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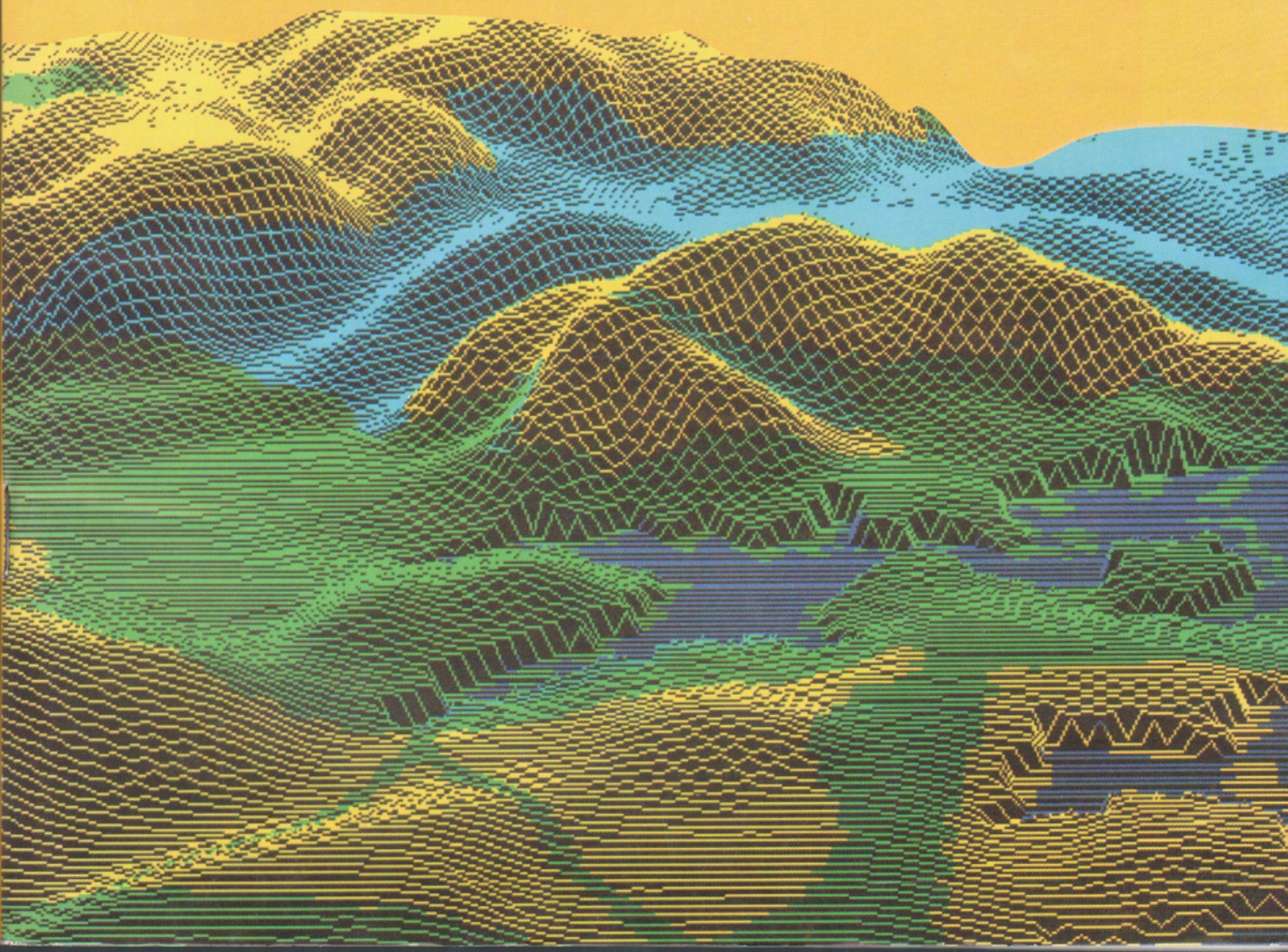

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Contents

NEW FINDINGS ON THE GEOMORPHOLOGY OF MORAVIA

Jaromír KARÁSEK

Abstract

New form of the Bachelor studies at the Faculty of Science, Masaryk University, in Brno has considerably stimulated professional activities of students who defend their bachelor projects already in the third year. They present results of their own research, which are in many cases remarkable and worth publishing. This paper presents main results of three bachelor projects in geomorphology. Each of these projects deals with either new findings on geomorphological conditions in the region under investigation or at least documents some facts known so far only empirically.

