

DEVELOPMENT OF THE SURFACE OF LEVELLING IN THE BOHEMIAN MASS WITH SPECIAL REFERENCE TO THE NÍZKÝ JESENÍK MTS.

Vývoj zarovnaného povrchu v Českém masivu se zvláštním zřetelem k Nížkému Jeseníku. — Zarovnaný povrch se v oblasti Nížkého Jeseníku vyvíjel během dlouhého období, a to v závislosti na klimatických změnách a tektonických pohybech. Každý soubor geomorfologických procesů vlastní té či oné klimamorfogenetické oblasti se ve své době projevil v jeho tvárnosti a přispěl k jeho polygenetičnosti. Zatímco neotektonické pohyby způsobily vznik vesměs velkých ker, vyvolaly erozně-denudační procesy v pliocénu na těchto krách vznik malých stupňů plošin, které jsou příznačné pro rozvodní partie území Nížkého Jeseníku. Výsledkem odnosu v pliocénu bylo značné snížení a zmenšení plochy starého zarovnaného povrchu, které bylo od místa k místu značně různé a záviselo na hloubce bazální zvětrávací plochy a místních geomorfologických poměrech, a vedlo ke vzniku dnešní stupňoviny plošin. Svým založením je zarovnaný povrch starý, svou dnešní tvárností však mladý. Pliocenní modelace dosáhla takových rozměrů, že mu vtiskla jeho dnešní základní rysy.

V závěru práce jsou stručně naznačeny některé problémy zarovnaného povrchu v celém Českém masivu. Autor zdůrazňuje, že v této oblasti nelze mluvit o tzv. oligocenní parovině, která byla mladšími geomorfologickými procesy již rozrušena.

Introduction

During the last years a still greater attention was paid in Czechoslovakia to the origin of the planations on the watershed parts of the terrain. These planations cut the surface of the differently resistant rocks and are one of the basic elements of the relief of the Bohemian Mass. They occur in various altitudes even within the scope of the same geomorphologic region. The solution of their genesis and age is a considerably complicated problem for the time being. They are opinions namely, that in some areas these are altiplanation terraces, plains of abrasion, pediments, or most often, that the planations are relicts of the originally uniform Oligocene peneplain uplifted by tectonic movements and broken into blocks, or finally, that two up to three surfaces of levelling of different age are found on the territory of the Bohemian Mass.

Genesis and age of the surface of levelling in the Nížký Jeseník Mts.

The Nížký Jeseník Mts. occupy the most eastern part of the Sudetic Mountains; they reach their greatest altitudes in W (up to 809 m) and are slowly sloping towards east generally (altitudes of about 320 m). They are separated from the environs by mostly expressive slopes. The summit level of the Nížký Jeseník Mts. is formed by the moderately undulate surface, represented by planations and widely rounded watershed ridges. The planations level the surface of folded and differently resistant Culm and Devonian rocks, consisting predominantly of greywackes and schists. They are either nearly even, (especially in the east part of the territory — angle often less than 1°), slightly undulate, or they are sloping slowly in one direction. The most often differences in height are 10 up to 30 m among the near planations, less often up to 100 m and even more. The planations are separated by valleys, flat passes and slopes. The low slopes are denudated considerably and they have not the marks of the young fault-slopes (V. Panoš 1962). Their direction varies very often and their length like the length of the planations does not usually surpass 1 km. Elsewhere (less often) high, long slopes reaching the height of about 100 m and being parallel with some of the marginal faultslopes of the Nížký Jeseník Mts. are concerned. These slopes are often founded on tectonic lines, along which the vertical movements of the area had a different intensity on both sides of the fault line. We meet consequently in the investigated area with expressive steps of planations on the watershed of the streams (fig. 1, 2). The subsidence of the altitude of the planations towards east is not fluent everywhere. Cases are found, where the planation lying west of the adjoining one, is lower than the east one. But on the whole the subsidence of the height of the planations towards east and also towards the marginal slopes is very distinct. On the planations the basal layers of the Tertiary weathering products and the Quaternary products of weathering can be found (fig. 3). For the solution of the genesis and of the age of the planations, the fact is of importance on one side, that on some of them the products of the Tertiary weathering are missing and only the weathered material formed during the Quaternary

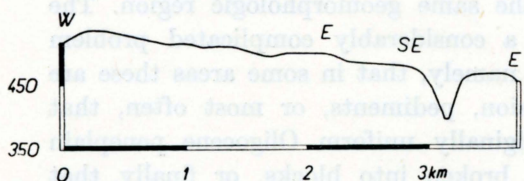


Fig. 1 Planations on Culm greywackes, north of the village Vrchy in the Nížký Jeseník Mts.

