - Vavro, 1996). In the conception of Mísař - Dudek (1993) the boundary is a part of the Moravian-Silesian tectonic zone which crosses the Rychlebské hory (Mts.) as well as the Main European Divide in their axial section. Therefore, and with respect to its Variscan structure, the Marginal Sudetic Fault is considered to be a transversal element.

The Lugicum-Silesicum boundary seems to be a problem even on the Fore-Sudetic block. In the conception of Skácel (1989; see also Mazur - Puziewicz, 1995), it is roughly identical with the boundary between the Javornická and Žulovská pahorkatina (Hilly land), which is a part - together with the Sokolský hřbet (Ridge) - of the deeply eroded Vidnava dome (Skácel, 1981; Cháb - Žáček, 1994). Vertical tectonic movements of the Sudetic and Fore-Sudetic blocks were reverse prior to the neotectonic uplift. The deeper denudation level on the Fore-Sudetic block, by some 2 km as mentioned in Oberc (1967, 1972), points to the tectonic inversion. Skácel (1989) estimates the denudation level differences of 2.5-10 km. This also shows in the Moho depth with greater crust thickness on the Sudetic block (see profile in Żelaźniewicz - Cwojdziński, 1994). The subsided Fore-Sudetic block is to larger part covered with Tertiary and Quaternary sediments of the Paczkow graben (Oberc - Dyjor, 1968; Ciuk - Piwocki, 1979; Dyjor, 1983a, b).

The southeastern termination of MSF connects with change of morphology on the NE Fore-Sudetic block. While the mountaineous topography of the Sudetic block exhibits only slight altitudinal differences in the NW-SE direction and the elevation of the 20 km-long main ridge is increased by mere 200 m, the Fore-Sudetic block shows an increase by 800 m within the same distance with the topography dramatically changing from the initially flat, erosion-accumulation hilly land into dissected, erosion-denudation hilly lands and then into dissected mountain ridge (Fig. 7).

Taking into account the above mentioned differences, there are three following sections distinguishable in the Rychlebské hory (Mts.) along the Marginal Sudetic Fault (Fig. 2):

1) The NW section of Bílá Voda - Vlčice (14 km), with a sharp contact of the Travenská hornatina (Mts.) and Javornická pahorkatina (Hilly land), (Figs. 3 and 4). The Marginal Sudetic Fault scarp is accompanied by step-like foot blocks delineated by the subordinate fractures of Bílá Voda Fault (Skácel - Vosyka, 1959) and Javorník Fault (Oberc - Dyjor, 1969) on the N outer side.
2) The central section of Vlčice - Vápenná (9 km) where the Marginal Sudetic Fault scarp separates the the W parts of the Žulovská pahorkatina (Hilly Land) and of the Hornolipovská hornatina (Mts.) (Fig. 5).
3) The SE section of Vápenná - Dolní Lipová (8 km). Both sides of the Marginal Sudetic Fault show mountaineous topography with the culmination part of the Hornolipovská hornatina (Mts.) on the SW block (Smrk, 1125 m) and Sokolský hřbet (Ridge) on the NE block (Studničný, 991 m) separated by excessively wide valley of the river Vidnávka along the MSF (Fig. 6).

2. The Section of Bílá Voda - Vlčice

The NE mountain front of the Travenská hornatina (Mts.) is complicated by foot blocks determined by subordinate fractures of Bílá Voda Fault (Skácel - Vosyka, 1959) and Javorník Fault (Oberc - Dyjor, 1968) which are partly oblique to some MSF parts. The faults separate the foot basement blocks from the flat foreland built of the Tertiary and Quaternary sediments of Paczkow graben. The relief is dominated by the fringe of coalescent alluvial fans (Götzinger, 1915) with very gentle gradient sloping towards NE to the ice-marginal (outwash) valley of Nysa Kłodzka (Walczak, 1955).

The combination of MSF and the Bílá Voda Fault with transversal SW-NE tectonic elements gave rise to a fault block mosaic near Bílá Voda (Fig. 3, profile A). The block mosaic has a morphological dominance in the limestone block Na vyhlídce (430 m). According to Skácel and Vosyka (1959), the Bílá Voda Fault might have been active as late as in the Pleistocene. A large number of erratic boulders and cobbles suggest a possible locally greater thickness of the ice sheet and its orientation towards the col of Růženec (590 m). However, col overcoming by the ice sheet (Walczak, 1955) is doubtful (Gába, 1972b).

The Javorník foot step is a 9 km long and 1 to 1.5 km wide hilly block ending on the NE side in an up to 60 m high scarp with pronounced features of glacial sculpturing. The scarp height declines towards the NW, which well corresponds with the dropping height of gently undulating flats from over 360 m down to 320 m. The foot step is crossed by valleys of the Javornický and Hoštický potok (Brooks) which debouch onto the Holocene alluvial fans on the NE face of the step.

Götzinger (1915) classified the gently undulated topography of the step as a typical glacial topography of mammilated rock surfaces (Rundhöckerlandschaft) formed by glacial remodelling of the Miocene marine abrasion platform. It follows from the context of his work that he connected the Sudetic block uplift with the fault on the NE outer side of the foot step while neglecting the course of the fault in the rear part of the step. Hence his conclusion of step flats coming into existence via marine abrasion and the step facing scarp being an abrasion cliff remodelled by subaerial denudation. The interpretation had a long tradition of some fifty years in the literature. Only the later research brought an evidence of the Marginal Sudetic Fault running along the foot step inner side (Skácel, 1963, 1989; Ivan, 1972).

The sudden appearence of the Javorník fault scarp and the gradual height drop of its flats towards the NW indicate that the step is an intermediate block of the fault splinter type situated between the mountain mass and the floor of the Paczkow graben (Figs. 3D, 4C and 4E). Flat rests are most probably of subaerial origin. Their unambiguous glacial modelling is younger, doubtless. Analogically to the similar situation in the Žulovská pahorkatina (Hilly Land), the gentle undulation of flats is rather assumed to reflect irregularities of the basal weathering surface (see chapters 5 and 7).

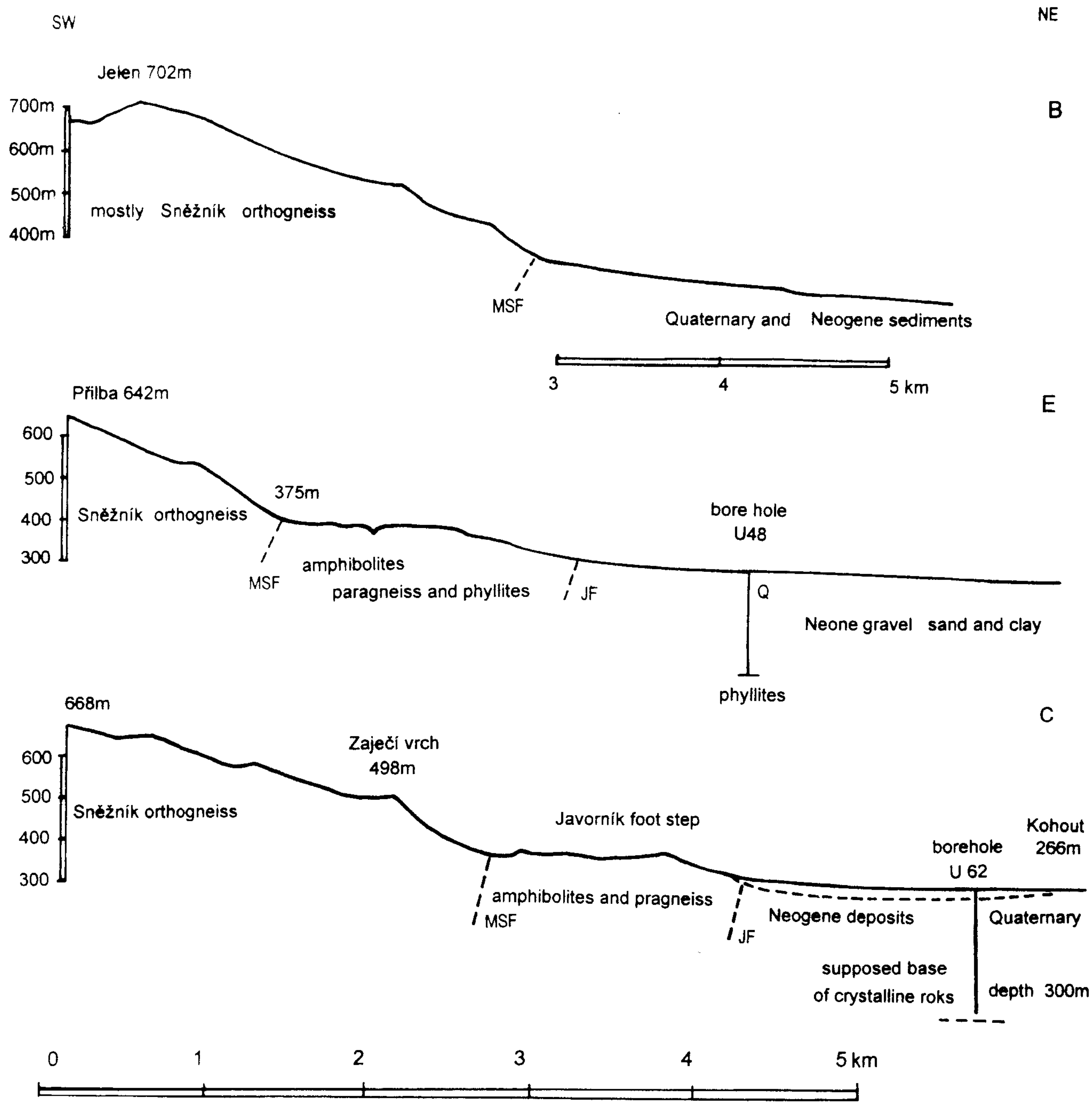

Fig. 4 Cross profiles B, E and C of the high segmented fault scarp of MSF, between Bílá Voda and Vlčice

Differences in resistance of Orlice-Kladsko Crystalline rocks that build the NW section of MSF scarp are obvious both in its height and profile. With a certain simplification, there are two types of the profile to be distinguished, which are designated here as a high segmented scarp (Fig. 4B, 4E, 4C) and a low steep scarp (Fig. 3D and 3L).

The high segmented scarps (up to 300 m) can mainly be found on Sněžník orthogneiss and consist of two parts: a generally gentler (8-10°) upper part which is higher, more complicated and longer, and a lower part which is shorter and steeper (14-21°). The two parts are separated from each other by an edge of differently distinct character, in some places even with a flat or a saddle which are not controlled by petrography and have no constant elevation. The edge points out the prevailingly convex scarp profile. Examples of this type are the scarps of Jelen (702 m, Fig. 4B), Skály (691 m), Přilba (642 m, Fig. 4E), and Osutý (717 m). Above the scarps there are mountain spurs with planation surface remnants of different sizes in some places.

Morphology of these scarps is complicated by cryogenic forms such as cryoplanation terraces, frost-riven cliffs, debris accumulations as well as by joint zones

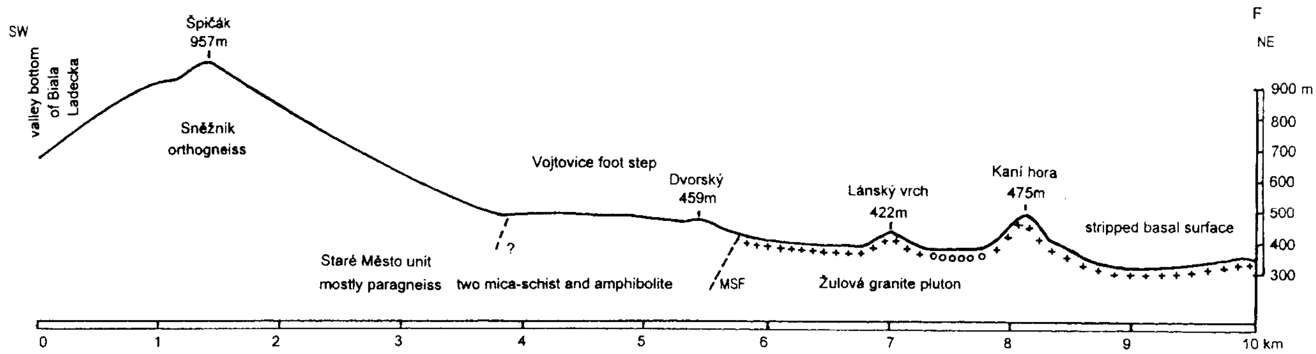

Fig. 5 Cross profile F of the western part of the Hornolipovská hornatina (Mts.) and Žulovská pahorkatina (Hilly land).

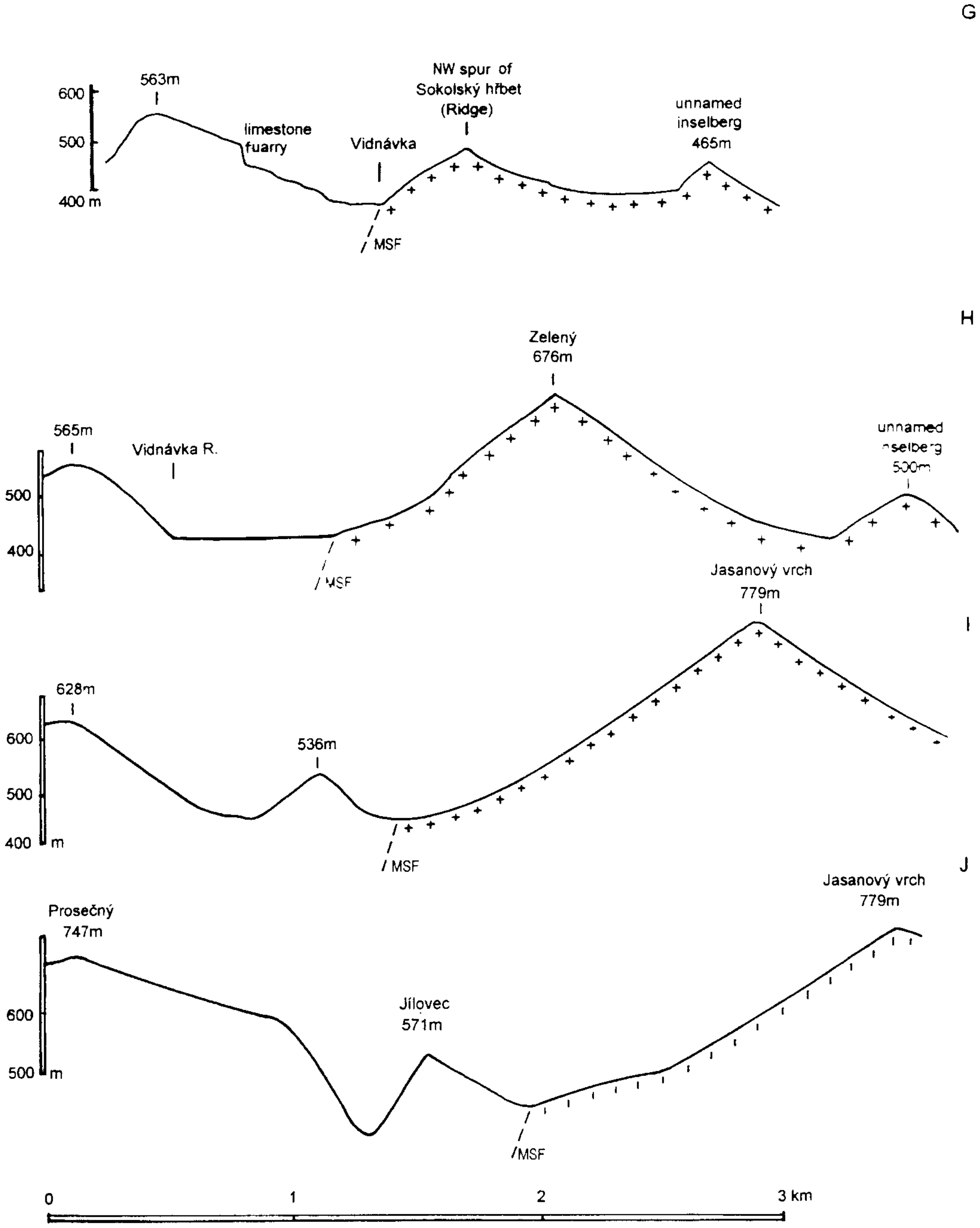

Fig. 6 Cross profiles G, H, I and J in the eastern section of the MSF.

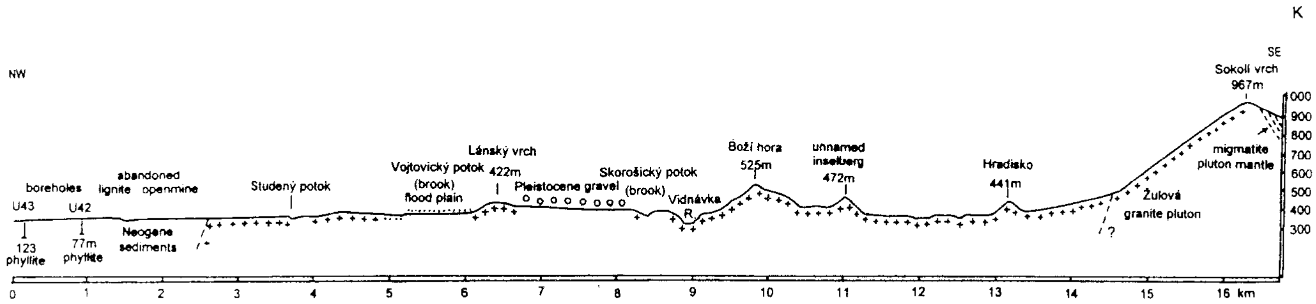

Fig. 7 Cross profile K, situated on Fore-Sudetic block, parallel to MSF.

running mostly parallel to the Marginal Sudetic Fault. They show in sharp changes of river valley trend, local widening of their floors, and in some cases also in shallow saddles on NE-oriented spurs (south of Bílá Voda).

Height and slope angle of low steep scarps which are less frequent are approximately identical with the lower part of high segmented scarps. The low steep scarps came into existence on less resistant rocks such as mica-schist paragneiss, phyllite and Javorník granodiorite. The relief above these scarps is formed by flat ridges and exceptionally also by larger flats. A large erosion flat is situated above the left valley slope of the Javornický potok (Brook) between Javorník ve Slezsku and Travná at the altitude of 530-540 m (modified valley pediment ?).

In front of the low steep scarp near Uhelná there is a fringe of flat alluvial cones of the Račí and Červený potok (Brooks). Upper Pleistocene and Holocene gravels cover the Miocene sediments formed mainly by reworked kaolinic weathering products, clays and lignite (Frejková, 1968; Prachař, 1971). This is the only MSF part in our territory where the fore-field sediments reach as far as to the scarp foot (Fig. 3L). In order to define an actual amplitude of fault movements, the thickness of sediments must be added to the scarp height in this case.

The different scarp types resulted from petrographical differences occurring in the course of long tectonic and erosional development. The low steep scarps only reflect the weaker younger stage, the high segmented scarps on more resistant bedrocks, mostly Sněžník orthogneiss, also reflect older (probably much longer) stage.

3. The Section of Vlčice - Vápenná

In the section the MSF separetes the W part of Hornolipovská hornatina (Mts.) on the SW and western part of the Žulovská pahorkatina (Hilly Land) on the SE. As the topography on both sides of MSF is formed by crystalline rocks (but with quite different petrography) and valleys of this part of the Hornolipovská hornatina (Mts.) continue across the Žulovská pahorkatina (Hilly Land), the contrast between the topographies of the Sudetic and Fore-Sudetic blocks is less evident in this section (Fig. 4).

Although the Hornolipovská hornatina (Mts.) is higher and more complicate than the Travenská hornatina (Mts.), the MSF scarp is gentle and low. A marginal mountain front similar to that occurring in the section of Bílá Voda - Vlčice is missing. The more intensive dissection relates to the more diversified geological structure with greater representation of less resistant rocks of Staré Město zone. No less important is the smaller distance of the foot from the main ridge.

The only several tens of metres high MSF scarp is gentle, dissected and composed of several short echelon sections (Ivan, 1983; Skácel, 1989). The features relate to the lesser resistance of rocks in the Staré Město zone which - in addition - accommodates to the MSF direction by its bending towards the NW. The scarp height irregularly increases towards the SE with changes being obvious particularly at tips of the individual echelon sections (Fig. 1). The scarp foot elevation increases in the same direction from 350 m near Vlčice up to 420 m at Skorošice. Similarly as in the low steep scarp in the section of Bílá Voda - Vlčice the scarp is probably a feature of only the last stage of block movements.

A topographic form that clearly shows its relation to block tectonics in this part of the Sudetic block is only the Vojtovice foot step with problematic planation surface rests at the height of 430-460 m. Between the villages of Vlčice and Petrovice the rests are situated above the MSF scarp. The first to notice them was again Götzinger (1915) who but carefully decided on the marine abrasion even here. In comparison with the Javorník foot step the flats are of a less preserved and even their glacial modelling appears to be rather problematic (Gába, 1972a).

Later on, Finckh - Götzinger (1932) interpreted the flats as valley floor remnants which most probably formed a pediment-type surface that came into existence by lateral fluvial planation, probably prior to the last stage of tectonic movements responsible for the

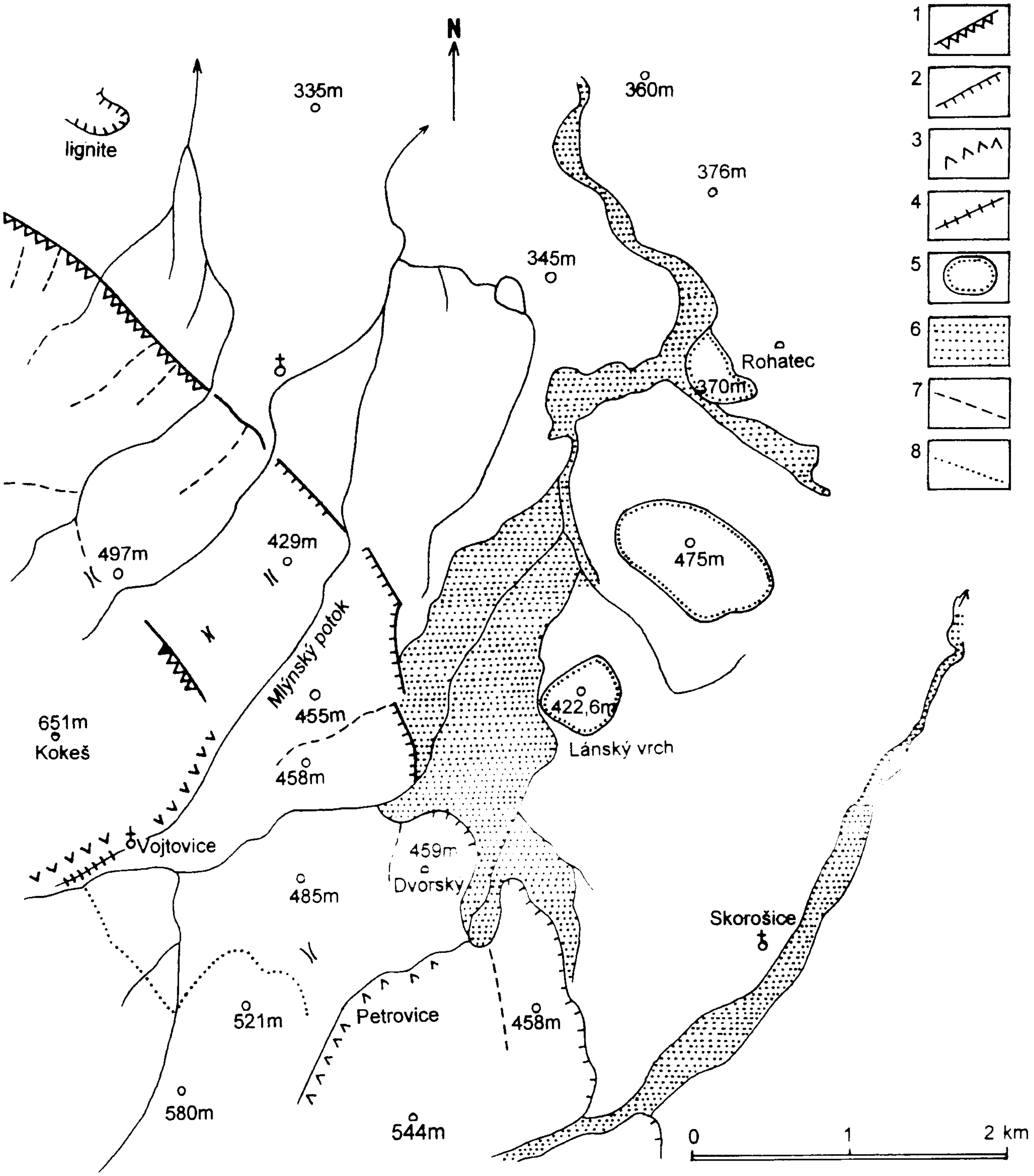

Fig. 8 Basic topographic features in the middle section of the MSF.

1 - high fault scarps
2 - low en echelon fault scarp
3 - higher valley slope of assymetric valleys
4 - artificial bifurcatin by race mill at Vojtovice
5 - inselbergs in adjacent part of Žulovská pahorkatina (Hilly land)
6 - wide flood plains of water courses in the Žulovská pahorkatina (Hilly land).
7 - supposed fault lines or joint zones
8 - inner edge of the Vojtovice fault step

echelon low scarp on the Marginal Sudetic Fault. Nevertheless, any direct evidence of pedimentation is missing due to later denudation and the only hint can be considered a fan-like to radial valley pattern with rests of flat in the apical section of the step near Vojtovice. Very interesting is an artificial mill race connection of the Vojtovický potok (Brook) with the valley of Mlýnský potok (Brook) that was probably an original fan branch but formed a valley of its own by incision (see Fig 8).

4. The Žulovská pahorkatina (Hilly Land) topography

In its W part along the Marginal Sudetic Fault the Žulovská pahorkatina (Hilly Land) has a subdued relief formed by the vast piedmont Skorošice flat (Ivan, 1983) with a thin cover of fluvial gravels and an admixture of erratic material.

On the other hand, a completely different and unique topography has the eastern part Žulovská pahorkatina (Hilly Land) on right side of Vidnávka river adjoing on the E and S the Sokolský hřbet (Ridge). The polygenetic, mainly erosion-denudation relief of this part of the hilly land, with plenty granite forms (bornhardts, low exfoliation domes, tors, different microforms etc.), has a particular significance both for the reconstruction of landscape development as well as from the regional viewpoint (Demek, 1995; Ivan, 1983).

At the height of 420-350 m, the Skorošice piedmont flat gently inclines to the NE from the foot of MSF echelon scarp in order to end at the height of some 300 m as upper edge of a vague NW-SE oriented slope of probably the tectonic origin (Ivan, 1965). Skácel (1989) assumes the Bernartice-Hukovice fault at this place. The distance from the base of the echelon fault scarp to the upper edge of slope between Bernartice and Hukovice is 5-7 km, average slope of the Skorošice flat being less than 1°. The flat is dissected by mostly V - shaped river valleys and also some inselbergs (Kaní hora 476 m, Lánský vrch 422 m) rise above its level (Figs. 7 and 8). Apart from the major slope towards the NE, the flat has a subordinate transversal slope towards the NW, which can be documented by the decreased altitude of echelon MSF scarp foot. The tilting is apparent also from the tendency of water streams coming from the Hornolipovská hornatina (Mts.) to bend from the SW-NE direction to the SSW-NNE up to the S-N (Střední, Studený and Vojtovický Brooks) and it shows also in the type of flat dissection and processes occurring on the flat.

The character of the highest parts of the flat to the SE of Skorošice (430 m) above the Skorošický Brook valley slopes is that of a river terrace. But gravel thickness over the sandy weathered granite does not exceed 1 m. The flat surface slopes very gently towards the NW and pass laterally into the recent gravel cover of the Petrovický and Vojtovický potok (Brooks). The height difference between the oldest part of gravel surface above the village of Skorošice and the actively modelled surface east of Vlčice - measured at the foot of the Vojtovice foor step - is some 70 m.

The Skorošice flat was formed by fluvial processes after retreat of the last ice sheet (Götzinger, 1915) and this is true also for valleys of Skorošický and Stříbrný potok (Brooks). Their depth which decreases downstream is not a mere function of discharge. It clearly follows from the flat morphology that the brooks after having left the Hornolipovská hornatina (Mts.) could have originally shifted laterally and their present position was fixed only after the incision into granite. The incision and development of the valleys occurred first on the SE due to the transversal inclination while the ability of lateral migration has been preserved for the streams in the NW up to the present (Vojtovický potok Brook). It means that while valleys of the Stříbrný and Skorošický potok (Brooks) cut across the flat to continue towards the NE, the Petrovický and Vojtovický potok (Brook) debouch from the Vojtovický foot step onto an flat accumulation surface formed by recent gravels. Some 3 km from the MSF echelon scarp foot the two brooks join and only after a distance of some further 2 km downstream they incise into relatively fresh granite forming flat-bottomed valley (Fig. 8).