Shrnutí

Nové poznatky o geomorfologii Moravy

Nová forma bakalářského studia na přírodovědecké fakultě Masarykovy university v Brně značně přispěla k odborné aktivitě studentů, kteří již ve 3. ročníku obhajují tzv. bakalářské projekty. V nich předkládají výsledky svého vlastního výzkumu, jež v některých případech jsou přinejmenším pozoruhodné a zasluhují zveřejnění. V předloženém příspěvku jsou prezentovány výsledky tří bakalářských projektů z geomorfologie. Každá z těchto prací buď přinesla zcela nové poznatky o geomorfologických poměrech zkoumané oblasti nebo alespoň dokumentačně ověřila některé skutečnosti známé dosud jen z empirie.

Key words: bachelor project, structural control of relief, paleokarst, Miocene deposits, exhumation of forms, fault valley, fault-line valleys, rotational of scissors fault.

1. Southern Part of the Moravian Karst

Geomorphological research of selected forms in the surroundings of Brno built by diagenetic lithificied sediments dating back to the preneotectonical geological periods (Stránská skála, Babí lom and others) discovered correspondence of spatial orientation of some form elements with paleotectonic structural elements (J.Karásek 1991). This fact initiated investigation of interrelations between the structural elements and those of forms in the southern part of the Moravian Karst (L.Vašková 1993). Field measurements evaluated the values of bedding planes gradient and joints in outcrops and rock exposures. The same structural elements were evaluated from the viewpoint of their spatial orientation, i.e. direction of their dip. To find out the grade of mutual dependence of the structural elements and those of forms it was necessary to also measure slope gradients and to statistically elaborate the whole set of the carried out and derived measurements. The elaboration has resulted not only in a series of original geological cross sections (Fig.2) but also in the diagram presenting the percentual share of derived measurements of the direction of structural elements and those of form in the intervals of 5 (Fig.1).

Comparison of the diagram with main directions of tectonic disturbances known so far (e.g.K.Zapletal,1922-23,1927) results in the fact that there is a demonstrable relationship between the system of geologically investigated faults and the spatial orientation of joints. Nevertheless, there is no correspondence between the prevailing directions of joints and the prevailing slope gradients. Similarly, it can be stated that there is no statistically demostrable relation between the strike of strata and the direction of slopes (Fig.1).

Regarding this fact we can presume that the drainage pattern of the middle flow of the Říčka river is adapted to spatial orientation of structural elements only to a very small extent and thus it should be dendritic in the groundplan. In the case that some details are not taken into consideration, this presumption can be confirmed but there are evident detail deviations from the dendritic drainage, namely in the area NE of Líšeň (I.Veselý, 1974). Their analogy can be seen also on the line of the so-called Mokrá-fault in the sense of K.Zapletal (1922-23). On the basis of the hitherto known structural measurements we are not able to explain the deviations and solution of this problem will depend on further research.