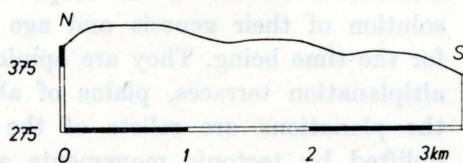


Fig. 2 Planations (built predominantly of Culm schists) on the watershed between the streams Děrenský potok and Gručovka, north of the village Děrné in the Nížký Jeseník Mts.

is found here, on the other side the occurrence of the marine sediments in valleys and of the correlate sediments of Pliocene age in the area of the Hornomoravský úval (Upper Moravian Graben).

The planations in the Nížký Jeseník Mts. have consequently all marks of the destruction forms created during the long development. They are the components of the surface of levelling. Its development can be followed by the geomorphologic methods since Tertiary and especially since the Lower Tortonian.

The present investigations show, that even before the Lower Tortonian sea transgression there was in the Nížký Jeseník Mts. on the watershed parts of the terrain a flat surface with thick products of weathering which was during the further development modelled to such an extent, that it is not possible to speak in this area today about a surface of Oligocene age. From the fact, that the planations have not the marks of the forms created by the marine erosion (to compare with J. Krejčí 1944) and from the geological knowledge about the Lower Tortonian transgression (I. Cicha—J. Paulík—J. Tejkal 1957, I. Cicha 1961) follows, that the system of the marine-cut terraces does not occur here. During the transgression, the sea abraded in the products of weathering and during the regression especially in its own sediments. Only in the narrow stripe close by the Moravian Gate the abrasion could in the first phase of the Lower Tortonian transgression reach even the rock substratum of the fossil weathered material. During the transgression the intense modellation of the old surface came to pass, which reflected first of all by the removal of a great part of the fossil products of weathering. It is not out of the question that on suitable places the removal of all or nearly all old products of weathering could occur, which caused a considerably surface lowering.

After the regression of the Lower Tortonian sea caused by the uplifting of the Nížký Jeseník Mts. (I. Cicha 1961) the weathering and the removal of the weathered material in sub-aerial conditions continued. This removal caused especially by the sheet-wash (J. Büdel 1957 and others) reached a considerable

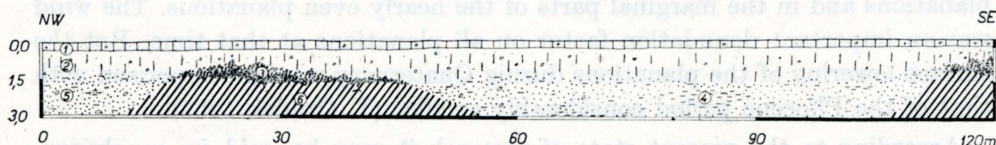


Fig. 3 Weathered material on the planation at the east margin of the town Vítkov in the Nížký Jeseník Mts. 1 — brownish - grey softly sandy humus loam with solitary fragments of Culm greywackes (Holocene soil), 2 — yellowish-brown softly sandy greyspeckled loam, strongly sandy on base, with solitary fragments of Culm greywackes and well rounded quartz-stones (Quaternary), 3 — angular fragments of Culm greywackes mixed with sandy loam, formed by the frost weathering (Pleistocene), 4 — greyish-white up to white kaolinic weathered Culm greywackes (Neogene), 5 — ochre yellow, rusty and greyish-green slightly loamy up to loamy sand with solitary strongly weathered rounded fragments of Culm greywackes — weathered greywackes formed in the warm climate (Neogene), 6 — slightly weathered greywackes (Culm).

intensity and culminated during the Upper Pliocene. On the elevations of the basal surface, which is considerably undulate, (J. Büdel 1957 and others) the removal of nearly all, or on some places even of all products of weathering set in, while in the depressions of the basal surface on the watershed of the streams and in some lower parts of the terrain only their upper layers were removed. The considerable lowering of the old surface of levelling (founded during the long period before the Tortonian), can be considered as the result of the removal in Pliocene, but in no case this removal reached the base level. This may be claimed especially, because the Lower Tortonian sediments which are found on more places in a thickness of more than 20 m, could not occur in the valleys in the given case. The extent of the lowering of the ground surface depended not only on the depth of the basal surface (given especially by the local geological conditions), but on the local geomorphological conditions too. Therefore the extent of the lowering of the surface of levelling was from place to place considerably different, which led to the origin of the present steps of planations on places, where the vertical movements along the faults among the planations cannot be assumed (T. Czudek 1963). It may be said consequently, that while the young tectonic movements caused the origin of the steps of large blocks, the erosion-denudation processes caused the origin of small steps of planations during the Pliocene period, which are characteristic for the whole described area. The intensive removal during Pliocene caused also, that in the cold periods of Pleistocene the less weathered Culm and Devonian rocks on the planations, especially on numerous places of the elevations of the basal surface, were within reach of the intense periglacial weathering. This weathering caused the origin of the coarse-grained rock fragments mixed with loams and the further decomposition of the Tertiary weathered mantle. In the middle parts of the nearly even planations the cryoturbation was acting intensively and the solifluction did not occur. But the solifluction affected together with the sheet wash on the tilted, more undulate planations and in the marginal parts of the nearly even planations. The wind was an important denudation factor on all planations at that time. But the surface lowering of the planations during Quaternary was in comparison with that of the Pliocene period considerably smaller (T. Czudek 1963).