Parts of the Skorošice flat at mouths of the Petrovický a Vojtovický brooks from the Vojtovice foot step appear to be modelled by processes of lateral migration of water streams even today, similar to those on the alluvial fans. Gravel depositions on sandy weathered granite near Skorošice suggest that the lateral migration of streambeds might have partly affected also the parent rock, showing some features of pedimentation (comp. Mackin, 1970).

The eastern part of the Žulovská pahorkatina (Hilly Land) with typical granite topography (bornhards etc.) is separated from the upper catchment of Vidnávka (upstream of Vápenná) following the Marginal Sudetic Fault) by a 6 km long SE-NW spur of the southernmost part of the Sokolský hřbet (Ridge). The arrangement is the main cause to the fact that in contrast to the W part of the Žulovská pahorkatina (Hilly Land) where water streams from the Hornolipovská hornatina (Mts.) contiue to the NE, this E part is practically drained only by streams springing here or on the NW slope of the Sokolský hřbet (Ridge).

This E part of the Žulovská pahorkatina (Hilly Land) faces on the N (between Hukovice and Vidnava) by a distinct slope of WSW-ENE direction, which corresponds to the Vidnava fault, schematically delineated by Dyjor (1983 b), a very flat relief built of Quaternary and Tertiary sediments. The fact that the Vidnávka River closely follows the slope foot as well as considerable thickness of Tertiary sediments in the near forefield (Gabriel et al., 1982; Kosciówko, 1982; Ciuk - Piwocki, 1979) strongly support the tectonic origin of slope.

Even this E part of the Žulovská pahorkatina (Hilly Land) is generally inclined to the NE and at the same time to the NW. Water streams again bend to the NW and most of the total number of 34 inselbergs can be found in the E more uplifted part of hilly land near the Sokolský hřbet (Ridge). The inselbergs found here have the greatest absolute and relative heights (Fig. 2).

Formation of the typical and in our country unique granite topography is connected with long-term deep chemical weathering (etching) and the resulting planation surface formed by removing of deep weathering products is designated as a stripped basal surface or etchplain. Demek et al. (1964. see also Demek, 1995) used a non-genetic term „principal surface" which is a more fitting expression for gentle undulating granite topography and occurence of inselbergs and low exfoliation domes. In English terminology it rather corresponds with a relief designated as etchsurface. Rests of thick kaolinic mantle (Kužvart, 1965), which are probably very old (Bakker, 1967), the buried tropical karst (Panoš, 1964; Demek, 1995) as well as glacial and glacio-fluvial sediments point to a long polygenetic history. Although Götzinger (1915) characterized the Žulovská pahorkatina (Hilly Land) as a glacially modelled undulated landscape (Rundhöckerlandschaft), the abundant fossile weathering products, tors and inselbergs suggest an apparent overestimation of ice sheet modelling significance in the past. The existing topography rather represents a rare case of glacially modelled basal weathering surface relief with its original elevations (Grundhöcker) (comp. Büdel, 1977; Thomas, 1994; Ivan, 1983; see also Anders, 1939).

Notwithstanding the fact that the inselbergs and kaolinic weathering crusts were formed under different climatic conditions, the processes of sandy granite weathering and hence the etching processes can continue even in the present humid climate (comp. Thomas, 1994).

5. The Section of Vápenná - Dolní Lipová

The height increase of MSF line towards the SE continues even in the fault-block dissected topography of the Hornolipovská hornatina (Mts.) to culminate in the col of Na Pomezí (579 m). In the distance of 8 km the height difference between the scarp foot near Vápenná (contact with the Žulovská pahorkatina (Hilly Land) and the col of Na Pomezí is some 150 m. In the MSF fault zone, an up to 1.5 km wide fault valley of Vidnávka River came into existence in rocks of Branná series, which gradually opens towards the NW in order to link up with the subdued surface of the Skorošice flat. There is no doubt that its formation was heavily contributed to by fluvial erosion (Fig. 6). The incomplete isolated hills (Jílovec, 571 m, hill spot 536.5 m) rising from the wide valley floor are most probably re-modelled fault blocks (Fig. 6I and 6J). Downstream, the Vidnávka River bends to the N-NNE near Vápenná and forms a very narrow valley in the granite of Žulovská pahorkatina (Hilly Land).

An asymmetric drainage pattern is characteristic of the upper Vidnávka catchment (upstream Vápenná) partially following from the patterns of mountain spurs in the W part of Hornolipovská hornatina (Mts.), which radially run out from Smrk Mt. and end above the wide valley of Vidnávka. With an exception of some short steep water streams running down from the southern slope of Sokolský hřbet (Ridge), all tributaries arrive from the left side from the Hornolipovská hornatina (Mts.). Rectangular stream junctions suggest the existence of subordinate cross faults or fissure zones.

The Vidnávka River springs on the SW slope of Sokolský hřbet (Ridge) at an altitude of some 870 m and sharply turns to the NW after 2 km in the col of Na Pomezí. The height difference between the col and Studničný (992 m) on the MSF norther block is over 400 m. The col floor is located higher than the highest inselbergs in the adjacent part Žulovská pahorkatina (Hilly Land) (Boží hora 525 m, Jestřabí vrch 507 m), which suggests that uplift movements were probably not all of exclusively fault character and that there are also the movements perpendicular or oblique faults to the MSF direction and possibly an en bloc uplift, too.

In the area of Na Pomezí, planation surfaces on the S block of MSF are situated only some 150 m above the col floor (between Smrčník 799 m and Přesečný 743 m). The top surface of the block (Smrk 1125 m) is by more than 600 m higher, though. We assume that in addition to tectonic movements on the Marginal Sudetic Fault there was an up-doming or movements on other faults which are partially delineated by the rectangular valley pattern (e.g. the branch of Bělá fault running towards the SW into the valley of Biala Lądecka). Here, the deepest valleys in the whole Rychlebské hory (Mts.) can be found (Stříbrný and Bučinský potok brooks). Unique tributary hanging valleys and waterfalls near Nýznerov indicate a rapid and continual incision. The Stříbrný brook runs to the NNE, crossing the SE edge of Žulovská pahorkatina (Hilly Land) with a deep valley prior to joining the river of Vidnávka.

The triangle-ground plan block of Sokolský hřbet (Ridge) on the NE side of MSF belongs already to the Fore-Sudetic block with the greatest height (991 m) and width (10 km) on the SW along the Marginal Sudetic Fault. The ridge becomes rapidly narrower towards the NE, declining stepwise by cross faults. The prevailing direction of drainage towards the NW suggests that the ridge originally had a secondary inclination to the NW too. The ridge ends on the presupposed fault of Vidnava-Głuchołazy (Dyjor, 1983) which is not distinct in present morphology.

6. Discussion

A) The development of the Rychlebské hory (Mts.) topography on the contact between Lugicum and Silesicum is a result of mainly young tectonic block movements and it is possible to agree with designation of the process as neotectonic epiplatform orogenesis (Kopecký, 1989). Uplift of the Bohemian Massif was differentiated both in time and in space, and its causes, mechanisms and temporal course have not been a subject of comprehensive study yet and the expertise rather finds itself in the stage of speculation. Complex character of the issue can be exemplified by six years of systematic research (geological, geomorphological, geophysical, dating) of the less complicated uplift of the Rhenische Shield (Fuchs et al., 1983) with a much lesser horizontal and vertical differences, which - unlike the Bohemian Massif - is not even in the direct contact with the young Alpine-Carpathian collision orogene. In the Rhenische Shield, main cause to the uplift (with the exception of the E part) that took place as early as from the end of the late Cretaceous is considered to be partial melting of the mantle in the anomalous sublithospheric layer in the depth between 50 and 150 km.

A main feature of the young epiplatform Bohemian Massif uplift was block disintegration whose intensity increased with the increasing height differentiation causing the formation of ever smaller blocks. Although it can be assumed, for example on the basis of neovolcanite composition (see e.g. Cwojdziński - Jodłowski, 1982), that the uplift cause was most approximately in the mantle, the differentiation into major morphostructures is characteristic of its relevance to the structure and features of crust, and particularly to the block structure of the massif. This is clearly apparent in typological relief classification Czech Republic (Czudek ed., 1972). Another relation exists between the crust type (Zeman, 1978) and the prevailing type of relief in main geomorphological units. Certain differences can be anticipated mainly at the S and SE margin of the massif on the contact with the Alpine-Carpathian system. On the other hand, however, should the character of the uplift of large blocks reflect regional differences in their geological structure, there is only a little probability for the differences not to be respected on the lower levels of regional division with the entire massif being a subject to detailed surface folding of the mezo-kenozoic planation surface including the most consolidated crystalline basement of Moldanubicum (Kopecký, 1989). We therefore cannot agree with another opinion of Kopecký (1971, 1989) that the faults in epiplatform orogenesis were of only minor importance.

B) Greater differences in the character of epiplatform orogenesis in the Bohemian Massif can be expected mainly at its margins as well as along contacts of large blocks. The Ramzová and Nýznerov thrusts on the Lugicum-Silesicum contact are practically an integral part of the boundary of higher order represented by the Moravian-Silesian tectonic zone (Mísař - Dudek, 1993) in which Cadomian consolidated Brunovistulicum comes into contact with the Variscan consolidated units. An important disturbance in the area appears to be the Złoty Stok - Trzebieszowice regional shear zone of the SW-NE orientation, running in parallel to the Moravian-Silesian tectonic zone (Cymerman, 1996; other interpretations see Cwojdziński, 1975, 1976; Oberc, 1995). In the area where the Moravian-Silesian tectonic zone cross the Rychlebské hory (Mts.) the uplift amplitude suddenly increases by some 300 m towards the SE to the area of Hrubý Jeseník (Mts.) and the MSF morphology exhibits sudden changes. At the same time, the morphologically distinct uplifted NE margin of the Bohemian Massif is located some 15 km to the NE (the fault of Vidnava - Głuchołazy?). Width of the elevation is greatest in the Hrubý Jeseník (Mts.) culmination area too. In the first approximation the wider area of Hrubý Jeseník elevation between the Paczkow and Hornomoravský Grabens can be considered a mosaic of fault blocks suggesting a broad block anticlinorium.

C) According to Roth (1980), the eastern margin of the Bohemian Massif on the contact with the Carpathians, which belongs to the Brunovistulicum and is today covered with Miocene sediments of the Carpathian Foredeep and flysh was its most mobile part from the Upper Cretaceous. The N fore-field of Rychlebské hory (Mts.) exhibits the influence of neoide Carpathian structure by the Meta-Carpathian Range and Paratethys bay appearing on the Fore-Sudetic block up to Paczkow (Dyjor, 1983b). In the elevation relief, the influence of this structure most probably reaches as far as to the area of Králický Sněžník (Mts.) or Nysa Graben and is indicated by the changing orientation of the Main European Divide from the SW-NE to NW-SE.

D) Geomorphological features important for an analysis of epiplatform orogenesis include mainly fault-related scarps, planation surfaces (and their deformations) and the valley pattern. As to the first mentioned forms, fault-related scarps, the use of criteria from areas present active block tectonics (e.g. Blackwelder, 1928; Cotton, 1950; Wallace, 1978) are limited in the area under study by present low tectonic and seismic activities that are by several orders weaker. This showed for example in the geomorphological research of the most marked section of the MSF scarp in the Sowie Góry (Mts.) (Migoń, 1993; Kryzskowski - Pijet, 1993). Limited possibilities provided by these geomorphological phenomena were discussed by Migoń (1995).

The MSF scarp is a true fault scarp (Ivan, 1965). On the other hand, formation of scarps on the Bílá Voda Fault and Javorník Fault, similarly as on the fault of Bernartice - Hukovice might have been to a certain extent result of differential erosion, which would mean that the slopes in question may either be fault-line scarps or exhumed fault scarps. A probability of composite fault scarps is low. As to the character of MSF movements a hypothetical statement can be made of the reverse fault (steep-angle thrust) from the asymmetrical cross profile of Vidnávka valley in the section between Vápenná and Horní Lipová. In this context it is worth mentioning that there are no occurences of neovolcanite effusions or mineral springs on the Marginal Sudetic Fault in our territory. Another fact worth attention may be considered the statement of Panoš in the discussion to Vosyka's paper (1960) concerning hydrogeology of the Rychlebské hory (Mts.) that the hydrological system of MSF can be considered entirely inefficient. Mineral springs in the Sudeten, particularly those containing CO_2 can generally be found inside the mountains as for example is the case of the Hronov-Poříčí Fault (Dowgiałło, 1987). The continuous tectonic uplift is suggested by geodetic measurements (Gierwielaniec - Wożniak, 1983) as well as the intensive and deep erosion of water streams, namely in the Hornolipovská hornatina (Mts.).

E) The dating of young tectonic movements is based mainly on the age of the Tertiary sediments and neovolcanites. A general scheme of three stages of MSF development was outlined by Oberc - Dyjor (1968, later precision see Dyjor, 1983a, b). According to these two authors (1968), the MSF scarp development was preceded by a flexure bending of the Sudetic block along the NW-SE axis. In the Oligocene and Lower Miocene, sedimentation on the Fore-Sudetic block occurred in depressions delineated by W-E oriented faults. An important fore-field topographic feature was the embayment of Carpathian Foredeep, ending in the NW on the divide Meta Carpathian Range that separated the Paczkow - Kędzierzyn graben (Dyjor, 1983a, b) from the graben structures in the fore-field of Sówie Gory (Mts.) (Grocholski, 1977). Most significant for the development of block relief were fault movements in the end of the Sarmatian and in Pliocene, which also continued in the Quaternary. Hypothetic considerations concerning the formation of the presently existing MSF scarp include only the younger stages - Pliocene and Quaternary.

F) As to the dating of tectonic movements by neovolcanites, Birkenmajer et al. (1977) distinguished three following stages in the Sudeten fore-field: 1) the Upper Oligocene (Odra stage, tensional) which rather relates to WNW-ESE-oriented faults in the E part of the Sudetic fore-field, 2) the Upper Oligocene - Lower Miocene (Opole stage, compression), and 3) the Middle Miocene, mostly Badenian (Jawor stage, tensional). Another dating which is much closer to the scheme known in our part of the Bohemian Massif is presented by Jerzmański and Majciejewski (1968). The position of neovolcanites in a wider regional context was studied by Cwojdziński - Jodłowski (1982).

Neovolcanites in our territory are younger and crop out mainly on the NW-SE oriented faults (Přichystal, 1993). Small isolated findings of nepheline basanite in the Rychlebské hory (Mts.) at Zálesí and Lutynia (Berger, 1932; Frejková, 1954) belong to the youngest ones in Silesia and according to the scheme of Cwojdziński - Jodłowski (1982) originate from the greatest depths of some 90 km. They are situated in the area of the Travenská hornatina (Mts.) main ridge. According to Fediuk - Fediuková (1989) ultramafic nodules from nephelinite basanite from Zálesí may designate temperature about 1100 °C at depth of approximately 80 km. It seems that together with the NW-SE tectonics they are on a NNE-SSW oriented lineament (comp. Chrt et al., 1968) that is indicated by fluorite mineralization (with characteristic Ni and Co elements) near Zálesí, radioactive springs at Polish Lądek, and a fluorite deposit in Kletno.

G) The mechanism and to some extent also the temporal course of the mountain elevation development can be derived also from the step-like arrangement of planation surfaces. Their general weak point is the fact that „Unlike sedimentation upon which most of the study of historical geology is based, erosional processes are historically defective in that they tend to destroy the signs of their own agency" (Chorley - Schumm - Sugden, 1984, p. 22). An important complicating factor are climatic changes (Bakker - Levelt, 1964). Complexity of the issue of denudation chronology of the area under study can further be illustrated by an experience made by Panoš (1968, p. 110) that „the step-like planation surfaces of East Sudetes of unambiguously tectonic origin combines with systems of erosion surfaces...". It appears that the so called Paleogene peneplain was in fact an etchplain which has been buried under the Tertiary sediments on the Fore-Sudetic block together with the kaolinic weathering crust. The etchplain is partially preserved in the Žulovská pahorkatina (Hilly Land) and its traces can also be seen even on the Javorník foot step. Remains on the main ridge of the Rychlebské hory (Mts.) at altitudes of 900-1100 m, which point to a minimum amplitude of the entire neotectonic uplift can presumably be considered its analogy.

Opinions of how the planation surfaces were displaced into their present position and what is their age rather differ. One type of interpretation assumes block faulting of an originally uniform regional planation surface whose remains can be found at different altitudes and are of the same age (e.g. Demek, 1971). An extreme variant of this conception, which is however contradictory to the present state of re a certain problem being presented however in the Góry Bardzkie (Mts.). The model probably applies also to the NW part of the Rychlebské hory (Mts.). Larger remains of the Paleogene surface on the main ridge can be seen on the Borůvková hora (Mt.) and on Smrk (Mt.). The younger surface around 700 m (Jelen, Osutý) is best preserved on Sněžník orthogneiss. The youngest stage of movements reflect the MSF fault scarps which divide into partial phases delineated by the profile of higher segmented scarps. They were separated by the period of tectonic quiscence in the course of which a partial planation surface was formed with flats at 530 m between Javorník and Travná, and possibly also the Vojtovice foot step pediment. The situation in the SE part of the Hornolipovská hornatina (Mts.) affected by young dome-like deformation is more complex and less clear.

H) A very promising direction in study of tectonic geomorphology and denudation chronology is the analysis of valley pattern which passed through radical changes in the course of epiplatform orogenesis (comp. Jahn, 1995). There are two important features in the wider surroundings of Rychlebské hory (Mts.) that point to the complex character of the issue in the area under study and to its significance for the relief development. The first of them is a fact that the Králický příkop (graben, as a southern part of the Kłodzko Basin) is being drained into the rivers of Elbe, Odra and Danube! The second one is the paleogeographical situation on the Fore-Sudetic block in the Miocene. The existence of a canyon-like buried valley, partly incised in the Cretaceous sediments in surroudings Opole (Poland) and filled with the Miocene deposits in the elevation of the Meta Carpathian Range has been known since the 30's (e.g. Kotański-Radwański, 1977). It probably links up with a pattern of similar buried valleys in the region of Ostrava.

7. Conclusion

The change of MSF topography from marginal fault scarp into fault valley relates to the Lugicum-Silesicum transition area. It shows a great influence of the Variscan and possibly even older tectonics on the character of epiplatform orogenesis as well as on synorogenic denudation of the relief formed by the neotectonic uplift.

There can be no doubt that one of the most pronounced geomorphological feature of orogenesis in the Rychlebské hory (Mts.) - the MSF scarp is a true fault scarp, although strongly degraded. With its morphographical and morphometrical features it suggests at least two stages of young fault movements. However, the scarp height is a demonstration of only a minor part of mountain block uplift. The remaining major uplift part (between the upper scarp „edge" and the top parts of axial ridge) may either relate to older stages of fault movements whose topographical features were destroyed by denudation processes, or to other types of movements such as a large-scale domal uplift, general epeirogenetic uplift or isostatic response to denudation unloading.

In addition to denudation chronology, an analysis should be made to find a proper explanation of epiplatform orogenesis in the development of valley and river patterns which were essentially reshaped and reorganized during young tectonic movements.

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NEW PROSPERITY FOR RURAL REGIONS

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Abstract

Institute of Geonics, Czech Academy of Sciences - Branch Brno, and Institute of Geography in Ljubljana cooperate at a research project aimed at the transformation of marginal rural regions, particularly those located in border lands of the two countries. The project is to study a realistic course of the transformation in marginal and border conditions, social consequences of the transformation, roles of entities, social conditions of transformation success, relations between region prosperity and full-scale nature protection. An important factor of the issue is a new situation on the state borders. Seven following model areas in the two countries were chosen for the project: The White Carpathians, the Middle Dyje Basin, the Kunštát region and the regions of Lower Dráva River Basin, the Sáva River Basin, Istria and Bela Kraina in Slovenia. By comparing research results in the individual regions and by applying different methods in each of them the team of experts intends to arrive at a general scheme of regional transformation and its consequences in marginal areas.

Shrnutí

Ústav geoniky AV ČR, pobočka Brno a Geografický ústav Ljubljana řeší výzkumný projekt zaměřený na studium transformace marginálních rurálních regionů zejména v pohraničních oblastech obou států. Otázkami, na něž chce projekt odpovědět, je reálný průběh transformace v marginálních a pohraničních podmínkách, důsledky transformace pro sociální systém, role subjektů, sociální podmínky úspěchu transformace, vztah mezi prosperitou regionu a velkoplošnou ochranou přírody. Podstatným faktorem problému je nová situace na státních hranicích. V obou zemích bylo vybráno sedm modelových oblastí: Bílé Karpaty, Horní Podyjí, Kunštátsko a regiony Dolního Podráví, Posáví, Istrie a Bílé Krajiny ve Slovinsku. Porovnáním hodnocení jednotlivých regionů, ale i aplikací různých metod v každém z nich hodlá výzkumný tým dosáhnout zobecnění regionálního průmětu transformace a jejich důsledků v marginálních oblastech.

Key words: geography rural, regions marginal, border problems, Czech Republic, Slovenia

1. Introduction

State borders in countries of Central, East and South-East Europe exhibited considerable changes at the beginning of the 90's. Borders separating the post-Communist countries from other European countries changed their character in connection with the fall of the iron curtain. The changed state borders between the individual post-Communist countries became standard. The former borders between relatively independent republics became the borders between sovereign countries due to the disintegration of the former Soviet Union, Yugoslavia and Czechoslovakia. All these changes occurred within an unprecedental historical context.

The conditions affected not only bilateral and multilateral relations among the individual countries but also border regions and their population. The development of lively exchange of persons, goods and services has brought both proes and cons to inhabitants in these regions. There are attempts at international collaboration on the basis of the so called euro-regions. An ever greater emphasis is being put on the joint environment protection. The labour market is being formed into entirely new shapes. Some of the former peripheral regions have been given a new stimulation for their development, the position of other ones has become marginal. Each type of region shows different response to the change of its borders.

Countryside is one of the most discussed transformation issues in the post-Communist countries. It is because the transformation of countryside has a marked regional aspect: its course is much different in the background of large cities with a great diversity of jobs, different in regions with conditions favourable for competitive agricultural production, and very much different in marginal regions.

Numbers of people employed in agriculture and industry show a long-term steady decrease in advanced countries. The introduction of market economy in the post-Communist countries has brought problems on the labour market in the marginal regions. Backwardness of these regions becomes ever more alarming in the field of infrastructure. Young and skilled people with their families leave for towns, which firstly results in structural population problems and secondly also in a considerable drop of the population in some countryside settlements. The very existence of some has even been put into danger. A good portion of lands in areas with conditions unfavourable for agricultural production tends to lay idle. The decline of countryside settlements and agricultural cultivation of rural land in marginal regions result in the loss of landscape-forming functions of population and agriculture. Nevertheless, thanks to the polycentric development of settlements by means of new jobs in Slovenia it was possible to keep a certain part of young generation in rural regions.

Rural geography has lately been paid much attention at many workplaces namely in France. Rural geography includes all works discussing issues of geographical spaces outside towns and conurbations. Although the greatest attention is paid to geography of agriculture, there are many other issues studied such as environment in rural regions, utilization of rural areas, village-town relations, commutation, problems of rural regions in connection with extraction of raw-materials for industrial production and deposition of communal wastes in rural areas, utilization of these areas for second housing and recreation, and last but not least the issues relating to the marginal character of rural areas.

The issue of peripheral areas has been paid a considerable attention already for some time in West European countries. Even in these countries the regions in question are those of alpine and sub-alpine character with less favourable or unfavourable conditions for agricultural production, sometimes hardly accessible by usual means of transport, with non-existing more significat concentration cores of settlement. All these problems are usually discussed within the subject of rural geography. As mentioned above, one of the countries where the peripheral areas have been paid much attention by geographers is France. A comprehensive monograph dealing with the issue was worked out by Bonnamour (1993) - Géographie rurale, position et méthode. The issue of peripheral areas has been tackled by many other geographers, though. Of numerous authors, let us mention Fruit (1984, 1986), Wackermann (1977a, b) from Paris, or experts from Toulouse (R.E.M.I.C.A. 1978), Lyon (Houssel, 1978) and Rennes (Bonneau, 1978). All of them can see animation of these areas in newly introduced industrial activities as well as in their reacreational use. Both French and German geographers also study the changes of rural regions in the post-Socialist countries of Central and East Europe (e.g. Grimm, 1995a).

Traditional Czech rural environment, its history and development was tackled by Sedláček (1996) whose efforts were concentrated on a causal analysis of national cultural heritage decline from the 50's to the end of the 80's. The author can see the major cause in refutation of all traditional values existing in the country environment and country life (and not only there) till the end of the 40's. The second cause is then seen in a considerable loss of aesthetic feeling in a great deal of of population, the factor closely related to the first cause.

Another author who has been dealing with the history and development of Czech village was Schmeidler (1996). While the village once used to be a self-contained independent form in terms of its life, which provided nearly all vital functions, its character consisting mainly in agricultural production, today a considerable part of country population is employed in various industries, working outside the village. As mentioned by the author, the term „rural" does not automatically relate to agriculture in industrially advanced countries. Bringing closer social structures of population in towns and villages in the 80's became a basis for a work by Illner (1988). In his analysis the author claims that the majority of rural working population is formed by employes outside agriculture. Social composition of the population in towns and villages has become almost identical with neither rural or urban environments being a domaine of a special social group.

One of important stimuli for revitalization of the rural space in the Czech Republic was the „Countryside Restoration Programme". The first steps that were to help to cure the situation of countryside settlements and landscape were made as early as in the 80's but with no special emphasis on their finalization. Hence with insufficient results. Motivation for the Countryside Restoration Programme announcement was described in an article by Kutěj (1992) in which the greatest importance of the Programme was attributed to restoration of losses caused to village and rural environment after 1948 in consequence of the then concept of socialist large-scale agricultural production and unsound administration application of central settlement system. Main objectives of the Programme were seen in its dwelling on the awareness of traditional rural values as well as on the prospect of its sound development within the sustainable development of society. The Programme was to initiate enthusiasm in the rural population to strive for the development of healthy and ecologically sound living environment. The Programme does not aim at a mere restoration of the intravillan but also at the improvement of the surrounding landscape in the cadaster area of the municipality with all its ecological problems, nature protection and agricultural production. Results of the Programme on revitalization of rural environment in the Czech Republic were appreciated by Dejmal (1995). According to the author, the „Countryside Restoration Programme" has become a recognized form of organizing restoration and developmental programmes in our countryside. On the other hand, Sedláček (1996) claims that it would be irrealistic to rely upon rural inhabitants and their enthusiasm to return to the disturbed environment its original values since it is exactly them who have to face perhaps the most severe struggle for existence.

Facilities available in the rural settlements significantly affect satisfaction of the rural population. Villages still have fewer social facilities than towns and the issue was studied by many authors in the 80's (Krůček, 1982; Andrle - Srb, 1987; Hoferek - Martínek, 1987) and in the 90's (Schmeidler, 1996).

Demographical development is another index that shows great differences between rural and urban areas in the Czech Republic. In the end of the 80's, the population age structure was studied in details in settlements with up to 500 inhabitants and developmental trends of population numbers in these settlements up to the year of 2000 (Andrle - Srb, 1987). In spite of the fact that the population structure in rural areas is at present different from that in towns (particularly in terms of birth rate and age structure), the rural figures are expected to get much closer to those in towns in the future (Schmeidler, 1996).

After 1989, the Czech rural space exhibits pronounced changes which have been a cause to problems of different kinds. An analysis of these problems of rural development was made by Slepička (1994) together with a schematical proposal for their solution. The author can see cons of the development in the rapid decrease of production, increasing prices of all production means, in restricted public transport services in rural settlements, decreasing income of people working in agriculture and forestry, in high above average rate of unemployment in rural areas, in a considerable increase of retail and self-supply forms of agricultural production, in the fragmentation of state administration, in the monopoly position of manufacturers and suppliers of agricultural machines and equipments, insufficient organization and poor solidarity of farmers. On the other hand, proes can be seen in the favourable course of privatization and transformation as well as in the integration of 300 000 redundant workers from agriculture into other branches of national economy.

The change of political and economic conditions after 1989 reflected in structural changes of Czech agriculture which is an important element of the rural landscape. Decreased importance of agriculture in rural areas and its consequences were studied by Schmeidler (1996). The author claims that the decrease has influenced the character and formation of rural settlement in consequence of which unused buildings become dilapidated, the social and economic structure changed, and historical identity with the place disappearing. After 1989, the rural population showed interest in a possibility of private farming and an interesting issue became their readiness and preparedness for the challenge. A public inquiry into pre-requisites of land owners for the development of private farming was made by Horská - Chromá - Slámová - Šopek (1991). The paper brings results of the inquiry which was aimed at finding what kind of people were included in the research, what were their stimuli for private farming, what are their qualifications and other pre-requisites for establishing a farm, what are their ideas and plans for the future, what are their external (objective) conditions in which they made the decision to go for private farming and conditions limiting their efforts.