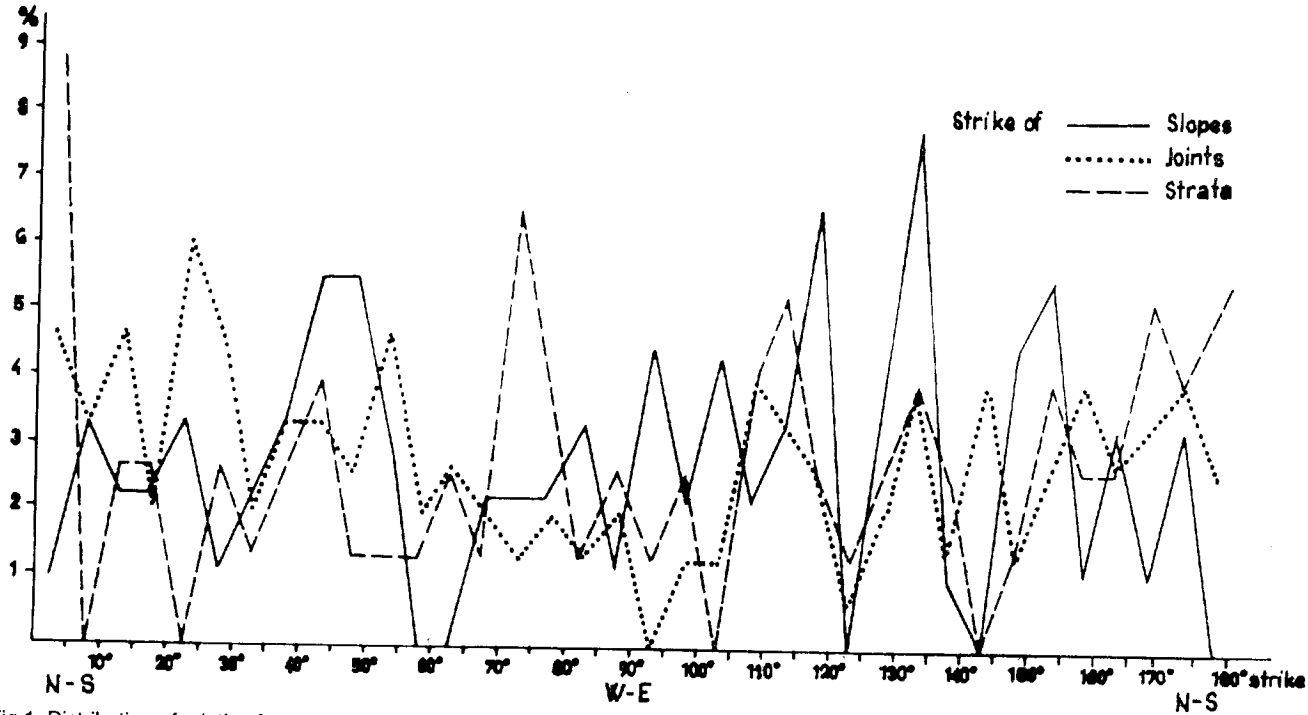

Fig.1. Distribution of relative frequences of the strike of structural elements (slopes, joints, strata) in azimuth intervals about 5 degrees (by L. Vašková, 1993)

2. The Rozdrojovice-Part of the Bobravská vrchovina (Highland)

Main mass of the Bobravská vrchovina (Highland) can be divided into parts that are separated from one another by water gaps. The nothernmost part is the Rozdrojovická vrchovina(*) (Highland) north of the water gap of the Svratka river inundated by waters of the Brno dam. It became the object of studies of the following bachelor project (Z.Máčka 1994). The author has come to very important conclusions, partly on morphostructural position of the Rozdrojovická vrchovina (Higland) and partly on manifestations of modelling processes.

a) The Rozdrojovická vrchovina (Highland) is - within the framework of complex main mass of the Bobravská vrchovina (Highland) - the only elevation whose western straight-lined and distinct bound does not correspond with a lithological boundary between the rocks of Brno Massif and permocarbonian deposits of the Boskovická brázda (Furrow). The morphostructural boundary of the Rozdrojovická vrchovina (Highland) is situated in the Rokytná-conglomerates of the Boskovická brázda (Furrow) and compared with the western bound of the southern Omická vrchovina (Highland) it is shifted approximately 500m to the West. However, the direction of both morpho- structural lines in question is identical (NNE-SSW).

b) The water gap of Kuřimka, which bounds the Rozdrojovická vrchovina (Highland) in the north, extends in the direction generally identical with the other water gaps of the Bobravská vrchovina (Highland) (WNW-ESE), but the gradient of its bottom is opposite (the direction of drainage towards WNW). Both these facts can be interpreted in casual nexus with neotectonic splitting of the eastern margin of the Bohemian Massif where the so-called "line of Labe" intersects with tectonical suture of the Boskovická brázda (Furrow) (compare A.Ivan 1974).

By the lithological boundary of the Brno Massif rocks and the Rokytná-conglomerates of the Boskovická brázda (Furrow),i.e.in the hilltop part of the Rozdrojovická vrchovina (Highland) there is a stripe of Devonian limestones, in places more than 500m wide (compare Z.Novák et al. 1991), extended in the direction corresponding with the western margin of the Rozdrojovická vrchovina (Highland). Resulting from the field research and from the studies of the unpublished archival documentation (A.Polák 1954), Z.Máčka succeeded in finding forms of at least two stages of karstification of these limestones. Quaternaire, and subrecent stage of karstification, respectively, is represented by karrens, sinkholes and small dry caves, one of which was already documented in the past (K.Kirchner 1991). What is more

(*) The name is not officially used as an oronymum, nevertheless, its application is logical with regard to the criteria common with detailed orographical division of the Bobravská vrchovina (Highland) (e.g. J.Demek et al. 1965).

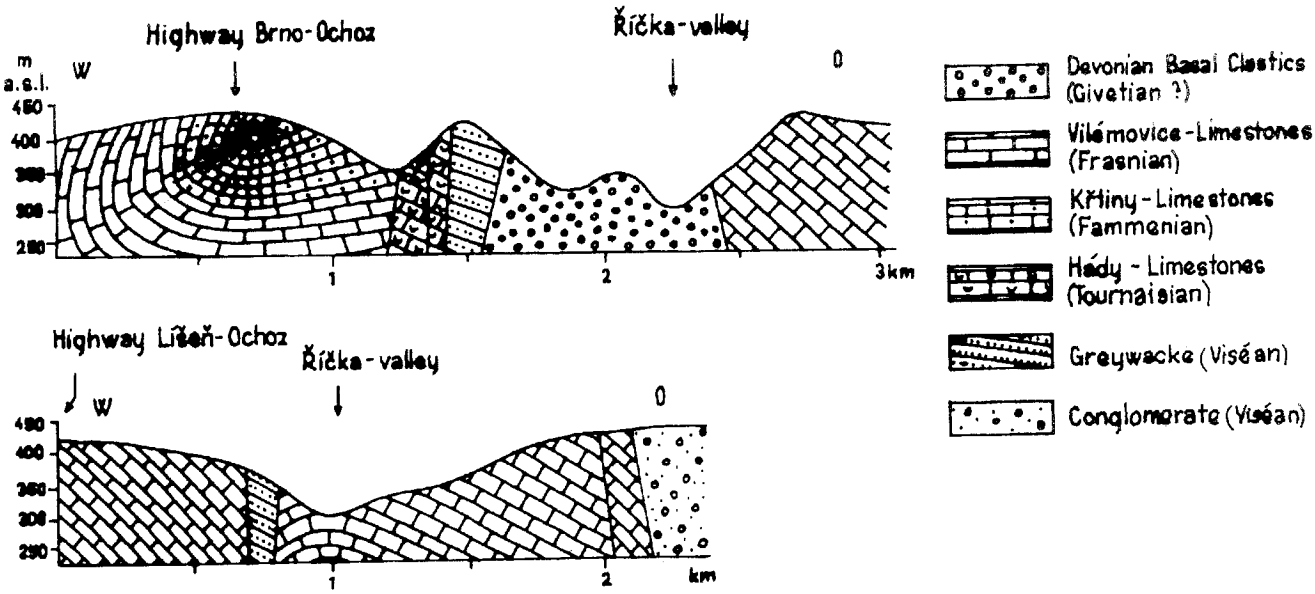

Fig.2. Examples of geological cross sections compiled after morphostructural measurements (by L.Vašková - 1993, stratigraphy by J.Dvořák in R.Musil et.al.1993)

interesting is the fact that the karstified Devonian limestones on the hilltop of the Rozdrojovická Vrchovina (Highland) are covered with Miocene deposits, presumedly with Badenian ones that are filling the caverns of Devonian limestone.

There is the only logical explanation of this fact that the karst caverns in limestones must have existed even in the period preceeding the Badenian transgression. It is then another verification of the existence of paleokarst by the western margin of the Bobravská vrchovina (Highland) (the preceeding evidence see P.Bosák et al. 1989).

The occurrence of Miocene deposits in the flat hilltop part of the Rozdrojovická vrchovina (Highland) at the elevation of about 400m above sea level (see Fig.3) is also worth considering from the paleogeographical point of view. One can argue for the opinion that in the period of Miocene transgression the area of the present Bobravská vrchovina (Highland) was covered with Miocene deposits and that the youngest regional levelling of the eastern margin of the Bohemian Massif dates back to the post-Badenian period. The existence of paleocaves almost excludes the possibility of Badenian transgression over the levelled surface (compare J.Karásek 1988).