Another interesting public inquiry was made at the beginning of the 90's, which was to find out what the rural population thinks of the future of both countryside and agriculture (Brabenec - Šařecová, 1991). Basic questions were focused on the interest of rural population and workers of agricultural establishments to run private farming business, on the mapping of public services in villages and their standard, and theoretical possibilities of employment in other than agricultural establishments. Other questions were directed to the issue of leisure time and leisure time activities.

Results of public inquiries made at the beginning of the 90's were summarized by Schmeidler (1996). The author brings an evidence to the fact that the recent public inquiries as well as other forms of research find out a relatively great popularity of rural settlements. Assets of villages are seen in social (a considerable identification with the locality, a well developed network of social contacts, high appreciation of village togetherness) and ecological (content with special environmental qualities, nature closeness and clean air) qualities. In contrast, negative statements concerned cultural facilities, schools and infrastructure in general as well as the insufficient connection to the transport network. With greater mobility and leisure time the village still seems to have a certain attractiveness as a place of recreation and meaningful leisure time activities.

The cooperational efforts of OECD countries at searching new possibilities for the development of rural regions are described in Kašparová (1995). Special attention at these considerations about the further development of rural areas is paid particularly to the standard of economy, standard of living environment, preservation of cultural heritage and general quality of living in the OECD countries, rural regions. At present, the programme of OECD rural development includes four key areas: analyses and studies of effects of adopted policies, development of the countryside and employment, natural and cultural values (key factors of rural development), and the issue of industrial policies versus rural development.

A general view of the issue of social system geographical differentiation and its causes in the Czech Republic presented Hampl et al. (1996). According to this author the most distinctive features of marginality are exhibited by metropolitan regions situated in the eastern part of the country, i.e. Moravia and E. Bohemia.

The new state borders, in our case between the Czech Republic and Slovakia, and between Slovenia and Croatia, impaired the labour market as well as the market with products in the borderland regions. New economic, transport and psychological barriers came into sight and traditional contacts built for tens of years were suddenly found in pieces. The recent historical development appears to be negative in some respects. Building of new relationships is still at the beginning. However, the situation facilitates the economic growth of certain population groups (trade) at some places, particularly in the vicinity of important border crossings.

A conception of across-the-border relations of individual regions is needed at which opening of the border would meet every day´s requirements of local population so that living in the border land becomes attractive. Neighbouring countries will have to make use of their potential for such a kind of relations on both sides of the borderline. At this, the knowledge of traditions, mentality and language of the other party is not irrelevenat at all. The border areas will have to play an important role of intermediary at negotiations of central authorities from the partner countries.

It was relatively early that the issues of border geography became to be studied by geographers in Central Europe. International projects are coordinated by the Institute für Länderkunde in Leipzig (Grimm, 1993, 1995a) which concentrates not only on an analysis of the situation on the German border itself (including important pieces of knowledge from the former border line between the two German states) but also on an analysis of borders located in the German sphere of interest. Methodology of the works is based both on classic socio-geographical methods which analyze actual regional changes occurring in the border land, and on sociological methods that rather concentrate on the perception of these changes. As mentioned by German geographers, we should probably speak of a new geographical discipline coming into existence.

Possible solutions of these social problems are generally known. It is the development of ecological agriculture, growing of special crops, utilization and special processing of local raw-materials, development of agro-tourism, utilization of relatively less disturbed natural areas for educational and cultural purposes at simultaneous preservation or restoration of identity of individual rural settlements.

The hitherto experience indicates a low utilization of the actual potential of marginal regions. A cause to this phenomenon shoud however be seen in people. Education, adaptability to conditions of market economy as well as entrepreneurial spirit are low in the marginal regions and the human factor is usually at the background of other causes to the backwardness, e.g. the lack of finance.

2. Topics and methods

The Brno Branch of Institute of Geonics, Czech Academy of Sciences and the Institute of Geography in Ljubljana run together a research project named NEW PROSPERITY FOR RURAL REGIONS in 1996-1998. Objectives of the project consist in finding answers to the following major questions:

- What is the course of transformation in marginal regions: changes in ownership structure, methods of area administration, entrepreneurial standards, new activities,
- What are the actual consequences of transformation: employment rate, migration, way of living,
- What is the influence of the state border, what are the over-border contacts,
- What is the course of practical solution of the relation between environment versus economic and social prosperity,
- What are general conditions for successful transformation in marginal areas (generalization of results).

Partial tasks following out of the above objectives include:

- elaboration of basic theoretical and methodological solutions,
- an analysis of seven model regions of which four are in Slovenia and three in the Czech Republic,
- an analysis of the already existing forms of over-border cooperation, problems of bilateral land ownership, labour and product market, changes in the structure of supplies into the border settlements, organization and management of over-boder flows, over-border environmental problems, changes of geopolitical importance of individual regions and study of mutual ethnics,
- a comparison and generalization of acquired knowledge in two planes: a) to extend theory and methodology, b) to be applied by local and regional institutions.

The research period was defined for two years: from September 1996 to August 1998. The project should result in seven partial regional studies, a final comparison, and a whole range of partial documents, materials and pieces of knowledge. The partial results will be appreciated by the 2nd Moravian Geographical Conference CONGEO '97 held in Lednice in September 1997.

The main core of the analytical part of the project will consist in work with the model regions. Classic geographical methods will be used that are to be combined with sociological methods important particularly for the monitoring of latest developmental trends as well as for the acquirement of data about developing opinions of population and important entities in the terrain. It is also expected that behavioural methods will be used together with political geography relating to the theory of border regions and border land issues. It is a matter of course that cartographical methods will be made use of not only to present the phenomena but also to analyze them. Remote sensing methods based on aerial monitoring will be used as a model analysis.

3. Model regions

The name of the project indicates that teams of experts will study the marginal rural regions. These regions are often found on the state borders which play a role of the barrier evoking the region marginality. The marginal regions can sometimes be seen even in the inland, in areas with severe natural conditions unfavourable for the development of economic activities and - as a rule - usually in the dead zone between the spheres of influence of large settlement centres.

All regions have their specific features and to a certain extent represent an independent scientifical problem. Material for generalization of these individual issues is to be received through their mutual comparison. This plays an important role both for the development of theory, and for practical application of results. The following regions of interest were defined in the project on the basis of these starting points: in the Czech Republic:

- the region of Middle Dyje Basin,
- the White Carpathians Mts.
- the Kunštát region

in Slovenia :

- the Sava Basin
- the Slovenian Istria
- Bela Kraina
- the region of Lower Drava Basin.

The first step of project implementation will consist in the precision of model region boundaries. Here, a rule should apply that the regions form realistic socio-economically operating territorial units. In social geography, the concept is usually applied on the basis of nodal regions that include a centre and its background, which aims at an integral character of „natural" territorial units belonging to each other from the viewpoint of territorial logics. In terms of proposed objectives and methods of work the areas are not too extensive in order to facilitate a relatively detailed analysis including public inquiries.

When delineating the regions one must face a fact that unlike unmarginal regions the marginal ones usually miss any significant centres. Gravitational force of existing centres is too weak to be able to integrate the nodal region for the needs of our definition. On the top of it, the marginal regions are often located on the touch-point of natural districts consisting of several centres, which means that the gravitation is usually rather chaotic.

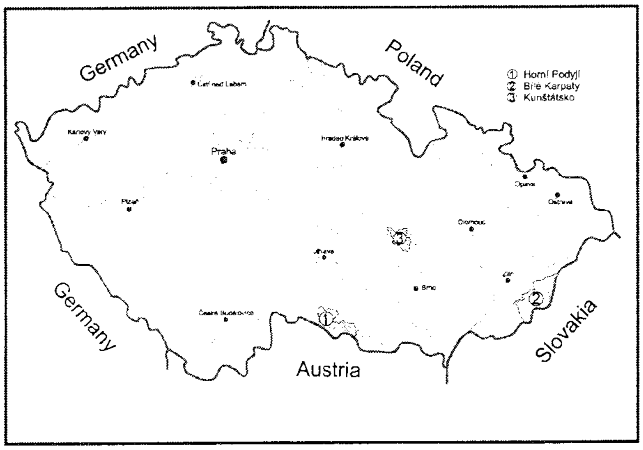

Fig. 1 Map of the Czech Republic with marked area under study

After having taken into account a whole range of aspects typical of the Czech Republic, we finally based our model regions on the former judicial districts of 1849 according to their situation in 1911-1938 (Fig. 1). The judicial districts cannot be considered genuine nodal regions; nevertheless, the condition of integrity of the existing socio-geographical regions in terms of even division of the territory was met. The judicial districts were not planning regions in the sense of administration units of the Socialist period. Therefore, unlike the present administration regions that have been taken over from the era of Socialism, which try to connect larger centres with peripheral microregions, the former judicial districts include a relatively more homogeneous area, much more suited for our purposes.

Delineation of Slovenian model areas was defined by localization of borderland and by general problems. As to administration, each of the regions splits into several municipalities: two of them being defined historically (Slovenian Istria and Bela Kraina), two of them playing mainly a functional role (Sava Basin, Lower Drava) (Fig. 2).

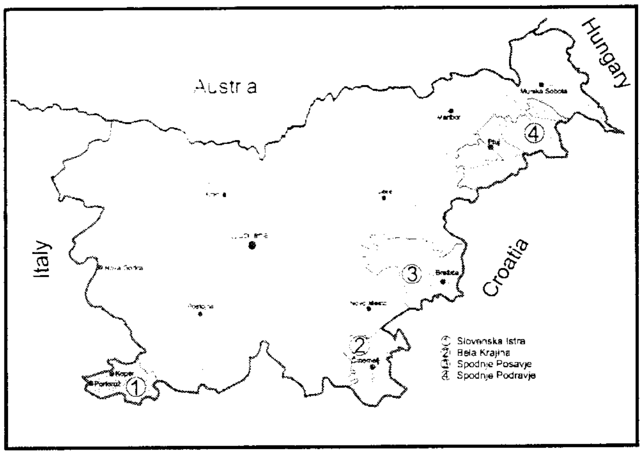

Fig. 2 Map of the SLovenia with marked area under study

3.1 The Middle Dyje Basin

The model area of Upper Dyje is represented by former judicial districts of Vranov nad Dyjí and Jemnice (Fig. 3). Its acreage is 472.5 km^2 and the largest portion of the area is situated at the altitudes between 350 and 600 m. Surface of the region belongs in the geomorphological complex of Jevišovská pahorkatina (Hilly Land) which is represented by the broken Bítovská and Znojemská pahorkatina (Hilly Lands) and Jemnická kotlina (Basin). Only the NE part of Jemnice district belongs in the flat Brtnická vrchovina (Upland) which is a part of Křižanovská vrchovina (Upland). Nearly the whole region belongs in the catchment of Dyje River which flows through the Vranov part of the model area in abundant meandres. A dam was built on the river in the first half of the 30's, whose reservoir is some 30 km long. The district of Jemnice is drained by Želetavka, the left tributary of Dyje. Climate of the region is relatively cold and dry with average annual temperatures ranging between 4 and 7 °C and average annual precipitations usually not exceeding 600 mm. The most eastwards situated part of the region belongs in the Podyjí National Park.

In this century, the model area passed through many political and administration changes that reflected in its today's character. The first milestone was foundation of Czechoslovakia as one of the successor states of Austro-Hungarian Monarchy in 1918. The state border was the first barrier to restrict economic contacts with Vienna. From the ethnic point of view, a considerable part of the region was German speaking up to 1945. In the consequence of this, 39 villages in the area were occupied and annected to Germany in 1938. The original administration was restored in 1945. The number of German population rapidly decreased during the War and in the post-war period due to a whole range of different causes such as persecution of German antifascists and Jews by Hitler's regime, war losses of German soldiers, flight of the German population from the front and evacuation. With the greater part of population the region also lost a good portion of its identity and economic activity. Further marginalization occurred due to the iron curtain after 1948. The latest marginalization impuls so far was the administration arrangement that was put into force in 1960 and which tore the Jemnice

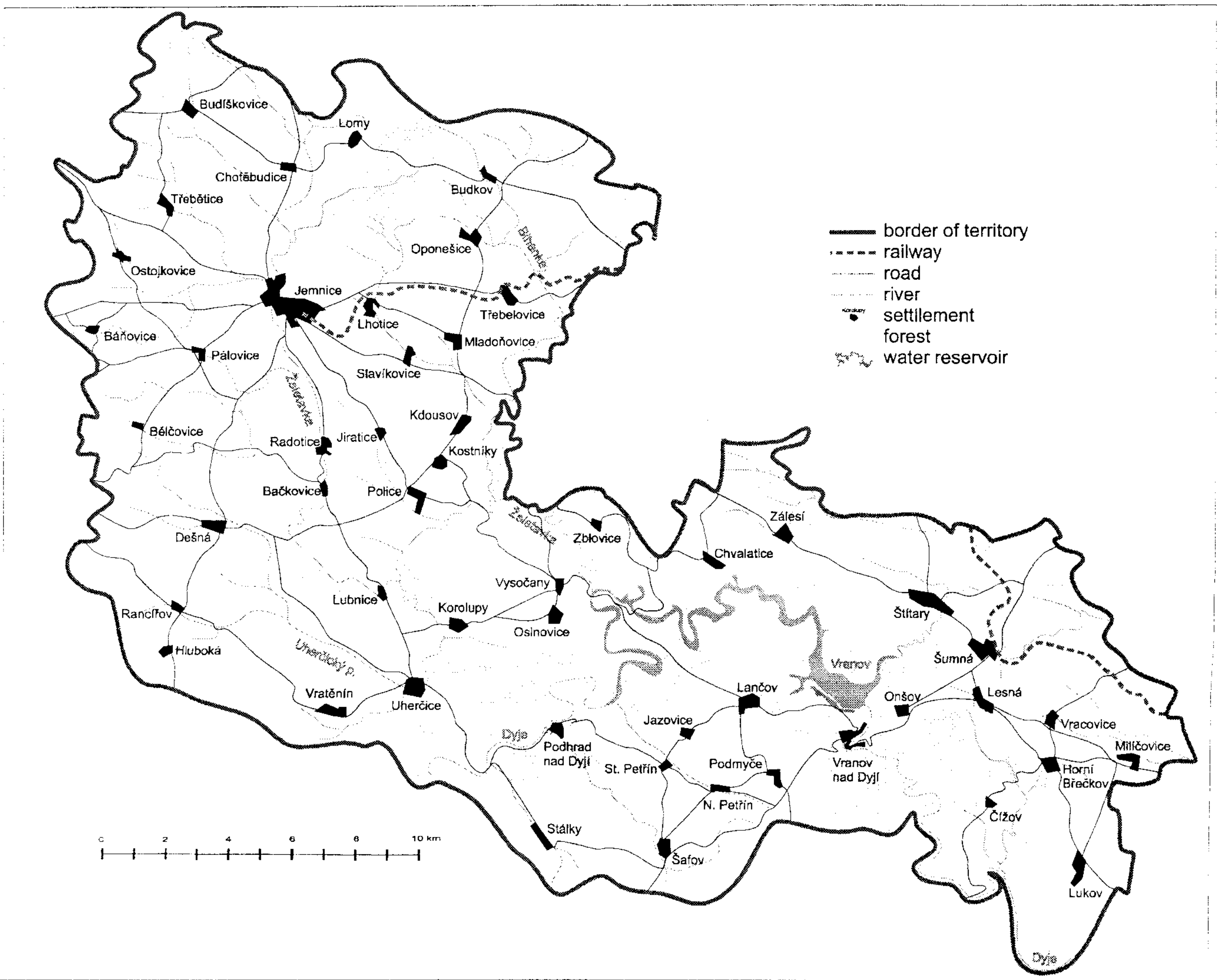

Fig. 3 The Middle Dyje Basin - area under study

part of the region into three pieces belonging now in three districts of two regional administration units. Thus a significant administrative barrier came into existence not only from the viewpoint of the population but mainly from the viewpoint of economic development.

Economy of the model area has always been depending on the primary sector, particularly on agriculture. However, conditions for agricultural production are less favourable here than in lowlands situated east of the model region. The main crops grown in the area were rye, oats, potatoes, fodder crops, animal production included mainly cattle, pigs and poultry. Farms of decisive importance were those in Vranov, Bítov and Jemnice. Industrial production in the proper sense of the word did not practically exist. Should we speak of industry then we would have to mention mere primary processing of agricultural products, small-scale trades and building.

With the exception of Jemnice and its connection to Moravské Budějovice, the whole region is very much „out-of-the-way" for transport and traffic. It would not be realistic to speak of any transit significance of particularly the Vranov part of the area. The only local railway connects Jemnice with Moravské Budějovice while the greater part of the region is without any railway connection. The only road border crossing in the area, Vratěnín-Drosendorf is meant only for citizens of the Czech Republic and Austria.

The region of Vranov dam lake ranks with important recreational areas in Moravia. Recreation can be combined with water sports and tourism in a forested landscape which is only little affected by industrial production and urbanization as well as with sightseeing of important architectonic monuments such as the Baroque Chateau in Vranov nad Dyjí, Bítov Castle, and ruins of the Cornštejn Castle. The districts of Bítov and Vranov were sought by modest tourists and families for summer stays before the construction of the dam lake.

There are 41 municipalities, 59 municipal parts, and 15 590 inhabitants in the area. This represents an extremely low average population density of 33 inhabitants per km^2 including the only larger settlement of Jemnice and 25 inhabitants per km^2 without Jemnice. Jemnice is the largest settlement in the region, whose core has 4 thousand inhabitants. The most popular company in the town is JEMČA - Tea Packaging, and there are also small companies specialized in engineering, construction business and ready-made clothes manufacture. The number of inhabitants in any other village does not exceed a thousand. Vranov nad Dyjí is important in historical and cultural terms as well as for recreation. A nearly fifty percent of municipalities rank in the class of very small settlements. A total of 5 municipalities have less than 100 inhabitants, other 14 villages have a population of between 100-200.

The social system of the area suffers from its rural character, remoteness, low diversity of jobs, and the ethnic population change after 1945. All this relates among other to lower adaptability of the region to new conditions and lower entrepreneurial spirit of the population. The capacity of using the potential of business and consumer innovations from near Austria is apparently not too high.

3.2 The White Carpathians

The model area of White Carpathians consists of the former judicial districts of Bojkovice and Valašské Klobouky and its acreage is 533 km^2 (Fig. 4). Surface of the region is filled with hilly lands, uplands and mountains of three complexes of the Moravian-Slovak Carpathians. Viewed from the West, we can see dissected formations of the Hlucká pahorkatina (Hilly Land) which melts into the Luhačovická vrchovina (Upland) and reaches the highest altitudes in the flat Komonecká hornatina (Upland). The Slovak border edge is formed by massive flat mountain ridges. The Javorníky Mts. reach the model area with their Pulčínská hornatina (Upland). The Chmelovská hornatina (Upland) is another part of the White Carpathians, which links up with the Lopenická hornatina (Upland) behind the pass of Vlara River. Altitudes range between 500 and 800 metres.

A greater part of the territory belongs into the Morava River catchment that is drained by the Olšava River. The NE part of the region is drained by the Senica River into the Bečva River while the border area is drained by the Vlára River into the Váh River. Compared with the previous region, the White Carpathians are warmer - though located at a higher altitude- with average annual air temperatures from 4 °C in the borderland mountains up to 8.5 °C in valleys, and more humid too - with average total annual precipitations ranging between 600 and 800 mm. The borderland area from the South up to approximately the present boundary between the districts of Vsetín and Zlín belongs in the protected landscape area of White Carpathians, which is partly forested but typical with its vast meadows.

The model area did not have to pass through serious changes in the new age past as the region of South Moravia. In contrast, the foundation of Czechoslovakia in 1918 opened a door to even better Czecho-Slovak collaboration the roots of which date back from at least 1848. In the terms of ethnics, the entire region could be considered Czech, and a negligible German (Jewish) minority could be met with only in towns. In 1960, the whole area was broken to suddenly belong in three districts of two regional administrative units (Uherské Hradiště, the then Gottwaldov and Vsetín) due to administrative reorganization, but remained to be of transit character in the WE direction. Later on (in 1980) it acquired a partial connection in the NS direction by the constitution of the Protected Landscape Area of White Carpathians. A real barrier came into existence only in

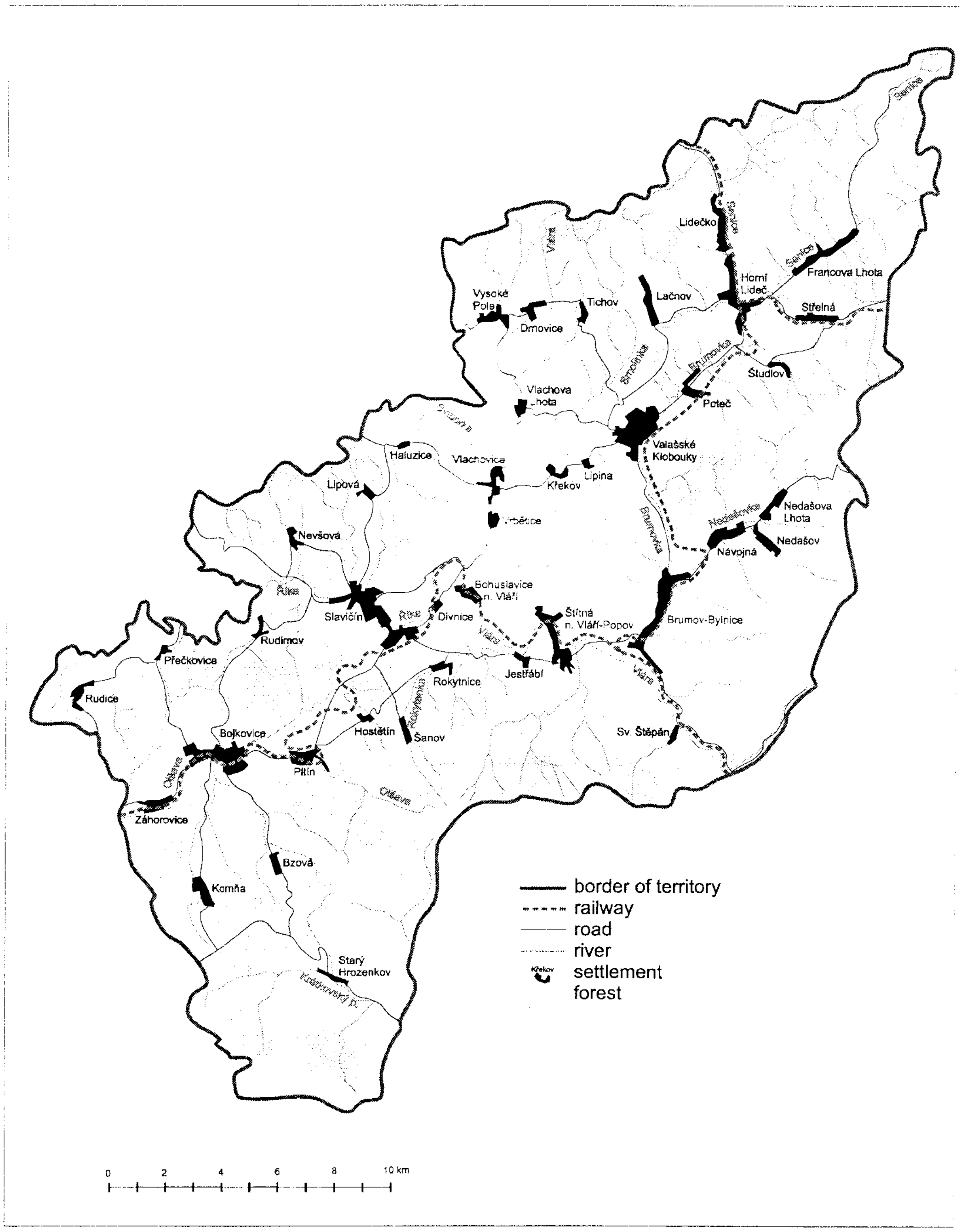

Fig. 4 The White Carpathians - area under study

Moravia. Industrial production was represented by several glassworks on the Moravian-Slovak border, hand-made cloths and slippers, and by primary processing of local raw-materials in sawmills, flour mills and distilleries. In the period between 1918-1938, the government promoted the development of engineering production in Bojkovice, Slavičín and Vlachovice in connection with requirements for country defence. There were new food and wood processing establishments in Brumov and Bojkovice, textile works in Valašské Klobouky, and a shoe factory in Slavičín. On the other hand, the glass making industry declined. The region was influenced by entrepreneurial activities of Baťa Company in Zlín, not only by new jobs available but also by the improving entrepreneurial atmosphere.

The region was interconnected with the inland by the Vlára railway (Brno - Trnčianská Teplá) which was finished in 1888. Other important transit transport lines connecting Moravia with Slovakia were built in the 20's and 30's. They included a railway junction of Horní Lideč - Púchov, a motorway (the present E50) from Uherské Hradiště to Trenčín, etc. The area is expected to soon become crossed by the most significant Czech highway D1 from Prague and Brno to Slovakia. There are two railway and four road border crossings of which three operate for long-distance traffic. On the other hand, the NS direction which could have integrated the model region has been of much lesser importance up to now. The present development which is supposed to bring weakening

1993, after disintegration of Czechoslovakia, more precisely said - a bit later, after currencies and economies of the two countries were split.

Up to 1918 the region was mainly rural with unfavourable conditions for agricultural production namely in the district of Valašské Klobouky full of slopes and clearings. Prevailing agricultural production included cattle rearing, vegetable growing and fruit growing specialized in plum and seed breeding. A certain percentage of the population made their living by domestic small commodity production, peddling and seasonal works related to either building or animal-trimming. Emigration to find new jobs in this region was greatest in

(Fig. 5). Surface of the region is of mainly upland fea a height of 500-750 m. A SE part of the region reaches as far as to the Boskovická brázda (Furrow).

The area has no important water stream. Waters of its eastern half are caught by the Svitava River, waters of the western half are taken away by the Olešnický potok (Brook) into the Svratka River. The NE corner of the area is crossed by the Křetínka River with the water reservoir at Letovice, situated partially in the model area territory and nearly reaching the Vír dam reservoir on he Svratka River on the NW. Climatic characteristics are similar to those of White Carpathians, i.e. average annual temperature of 4-8.5 °C, and average annual precipitations ranging between 600 and 800 mm.

The model region has not been much affected by historical changes of this century. Yet, it could not avoid a split into three following districts of two regions after the 1960 administrative reform: Blansko, Žďár nad Sázavou, and Svitavy in order to form a lateral periphery to all three districts, whose remoteness was made even more visible by transferring the function of district towns to Blansko and Žďár nad Sázavou. In terms of its ethnics, the region has always been exclusively Czech.

Although its natural conditions are not too favourable, the region was mainly rural in the past and belonged in the corn and potato production area. The only industrial settlement was Olešnice with its textile production. Other industries were limited to the processing of local raw-materials (well-known is the Kunštát pottery) and trades. Industrialization has left the region intact even after 1945.

Remoteness of the region fully justifies its classification as an inland periphery. The single important road communication passing through the region in its WE direction is the road No. 18 Žďár nad Sázavou - Prostějov. There is no railway in the area neither is the region destination of tourists, perhaps with the exception of summer cottages. All this despite the fact that a vicinity of the large regional centre of Brno as well as of good terrains for tourism could be an advantage.

The region has 43 municipalities, 63 municipal parts and 16 537 inhabitants, which represents an average population density of 61 persons per km^2. There are three centres of rural character here (although Kunštát has formally been town since 1995): Kunštát, Olešnice and Lysice. The municipalities do not form any hinterlands. Real centres are the towns of Boskovice, Letovice, Bystřice nad Perštejnem, possibly also Polička and Tišnov. The towns which are located outside the model area, however, rank with the class of smaller centres and their distance from settlements of Kunštát district weakens their gravitational influence. It is therefore possible to claim that centripetal forces in the region are of a relatively complex character and combine with the influence of distant towns and nearer rural centres. The majority of settlements concentrate in small villages of which 3 have less than 100 inhabitants and the population of other nine ranges between 100 and 200.

The largest of municipalities is Kunštát with the population of 2 200. It is known mainly as a cultural centre, a birth place of the Bohemian King George of Poděbrady, and a place of work of František Halas, the well-known poet. The town has an insignificant production of grinding tools and pottery. Olešnice has a production of artificial flowers and food.