3. The Mikulov-Part of the Dolnomoravský úval (Graben)

The topographical position of the well-known paleontological locality of Kienberg near Mikulov (J.Tejkal 1955) evokes an idea of a fossil strand in the direction of transgression of the Upper-Badenian sea from the West. West of Kienberg we can find a flat, open field of a depression extending to the foothill of the Pavlovské Vrchy (Hills), the so-called Podmušlovská sníženina (Depression), which is a part of the Dolnomoravský úval (Graben) (J.Demek - M.Macka et al. 1970). There is an argument against the conception of the opposite direction of transgression, i.e. from the East, - a distinct offset of the flysch Milovická pahorkatina (Hills) (Vysoký Roh) towering over the level of the Podmušlovská sníženina (Depression) about 100m. From the geological viewpoint there is no doubt about the transgression of the Upper-Badenian sea from the east (e.g. P.Čtyroký in P.Havlíček et al. 1992). There is an evidence to prove it - conserved denudation relics of Upper-Badenian deposits in the hilltop parts of Vysoký Roh (Fig.4) in the roof of flysch. With this discrepancy between the topographical and geological situations deals another bachelor project (A.Petrová 1994), further to the early morphostructural study of the immediate neighbourhood (A.Ivan 1967).

The facts in question result in two possible interpretations.

a) The relief of the field here in the period of the Upper-Badenian transgression was generally similar to the present relief. We can say that the sea level was so high that it covered even the hilltop of the dominant Vysoký Roh. It would be necessary then to regard the present relief as a result of the post-Badenian exhumation.
Before we start to verify this hypothesis, it is necessary to draw attention to several facts already mentioned (A.Ivan 1967). For instance, angular unconformity between the Ždánice-Hustopeče flysch and the Upper-Badenian deposits may give evidence of the facts that the flysch surface was levelled before the Upper-Badenian transgression

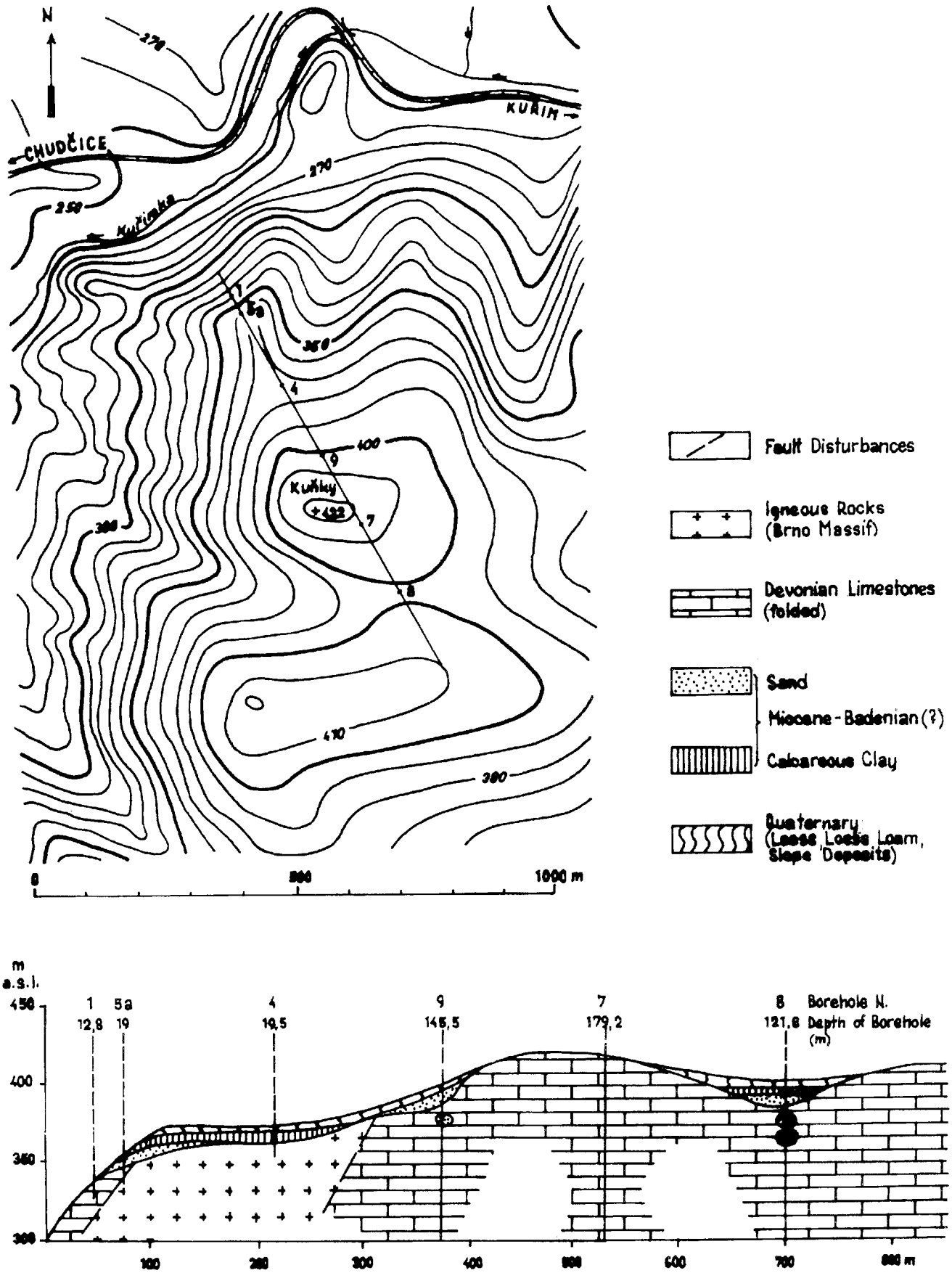

Fig.3. Morphostratigraphical situation east of Chudčice (modified from Z.Máčka, 1994)