The district of Kunštát is a typical inland periphery. The strongly rural area with limited prospects of prosperity has been formed in the consequence of natural conditions unfavourable for agricultural production, traffic remoteness and absence of urban-type settlement centres even without any negative socio-political influences occurring on the state border. Certain hopes can be seen in a possibility of integration of the region into the recreational background of Brno aglomeration.

3.4 The Slovenian Istria

The region under study is a part of Istria, the peninsula whose largest part belongs to Croatia at present (Fig. 6). The Slovenian part of Istria includes three municipalities which take up 34 459 ha (1.7 % of Slovenia, and its population was 77 964 (3.9 % of Slovenian population) in 1995. There are 122 settlements in the region, of which three are towns: Koper (24 595 inhabitants), Izola (10 460 inhabitants) and Piran (4 773 inhabitants; in conurbation with Portorož and Lucija 13 558 inhabitants). The region splits into three administrative municipalities: Koper (46 270 inhabitants), Izola (14 354 inhabitants), and Piran (17 340 inhabitants).

Situated right on the edge of Istria is the town of Terst (257 000 inhabitants) which used to be the main economic centre of Slovenian Istria and a great part of Croatian Istria till the end of World War II when it was annected by Italy after alignment of a new state border.

The Slovenian Istria consists of the following landscape units: coast belt with accumulation lowlands and wider inland. The prevailing flat landscape of the coast belt at low altitudes was in the past used for salines and for intensive farming on edges while the present activities of the area are evenly distributed among transport (the harbour of Koper), tourism, settlement, processing industry and agriculture.

A flysch area gradually rises from the sea to the inland in the SE direction - from the lowest hills (above 200 m) up to the highest flysch hills and flats at the height of 300-500 m. In the NE the region enters a karst world. The climate of Slovenian Istria ranks with the class of Mediterranean climate with air temperatures in the warmest month exceeding 22 °C and average January air temperature in Koper being 4.5 °C. A stronger continental influence can be seen on the tops of flysch hills as well as on the karst edges and depends on the altitude and distance from the sea, which also shows on the vegetation and cultural crops (needed mainly for cattle feeding).

In the 19th century and at the beginning of the 20th century the region functioned as an agricultural background of the harbour and industrial centre of Terst. The lower situated areas near the coast, adjacent to the town, produced vegetables and milk for Terst while the higher situated inland supplied the town with hay and wood. Set-up of the new state border in 1954 caused a dramatical change in the political and economic situation. In the period of 1945-1956, 25 070 inhabitants of Slovenian Istria emigrated to Terst, the number that represented nearly a half of its population (57 303 inhabitants in 1931). The refugees came mainly from coast towns and from the immediate background of Terst. Their places were taken by colonists from higher altitudes of the Istrian inland and from other parts of Slovenia.

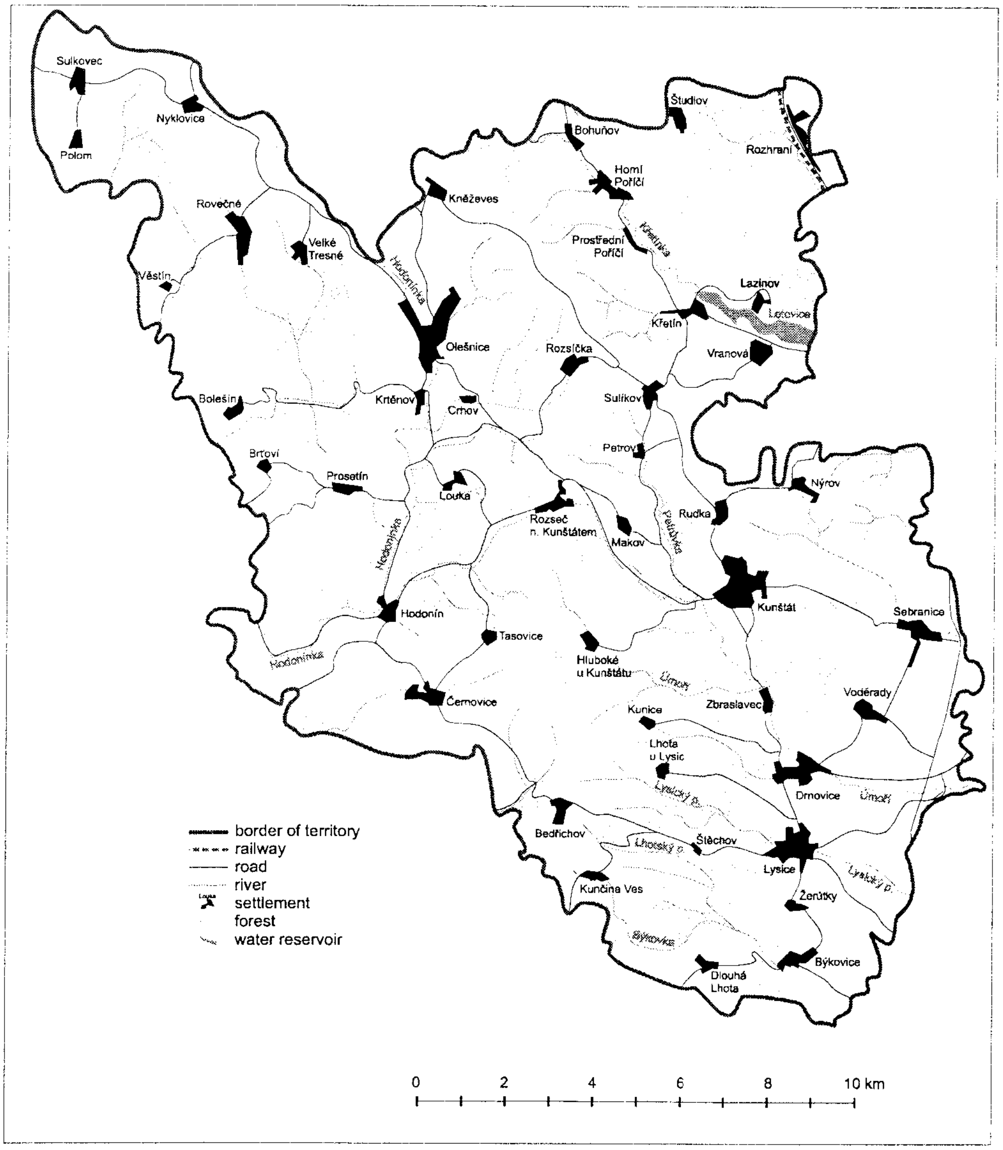

Fig. 5 The Kunštát area - area under study

In 1954, at the time of integration of Slovenian Istria to Slovenia, the area was of exclusively rural character. Due to strong industrialization, intensive immigration (supported also politically) and development of other activities (transport in Koper harbour, tourism, trade) towns on the coast, namely Koper, have grown up into important economic centres of the country. The rapid growth can best be expressed by the increasing population between the census made in 1948 and the one made in 1991 when the number of inhabitants increased to 176.9 %.

The present economic structure is presented by means of data on economically active population by individual sectors of national economy. The tertiary sector is dominated by transport, tourism and trade. Besides the favourable location by the sea the economic development is conditioned also by border location of the region that facilitates cooperation with Italy. In addition, Koper has expanded its influence into the territory of Croatian Istria.

The rapid economic growth reflected in significant alterations in the settlement structure in the region. The population and its activities are concentrated in three coast towns with 66 % of total population of the region. The area of settlements whose population has been steadily increasing after the War represents 26 % of the region with 93 % of the population and population density of 553 persons/km^2.

Rural areas which take up approximately two thirds of the region exhibit a considerable depopulation trend their population having been reduced by nearly a half since the War. Many small villages and settlements are in ruins and the cultural landscape deteriorates. The greatest emigration can be seen in areas along the Croatian border which is far away from the coast agagglomerations. After the state border set-up the situation of these territories has become even worse since the area partially gravitated to the nearest Croation centre of Buzet.

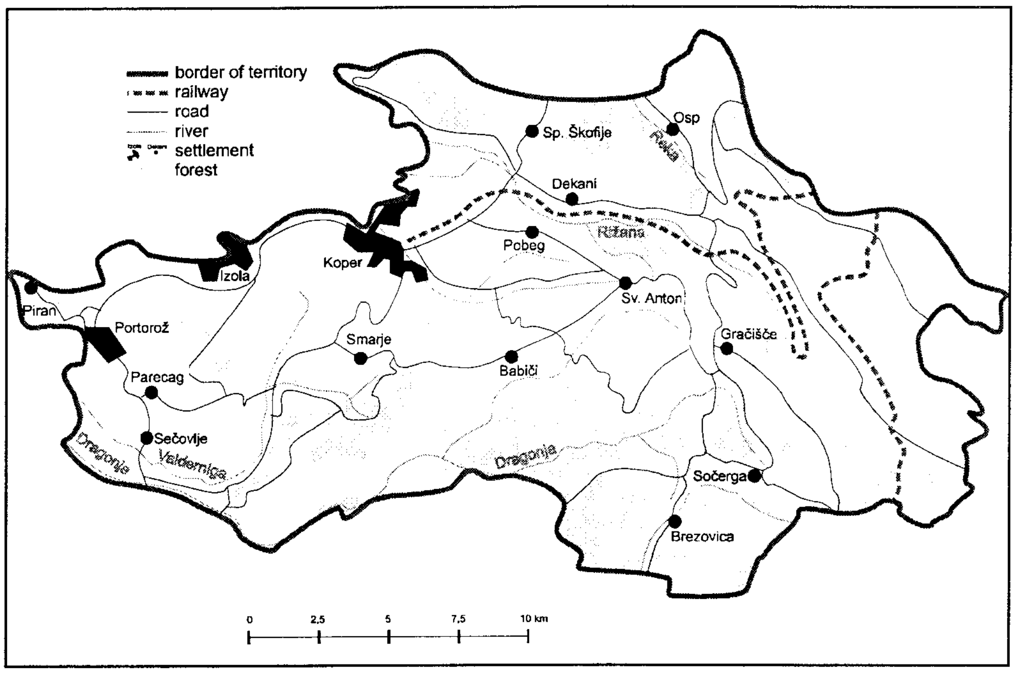

Fig. 6 The Slovenian Istria - area under study

The contemporary asymmetries of the spatial development are being resolved in municipalities by means of accelerated equipment of rural areas with the communal infrastructure (roads, water supplies, waste water systems) which is expected to gradually form conditions suitable for living in these parts of the region.

3.5 Bela Kraina

The region of Bela Kraina occupies an area of 593 km^2 and its population was 26 558 in 1991 Fig. 7). It divides into three administrative municipalities: Metlika, Črnomelj and Semič. Distance from main Slovenian centres, barriers formed by the Gorjanci Mts. in the North and by the Kočevski Rog Mts. in the West as well as openess of the area towards Croatia put the region - together with its historical development - into the position of a considerably specific Slovenian region in the SE Slovenia along the Croatian borders especially in terms of language and culture.

The region consists of five different areas differentiated from one another by physical and geographical features, population density, infrastructure facilities and border-related problems. Bela Kraina ranks with entirely karsted Slovenian regions, very similar to Kras and Suha Kraina. The karst character shows everywhere. The most extensive part belongs in the so called Belokraine platform which is low and intensively planated but combined with karst furrows. The platform declines from its central location to the lowland of Kolpa River. Slopes of the Gorjanci Mts. rise up from this lowland in the northern direction into the much discussed Žumberak. The third part is represented by eastern slopes of Kočevski Rog Mts. - a denser populated belt in the thermal zone which is the most famous and most extensive vine-growing area in Bela Kraina. The fourth part is the nearly uninhabited Poljanska gora, a southern spread of Kočevski Rog Mts., which does not differ from the previously mentioned area with the exception of lower altitudes. The last part is Poljanska dolina - a widening dry valley right above Kolpa, which immediately borders with the area of Kočevie.

As long as until the 12th century, Bela Kraina was under the church and civic administration of Croatia. Later on the territory fell into ownership of Counts of Višnia gora and the church in the area was transferred to the Aquilleian patriarch. After 1209, the territory was owned by the family of Andechs-Meranes, then by the Sponheims and Counts of Gorizie. In 1374, the territory was passed to the family of Habsburgs. Around 1440, Bela Kraina was annected to Carniola where it remained till the provincial division of the Austro-Hungarian Monarchy was annuled. Bela Kraina long included also villages in Žumberak, which are to be found in Croatia today. After 1919, Bela Kraina was first integrated into the Dráva province that included whole Slovenia within the first Yugoslavia. Later, several years before World War II (1936/39/40), it was integrated into the Sáva province, in other words into the Croatian province. Borders in certain sections were often changed, e.g. above Metlika, near Marindol, and their post-war form has survived till the present time. After Slovenia has reached independence and Slovenia and Croatia recognized each other to be sovereign countries, the border between the republics became a state border, i.e. an international border.

The border is unambiguously respected in the greater part of the region since it runs along the river Kolpa which flows through a shallow karst canyon and does not change its bed. In contrast, the situation in Žumberak in the Gorjanci Mts. is entirely different. The border line has been a subject of many tempestuous discussions because on its way through the broken mountaineous topography and furrowed karst it forms three larger and several smaller border pockets. On the top of it, its visibility is poor due to numerous vineyards and fields. There are two border crossings here: one in the South near Vinice, and the other in the North at Metlika.

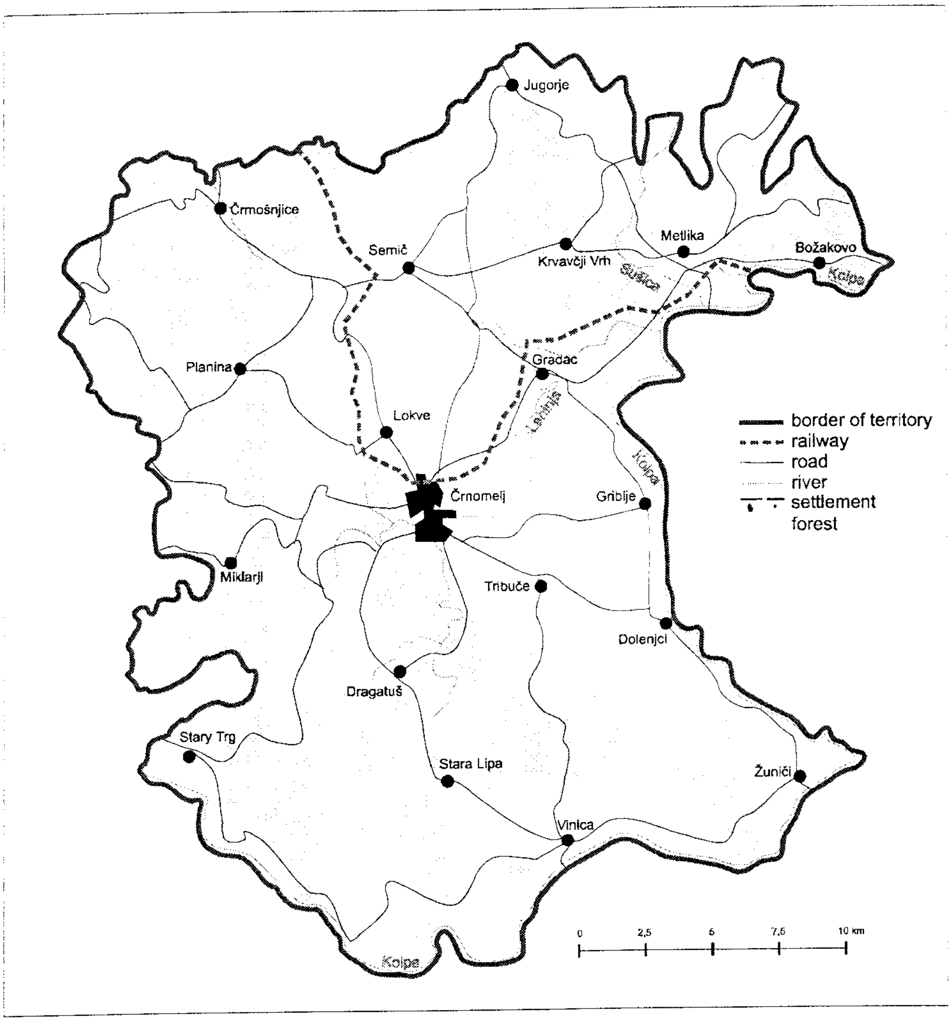

Fig. 7 Bela Kraina - area under study

cultural environment. In addition to these refugees, the immigration element is also represented by Roma who have settled at four places in Bela Kraina.

Bela Kraina is an unambiguously depopulated area. Mass emigration occurred in the second half of the 19th century due to agrarian overpopulation and it was channeled particularly to the U.S.A. and later to industrial areas of West Europe. After World War II, the emigration flow was directed to the towns of Ljubljana and Novo Mesto, low number of inhabitants emigrated to Croatia. Numerous gastarbeiters from Bela Kraina still work in Germany, Switzerland and Austria.

The existing economy is represented by processing industries and various kinds of services which are localized along the major traffic veins and in larger settlements. The new border represents a strong impuls for a more intensive development of tertiary sector in rural areas, particularly of those adjacent to the border.

As to landscape forms the region opens into Croatia from which it is distinctly separated by the river Kolpa. Due to numerous flour and saw mills the river was a contact line rather than a division. In the past times, the contacts over the border used to be lively. In spite of having been linked with mainly large Slovenian towns in terms of administration, culture and education, local inhabitants did their shoppings over the border and worked on the other side of the border. Only very seldom they studied at Croatian secondary schools or universities.

With its population density of 45 inhabitants per km^2 Bela Kraina ranks with the least populated Slovenian regions. There are only two more densely populated belts here of which one is in the western part of the area at the foot of Kočevski Rog Mts. (vine-growing area) and the second is situated in the northern part in the surroundings of Metlika. The degree of urbanization is low and there are only two settlements of urban character here: Črnomelj (5 000 inhabitants) and Metlika (2 000 inhabitants). Origin of the population is diverse since many refugees - mainly Serbs from territories of Croatia and Bosnia - have found their new homes in the area since the times of Turkish invasion. This had a great influence on the formation of cultural landscape, language and

3.6 The Sava Basin area

The basin of Sava River is a small geographical and spatial unit representing 4.5 % of Slovenian territory and 3.7 % of total Slovenian population (Fig. 8). It is situated in the SE Slovenia along the border with Croatia and consists of three municipalities of which largest is Krško with 344 km^2 and 28 576 inhabitants, and Brežice with 268 km^2 and 24 724 inhabitants. With the population density of 92.3 inhabitants per km^2 is the Brežice municipality most densely populated area in the region. Nevertheless, even this density value is below the Slovenian average. Census data indicate a certain stagnation in the post-war period with the growth index for 1991/1948 being 103.3 %.

The Sava Basin region is dominated by the lowland along the Sava River. Higher and hardly passable ridges of the Posavsko hribovje Mts. strictly separate the Sava Basin region from the eighbouring region of Savinjsko. On the other side the lower Krško Mts. and a valley along the river Krka form a less pronounced partition from the regions of Dolenjsko and Novo Mesto.

The territory is divided in the middle into two identical parts near Sava along which run the main railway and a regional road of similar importance. In general, the belt along Sava, in other words the centre of Krško-Brežiško polje lowland, represents an important development axis whose various production activities come lately to the fore. Another important traffic vein is a „highway" link between Ljubljana and Zagreb, which connects the country centre with the two centres of Sava Basin.

The region is typical of extensive inundated areas that take up over a quarter of the Krško-Brežiško polje lowland. All three main rivers of Sava, Krka and Sotla exhibit periodical floods similarly as their tributaries, particularly those flowing out of the Krške gorice Mts. and Bizeljske gorice Mts. Extensive floods are also regular in the area of Krakovski gozd.

48 % of the Sava Basin region is formed by rural land which is concentrated mainly in the lowland of Krško-Brežiško polje and along the river Sotla where conditions for agricultural production are most favourable and the rural land takes up more than 70 % of the total area. The Sava Basin upland on the right bank of Sava River has rather poor conditions for agriculture. In the municipality of Sevnica the conditions are most favourable in the Sevnica basin and around Senov. Due to good climatic and soil conditions the majority of slopes in the norther parts of Brežice and Krško municipalities are covered with orchards and vineyards. Here are the most famous vine-growing districts of Bizeljsko and Sremic and the sunny slopes of Gorjanci.

The Sava Basin region has no clear regional centre since the region is not homogeneous enough. The role of municipal centres is divided between Krško and Brežice. Brežice with its tertiary and quaternary infrastructure (hospital, secondary school) came up as a regional centre during the first post-war years. However, due to the faster industrial growth and important functions for power industry as a seat of nuclear power plant, Krško became an even more important centre. Central regional functions have not developed due to relative closeness of other centres because demographical and economic standards of the territory are lower, and partially also due to the borderland character of the region and the long-term metropolitan influence of Zagreb.

Compared with other Slovenian regions the Sava Basin region can be distinguished by the following characteristics:

- the population is lower than in the neighbouring regions of Celje and Dolenjsko but higher than in Zasavsko,

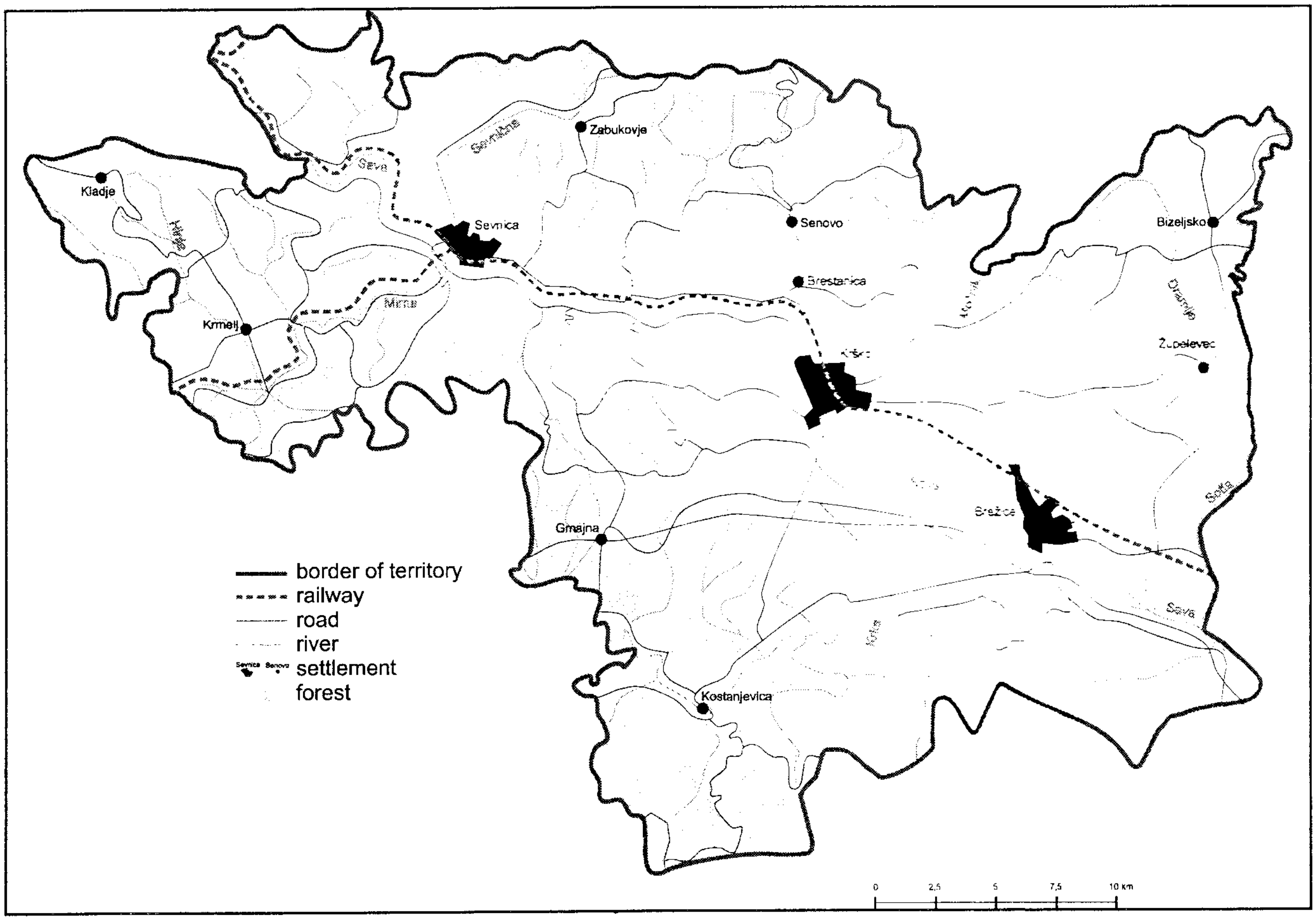

Fig. 8 The Sava Basin region - area under study

- the number of jobs is between a third and a half of those in Dolenjsko and Celje,
- different sizes of regional centres can be the best illustration: Celje, Novo Mesto and Trbovlje are six-, three, and more than two-times larger than Krško or Brežice.

The number of urban population hardly exceeds a quarter (26 %) of total population. The growth of towns was relatively slow, which corresponds with a rather small gravitational background but does not correspond with other generally favourable conditions such as a good location near the important traffic corridor, a great surplus of jobs, and not just a poor standard of industrialization. In the comparison with neighbouring regions the urban centres in the Sava Basin area are smaller and their offer of jobs is lower and less diversified. Also, there is no genuine regional centre because Krško and Brežice compete with each other rather than cooperate. Therefore, in terms of services of medium and higher standard the area is linked with the centres of Novo Mesto, Celje (and Zagreb) in many aspects.

Values of many economic and geographical indices are below the Slovenian average and below the average of neighbouring regions. Economic power of the region declines, the old structure falls into pieces while the new one comes up at a far much slower pace than elsewhere in the country. Analyses of developmental potentials indicate that the municipalities of Krško and Brežice rank with a group of municipalities with the below-average developmental potential and Sevnica belongs in the municipalities with the most below-average developmental potential. The analyses confirmed that Sevnica and Krško belong in the group of centres with an unambiguous orientation to secondary activities and Brežice in the group with a weak orientation to tertiary activities. Due to the economic recession which has been lasting many years, regional disparities of the Sava Basin area increase in the comparison with central Slovenia. Typical of the region is a mixture of the more or less unfavourable economic and qualification structure contrasting with satisfactory infrastructure facilities. Striking are industrial areas with structural and environmental problems, high unemployment as well as rural areas with the decreasing population, poor population mobility, emigration of young generation, etc.

3.7 The Lower Drava Basin area

The area under study occupies 1038.6 km^2 and consists of 11 municipalities situated in the NE Slovenia: Ptuj, Kidričevo, Majšperk, Videm, Zavrč, Gorišnica, Dornava, Juršinci, Desternik-Trnovska vas, Ormož and Ljutomer (Fig. 9). Landscape ecological features include two landscape types otherwise typical of the whole Sub-Pannonian and Pannonian Slovenia: vast lowlands along the rivers of Mura and Drava, which are dissected by large gravel-clay terraces, and between them relatively low hills in long ridges divided by narrow valley along larger water streams. The hills are formed mainly by Miocene marl and sand sediments, valley floors mainly by clay and clay-sand alluvia. This is why they are wet and exposed to numerous floods. Favourable geomorphological and climatic conditions (av. altitude 251 m, av. slope 6°, av. received solar energy over 4100 MJ/m^2) affect a relatively dense but not evenly distributed population (101 inhabitants/km^2) and intensive agricultural utilization of land. Fields and vineyards take up 11 % and 3 %, respectively, of the total acreage and surmount three times the Slovenian average while the percentage of forests (2 %) is by nearly a half lower. Significant from the viewpoint of arable land are lowlands along Drava and Mura, and vineyards in Slovenska gorica and Haloze.

Settlements are localized on slightly raised warmer valley edges, on ridges and elevated places where they are safe from floods as well as from frequent soil slides. The landscape diversity is further accentuated by great differences in land utilization between usually cultivated, sunny, southern, south-eastern and south-western slopes, and slopes with no sun that are mostly covered with forests.

According to the last census made in 1991, there were 104 826 inhabitants in the area. Population trends studied over the last thirty years indicate that the majority of municipalities exhibit negative trends as none of them was capable of maintaining natural rise in population in its area. Even the two largest municipalities of Ptuj and Ljutomer, where the population shows a slight increase, maintained less than a half of their natural rise of population.

The area suffers from a relatively high surplus of agricultural work and unemployment of industrial workers. According to the last census, a good quarter of population lives on farms. An average farm in this area is smaller than the national average and 34 % of all working inhabitants are employed in the primary sector.

Location of industries in the region is extremely uneven with the highest concentrations in Ptuj, Ljutomer and Ormož and some rural areas with no industrialization at all. Main factors for the localization of industries are the locations near Drava, main motorway and railway. Active population employed in the industry amounts to 26.8 % (census 1991) while the national Slovenian average is 35.7 %. Of the industries, most usual is food production which directly relates to the agricultural background, metal processing and metallurgy with high demands of power generated by hydroelectric power plants on the river Drava, and the textile industry. Two thirds of industrial plants employ less than 250 persons.