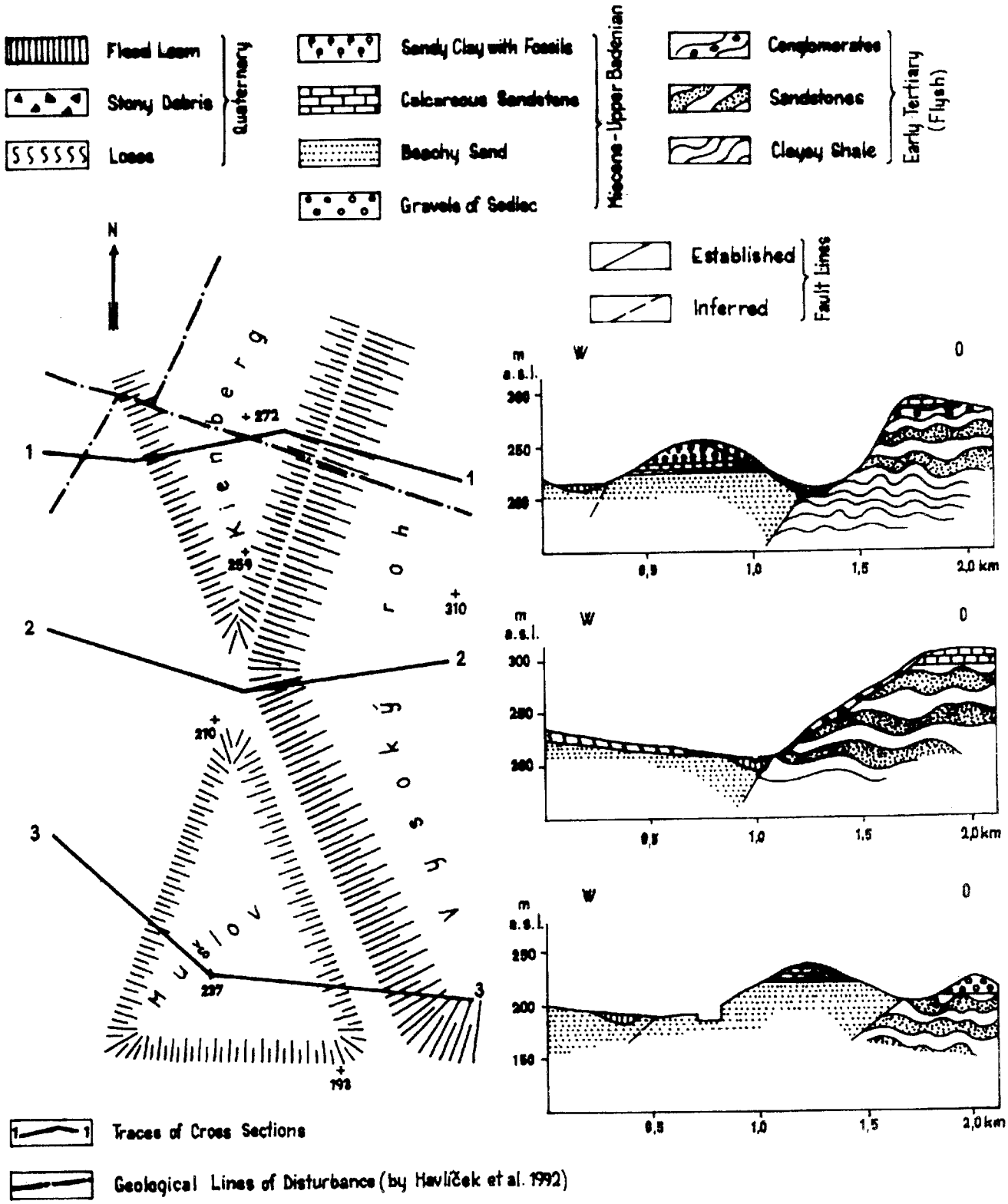

Fig.4. Morfostructural situation east of Mikulov (modified from A.Petrová, 1944)

("main levelling" in the sense of A.Ivan). The present levelled surface on the hilltop of Vysoký Roh 300-350m above sea level has its origin after regression of the Upper-Badenian sea because it truncates the Ždánice-Hustopeče series of strata and Upper-Badenian deposits in the same level (A.Ivan 1967,p.19).

Another important fact is the existence of two valleys in the Milovická pahorkatina (Hills) extended in the N-S direction but with different bottom gradient. They are separated from each other by a flat levelled surface and therefore A.Ivan considered them to be fault-line valleys. The continuation of the southern valley is to the NE from the community of Mušlov where it turns steep from the N-S direction to NNE-SSW and separates the offset of Kienberg from Vysoký Roh. The western slope of Kienberg is bounded by the valley of the Mušlovský potok (Brook) and by extension of its left tributary in the direction NNW-SSE. In the area of the ponds of Mušlov, the valley of Mušlovský potok (Brook) is connected in an acute angle with the valley bounding Vysoký Roh in the West so that the offset of Kienberg projects in a relatively sharp cusp. In the extension of the valley line of the Mušlovský Potok (Brook) to the SSE we can find a col by which the hill of Mušlov is separated as a satellite elevation from Vysoký Roh. The morphostructural independence of Mušlov from Vysoký Roh is evident partly by comparing absolute heights of crests of both elevations, partly by the fact that Vysoký Roh is built mainly of flysch while Mušlov (just as Kienberg) is built solely of Upper-Badenian deposits. The N-S fault found out by A. Ivan to the South from Milovice is then substituted to the NNW from Sedlec by a pair of faults bordering in the knot near Mušlovské rybníky (Ponds) (see Fig.4)

b) If we admit - in accordance with A.Ivan - that the surface of flysch was levelled in the period of Upper-Badenian transgression, then a different height of transgression plane of Upper-Badenian deposits (approx. 300m above sea level on Vysoký Roh and considerably less than 210m above sea level on Mušlov and Kienberg) is an unambiguous argument for post-Badenian displacements along fault lines of the NNE-SSW and NNW-SSE directions. In this case there are no fault-line valleys but real fault valleys in the sense of common classifications (C.A.Cotton 1948, W.D.Thornbury 1956, p.114).

This interpretation is in an apparent discrepancy with that of A.Ivan. The main Ivan's factographical argument, i.e. the morphological inexpressiveness of the fault between the northern and southern valleys on the water-divide to the south of Milovice is indisputable. No interpretational use was made of another Ivan's important finding concerning different or opposite manifestations of height assymmetry in the northern and southern valleys. This fact seems to give evidence for the interpretation that the NS section of the Milovice-fault may be regarded an axial rotational fault (see e.g. F.H.Lahee 1941, p.215 - "scissors fault", and J.Jaroš-J.Vachtl 1992, p.259) with a rotational axis in the area of the divide. Deflection of the Milovice-fault from the N-S direction to that of NNE-SSW to the North of Sedlec rather complicates this simple morphotectonic interpretation but it does not cast any doubt on it.

Doubts might probably result from the comparison of the course of tectonic lines recorded in this area during the geological mapping (P.Havlíček et al. 1992 - see Fig.4) and that of morphotectonic lines whose geological importance is evident from the enclosed geological profiles (Fig.4). The unambiguous interpretation of geological and morphological conditions in interrelations will probably still be under discussion. There will be a great obstacle to the final solution - an exceptional lithological variety of Upper-Badenian deposits. It is not clear whether this variety reflects heteropic facies or whether it is of lithostratigraphical importance.

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