Importance of the area for tourism in Slovenia is gradually increasing. Tourism is focused on some specific types of recreation such as cultural and educational travelling connected with the rich cultural heritage, and

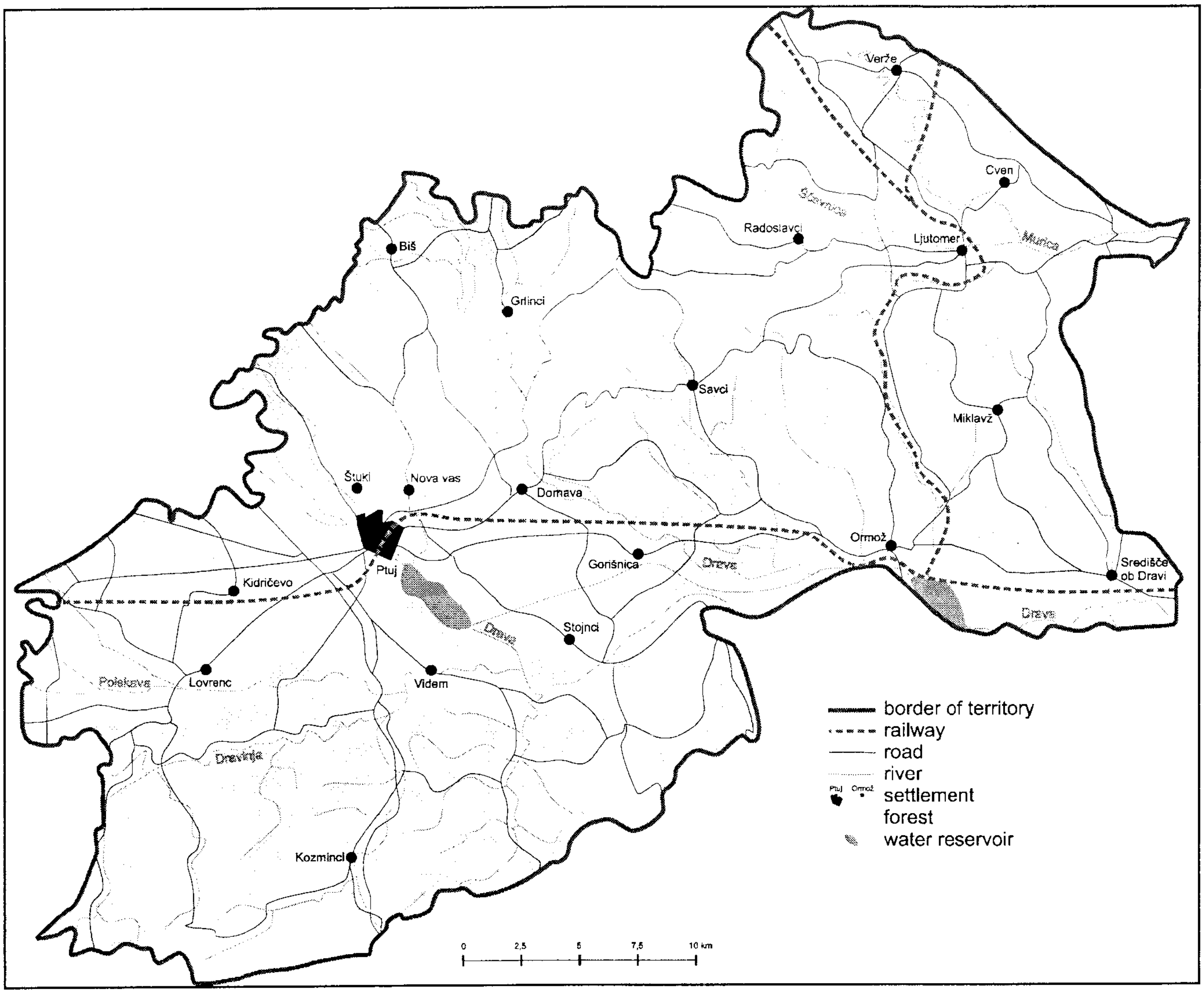

Fig. 9 The Lower Drava Basin region - area under study

agrotourism which indirectly stimulates restoration and maintenance of rural landscape.

The area can be roughly divided into three gravitational backgrounds of three urban centres: Ptuj, Ormož and Ljutomer which are not only the biggest centres in terms of job opportunities, supply and education, but also seats of communities. This is why they have still retained many administrative and central functions of general character.

The lowland part of the area under study struggles with problems concerning an uncontrolled communal infrastructure, excessive use of chemicals in agriculture in consequence of which underground waters are contaminated and hence also one of the largest reservoirs of drinking water in Slovenia, uncontrolled expansion of settlements, etc. The part of uplands and hilly lands in this area has to face problems of depopulation, abandoned cultivated land and insufficient infrastructure. Difficulties also appear in connection with the new state border which affects nearly the whole area woth any future colonization and life itself having become practically dangerous in the Haloze Mts. The difficulties can be relieved or cured only by means of a new conception which would advocate an over-border interconnection of borderland areas that would meet all necessary basic requirements of local population in the case of border opening to facilitate all advantages of living on the border.

Present traffic across the newly established border is of mainly local character. There are only three international border crossings operated for international transport (Gruškovje, Središče nad Dravou, and Zavrč). The highest percentage of the traffic is represented by motorcars of Croatian citizens who cross the border in order to do shopping or work in Slovenia. The analyses showed that the borders do not have any significant influence on the change of traffic stream channeling but only make the travelling longer.

Openess of the borders in the former common state facilitated intensive population flows across the border. If the farmer left his land in the Slovenian territory along the border in order to work in the industry or just move elsewhere, the farm was usually purchased by his Croatian neighbours. The majority of bilateral land owners is localized along the border section whose line was altered several times after the fall of Austria-Hungary.

4. Hypotheses

There is a typical barrier characteristic for each of the model areas under study, which represents a limitation to their prosperity. In the majority of cases, this barrier is the state border with some additional factors. Each of the model regions is different from the viewpoint of its economic and population structures. Their com a subsequent economic fall of the region, its depopulation, idle rural land and final loss of landscape-forming function of agriculture and population.

A solution can be seen in a concept of sustainable development, which plans the development rather in its qualitative plane and in agreement with environmental requirements. However, application of the idea in actual practice meets with permanent conflicts of different kind and conflicting interests under permanently changing conditions. Sustainable development can be considered an ideal framework rather than guidelines for an activity. Therefore, its application in each of the regions and at any time will be different.

One of typical features of market economy is regional differentiation within the framework of which there are both rich and poor regions coming into existence. We have to abandon an idea of marginal regions being rich. On the other hand, even here there are people living and companies doing well. It follows that there must be some reasons for their staying or for a new localization of human activities in these areas. We assume that marginal regions should not become a target for development but a target for such a standard of prosperity that would be capable of ensuring their proper functionality. As to terminology, it would therefore be not the sustainable development but rather the sustainable prosperity - within normal fluctuations of market economy, though.

In this context, the major decisive factor will be man with his adaptability to changing conditions, his motivation, skills and capabilities. Extreme engagement of the man can conquer even the marginal conditions. Thomas Baťa, the popular Czech entrepreneur of the period between the wars, built his first factories as a rule in marginal regions of the then Czechoslovakia in order to give birth to a world-wide shoe-making empire. However, in common life it is other entities that run their activities in marginal regions: small and medium-size entrepreneurs, local councillors, intelligentsia, people of younger and medium age categories. Not even the best programme of prosperity can be fulfilled without these human subjects.

The most important impuls to launch the programme of prosperity in a region is to define its idea, to find region identity and to work out the programme. Idea of the region consists in finding its place within the regional structure, in determining the sense of its existence and in defining the goal for common efforts. Identity of the region as well as identity of any municipality is a necessary condition for restoring positive effects of rural style of life - high standard of social control, collaboration between neighbours, awareness of unity with the village and region. An efficient and long-term programme will have to define methods of how to make use of the already existing potentials in regions, and the support from outside should be directed to further development of these potentials rather than to consumption.

A compromise will have to be worked out between the concerns of local population with its requirements for life standard and concerns of countries and wider (also international) community in utilization of the given area.

5. Conclusions

New Prosperity for Rural Regions - it is an economic, social and scientific problem of the present time and future. Differentiation of economic success achieved by not only persons and companies but also by regions is a natural attribute of market economy. Economic and social failure of some areas is extremely unfavourable for the country since the government has to adopt a scheme of regional redistribution of finance. Regions situated on the state border deserve attention not only from the viewpoint of their own prosperity but also from the viewpoint of the role which they play in contacts between countries.

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IMPACT OF SOCIO-ECONOMIC ACTIVITIES ON THE LANDSCAPE IN THE CATCHMENT AREA OF ŘÍČKA

Pavlína HLAVINKOVÁ

Abstract

Diverse geological and geomorphological structure and climate are two main factors conditioning colourful representation of soils and vegetation in the catchment area of Říčka. The different natural conditions were then reflected also in ways by which the man used the landscape. The area of lower reach of the river, with a relatively only little broken topography and very favourable climate and soils has been converted into the landscape with intensive agricultural production in which only a few environmentally important landscape segments were retained. This is the reason why it is necessary to stabilize the landscape from the ecological point of view. In contrast, the spring area of Říčka and its main affluents, whose topography is much more broken, has preserved its original forest character to considerable extent and could be considered a nearly stable landscape from the ecological point of view. Its ecological potential can be illustrated by the status of Protected Landscape Area given to the Moravian Karst and that of Nature Park granted to the Říčka catchment area.

Shrnutí

Různorodá geologická a geomorfologická stavba v povodí Říčky podmínila spolu s klimatem pestré zastoupení půd a vegetace. Tyto odlišné přírodní poměry se pak odrazily i ve způsobu využití krajiny člověkem.

Oblast dolního toku, relativně málo členitá, z hlediska klimatu a půdního zastoupení velice příznivá část byla přeměněna na intenzivně zemědělsky využívanou krajinu, v níž se zachovalo jen nepatrné množství ekologicky významných segmentů krajiny, a je proto nutné ji z ekologického hlediska stabilizovat.

Naopak pramenná oblast Říčky a jejích hlavních přítoků, jež je daleko více členitá, si zachovala do značné míry svůj původní lesní charakter a je možné ji z ekologického hlediska považovat za krajinu téměř stabilní. Její ekologický potenciál potvrzuje rovněž statut CHKO Moravský kras a Přírodní park Říčky.

Key words: catchment area of Říčka River, Protected Landscape Area of Moravian Karst, Nature Park of Říčka, EILS - ecologically important landscape segments, karst phenomena, forest type groups, anthropogenic impacts, proposals for landscape reconstruction

1. Introduction

Past efforts in this country were aimed at the most intensive utilization of natural potential by human society. Possible impacts of these methods of management such as surplus fertilization, reclamation, straightening of water streams, deforestation or forestation with inappropriate tree species composition were not sufficiently taken into account. Therefore, the so called ecological area planning becomes an important necessity at present when efforts aimed at the repair of the damages increase hand in hand with the increasing environmental awareness.

Deeper knowledge of the environment damage, undesirable localization of human activities, excessive utilization by agriculture and forestry, and of all kinds of pollution serves as a basis for regeneration and subsequent protection of the area in question. Programmes of the future landscape development can then be set up based on these data.

Possible reconstructions of the present cultural landscape with regard to its topical use were suggested on an example of the Říčka River catchment model area after evaluation of natural conditions. The paper is based on author's dissertation (Hlavinková, 1995), worked out under the leadership of doc. RNDr. A. Hynek, CSc., Department of Geography, Faculty of Natural Sciences, Masaryk University in Brno, and represents main achieved results.

2. Model area

The catchment area of river Říčka (approx. 145 km^2) as an integral whole with natural boundaries was chosen as a model area which is adjacent to the eastern limits of Brno and represents a typical interface be-
Fig. 2) by a frequent alternation of deeply incised val

a character of broken upland. The terrain declines towards the South in order to pass a stage of hilly lowland and gradually blend into a relief of river terraces in the surroundings of Brno. This is why the terrain forms in the southern (graben) section of the catchment area, built of mainly Neogene and Quaternary sediments, can be characterized as soft - where mild slopes with slow gradient changes separate individual shallow valleys. An exception from this general character of topography can be considered elevations near Brno, built of Lower Carbonian conglomerates (e.g. Žuráň, Santon) and further to the South small isles of Neogene lithotamnial limestones (e.g. Pracký hill). In general, the Brno surroundings are characteristic by mutual mingling of these forms in the contact zone between the Bohemian Massif and the Carpathians (Fig. 2).

Attractiveness of the area is further enhanced by caves occurring in Devonian limestones (e.g. Ochozská c., Pekárna c., Malčina c., Švédův stůl, Netopýrka c.), connected with each other by underground water streams of Říčka, Hostěnický and Ochozský brooks. The complex of caves offers other accompanying karst phenomena such as sinking depressions near Hádek and Hostěnice and springs of the mentioned water streams including the so called Hádecká estavella and other small karst phenomena (karren). Varied plant communities in the model area are conditioned by the location on the interface of Hercynian hilly land flora district (Hercynikum submontanum) and the district of Moravian Pre-Carpathian flora (Praecarpaticum moravicum) (Dostál in Vaněčková, 1983), as well as by varied site conditions.

Geological parent rock, relief form, varied valley depth and width, different aspect, sloping, soil type (most frequent are kambizems, dominating mainly in the non-karst area of Lower Carbonian age, combined with rankers and pseudogleys at some places; rendzinas characteristic for the territory of Devonian limestones and conglomerates (karst); luvisols which melt into chernozems in the South, typical for loess and loess loam covers; fluvisols and gleys blending into Fluvigleyic Phaeozems in the South, characteristic for valley floors thanks to alluvial regime) and topoclimate (particularly affects of sun aspect, air humidity and temperature, and soil water content and temperature) - all this generates very different conditions for plant growth in the given area and conditions intermingling of species spreading from neighbouring floristic zones.

Original forest communities representing altitudinal vegetation zones 1 through to 4 in the SN direction were those of extensive deciduous forests melting into forest-steppe to steppe communities towards the South and communities of alluvial plains and floodplain forests with wetland vegetation.

Beech stands, at some places with an admixture of fir, were the original forest type of platforms at higher altitudes (450 m and up). Oak-beech stands (400-450 m) and beech-oak stands (350-400 m) were then characteristic of lower altitudinal zones and blended into oak-hornbeam woods (300-350 m) in the South (towards the edge of the Bohemian Massif).

Some beech stands still occur at the higher altitudes but with much fewer firs. At many a place these beech stands were replaced by mixed forests with the most frequent representation of Quercus petraea, Fagus sylvatica, Carpinus betulus, Picea abies and Larix europaea, or by pure coniferous stands of mainly Norway spruce. The typical beech stands were preserved only at some places to the west of Březina and on slopes in the Říčka River spring area.

The oak-beech stands are often combined with demanding broadleaved species such as Tilia platyphylla, Tilia cordata, Acer platanoides and Acer pseudoplatanus.

The oak-hornbeam woods are disturbed by the plantation of other tree species (Pinus sylvestris, Picea abies) to a lesser extent than the forests in the spring area. Represented are mainly Quercus petraea with Quercus robur, and also Carpinus betulus takes up a considerably large area. Shrub and herb understoreys are abundant and varied. The transition of oak-hornbeam woods into acidophile and subxerophile oak stands well shows in the greater occurrence of Acer campestre and Sorbus torminalis.

Valley slopes have a colourful mosaic of plant communities whose composition is affected by different aspects as well as by different stages of talus stability. In addition to the aspect, shade plays also a very important role. Many times, the aspect influence can be seen only in the upper part of the slope since the lower part is shaded by the opposite slope. The area exhibits inversed altitudinal vegetation zones and therefore great differences are found in the local relief as to the composition of vegetation even on very tiny areas. Talus forests are preserved only at sporadic places, mainly at the foot and on the steep slopes of canyon-like karst valleys. Forest type groups of lime-, hornbeam- and beech-maple stands and maple-ash stands can be

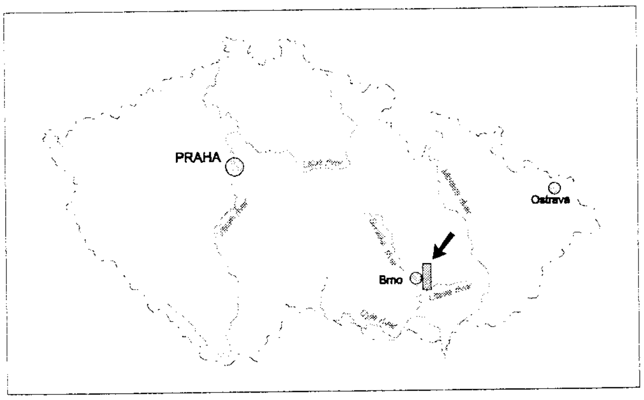

Fig. 1 Model area of Říčka catchment

found on the shaded slopes. Major tree species of these talus forests are Acer platanoides, Acer pseudoplatanus, Fraxinus excelsior, Tilia cordata and Carpinus betulus.

The maple-beech-oak stands occur in lower parts of sunlit slopes with mostly southern aspect, which gradually blend into communities of beech-oak stands up the slope.

Xerothermic communities developed on shallow soils (mainly on rendzinas). The sites are of forest steppe character with a usually opened shrub layer and a closed herb cover with the rich species composition.

Dogwood-oak stands occur at the warmest and driest places with abundant representation of Quercus petraea and Cornus mas. Of determinant species let us mention Sorbus torminalis, Carpinus betulus, Tilia cordata, Tilia platyphyllos, Ulmus carpinifolia, Acer campestre, Crataegus oxyacantha and Prunus spinosa.

Some areas occur in the southern part of the Protected Landscape Area of Moravian Karst, in which the composition of tree species has been more or less preserved and maintained in optimum balance corresponding with original natural conditions. This was the reason to establish small-scale protected landscape areas such as National Nature Preserve of Hádecká planinka [1], Nature Preserve of Říčka valley [5], National Nature Relic of Pekárna [4], Nature Relic of Březinka [6], Nature Relic of Hornek [2], and Nature Relic U staré vápenice [3] (Fig. 4).

In the southern part of the catchment area, which is intensively used for agricultural production all remaining near-natural vegetation has irreplaceable ecological and aesthetic functions as a fauna refuge and nesting area.

The majority of forest-steppe and steppe vegetation remainders is bound to isolated elevations formed by Culmian conglomerates, possibly also to their southern slopes or top flats. Main representation is that of grass-herbal communities with the occurrence of thermophilic and xerophylous species of which examples are Verbascum austriacum, Pulsatilla grandis, Allium flavum, Geranium sanguineum, Iris pumila, Asplenium trichomanes and various Cyanus species. Of shrubs, frequently represented are Crataegus sp., Prunus spinosa, Rosa canina, Cornus mas, Rosa dumetorum and Euonymus verrucosa. The most important localities were announced protected areas: Nature Preserve of Velatická conglomerate hillside [7], Nature Relic of Horka [10], Nature Relic of Návrší [11], Nature Relic of Santon [9], and Nature Relic of Vinohrádky [8] (Fig. 4).

Forest and forest-steppe communities (e.g. in the area of Nature Relic Velký Hrádek [12] and in the area of Nature Relic of Andělka-Čertovka [13]) (Fig. 4) with prevailing Quercus petraea and Carpinus betulus, and with the admixture of other species such as Acer campestre, Acer platanoides, Fraxinus excelsior and Ulmus carpinifolia can be found on slopes with other aspects. Frequent shrub representatives are Sambucus nigra and Euonymus europaea, dominating undergrowth species are Corydalis cava, Polygonatum officinale, Anemone ranunculoides, Anemone nemorosa, Ficaria verna, Viola sp. and other. An undesirable admixture in these forests (prevailing at some places) is Robinia pseudoacacia. Thanks to former efforts aimed at the forestation of forest-steppe slopes with this species, there are gradually ever fewer suitable places with the xerothermophilic steppe vegetation. and the steppe fallow land communities exhibit degradation and finally total decay.

Communities with Alnus glutinosa, Fraxinus excelsior and Salix sp. the undergrowth of which includes a wide range of wetland herbal species can be found in narrow alluvial plains along smaller water streams.

The Říčka River valley itself as well as valleys of larger affluents such as Hostěnický, Ochozský and Roketnice brooks is not forested in its greater part with forest sections occurring only in the vicinity of spring areas and in the area of Moravian Karst. The flat valley of upper Říčka is characteristic by wet to waterlogged meadows with natural meadow to wetland communities where some endangered plant species still can be seen such as Leucojum vernum, Trollius altissimus, Primula elatior, Dactylorhiza majalis, Iris sibirica and other. However, these meadows gradually change into cultural meadows by human activities (land drainage and grazing).

Tiny remnants of floodplain forests with the greatest representation of Alnus glutinosa with admixtured Fraxinus excelsior, Acer platanoides, Tilia cordata, Salix sp. and Populus sp. can be found in the lower reach of Říčka. Robinia pseudoacacia is an undesirable species similarly as in the forest communities. Permanent grasslands which are often waterlogged can be seen at some places in valleys with narrow alluvial plains.

The remaining area of Říčka catchment is inhabited by intravillan communities of field crops. gardens, orchards, vineyards and fallow lands - all with an admixture of ruderal vegetation and all impacted by anthropogenic activities.

In the part that is in direct touch with the Brno conurbation the two landscape types and their components combine in order to form a very colourful mosaic.

5. Present use of cultural landscape in the Říčka catchment

The different natural conditions in various parts of the catchment area greatly affected utilization of the landscape by man and hence the formation of varied types of cultural landscape. The following landscape

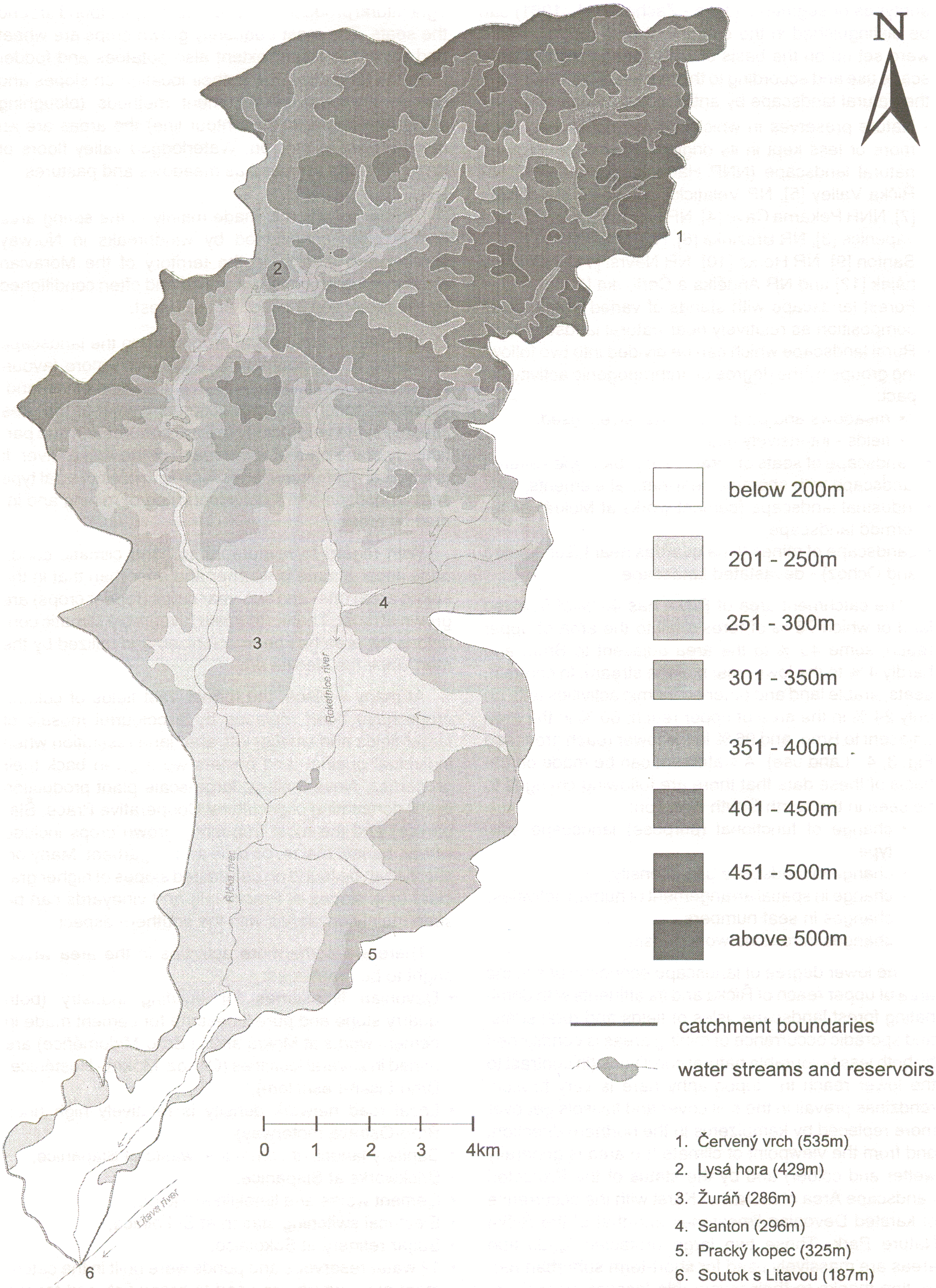

Fig. 2 High diversity of the Říčka catchment area

subtypes or segments (Jůva - Zachar et al., 1981) can be distinguished in the catchment under study, which were set up on the basis of data concerning the landscape use and according to the degree of disturbance of the natural landscape by anthropogenic activities:

- Nature preserves in which the vegetation has been more or less kept in its original natural condition as natural landscape (NNP Hádecká planinka [1], NP Říčka Valley [5], NP Velatická conglomerate hillside [7], NNR Pekárna Cave [4], NR Hornek [2], NR U staré vápenice [3], NR Březinka [6], NR Vinohrádky [8], NR Santon [9], NR Horka [10], NR Návrší [11], NR Velký hájek [12] and NR Andělka a Čertovka [13]).
- Forest landscape with stands of varied tree species composition as relatively near-natural landscape,
- Rural landscape which can be divided into two following groups by the degree of anthropogenic activity impact:
  - meadows and pastures - extensively used,
  - fields - intensively used,
- Landscape of seats of rural or suburban type - altered landscape with sporadic near-natural elements,
- Industrial landscape (cement works at Mokrá) as reformed landscape,
- Landscape of mines (lime quarries near Líšeň, Mokrá and Ochoz) - devastated landscape.

The catchment area of Říčka has 40 % of forested land of which 76 % of forests fall to the area of upper reach, some 40 % to the area adjacent to Brno, and hardly 4 % to the lower reach of the stream. In contrast, seats, arable land and other economic activities take up only 24 % in the area of upper reach, 60 % in the area adjacent to Brno, and 96 % in the lower reach area (see Fig. 3, 4 - Land use). A statement can be made on the basis of these data that there are following changes to be seen in the North-South direction:

- change of functional (purpose) landscape subtype,
- change in landscape use intensity,
- change in spatial arrangement of human activities,
- changes in seat numbers,
- changes in road network density.

The lower degree of landscape economic use in the area of upper reach of Říčka and its affluents with dominating forest landscape, isles of fields and rural seats, and sporadic occurrence of mining areas is conditioned by both less favourable natural conditions (in contrast to the lower reach the topography here is very broken, rendzinas prevail in the soil cover and luvisols get ever more replaced by kambizems in the northern direction, and from the viewpoint of climate the area is generally wetter and colder) and by the status of the Protected Landscape Area of Moravian Karst with the occurrence of karsted Devonian limestones and that of the Říčka Nature Park. These two large protected landscape areas are massively used for short-term suburban recreation thanks to their favourable location near Brno, good access and attractive environment. Areas used for agricultural production (fields) can only be found around the seats. The most frequently grown crops are wheat and barley, to lesser extent also potatoes and fodder mixtures for cattle. Due to their location on slopes and due to improper management methods (ploughing along perpendicular to contour line) the areas are an easy subject to erosion. Waterlogged valley floors of larger streams are used as meadows and pastures.

Timber extraction is made mainly in the spring area and is often conditioned by windbreaks in Norway spruce pure stands. In the territory of the Moravian Karst logging is strictly controlled and often conditioned by the protection function of the forest.

The rate of agricultural production in the landscape increases in the southern direction with more favourable natural conditions. Intensive utilization of the landscape for agricultural production is typical of the area situated in the very vicinity of Brno conurbation and particularly of the area of lower reach of the Říčka River. It is a typical agricultural landscape with isles of rural type seat landscape and local occurrence of mining and industrial areas.

With regard to favourable soil and climatic conditions (local climate is warmer and drier than that in the spring area) one- and two-year crops (fodder crops) are grown at most. Thanks to these favourable climatic conditions the area has been colonized and utilized by the man since the Neolite era.

At many a place, the former vast fields of cultural crops have been replaced by a colourful mosaic of larger fields and smaller lots after land restitution when individual original land owners were given back their properties. Nevertheless, large-scale plant production is still dominating (Agricultural Cooperative Prace, Šlapanice) and the most frequently grown crops include wheat, barley, maize, oil rape and sugarbeet. Many orchards can be found on deforested slopes of higher gradient (e.g. slopes of Pracký hill) and vineyards can be seen mainly on slopes with the southern aspect.

There are some more activities in the area which ought to be mentioned:

- Devonian limestones for building industry (both quarry stone and pure limestone for cement made in cement works at Mokrá and in Brno-Maloměřice) are mined in several localities (Ochoz, Mokrá - Hostěnice, Brno-Líšeň-Lesní lom).
- Local road network density is relatively high (incl. Brno-Ostrava motorway).
- Sanitary landfill of communal waste at Šlapanice,
- Brickworks at Šlapanice,
- Cement works and limekiln at Mokrá,
- Electrical switching station at Sokolnice,
- Sugar refinery at Sokolnice,
- 12 water reservoirs and ponds were built in the catchment area, which are used to breed fish and for rec a respect and it is unfortunately negative rather than

positive. The possible anthropogenic impacts on the landscape were divided into groups by causal activities as follows:

Agriculture and forestry

- Use of pesticides in agricultural production (original species disappear, the original trophic chain is disturbed, which results in disturbed ecosystem balance).
- Conversion of wetland meadows and spring areas of Říčka into pastures and cultural meadows. Drainage of these meadows results in accelerated run-off from the landscape, in the dropping underground water table and hence in drying out of soils and vegetation change (some wetland species such as Leucojum vernum, Trollius altissimus and many other show permanent decline).
- Grazing and cutting of these meadows gradually result in altered species composition of grass communities.
- Excessive fertilization - pollution of underground and surface waters (washings).
- Employment of heavy machinery in forestry and agriculture - soil degradation and compaction.
- Deforestation results in excessive erosion.
- Aforestation and improper choice of tree species (spreading stands of non-autochthonous Robinia pseudoacacia in the southern part, plantation of Norway spruce pure stands in the northern part) results in degradation and gradual liquidation of original communities (steppe and forest-steppe vegetation, floodplain and deciduous forests).
- Ill-considered aforestation or deforestation result not only in the liquidation of certain plant or animal species but also in the general disturbance of natural balance, which may result even in changed site conditions.

Industry and mining

- Generation of gaseous air pollutants and wastes from industrial production (cement works at Mokrá generate a considerable amount of dust articles which are deposited in the surrounding landscape) - pollution.
- Air pollution with gaseous and dust pollutants:
  - The largest source of dust and gaseous air pollution are the cement works and limekiln at Mokrá, which generate as much as 2028 tons of dust each year with fitful concentrations of dust exceeding 2000 $\mu g.m^{-3}$ in the areas of Hostěnice, Mokrá, Pozořice and Sivice (Hudec - Husák - Jatiová et al., 1995).
  - The sugar refinery at Sokolnice is a smaller air pollution source with 174 tons of SO_2 per year (Hudec - Husák - Jatiová et al., 1995).
- Landscape devastation due to mining (big limestone quarries near Mokrá, Hostěnice and Ochoz).
- Change of relief forms from natural into anthropogenic due to mining, waste depositions destroy the original landscape appearance and deteriorate its aesthetic value (quarries, landfills, spoil banks).

Building

- Built-up areas which were originally forest or grass lands.
- Ever increasing building activities near seats and main roads result in the shrinking arable land (service station Rohlenka and its background, ever increasing numbers of petrol stations, warehousing and production facilities near Šlapanice and Brno-Slatina).

Water management

- Straightening and regulation of water streams especially in the lower reach of Říčka (Tvaroženský brook, Roketnice b. and Prachý b.) leads to increased water erosion.
- Drainage and irrigation - change of vegetation, salinization.

Recreation

- Building of summer houses in garden plot colonies in the Protected Landscape Area of Moravian Karst and the Nature Park of Říčka (e.g. near Muchova bouda and Bělkův mlýn, at Hádek etc.) has already been put under control - decrease of landscape aesthetic function, occurrence of black dumps.
- Unrestrained movement of holiday-makers in forests and their regardless conduct and lacking discipline lead to anthropogenic erosion, picking and liquidation of some plant (mainly protected) species such as Iris pseudacorus, Leucojum vernum, Galanthus nivalis etc.
- Problems with access to summer houses by transport means (car entrance into the Protected Landscape Area and the Nature Park, parking).

The list of anthropogenic impacts on the landscape in the catchment area of Říčka could continue so that we eventually get aware of all their negative consequences. However, the above list should be a sufficient tool to help us in drawing of our own picture about the landscape disturbance.

In general, the influence of human society on the landscape has so many aspects that it would not be recommended to consider each of them individually. They all have to be assessed as a whole complex issue. A question still remains, however, whether the human society is capable of curing the already existing damages or at least prevent further devastation of the landscape.

A proposal of reconstructions in the cultural landscape

The different physical and geographical conditions of the upper and lower reaches of Říčka led to different formation of cultural landscape in the two areas during the long-term evolution and hence to different methods of their use.

From the ecological point of view, the upper reach catchment area is in a good state of preservation, i.e. it is less affected by anthropogenic activities than the lower reach catchment area. However, even this fact could be cast doubts upon as this northern part has

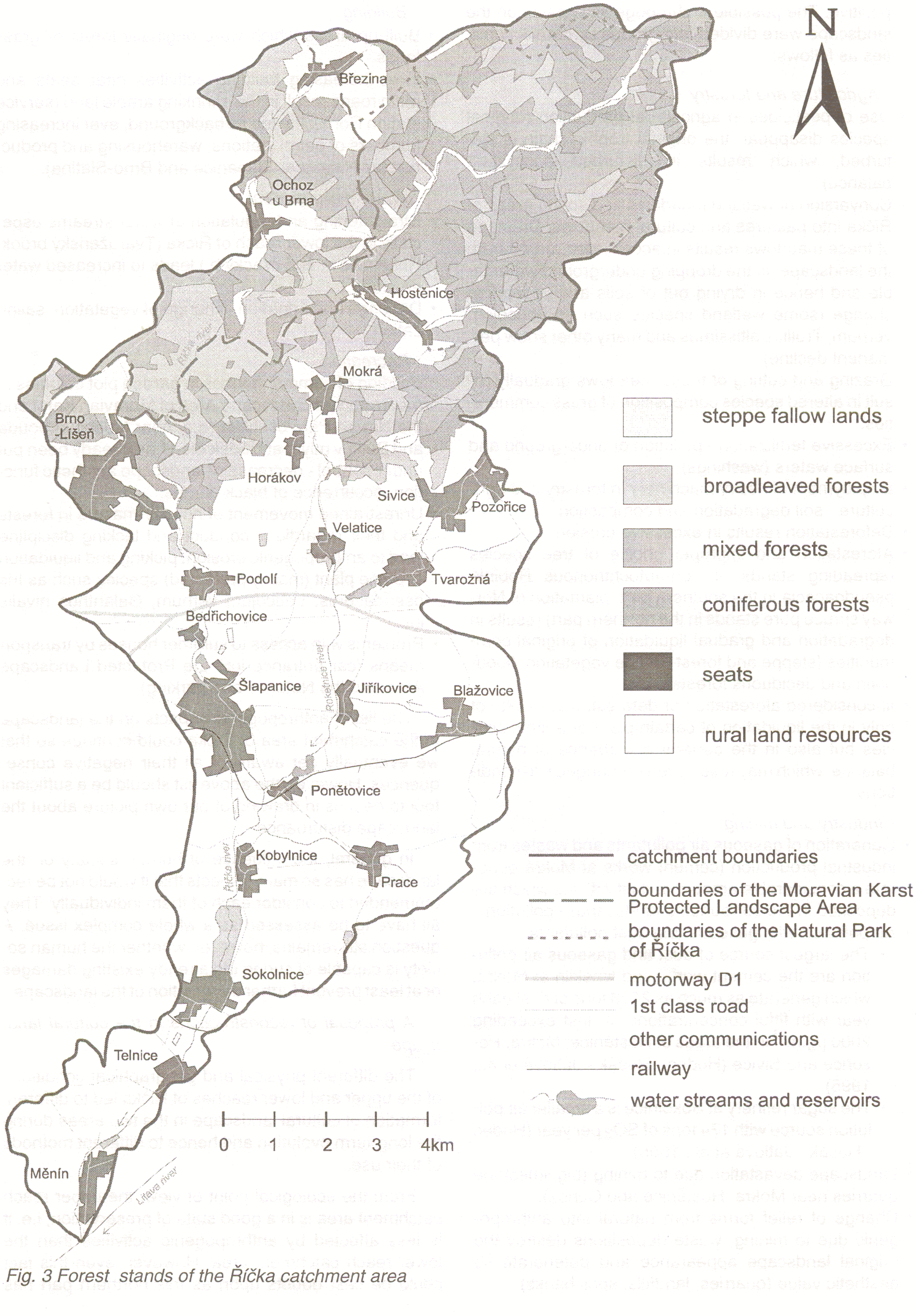

Fig. 3 Forest stands of the Říčka catchment area

been to some extent changed as well. Example could be seen in extensive pure stands of Norway spruce, which have replaced original broadleaved or mixed forests as well as areas of anthropogenically conditioned relief, devastated by limestone mining.

Following measures would help to improve environmental value of this part of the catchment:

- to put restrictions on further plantation of Norway spruce pure stands and to gradually replace these stands with mixed ones,
- to prevent further building of recreational facilities (summer houses) in the Protected Landscape Area of Moravian Karst and the Nature Park of Říčka,
- to control the movement of holiday-makers and hikers in the Protected Landscape Area and particularly in nature parks and nature relics e.g. by educational paths,
- to recultivate abandoned lime quarries (e.g. the abandoned quarry near Ochoz) and use them as a recreational background for summer houses situated nearby (a colony of summer houses and garden plots above the village of Ochoz) - playground, minigolf and the like,
- to make efforts aimed at the restriction of black dumps which occur mainly in the vicinity of seats and summer house colonies,
- to prevent further erosion losses of land resources by restoring balks and game refuges,
- to legalize the protection of other environmentally significant places in the catchment area such as Lysá hora (Hill), Spring Area of Říčka, and the valley of Roketnice.

With regard to the intensive use of the area in the lower reach of Říčka and its general instability, it is necessary to increase the number of enclaves of natural and near-natural ecosystems. This would mean adoption of the following steps:

- to increase the number of balks and game refuges,
- to restore corridors along water streams and roads by planting appropriate species,
- similarly as in the area of upper reach of Říčka and its tributaries to ensure protection of other environmentally significant landscape segments such as Pindulka, Žuráň, Sokolnický příkop (Graben),
- to gradually replace undesirable tree species (Robinia pseudoacacia, Negundo fraxinifolia) in existing environmentally significant landscape segments with autochthonous species (Fraxinus, Quercus),
- to revitalize the individual water streams and thus support the return of original ecosystems,
- to avoid soil erosion.

The above measures would be able to improve stability of this rural landscape and to increase its capacity to recover its own ecosystems.

Implementation of these recommendations for reconstruction of the cultural landscape in the catchment area of Říčka will however require not only time as the formation of territorial systems which ensure ecological stability in the cultural landscape is a long-term process, but it will also require some changes in the approach of human society to the landscape and methods of its use.

Conclusion

The paper presents a complete survey of data concerning natural conditions and anthropogenic activities in the cultural landscape of Říčka catchment area and recommendations for possible reconstructions in the cultural landscape.

The set of worked out data about the natural conditions and use of cultural landscape was made use of at working out a computer form of GIS in the southern part of Moravian Karst (Žufanová, 1996) for Administration of the Moravian Karst Protected Landscape Area residing in Blansko.

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BRNO FROM THE VIEWPOINT OF FACTOR ECOLOGY

Hana KELLNEROVÁ - Václav TOUŠEK

Abstract

The paper deals with internal differentiation of the town of Brno on the level of its town-planning districts. Four most important factors were extracted on the basis of 18 selected characteristics of population, housing resources and household equipment standard worked out by a method of factor analysis, which together explain for as much as 71.5% of total variability of the original collection. The factors that point out to the most important principles of socio-economic differentiation of Brno became a starting variables for the cluster analysis worked out typology. Its result consists in 7 different socio-economic types of territorial units.

Shrnutí

Článek se zabývá vnitřní diferenciací města Brna na úrovni urbanistických obvodů. Na základě 18 vybraných charakteristik obyvatelstva, bytového fondu a vybavenosti domácností byly pomocí metody faktorové analýzy vyextrahovány čtyři nejdůležitější faktory vysvětlující společně 71,5 % celkové variability vstupního souboru. Tyto faktory, jež poukazují na nejdůležitější principy socioekonomické diferenciace města Brna, se staly výchozími proměnnými pro zpracování typologie pomocí shlukové analýzy. Jejím výsledkem je 7 různých socioekonomických typů územních jednotek.

Key words: socio-economic differentiation, factor analysis, typology, Brno.

1. Introduction

„Any town, and a large city with long history in particular, contains in itself the past at any moment of the present, and in some sense also a code of its future development. In periods of rapid growth and decisive socio-economic changes it is dominating cultural and social values and meanings that are most deeply indented into the town structure, which-embodied into town material structures-survive far into the future the socio-economic conditions standing at their birth." (Matějů, 1980).

Internal structure of towns in Central and East Europe was considerably disturbed during forty years of Socialism. The period was characterized by centrally controlled localization of economic activities and resulting migration of the population and changes in its composition, building of large uniform housing estates, efforts aimed at the removal of social inequalities, and by homogeneization of the society. At the same time, however, the influence of older settlements and to some extent also that of the former social stratification of the population have remained noticeable at many a place.

Objective of the paper is to provide an information of results from the study of internal socio-economic structure in the town of Brno in 1991, i.e. at the beginning of the period of transformation from centrally planned economy into market economy, the period accompanied by many social changes.

2. Area development and building in the town of Brno

With its population of nearly 390 000 (census in 1991) Brno is the second largest city in the Czech Republic. There are several mile stones to be found in its territorial development. The original area of the town was first expanded as late as in the first half of the 18^{th} century. The new City wall system was then forever taken down in the 60's of the 19^{th} century. As early as in 1850, some suburban district were annexed to Brno, of which many consisted of only a single street or a tiny group of houses. The district of Brno-City with the total area of 1816 hectares came into existence on July 6^{th}, 1850. In terms of construction, there were also other villages connected to Brno in the 19^{th} century, which however remained independent until 1919. In this year, 23 municipalities were annexed to Brno whose area increased up to 12 379 hectares. The annexed municipalities were as follows: Bohunice, Brněnské Ivanovice, Černovice, Dolní Heršpice, Horní Heršpice, Husovice, Juliánov, Jundrov, Kamenný Mlýn, Kohoutovice, Komárov with Malá Mariacela and Petrohradská St., Komín, Královo Pole with Ugartov, Lískovec, Maloměřice, Obřany, Přízřenice, Řečkovice, Slatina, Tuřany, Žabovřesky with Vinohrádky, and Židenice. The more distant Líšeň was annexed in 1944. In 1957, a part of the area in the surroundings of Brno (Kníníce) dam lake was annexed to Brno, too, and in 1960 it was the remaining area of Bystrc and Kníničky, Mokrá Hora

Table 1 - The list of initial characteristics and their average values for the town of Brno and the Czech Republic (1991)

No.	Characteristic	Average value Brno	CR
1	Share of territorial unit inhabitants in total population in Brno (‰)		
2	% of inhabitants born in their domicile in total population	58.7	49.9
3	% of inhabitants with complete secondary or university education in population over 15 years of age	44.4	30.1
4	% of students in population between 15-24 years of age	34.3	23.3
5	% of population economically active in building and other industries in total economically active population	42.1	44.9
6	% of population economically active in other fields (tertiary sector without trade, public catering, transport and communications) in total population	38.9	9.8
7	% of population in post-productive age (men above 60, women above 55 years of age) in total population	22.6	20.5
8	Economic activity of pensioners - % of economically active pensioners in total population of post-productive age	16.2	5.9
9	Unemployment - % of job applicants in economically active population	1.6	2.9
10	Share of Roma in total population (‰)	0.5	0.3
11	% of permanently inhabited flats built before 1900 in total number of permanently inhabited flats	6.9	12.0
12	% of permanently inhabited flats built in 1971-1991 in total number of permanently inhabited flats	25.9	33.4
13	% of permanently inhabited flats of 3rd and 4th class in total number of permanently inhabited flats	5.2	8.6
14	% of permanently inhabited flats burning solid fuels (both local and single-storey heating systems) in total number of permanently inhabited flats	4.7	26.0
15	% of permanently inhabited flats in private houses in total number of permanently inhabited flats	18.9	41.2
16	Number of inhabitants per a dwelling room of at least 8 m^2 in size	1.05	1.04
17	% of census households with 5 and more members in total number of census households	3.6	6.3
18	% of flat households with telephone in total permanently inhabited flats	42.3	30.0

and Nové Moravany. The total area of Brno-City district amounted to 18 098 ha at that time. More remote villages with usually no construction relationship to Brno, which are nevertheless connected to the city via strong economic links and plied for public hire, were annexed in 1972 (Jehnice, Ořešín, Ivanovice u Brna, Dvorska, Bosonohy, Chrlice, Žebětín and Soběšice). The village of Útěchov has been a part of Brno since 1980. The town total area is now 23 036 hectares.

The period after World War II was a period of considerable construction development of the town with some new industrial premises coming into existence such as Zetor. Intensive block-building of housing-estate character was commenced in the 60's. The housing quarters of Juliánov and Štefánikova (originally Fučíkova čtvrť) were finished in 1967 and 1969, respectively. The housing quarters of Stará Osada, Žabovřesky, Kohoutova, Řečkovice, Lesná, Jundrov, Královo Pole, Komín, Bystrc I and Medlánky were finished in 1970 and the neighbourhoods of Bohunice, Kohoutovice, Bystrc II, Slatina, Chrlice, Nový Lískovec, Líšeň and Vinohrady were finished in the course of the 80's. The last housing quarter of Kamenný vrch was finished at the beginning of the 90's.

3. Factor analysis

The issue of internal socio-economic differentiation in towns has been one of the most popular topics in social geography from its very beginnings and a whole range of methods and approaches have been applied at its study (Sýkora, 1993). One of the most popular ones is a factor-ecological approach which makes use of the method of factor analysis. This rather non-traditional mathematical and statistical method facilitates a certain generalization and reduction of a great number of initial data into a much lesser number of so called factors which are decisive for learning main principles of town area differentiation. The factor analysis as one of methods to study the internal socio-economic structure of towns brings about numerous methodological problems of which most significant is a certain rate of subjectiveness both immediately at the selection of initial characteristics and in the selection of methods for standardization, factor extraction and rotation (Toušek -

Viturka, 1979; Heřmanová, 1991). The factor analysis imposes specific requirements on the entered characteristics whose basic pre-requisite consists in their mutual independence that is to be as great as possible. However, all initial characteristics should optimally have the normal division of their occurrence. It should be reminded here that the selected type of variables predetermines at the same time the character of resulting factors.

The presented analysis of internal differences occurring within the territory of Brno follows out of town-planning districts - the smallest territorial units for which census results are published. A criterium of min. 100 inhabitants was defined in order to ensure a possible mutual comparison of territorial units, particularly in terms of population. Each town-planning district with less than 100 inhabitants was annexed to one of neighbouring districts in such a way, that boundaries of town municipalities were respected and the resulting area formed a whole as homogeneous as possible. The original 272 town-planning districts formed 179 territorial units.

A source of information about the population, housing resources and household equipment for the individual town-planning districts were results from the 1991 census. Based on the analysis of mutual correlations the 54 initially selected characteristics were reduced to final 18 whose list is presented in Tab. 1.

Some methodological problems are to be mentioned in connection with the above list. They mainly concern item 9-Unemployment, and 10-Share of Roma population. The number of applicants for jobs relates to the date of December 31st, 1995 since labour market in the Czech Republic was relatively unstable in 1991 (in comparison with 1995). Item 10 is of orientation character only, following out of absolute numbers of Roma population in individual town-planning districts found at the 1991 census. However, the data are not precise since a certain number of Roma, although resident in Brno, have other domiciles, claim other than Roma nationality, and the like. Yet, by using these figures we can at least compare the town-planning districts, which is sufficient enough for needs of the factor analysis.

Data standardization by standard variable and extraction by the method of main axes were used to calculate factor loads. Rotation was made by the Varimax orthogonal method. The four obtained most important factors altogether explain for as much as 71.5 % of total variability of the original collection. All calculations were made by the SPSS programme.

Factor 1 can be interpreted as a social factor. It explains for 31.1 % of total variability of the original collection. It is represented by characteristics regarding quality and age of housing resources along with indices of Roma representation and unemployment rate. It follows from cartogramme 1 which territorial units are closest to one another in terms of the social factor. The highest factor scores, i.e. epresentation of the factor in individual territorial units, are obtained near the City centre where the largest concentration of

Table 2 - The rotated matrix of factor loads

Characteristic No.	Factor loads			
	Factor 1	Factor 2	Factor 3	Factor 4
1	-0.08794	0.03685	**-0.54289**	**0.49104**
2	-0.11578	-0.30930	**0.72494**	0.03231
3	-0.38826	**0.78134**	-0.16212	0.18180
4	**-0.48246**	**0.66259**	-0.03663	0.00727
5	-0.07794	**-0.85369**	0.12716	0.11720
6	0.01478	**0.88644**	-0.26356	-0.02808
7	0.02941	0.05742	-0.02488	**-0.90143**
8	-0.23372	**0.46226**	-0.23425	0.38419
9	**0.84477**	-0.07854	-0.13976	0.00293
10	**0.86660**	-0.03644	-0.07080	-0.05702
11	**0.76495**	-0.16757	0.21349	-0.16269
12	-0.25287	0.00515	-0.23427	**0.82276**
13	**0.74858**	-0.31054	**0.60588**	-0.22442
14	0.23637	-0.16252	**0.83201**	-0.11258
15	-0.28537	-0.28721	**-0.57611**	-0.20232
16	**0.66483**	-0.06256	-0.20055	0.09326
17	0.31519	-0.08630	**0.57369**	0.16352
18	-0.38198	**0.5998**	-0.20055	**-0.42053**

Roma population is bound to old housing resources of lower standard and shows also higher unemployment (Encl. - Fig. 1).

Factor 2 (education) explains for 18.9 % of total variability. It is fed mainly with indices of economic and educational population structure (Tab. 2). Areas with the highest factor scores are adjacent to the City centre - mainly from the West and NorthWest. Here we can find town-planning districts with older built-up villa areas (Masarykova quarter). Relatively high factor scores can also be found at some housing estates such as Bystrc and Lesná. In contrast, the lowest factor scores are exhibited by territorial units in the SouthEast (Encl. - Fig. 2).

Factor 3 was classified as a rural factor. It is characteristic of high factor loads of variables describing the rate of area urbanization or ruralization - the proportion of permanently inhabited flats in private houses, inhabitants born in Brno, the proportion of permanently inhabited flats burning solid fuels, the number of inhabitants per a dwelling room, the proportion of census households with five and more members, and the proportion of Roma inhabitants in total population of the town of Brno (Tab. 2). This factor explains for 14.3 % of total variability of the collection. The highest factor scores can be found in territorial units situated in the city limits. In the majority of cases, these suburbs used once to be independent villages. The lowest values can be found in territorial units with typically urban character of the built-up area - housing estates and units in the town centre with prevailing older blocks of flats (Encl. - Fig. 3).

Factor 4 can be considered a housing estate factor. It explains for 7.2 % of total variability of the original collection as it includes variables which take into account age of the built-up area, population age structure, territorial unit population density and equipment with telephones (Tab. 2). The highest factor scores can be found in the newest housing quarters (Nový Lískovec, Kamenný Vrch, Vinohrady, Bystrc, Líšeň) (Encl. - Fig. 4). Some older housing estates such as Lesná were finished as early as in the 60's and therefore reach considerably lower scores of the fourth factor.

4. Cluster analysis and foundation of typology

Similarly as the factor analysis, the cluster analysis issues from a pre-requisite of mutually independent original variables, requiring also independence on measuring units, i.e. a dimensionless character of figures. Another pre-condition consists in identical significance of the original variables. In case of their different significances, the requirement can be met by the application of appropriately chosen weights. Factor scores were used as the initial variables, which resulted from the preceding data reduction. Proportions of the individual factors in total variability served as the weights. The clustering resulted in seven territorial types (Encl. - Fig. 5).

Type 1 can be designated as a growth type. It associates 35 territorial units with dynamic growth in the last 25 years, which reflects particularly in Factor 4 scores. These territorial units are characterized by the high proportion of permanently inhabited flats that were built between 1971-1991 as well as by the low percentage of population in the post-productive age. The majority of them are housing estates but there also territorial units included in this type with mixed built-up areas such as Chrlice with 62.7 % of permanently inhabited flats in private houses, 10.1 % of permanently inhabited flats built before 1900, and at the same time, 43.0 % of permanently inhabited flats built in the period 1971-1991. Total population living in territorial units of this type is larger than 150 000 persons.

Type 2 is distinguished by rather mediocre values of all factors used. Territorial units of this type are situated mainly in the city centre and are characterized by the low proportion of permanently inhabited flats in private houses, high number of inhabitants per 1 dwelling room, the relatively high population living in the individual territorial units, the relatively high proportion of old flats (built before 1900), and the relatively high percentage of population in the post-productive age. The type includes 87 territorial units and more than 180 000 inhabitants.

Type 3 includes 12 territorial units with a high concentration of educated population that amounts to approximately 14 000 persons. There is no doubt that a decisive influence on its formation had Factor 2 scores. This means that the indices of the proportion of inhabitants economically active in other fields and the proportion of students in the age category of 15-24 years reach high figures as well. This type is not too specific as to its built-up area character and we would not find any extreme figures in its age or type.

Type 4 contains territorial units with high Factor 1 scores which means the territorial units with high unemployment, the relatively high proportion of Roma

Table 3 - Occurrence of territorial unit types

Type	Territorial units		Population	
	absolute	relative (%)	absolute	relative (%)
1	35	19.6	157677	40.6
2	87	48.6	181626	46.8
3	12	6.7	14086	3.6
4	5	2.8	7182	1.8
5	2	1.1	1399	0.4
6	37	20.7	25975	6.7
7	1	0.6	347	0.1

population, the high number of inhabitants per one dwelling room, and the high proportion of permanently inhabited flats built before 1900 and of the 3rd and 4th class flats. These 5 territorial units (Soudní, Hvězdova, Svitavská, Špitálka (including Radlas) and Přízová (including Rosická) with more than 7 000 inhabitants are situated eastwards of the city centre and form a segregation area of Roma population with the lower standard of living.

Type 5 includes only two small territorial units: Markéty Kuncové and Tržní, which together have 1 399 inhabitants. The two units are distinguished by high negative factor scores of nearly all four factors. In terms of entered variables, the values in these territorial units and their factor loads in the individual factors, this type could be classified as a type of old urban working-class quarters. It is characterized by the low proportion of flats in private houses, low percentage of population born in Brno, high employment in building and other industries, low percentage of population with secondary and university education, and the low proportion of students in the population between 15-24 years of age. The variables feeding mainly Factor 1 - the share of Roma population, unemployment and the proportion of permanently inhabited flats built before 1900 and the 3rd and 4th class flats have no significant application in this type.

Type 6 could be called a suburban type. Decisive for its formation was Factor 3 which represents mainly the proportion of permanently inhabited flats in private houses and the percentage of population born in Brno. The type is also distinguished by the high proportion of inhabitants economically active in building and other industries, low number of inhabitants per one dwelling room, and the relatively high proportion of census households with five and more members. The 37 territorial units with nearly 26 000 inhabitants are mostly situated in the town outskirts.

Type 7 consists of only one territorial unit: Kociánka (347 inhabitants). Thanks to the location of an old-people,s home the unit is of a very specific character and reaching such extremely high values of several indices (e.g. the proportion of population in post-productive age, number of inhabitants per one dwelling room, etc.) that it was not possible to put it together with any other territorial unit.

5. Conclusion

The paper wanted to reveal regularities of internal spatial differentiation in the town of Brno. To achieve this objective the method of factor analysis was used in combination with the cluster analysis. The initial collection contained 18 indices characterizing the population, housing resources and household equipment standard for 179 territorial units delineated on the basis of town-planning districts. The obtained four most important factors together explain for 71.5 % of total variability of the original collection.

a) Social factor 31.1 %
b) Educational factor 18.9 %
c) Rural factor 14.3 %
d) Housing estate factor 7.2 %

The first factor (social) illustrates a relatively strong segregation of Roma inhabitants as well as their lower standard of living. The highest values of factor scores were reached in territorial units located in town municipalities of Zábrdovice, Trnitá, Komárov, Husovice and Židenice.

The second factor (educational) suggests the existence of „prestigeous residential quarters" with the highest values reached in territorial units of Stránice (Masarykova čtvrt, Žlutý kopec), Pisárky and Bystrc. It is to be expected that the differentiation will further deepen in connection with increasing differences in the population income. related changes in the society and liberalization of the market.

The third factor takes into account rural character of marginal areas which were annexed to Brno relatively a short time ago. These territorial units could be characterized by the area built-up with private houses and by a more settled population.

The fourth factor represents mainly new built-up areas and young population with the highest values of factor scores being reached by territorial units of housing estate character (Líšeň, Vinohrady, Bystrc, Bohunice, Nový Lískovec, starý Lískovec and Kamenný vrch).

The typology of territorial units worked out on the basis of homogeneity by means of the method of cluster analysis made use of data concerning the differentiation of Brno territory, obtained through the factor analysis. Factor scores of four most important factors (for selected 179 territorial units) were used as initial variables. Extracted were seven resulting types which reflect the character of both the built-up area and the population. Encl. - Fig. 5 suggests a division into the internal city (Type 2), housing estates (Type 1) and external rural areas (Type 6). In this sense, it is possible to speak of a concentric arrangement. The types based mainly on specific features of the population (Types 3 and 4) are rather of a wedge character. The number of territorial units of Type 5 and Type 7 is so low that it is impossible to speak of any character of arrangement.

Contents of the most important factors and the above characteristics of individual types of territorial units illustrate a relatively distinctive internal differentiation of Brno. Formation of the present socio-economic structure in the town was affected by a whole range of regularities and processes:

- natural expansion of the town outside the medieval core and urbanization which proceeds from the centre towards edges,

- industrial revolution and foundation of capitalist society in the 19th century and at the beginning of the 20th century (separation of so called „prestigious residential" and „working-class" areas),
- a certain homogeneization of the society in the period of Socialism, building of housing estates and age differentiation of the population,
- segregation trends, particularly on both ends of the social hierarchy of the society.

In the future, further deepening of social differences between individual social layers is to be expected, which will relate to the general transformation of economy and society. A certain percentage of inhabitants with higher income will most probably prefer dwelling in private houses located in marginal parts of the town, which can provide environment of higher standard. Some suburban areas are already busy with building up the above-standard houses. The trend will reflect in changes of population economic and social structure, particularly so in the mentioned marginal parts. Other changes in social composition of the population in individual town-planning districts may follow the planned deregulation of rentals and conversion of rented flats into private possessions.

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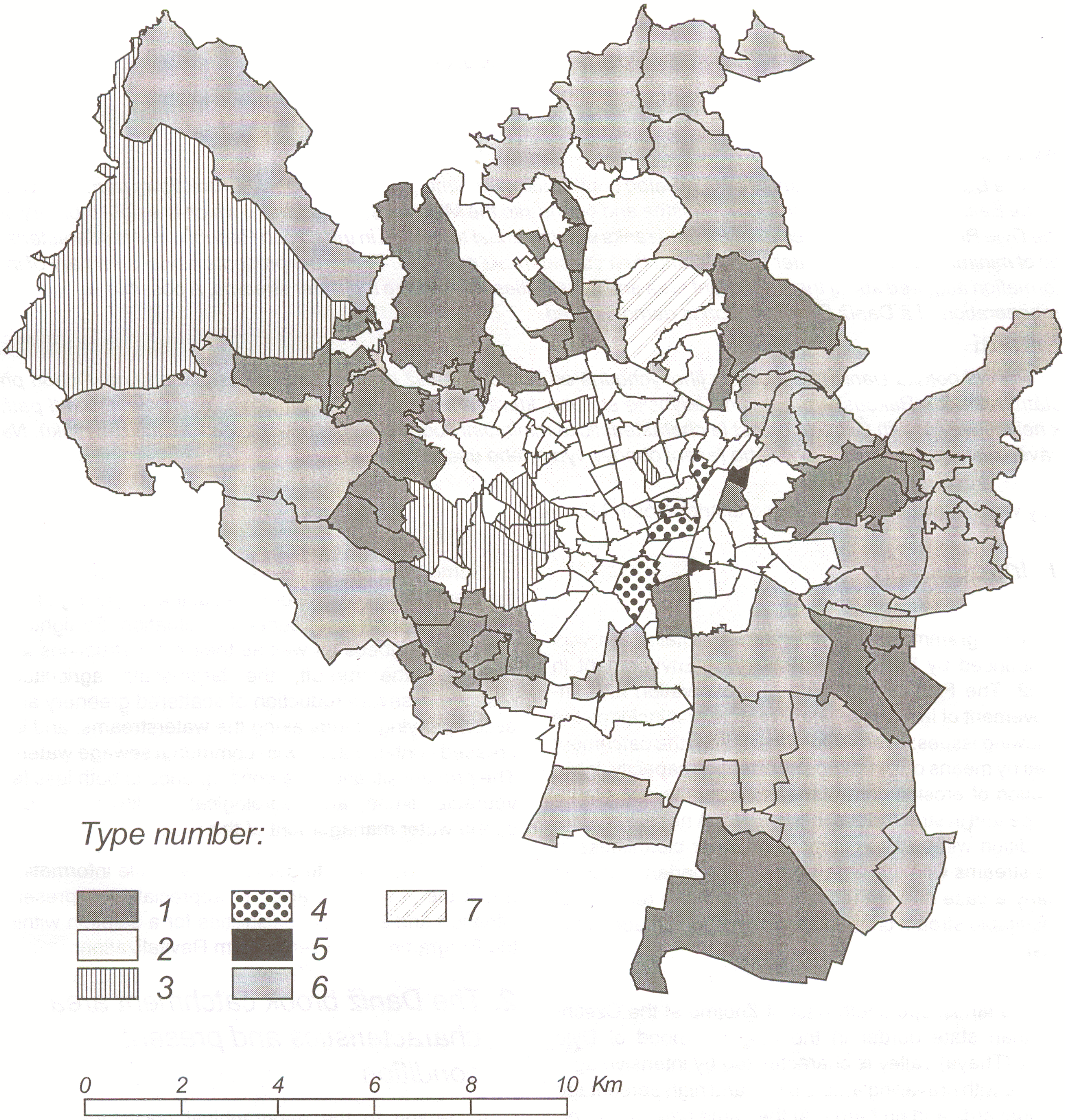


Fig. 5: Typology of territorial units in the town of Brno

POSSIBILITIES OF REVITALIZING THE DANÍŽ BROOK CATCHMENT AREA IN THE DISTRICT OF ZNOJMO, SOUTH MORAVIA

Jana TÁBORSKÁ

Abstract

The Daníž Brook catchment area is situated south-east of Znojmo (Fig. 1). The Daníž Brook flows from the West to the East along the state border with Austria and opens into the Mlýnská strouha (drain) which is a right tributary of the Dyje River (Thaya). The catchment area ranks with the driest territories in the Czech Republic and is characteristic of minimum volume of water streams and their considerable pollution. The paper presents a brief summary of information acquired about the catchment area and possibilities to revitalize the water streams. A possible solution for regeneration of a Daníž Brook section is demonstrated.

Shrnutí

Povodí potoka Daníž je situováno jihovýchodně od Znojma. Daníž protéká směrem ze západu na východ při státní hranici s Rakouskem a ústí do Mlýnské strouhy, která je pravostranným přítokem řeky Dyje. Povodí patří k nejsušším částem ČR. Pro oblast je charakteristická minimální vodnost a značné možnosti revitalizace toků. Na závěr je uvedena ukázka možného řešení obnovy vybraného úseku potoka Daníž.

Key words: revitalization, Znojmo district, South Moravia

1. Introduction

A Programme of River System Revitalization was announced by the Czech Ministry of Environment in 1992. The Programme aims at preservation and improvement of landscape water regime and includes the following issues: even water run-off from the catchment area by means of improved soil retention capacity, introduction of erosion control measures in the open landscape and in streambeds themselves. A necessary precondition will be improvement of water cleanliness in the streams with the regeneration of riparian stands in many a case and sometimes also with the removal of unsuitable stream channel reconstructions made in the past.

The landscape south-east of Znojmo at the Czech-Austrian state border in the neighbourhood of Dyje River (Thaya) valley is characterized by intensive agriculture with prevailing arable lands and high percentage of vineyards and orchards. At the same time, however, the territory ranks with the driest areas in the Czech Republic with low precipitations and a very thin network of water streams. This relates to some hydrological problems that are apparent from a mere fact that the Daníž Brook, the right tributary of the Dyje River, is considered an important water stream from the water management point of view although its water volume is negligible (Figs. 1 and 2).

Some hydrological reconstructions were made in the Daníž Brook catchment area at the beginning of the 70's, which further worsened the situation. Straightening of streambeds as well as their reconstructions accelerated the run-off, the large-scale agriculture resulted in severe reduction of scattered greenery and accompanying stands along the waterstreams, and increased contamination with communal sewage waters. The present situation is a consequence of both less favourable climatic and hydrological conditions and unsound water management of the area.

The study wants to gather all available information about the catchment area, to appreciate the present situation and suggest possibilities for a solution within the Programme of River System Revitalization.

2. The Daníž brook catchment area characteristics and present condition

According to the geographical encyclopaedia of Czech Republic (Vlček et al., 1984), total acreage of the Daníž Brook catchment area is 117.7 km^2 and is of oblong shape stretching from the West to the East. The Daníž Brook springs 2.5 km west of the village Hnanice, close to the state border on the Austrian side and its length is 25.5 km. Near the village of Jaroslavice it flows into Mlýnská strouha (drain) which opens into the Dyje River.

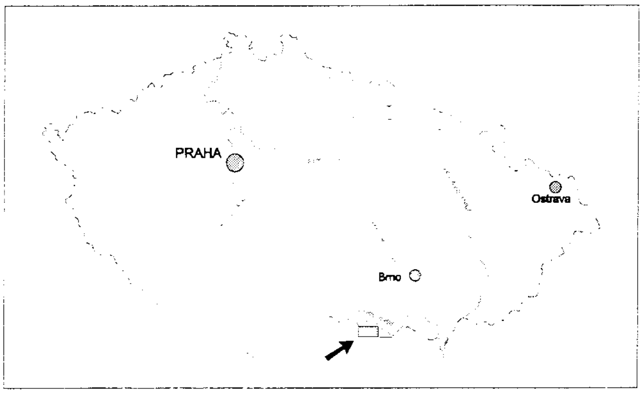


Fig. 1 Map of the Czech Republic with marked area under study.

The paper deals with a section (95 km^2) of the Daníž Brook catchment area from the Daníž spring down to its confluence with the Vrbovecký potok - Brook (Basic water management Map of the Czech Republic, 1973) (Fig. 1).

Geological and geomorphological relations

The Daníž Brook catchment area is situated in a transition territory on the boundary of two fundamental physical and geographical systems of the Czech Republic - the Bohemian Massif on the West and the West Carpathians on the East. Geology of the territory has been properly studied and detailed geological maps at a scale of 1:25 000 with legends are available for the entire catchment area (Basic geological maps of the Czechoslovak Socialist Republic, 1983-1995). Intensive research is currently being made in the Podyjí National Park.

With its geomorphology, the western part of Daníž catchment belongs in the sub-system of Bohemian-Moravian Uplands, in the complex of Jevišovská pahorkatina - Hilly land (Demek et al., 1987). This applies to the highest parts of the catchment with altitudes closely below 400 m and headwaters with many platforms (situated in Austria), which melt into the eastern marginal scarp of the Bohemian Massif by a deeply incised upper reach of Daníž as far as Hnanice. Topography is formed by narrow valleys with relatively steep slopes with sporadic rocky spurs in their upper parts. In terms of geology, this western part belongs in the Dyje Massif which is built of biotic granite and granodiorite, partly shaled with fissure permeability. This part of the catchment area is situated in the National Park of Dyje River Basin and its protection zone.

A major part of the catchment area, the central reach of Daníž from Hnanice down to the confluence with the

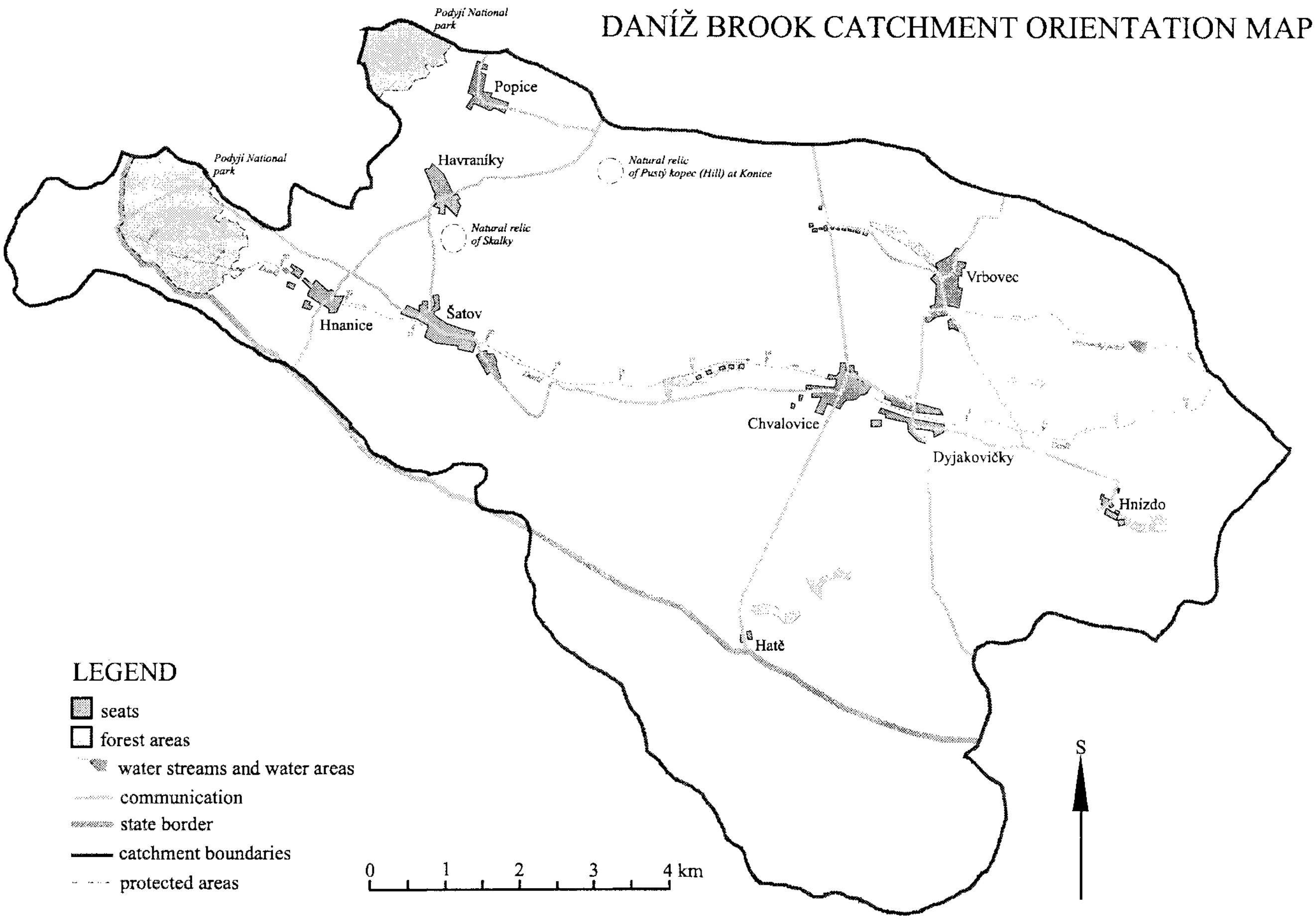


Fig. 2 Daníž brook catchment orientation map.

Vrbovecký potok (Brook) and the lower reach up to the opening into Mlýnská strouha near Jaroslavice, belongs in the system of Outer Carpathian Depressions, and in their more detailed classification in the system of Dyjsko-svratecký úval (Graben), sub-system Jaroslavická pahorkatina (Hilly land). The prevailing topography is that of flat hilly land with very mild slopes and platforms at the height of 200-300 m a.s.l. With its geology, the territory is a component of the Carpathian Foredeep formed by Miocene and Quaternary non-reinforced and relatively well penetrable sediments with pore permeability. Thickness of the Miocene sediments formed by gravels, sands, dust sands and clays amounts to 100-200 m and is increasing in the south-eastern direction. Pustý kopec (236 m) and Skalky (309 m) are two rocky elevations rising from the Miocene sediments. Of the Quaternary sediments most frequent are loesses. Fluvial sandy loam sediments can be found in the near surroundings of water streams. Floors of adjacent valleys which are dry at present are formed by deluviofluvial sandy loam slightly humous sediments.

Soil conditions

Structure of the soil cover closely relates to geology of the territory and hence to various pedogenetic substrates. There are two different areas in this locality:

The western one includes a national park with kambizems developed on acid effusive rocks in the prevailingly sloping topography. Rankers to lithosols can be found in upper parts of the slopes and on their tops. Typologically undeveloped soils - syrozemě are to be seen around rocky precipices and headlands. Accumulation of slope sediments which are seasonally water logged - Planosols occurs on valley and ravine floors. Gleys developed in spring areas (Hynek - Trnka, 1981).

The larger eastern part is covered with loesses, sands and clays on which Chernozems developed. Chernozem was eroded from top parts of the ridges. Isles of granites and granodiorites rise from Chernozems in the vicinity of the national park, which are covered with Rankers and Kambizems. The middle reach of Daníž is surrounded with Fluvizem which melts into Phaeozem between villages Šatov and Chvalovice that can most often be found also along tributaries and in water logged areas. In the past, some of these areas were salinized by hydroactivation of Neogene sediments containing soluble salts, sulphates and magnesium-, sodium-, and potassium chlorides. Today the salinization is limited by the damaged soil cover, reclamation and irrigation. Namely the irrigation may become a primary cause to the secondary salinization of irrigated soils (Basic soil maps from a complex research of agricultural soils, 1962-1971; and Soil Map, 1989; Hynek - Trnka, 1981; Smolíková - Němeček, 1990).

Climatic conditions

The western part of the catchment area, containing the national park and the village of Hnanice, belongs in the climatic zone T2. All the rest of the catchment ranks with the climatic zone T4 (Quitt, 1975). The whole territory under study is characteristic of a long summer which is also warm and dry, a relatively very short transition period with warm spring and autumn, and a mildly warm, dry to very dry winter with a very short-lasting snow cover. The Jaroslavická pahorkatina (Hilly land) is drier and warmer than the Jevišovická pahorkatina (Hilly land).

There is no meteorological station in the area of interest and therefore the meteorological data presented in the paper were supplied from the nearest facility of the Czech Hydrometeorological Institute at Kuchařovice. It must be pointed out here that the Kuchařovice station represents a somewhat colder area which is situated right on the border between the mildly warm climatic zone MT11 and the warm climatic zone T2.

Average air temperatures (°C) in the period 1951-1980	
Month	Meteorological station Kuchařovice
I	-2.4
II	-0.7
III	3.2
IV	8.5
V	13.2
VI	16.9
VII	18.4
VIII	17.9
IX	14.1
X	8.8
XI	3.5
XII	-0.4
I-XII	8.4

It follows from the table that the warmest months are June, July and August and the coldest months are January and February.

Mean total precipitations (mm) in the period 1951-1980	
Month	Meteorological station Kuchařovice
I	23
II	23
III	28
IV	34
V	53
VI	80
VII	64
VIII	62
IX	34
X	31
XI	35
XII	26
I - XII	493

The lowest precipitations are usually in winter months - December, January and February. The highest precipitations are in June and July. The precipitations show local differences which are given by different climatic conditions over forested parts of the area and over fields. The differences are ever more pointed out by summer thunderstorms.

The growing season lasts from April 26th-May 1st to October 1st-10th.

The catchment ranks with the areas of the shortest snow cover:

Av. number of days with snow cover in the period 1951-1980	
Month	Meteorological station Kuchařovice
I	19.4
II	13.4
III	7.0
IV	0.3
V	0.0
VI	0.0
VII	0.0
VIII	0.0
IX	0.0
X	0.2
XI	5.1
XII	15.0
I-XII	73.7

Average occurrence of winds (% of all observations) in the period 1971-1980	
	I-XII
N	19.4
NE	10.1
E	10.7
SE	14.6
S	7.9
SW	3.9
W	9.4
NW	20.7
calm	3.3

Prevailing are winds from NW and N.

Average occurrence of strong winds (11 m/s and stronger) in the period 1971-1980	
	I-XII
N	2.1
NE	0.1
E	0.4
SE	7.0
S	1.9
SW	0.1
W	3.4
NW	9.5
celkem	24.5

Strong winds usually arrive from NW or from the opposite SE. Numerous localities use to suffer from dust storms.

Air quality is impaired by local furnaces (particularly in winter), by dust from fields and partially also by road traffic.

Rather interesting is the fact that a general decrease of precipitations has been observed in the last few years. This can be documented by both results of measurements made at the Jaroslavice precipitation station for 1968-1978 (Červený et al., 1984), and by records in municiple chronicles. Nearly every other year is very dry.

Occurrence of a period with no precipitations can be documented by analyzing the precipitation series (for 1968-1978) from the station at Jaroslavice, which is situated in the vicinity of the Daníž opening into the Dyje River and is characterized by similar climatic conditions as the area under study. The period with no precipitations was considered to be a period meeting the condition of non-existent measurable precipitations within at least five days in a row.

Occurrence of days with no precipitations (%) in the period 1961-1980	
station Jaroslavice	%
I	8.4
II	8.9
III	9.8
IV	8.7
V	6.9
VI	7.2
VII	8.0
VIII	7.3
IX	8.9
X	9.6
XI	6.7
XII	9.6

It follows from the table that the greatest probability of days with no precipitations is in the Spring in March, and in the Autumn in October. The least probability of these days is in November and in May.

During the critical periods of drought, the whole area and small water streams in particular has to face total desiccation which lasts several weeks to months. Another extreme were annual floods in floodplains with prevailing floods occuring in the cold half-a-year at snow thaw and rain.

Hydrological conditions

Total area of the Daníž catchment is 117.7 km^2 (Vlček et al., 1984). With the length of 25.5 km and height difference 196 m (altitudes of spring and mouth are 381 m and 185 m, resp.), average slope is 7.7. Daníž has several short tributaries: Vrbovecký potok (Brook) from the left, Hatský potok (Brook) from the right (and its left-hand tributary Luční potok), and a nameless stream from the left before Hnanice. The watershed divide with Austrian water-course Pulkau in the South runs mainly along the state border slightly entering the Austrian territory near the village of Hatě. Area of the studied locality above the confluence with the Vrbovecký potok (Brook) is 95 km^2 and width of the catchment area rapidly shrinks on the remaining 9.3 km of the stream (Fig. 1). The Vrbovecký potok (Brook) has a catchment area of 25.1 km^2 (Basic water management map of the Czech Republic, 1973).

There is a through-flow pond on the brook (Vrbovecký rybník) whose area is 1.5 ha.

Relatively stable water stream in the catchment area can only be considered Daníž and its biggest tributary - Vrbovecký potok (Brook). Other tributaries of Daníž are nearly dried out during the year with water appearing in them merely in periods rich in precipitations or at rainstorms.

The Daníž Brook is managed by Povodí Moravy (The Morava River Catchment Company) and it drains water not only from the south-eastern part of the Znojmo district but partially also from the Austrian territory. Daníž springs out closely behind the state border on the Austrian side at a height of 381 m. Its flow is directed to the East and at the beginning passes a tight forested valley in the Dyje River Basin National Park. It is only this upper reach of the brook that still has a natural streambed. Slope is relatively large here: 25 to 30 . Above the village of Hnanice, Daníž leaves the valley and national park boundaries and its further flow is regulated up to its opening into the Dyje River. A reservoire was built on Daníž immediately above Hnanice into which irrigation water is pumped from Dyje. The stream is then utilized also as an irrigation channel up to the village of Chvalovice. The Daníž slope is milder (av. 7) from Hnanice to Šatov, and behind Šatov it even drops to mere 2.5 . Near Chvalovice the valley gets slightly narrower and the slope increases up to 7. An accumulation reservoir was built on Daníž westwards of Chvalovice, which helps to compensate for peak irrigations (Aquaprojekt, 1995).

At Chvalovice the Daníž Brook feeds a fire basin (Technical and operational records Daníž, 1972). The slope from here up to the confluence with the Vrbovecký potok (Brook) is no more than 3.5. The throughflow situation on Daníž is expressed by characteristics from the Hydrometeorological Institute in Brno for the period 1931-1980:

Profile no. 1 - Daníž, crossing with the railway line Znojmo-Šatov (20.9 river kilometers)

A = 17.15 km^2

Pa 31/80 = 574 mm

Qa 31/80 = 0.035 m^3/s

Throughflow values apply for the natural run-off regime (throughflows may be influenced by sewage waters).

Profile no. 2 - Daníž beneath the mouth of the Vrbovecký potok (Brook) (10.7 river kilometers)

A = 94.37 km^2

Pa 31/80 = 560 mm

Qa 31/80 = 0.162 m^3/s

Legend:

A - Catchment area above the measured profile

Pa - Annual av. precipitations on the catchment area A in the period 1931-1980

Qa - Av. annual throughflow in the period 1931-1980

The regulation of Daníž was carried out by The Morava River Catchment in 1965-1968. Reasons were floods and water logging of meadows and fields which then became useless for agricultural production. The floods caused great material losses in villages and water logging of roads. In contrast, extremely low throughflow values and putrid water were recorded in Daníž during summer months (The Morava River Catchment Company Brno, 1960).

The Vrbovecký potok (Brook) is managed by The State Amelioration Znojmo. The brook springs out in the Vrbovecký wood and the spring is partially utilized for drinking water supply (Horáková, 1995). The whole length of the Vrbovecký brook is regulated as well. The regulation was made by the company of Ing. R. ZAORAL from Břeclav in 1953 (Zaoral, 1953).

The Vrbovecký rybník (Pond) was reconstructed along with the brook regulation; a dam was built which raised the water level and enlarged the pond area. At present the pond is usually drained in summer and even after having been filled in winter it does not reach its full volume. The water level is gradually being overgrown with reeds which melt into stands of willows, ashes, aspens and alders on both banks. The reeds growing on the western side of the pond at the mouth of the Vrbovecký brook have a cleaning function but at the same time overgrow a wet meadow with the remaining halophyllous grass-herb vegetation. The territory has been claimed for a protection programme. The shallow pond provides a good environment for reproduction of amphibians and there are rare species of birds nesting here whose occurrence is, however, recently limited by water amount in the pond. The area is endangered by pollution from the Vrbovecký brook with consequent eutrophication, washing of fertilizers and pesticides from fields and desiccation (Návrh na vyhlášení Chráněného přírodního výtvoru Vrbovecký rybník, s.a., in Czech; Löw et al., 1995).

The Vrbovecký brook has generally a low slope which does not exceed 2.5. Throughflow values are minimal but drying out never occurs:

Profile no. 3 - The Vrbovecký brook, 250 m below the village

A = 18 km^2

Pa 31/80 = 566 mm

Qa 31/80 = 0.034 m^3/s

The measured throughflows are influenced by underground water withdrawals.

Profile no. 4 - The dam of the Vrbovecký pond

A = 23.86 km^2

Pa 31/80 = 563 mm

Qa 31/80 = 0.043 m^3/s

The cross-profile shape of Daníž and Vrbovecký brook streambeds in their full lengths is that of a simple trapezium. Dimensions of the streambeds should provide for a hundred-year water in village intravillans and for at least a ten-year water outside villages. At many places the banks were reinforced with stone pavements and stone slips.

All municipalities in the vicinity of Daníž and Vrbovecký brooks plan for the construction of a sewage water treatment plant. The sewage water treatment plant at Šatov does not have a sufficient capacity (only 30 % inhabitants connected) and is planned for a reconstruction. A new sewage water treatment plant was built at Hnanice, but according to oral statements of mayors only 50 % of inhabitants are connected.

Recent efforts of the administrator on the Daníž water stream for improvement of throughflow situation and planting of accompanying greenery are apparent. A tiny little lake in the close vicinity of Chvalovice was regenerated in winter months of 1995. Young aspens and al a major part of the area (except for the Podyjí National Park) is covered with extensive fields - agricultural pure stands, to lesser extent with vineyards and intensively cultivated orchards. The fields are divided by windbreaks which are an important component in the landscape as they prevent wind erosion but their network is still not sufficiently dense. The landscape greenery is complemented with small woods.

According to the phytogeographical classification of the Czech Republic (Hejný - Slavík, 1988) the studied territory belongs to the phytogeographical area of Thermophyticum, phytogeographical zone of Pannonian thermophyticum, and the phytogeographical district of Jihomoravská pahorkatina (South-Moravian Hilly Land).

The present condition of the landscape can be expressed in detail by comparing the potential vegetation (distribution of geobiocene type groups) typical for site ecological conditions with the existing vegetation and use of the territory. The geobiocene type groups are ecological and coenological units associating nature segments according to similar ecological conditions and similar potential vegetation. They capture changes of climatic conditions due to altitudes, aspect and configuration of terrain, they follow out of geological parent rock and soil cover and express natural conditions for plant nutrition, water regime and ways of water supply to the vegetation. The geobiocene type groups were mapped in local area plans for systems of ecological stability (Kolářová et al., 1994; Löw et al., 1995).

A major part of the area under study, and its eastern section in particular ranks with the geobiocene type group of Ligustri-querceta (oak stands with bird food). Soil types are chernozems or luvisols. Today, the area is intensively cultivated with fields prone to both water and wind erosion. Natural stands would be formed by Quercus petraea and the admixture of Carpinus betulus, Acer campestre, Sorbus torminalis, and Tilia. Undergrowth would consist of Ligustrum vulgare, Swida sanguinea, Cornus mas, Euonymus verrucosa etc.

The western part of the catchment, which belongs in the Dyje River Basin National Park, has rather different ecological conditions and can be considered a mosaic of various geobiocene type groups. Geological parent rock is formed by granites and granodiorites, prevailing soil types are kambizems, luvisols. Upper parts of slopes are rocky and the greater part of the territory is covered with forests. Most frequent are the following geobiocene type groups:

Carpini-querceta (hornbeam-oak stands) whose species composition is more or less natural. It is a mixture of Quercus petraea and Carpinus betulus. Absence of Fagus sylvatica is conditioned by the unfavourable moisture regime of heavily desiccating soils during the growing season. The undergrowth includes thermophilic drought-resistant species with well developed shrub layer on stand edges.

Fagi-querceta (beech-oak stands) can be found on mild to medium slopes and platforms of the forest complex. The tree layer of natural forest stands was formed by a mixture of Quercus petraea with an admixture of Carpinus betulus, Tilia, and Betula, with no shrub layer in fully closed stands. Tree species grown today in altered stands include mainly Pinus sylvestris with an admixture of Quercus petraea and Carpinus betulus with sporadic plantings of Larix decidua and Picea excelsa.

Fagi-querceta typica (typical beech-oak stands) can be seen on undulating inclined platforms with major tree species of natural forest stands being Quercus petraea and Fagus sylvatica, and Carpinus betulus, Tilia and at some places also Acer campestre as interspersed tree species. The present forest stands usually consist of a combination of Pinus sylvestris and Quercus petraea.

The rural landscape near the Dyje River Basin National Park includes granite rounded rock outcrops of isle character, today with the steppe thermophilic flora. Some of these areas are protected. It is a geobiocene type group of Querceta petrae hummilia (lower-degree dwarf oak stands). Soil types are kambizems, heavily desiccating during the growing period. Typical is sunlit aspect. The potential natural vegetation of this area is formed by Quercus petrae, Carpinus betulus, with a sporadic occurrence of Pinus sylvestris and an admixture of Betula genus. Characteristic is stunted growth and incomplete canopy. Of shrubs we should mention Rosa canina, Juniperus communis, Euonymus verrucosa, the genus of Crataegus and other species. At the present time, the area is that of the steppe character with an important herb layer including Calluna vulgaris, Genista pilosa, Pulsatilla grandis and some species from the genus Orchis.

The spring area of Daníž and its continuation in the national park is characterized by the following bioceme type group: Fraxini-alneta (ash-alder stand). Natural composition includes Alnus glutinosa with an admixture of Fraxinus excelsior, Frangula alnus, Ulmus laevis, Sambucus niger, Carpinus betulus, Populus tremula, Betula, Salix, Euonymus, Crataegus a.o. The current tree species composition nearly corresponds with the natural one.

The geobiocene type group of Fagi-querceta tiliae (lime-beech oak stands) is represented on bottoms of loamy glens, basal parts of stony slopes, and erosion rills in forested parts of the national park. Natural species composition nearly corresponds with the present one and consists of Fagus sylvatica and Quercus petraea with an admixture of Carpinus betulus, Tilia cordata, Acer platanoides and Acer campestre. Typical shrub layer is missing in fully closed stands and there may be a sporadic occurrence of Euonymus europaeus and Sambucus niger.

In water stream alluvia, out of the reach of regular floods, the geobiocene type group of Ulmi-fraxineta (elm-ash stands) should occur on gleyic to gley soils, possibly also on salinated soils. Major species would be Ulmus carpinifolia, Fraxinus excelsior, Fraxinus augustifolia, Quercus robur, Carpinus betulus, Tilia cordata, Acer campestre and Acer platanoides. The shrub layer would consist of Swida sanguinea, Ligustrum vulgare, Prunus padus, Euonymus europaeus, Salix species a.o. At present, the stands are almost damaged by the regulation of water streams and consequent drop of underground water table in their vicinity as well as by ploughing.

The geobiocene type group Saliceto-alnetum (willow-alder stands) occurs at the wettest places along water streams and around water reservoirs, at places with stagnating surface water, on waterlogged gleyic soils and on younger sediment loads. Prevailing species is Alnus glutinosa, important is representation of Salix alba and Salix fragilis, Populus alba, Populus nigra and Populus cinerea occur at less waterlogged places. Also these stands are nearly missing here.

The largest protected area in the catchment is the eastern part of the Dyje River Basin National Park. The area consists of two units of different natural characteristics: Havranické vřesoviště (Heathland) with the occurrence of thermophilic fauna and flora, and the part of national park westwards of Hnanice - several valleys with relatively steep slopes covered with forests. In the vicinity of the national park there are smaller protected areas near Popice and Šatov: Nature relic of Pustý kopec (Hill) at Konice, and Nature relic of Skalky. Both are of steppe character, with protected thermophilic species of flora and insects (Škorpík, s. a.; Český ústav ochrany přírody Brno,s.a.; Krejčí, 1982).

Natural relic of Pustý kopec (Hill) at Konice

Elevation: 250-263 m, area: 2.05 ha. The locality is situated to the North of the Popice-Havraníky connecting line, between the state border and the railway. It is an elevation with rising rocks. Thermophilic steppe species occurring here include Verbascum phoeniceum, Stipa pulcherrima, Stipa joannis, Gagea bohemica, Pulsatilla grandis, Genista pilosa, Ranunculus illyricus, and Iris pumila. Insect species are represented by the protected praying mantis and vertebrate species by common lizard. Other species seeking refuge in this locality include field hare, wild rabbit, roe deer, common pheasant and buzzard. The steppe features were acquired long ago by cattle grazing.

Natural relic of Skalky

Elevation: 280-309 m, area: 10.87 ha. The locality is situated near the village of Havraníky and stretches some 700 m southwards. It is a broken topography with a mild slope of SW and S aspects, frequent rock outcrops and rocky ridges. Plant species occurring in the locality are for example Pulsatilla grandis, Rosa pimpinellifolia, Gagea bohemica, Iris pumila, Helichrysum arenarium, and Peucedanum cervaria. The thermophilic community of insects is represented by praying mantis and swallowtail. Of vertebrates we should mention the occurrence of field hare, common pheasant, meadow bunting, red-back shike and Italian warbler. The steppe features were maintained by cattle grazing in the past. Today the locality overgrows with shrubs at some places.

Eastern part of the Dyje River Basin National Park

The Podyjí National Park was announced on the territory of the former Protected Landscape Area on March 20th, 1991. The eastern boundary of the national park protected zone is identical with the state road leading from Znojmo to the South to the state border, which has to pass through the villages of Havraníky and Hnanice. The territory of the national park itself, entering the Daníž catchment area, is represented by the Havranické vřesoviště (Heathland) westwards of Popice and Havraníky, and the area westwards of Hnanice.

Havranické vřesoviště (Heathland)

Elevation: 337-370 m. The locality is situated northwards of Popice and Havraníky and has an undulating topography with small rocks and rock flats formed by granites and granodiorites rising from the shallow soil profile. The local flora includes rare thermophilic species such as Calluna vulgaris, Rosa pimpinellifolia, Chamaecytisus ratisbonensis, Helichrysum arenarium, Pseudolysimachion spicatum, Orchis morio, Dactylorhiza sambucina, Verbascum phoeniceum and many other. With its western part the heathland links up with oak and oak-hornbeam stands. Although the soil fertility is low, some efforts were made in the past to convert the areas into arable land by blasting rock outcrops. An orchard was established here whose remains are noticeable up to the present.

The National Park section westwards of Hnanice

Elevation: approx. 330-390 m. An open and mildly undulating rural landscape blends into a more broken topography up to closed valleys with relatively steep slopes. Rock formations rise from hill tops. Fields and vineyards are in the protection zone, which link up with meadows melting into deciduous forest stands formed by alder on valley floors, oak and hornbeam on slopes, and pine on rocky sites.

Rather interesting is a finding that there used to be solonchaks along Daníž. Occurrence of halophytes is caused by increased contents of soluble salts of sulphates and chlorides in Neogene sediments (Hynek - Trnka, 1981). The richest halophyte localities near Dyjákovičky and Chvalovice do not exist any longer. The greater part of them was ploughed. The only known area in the catchment with the occurrence of halophyte vegetation is a meadow in the vicinity of the Vrbovecký pond. Of endangered species occurring here we should mention Lotus tenuis, Xerosphaera fragifera, Centaurium pulchellum (Grulich, 1987).

3. Possibilities of revitalizing the Daníž brook catchment area

The condition of the catchment area prior the regulation is a very important factor. The most obvious changes of the landscape in the Daníž catchment area were found out through a comparison of the historical map from the IIIrd military mapping in 1933 with the topographical map of 1983 and with the terrain survey. They include land consolidation into large arable fields, loss of small greenery and reduced number of small roads.

There are no great differences in terms of water-stream routes. Some sections were reconstructed prior the regulation (Daníž near cellars at Chvalovice and before the confluence with the Vrbovecký brook). In contrast to the present situation, no water areas on Daníž were marked before Hnanice and Chvalovice (Historical map, 1933). There used to be a much greater number of meadows (most probably the land under periodical floods) and both-sided tree stands along the water streams. Permanently waterlogged soil was marked at some places (e.g. right in the village of Dyjákovičky or before Šatov where later used to be a pond).

The conception of water stream revitalization includes changes relating not only the water streams themselves but their catchment area as well. The most important goal is to ensure sufficient water retention and to reduce erosion to minimum. In the catchment of Daníž, these steps will include an increased percentage of grass stands, balks, scattered small greenery, division of rural lands, composition of cultivated crops, improvement of windbreaks, etc. In these items the Programme of Water Stream Revitalization links up with other landscape programmes such as the Programme of Landscape Care, Programme of Village Restoration, and mainly with the formation of Area Systems of Ecological Stability. The area plans for Area Systems of Ecological Stability for Hnanice and Vrbovec cover the whole Daníž catchment area under study (Kolářová et al., 1994; Löw et al., 1995). The paper attempts at a solution of following problems:

Accelerated run-off from reconstructed and straightened water streams results in bank erosion (Fig. 3) as well as minimum throughflow values and drying out of some Daníž sections in summer months. A more even water run-off and shortage could be compensated for by reconstructing older accummulation reservoirs or by building new ones. Efforts were made to locate the streambed route in such a way that it would be identical with the valley line. Arches have been proposed at places with milder slope according to the historical map and according to the terrain.

Water pollution results mainly from sewage water discharge in the villages and from the lower self-purifying capacity of water. Water quality will be improved after the planned sewage water treatment plants have been put into operation. The self-purifying capacity of water should be improved by larger articulation of streambeds and banks both in their cross-section and longitudinal section (sills, pools, ditches in the bottom, changes in streambed pavement, arches on the stream) with the flood protection of the territory being retained. The streambed capacity remains unchanged. In some sections it is even proposed greater.

Minimum greenery for water streams

Fields in the area under study are ploughed up to the bank line, which results in the streambed being silted with washings from surrounding fields (Fig. 4). By making the bank sloping milder the underground water table could be raised, which will make it possible to plant a wider range of tree species along the streams. Opening of the banks and the greenery will take up a considerable amount of land.

Fig. 3 Insufficient retention capacity of the landscape often results in increased erosion of water streams. The Daníž brook in the vicinity of an accumulation basin for irrigation near Chvalovice: at this place, high water damaged even the solid concrete pavement (Spring 1994).

Solutions of problems usually connect with one another. A system of sills and pools not only improves the self-purifying capacity of the stream, but it is also an environment that could ensure survival of water biota at low water levels in summer months. The sills will have a positive influence on underground water table fluctuation, which is a favourable condition for riparian stands. These stands, in case of being of sufficient width and in good condition, should prevent any streambed sedimentation from field washings not speaking of their reinforcing and aesthetic functions. At the same time, the stream and its close vicinity are planned for a biocorridor (Kolářová et al., 1994; Löw et al., 1995). Roads will have to be constructed in some sections along the stream in order to provide access to it.

The both streams are divided into sections by grade conditions and by employment of the surrounding territory. The present situation of the stream and that of the vegetation in the surroundings of banks are described for each of the sections on the basis of terrain survey complemented with technical parameters from materials concerning regulation, possibly with a comparison with a historical map. Proposals for a reconstruction of streambed shape and bank greenery establishment follow. The material is combined with illustrations of the proposed profiles and their brief descriptions, maps (they are made according to the basic maps of Czechoslovak Socialist Republic) and photographs.

The proposed riparian and accompanying stands split into four types. Their species composition and location depends on results from mapping of the present stands, on the potential vegetation, climate (the western part of the catchment area is somewhat colder and with the higher occurrence of precipitations than the eastern one), on soil type, soil water content, height of underground water table, and on intensity of floods (Novák et al., 1986; Dostál et al., 1989).

Vegetation type A

The following type of greenery has been proposed for upper and middle sections of the Daníž brook, i.e. the sections around Hnanice and Šatov up to the railway, and then for sections with steeper banks with loamy sand up to loamy soils and underground water tables of 0.5-1.5 m under the surface, in sections where floods may occur once in a year:

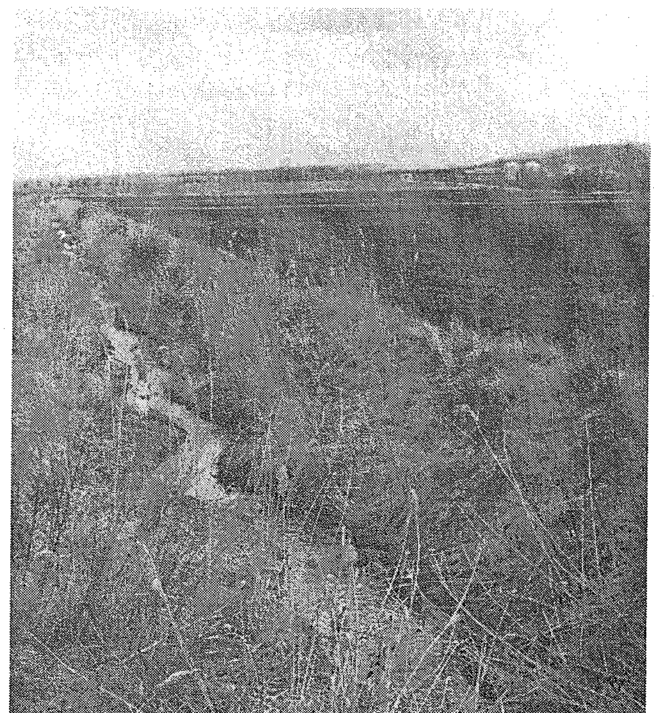


Fig. 4 The Daníž brook between the villages of Dyjákovičky and Hnízdo (Spring 1997).

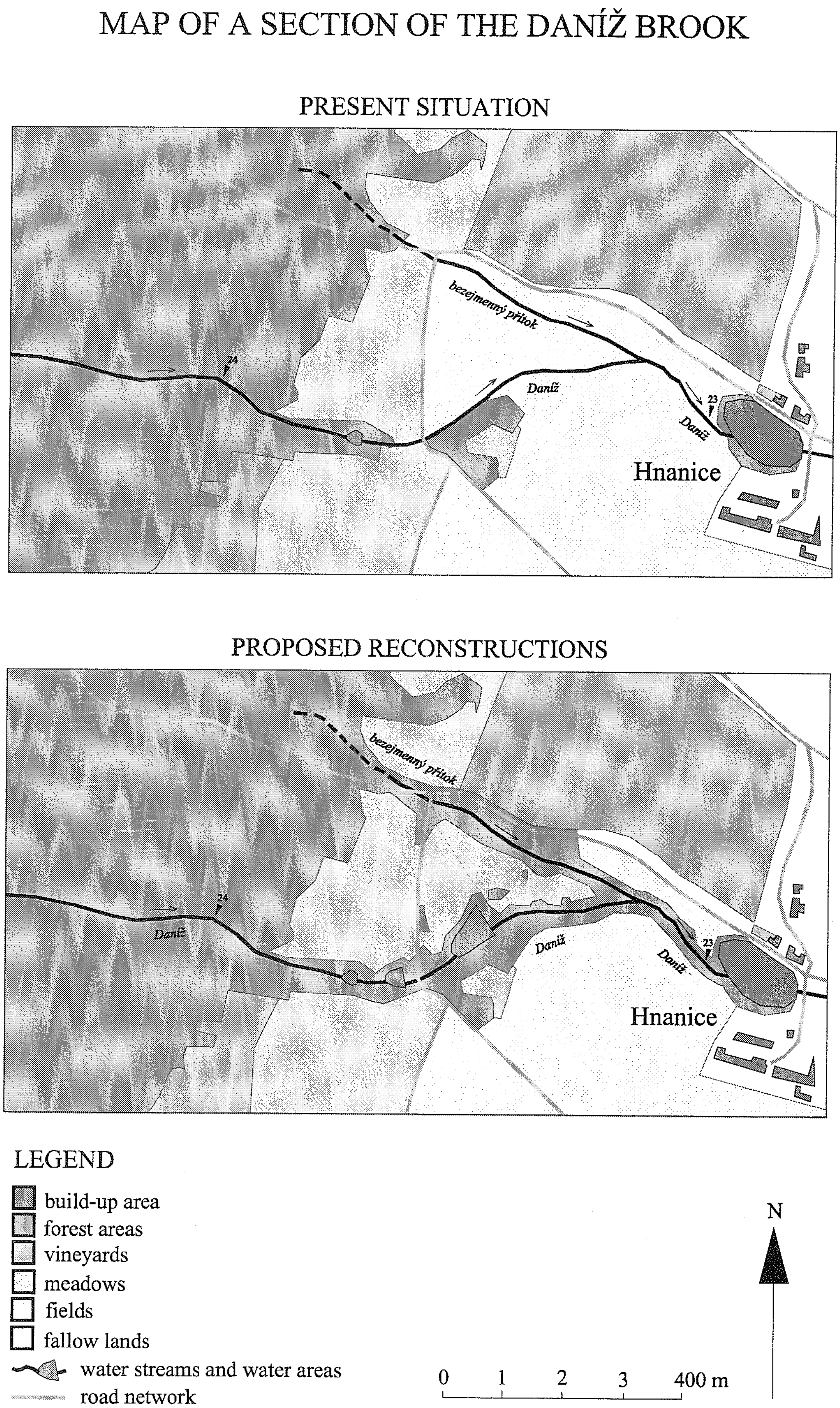


Fig. 5 Map of a section of the Daníž brook.

To sow the lower parts of banks with grass seed and to plant shrubby willows - Salix cinerea and Salix fragilis. The basic tree species in the zone from the mean stream level up to the bank line would be Alnus glutinosa combined with Carpinus betulus and Fagus sylvatica. Quercus petraea and Tilia cordata would be planted along the bank line. Interspersely planted species would be Frangula alnus, Salix alba, Populus alba and Padus avium. The shrub layer would be formed by Euonymus europaeus with Corylus avellana on edges of the riparian stands, and Ligustrum vulgare at sunlit places.

Vegetation type B

The following tree species composition has been proposed for lower sections of the stream, from the railway near Šatov up to the confluence and on mild banks with loamy or clay-loam soils with underground water tables of 0.5-1.3 m under the surface, possibly also for waterlogged places:

To sow out grass mixture in the stream immediate vicinity and keep a certain amount of reeds (to preserve Butomus umbellatus, Acorus calamus and Sparganium erectum in the stream), and to reinforce the bank with Salix cinerea where necessary. Main tree species would be Alnus glutinosa, Salix alba and aspens: Populus alba and Populus nigra. Carpinus betulus, Quercus petraea, Acer platanoides, Acer campestre and Fraxinus excelsior would have a lesser representation. The shrub layer would be formed by Cornus sanguinea, Viburnum opulus, Corylus avellana and Ligustrum vulgare.

Vegetation type C

Places more distant from the bank line where stands should be planted which are less moisture demanding, stands that would form bases of biocentres around streams or stands filling lands within stream route enclaves, with loamy sand to clay-loam soils, chernozems and luvisols, with underground water table levels some two meters under the surface should either be treated as meadow stands, regularly cut, or planted with tree species in approximately the following composition:

The main tree species would be Quercus robur, Fraxinus excelsior and Ulmus carpinifolia with less frequent Ulnus, Tilia, Populus and Acer species and interspersely occurring Carpinus betulus and Betula verrucosa. Some suitable places should probably accommodate also Juglans, Prunus and Padus species. The shrub layer then would include Cornus sanguinea, Corylus avellana etc.

Vegetation type D

Shallow basins and possibly also blind arms in the vicinity of Dyjákovičky and Hnízdo would have the following greenery:

Alnus glutinosa as a main species, Salix alba, and Salix fragilis with interspersed species of Populus, Fraxinus excelsior and Frangula alnus. The shrub layer in the immediate surroundings of the basin would be formed by willows: Salix cinerea, Salix viminalis, Salix triandra, Salix caprea and Viburnum opulus. Places more distant from the water area should have a similar greenery as the individual sections. A green belt of at least 20 m in width should be established around accumulation reservoirs and lakes, which should be forested on edges in order to prevent soil washing from neighbouring fields into the reservoir. The basins are usually shallow and will have to be well managed not to overgrow with reeds. Reeds and other ruderal herbs will be partially suppressed - also due to shade from grown-up trees.

The greenery should be planted on both banks, probably most often in belts or in groups of trees with occasional soliters so that the stands would not form any permanent shading on longer sections of the stream. Also, it is necessary to predict the size of tree crown canopy and take care of a certain height diversity.

4. An Example solution for a stream section

The confluence of Daníž and its left-side affluent and further on up to the Hnanice basin

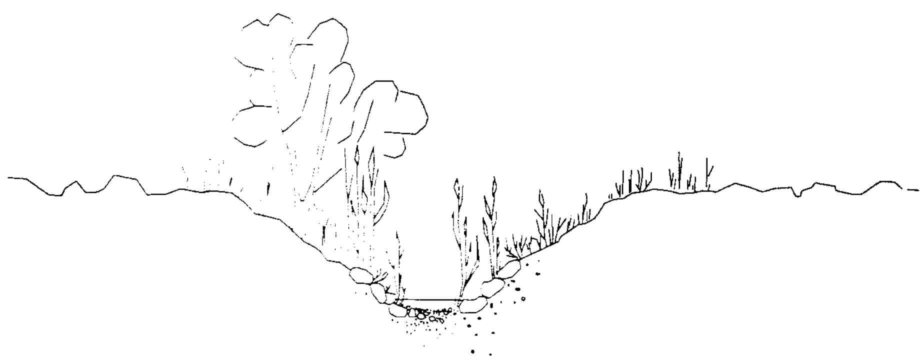
The section in question is situated in the national park protection zone and the presented solution includes the left-side affluent of Daníž in the area (Fig. 5). Streambeds of both water streams are very similar. Files say that the Daníž brook is not regulated here, yet it was artificially cut out to the depth of 1.5-2.0 m beneath the surrounding terrain. Grade was estimated by contour lines to be ranging between 25 and 30 ‰. There is only a tiny water stream on the streambed bottom which is formed of sand. The greenery near both brooks is minimal and consists of mere narrow herb ruderalized belts sporadically combined with grown-up tree species. The area along the streams is intensively cultivated with lands being ploughed up to the very bank line (Fig. 6).

The most frequently occurring tree species are Alnus glutinosa, Salix fragilis, Salix caprea, Rosa canina, Sambucus nigra, Euonymus europaeus, Humulus lupulus and Swida sanguinea.

The herb layer if formed by Lamium purpureum, Rumes obtusifolius, Symphytum officinale, Geranium pratense, Cirsium arvense, Urtica dioica, Filipendula vulgaris, Equisetum palustre, Aegopodium podagraria, Knautia silvatica, Phragmites communis, Phalaroides arundinacea, Rubus caesius, Tanacetum vulgare, Scirpus sylvaticus, Epilobium hirsuta, Tussilago farfara, Heracleum sphondylium, Stellaria nemorum, Melandrium pratense, Lythrum salicaria and Elytrigia repens.

CROSS-SECTION SKETCH

PRESENT SITUATION



The stream bed is of trapezium shape, banks are paved in their full lenght, ploughing is made up to the bank line, riparian forests are minimal.

PROPOSED CHANGES

The right bank is opened with stone sills in the bottom. Paving of the bottom and banks is made only in the vicinity of sills. The groundplan shows alternating mild stream widenings-pools and mild narrowings-places above sills.

Fig. 6 Cross-section sketch.

Proposal: To relieve sloping of the left bank in Daníž and right bank in the affluent. To build small stone dams in the bottom in order to form small pools. To pave the banks only in the vicinity of sills (the groundplan with widenings-pools and narrowings-sills). To convert the area between the two streams into a meadow with forested edges and soliters (oak and lime). To plant the remaining banks with shrubs and groups of tall trees. The meadow should be regularly cut. To open the streambed behind the confluence in the basin direction to both sides and to build sills and plant bank greenery here as well. Vegetation type: banks - A, meadow - C (Figs. 6 and 7).

Revitalization of other sections of Daníž and Vrbovecký brooks would be more difficult and several aspects should be taken into account. The intravillan of villages provides only a minimum space around the streams and some places are even housing piping networks (Šatov, Hnanice). Amelioration works were made in the open landscape and the proposed wider streambed profile as well as the arches will take up more agricultural land. Basins on the lower reaches can only be constructed as lateral in order to prevent their choking. Plantation of stands in these localities will only have a very distant link with the natural vegetation (unlike in the national park).

Conclusion

A primary cause to the lack of water is the geological parent rock - permeable loesses. Stream regulation and pollution have further worsened the situation. The paper forms a basis for partial, concrete revitalization measures in the catchment area of Daníž brook.

A principal task will consist in improved water quality (construction of sewage water treatment plants). The next step should include changes of streambed shape, building of accumulation basins and their planting with greenery. Parallel should be changes in the landscape. I assume that it will be very difficult to convince local inhabitants of necessity and realistic character of these revitalization measures, particularly in cases when the villages have to face much more pressing problems such as water supply, gasification, telephone, and the like. Problematic is also supposed to be solution of property rights related to the lands in the vicinity of water streams or concerning land reconstructions in the landscape and funds ensurance. Should at least some of these revitalization plans be implemented, it is going to be a great success.

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Reviewer

RNDr. Pavel Trnka, CSc.

ANTONÍN IVAN (60)

Our colleague Dr. Antonín IVAN, the member of Editorial Board and the hard working contributor to MORAVIAN GEOGRAPHICAL REPORTS, celebrated his sixtieth birthday on the 22nd November, 1996. The list of his publications up to now exceeds 110 titles and stands as a good evidence that Dr. IVAN has made a good deal of honest work for geomorphology. His life topic has been morphological research of South Moravia, especially of Pavlovské vrchy (Hills) and surroundings of the town of Brno. He has been permanently interested in morphotectonics and structural geomorphology applied to the eastern edge of the Bohemian Massif. Outstanding results have been achieved in his research of relief anthropogenic transformations and his contribution to the issue of alluvial plains should also be mentioned here.

The person being honoured is a modest and indefatigable research scientist whose internal satisfaction has been growing with each well written technical publication and the awareness that it was his research which helped to explain a certain problem.

Congratulations to your jubilee, Dr. Ivan!

Colleagues

Photograph: Antonín IVAN celebrating his 60th birthday. (Photo Mojmír HRÁDEK)

Semič in Bela Krajina: the region is separated by mountains from Slovenia and by the border from Croatia

Hrastovec in the Lower Drava Basin: one of a few Slovenian regions with an important agricultural function

Illustrations to the paper of A. Vaishar et al.; photos: Matej GABROVEC

Small restored pond near Chvalovice (Autumn 1996).

Illustration to the paper of J. Táborská; photo: Jana Táborská