According to the present state of research it may be said in conclusion, the surface of levelling to have developed in the Nížký Jeseník Mts. during a long period in dependance on climatic changes and tectonic movements. Every system of the geomorphological processes proper to this or to that climamorphogenetic region, had at its time certain effects on its shape and contributed to its polygenetic topography. But the Pliocene modellation of the old surface of levelling (the lowering and diminution of its area) which culminated in the Upper Pliocene, reached in the Nížký Jeseník Mts. such an extent, that it impressed to it its present basal feature.

Some problems of the surface of levelling in the Bohemian Mass

In the area of the Bohemian Mass the expressive planations on the watershed parts of the terrain levelling the rocks of different age and of different resistance are known already long. These are parts of the surface of levelling, which is situated in the individual geomorphologic areas in different altitudes (e.g. the Krušné hory Mts., the Slavkovský les Mts., the Hrubý and Nízký Jeseník Mts.); the differences in height of the ground surface being at a relatively short distance even more than 500 m. Even within the scope of the same geomorphologic unit the differences in height are among the planations on some places greater than 100 m. This surface got its present appearance in most geomorphologic units by a very intensive modellation as late as in Pliocene, so that we do not meet in the area of the Bohemian Mass with the Oligocene surface (the so called Oligocene peneplain), which has been desintegrated by the younger geomorphologic processes. While the old surface of levelling was broken into large blocks by the neotectonic movements, which operated even inside the geomorphologic units, the erosion-denudation processes during the Pliocene period caused on them the origin of the steps of planations (with small differences in height among the planations), characteristic for the watershed parts of the erosion relief of the Bohemian Mass. The surface of levelling of the Bohemian Mass developed during a long period in different climamorphogenetic regions. On the base of the present state of research it can be said, that it has in many areas of the Bohemian Mass rather the marks of a peneplain than of a pediplain, resp. of a system of pediments. But the pediments occur locally at the foot of some marginal slopes, below the Quaternary talus.

As for the effect of the marine resp. lake erosion on the development of the surface of levelling of some areas of the Bohemian Mass it may be said, that this geomorphologic process did not form the marine-cut terraces in an areally larger region. But the abrasion had a considerable influence on the modellation of the relief.

The problem of the so called Pre-Cretaceous surface of levelling and of the occurrence of two or three surfaces of levelling in the Bohemian Mass is very complicated for the time being. In all probability in some cases, e.g. in the area consisting of the Miocene and Pliocene sediments and along some larger streams the local surfaces of levelling were formed, which are as for their origin younger than the surface of levelling e.g. of the Krušné hory Mts., the Českomoravská vrchovina Highland, the Nízký Jeseník Mts., the Dražanská vrchovina Highland.

The surface of levelling had in most areas roughly the same features as it has today already before Quaternary (E. Neef 1955 and others). But it went on modelling in the periglacial conditions of Pleistocene especially. This

modellation reflected on the one hand by its moderate lowering (e.g. the Nízký Jeseník Mts., the Dražanská vrchovina Highland, the Slavkovský les Mts., the Tepelská vrchovina Highland), on the other hand in some areas by the origin of the altiplanation terraces (for instance the Hrubý Jeseník Mts., the Rychlebské hory Mts.) which occur below the frost-riven cliffs and in vicinity of some tors (fig. 4). The tors got, however in some areas (especially in the granite ones) due to the removal of the weathered material (D. L. Linton 1955) to the surface already during the Tertiary period or in some cases at least partly as late as in Pleistocene owing to the down-wearing of the ground surface. It is possible to speak in the vicinity of these tors about the more or less exhumed basal surface (B. P. Ruxton—L. Berry 1959) and not about the altiplanation terraces, developing by the more or less parallel retreat of the frost-riven cliffs (R. S. Waters 1962 and others) or it can be spoken in certain cases about the combination of both these surfaces.

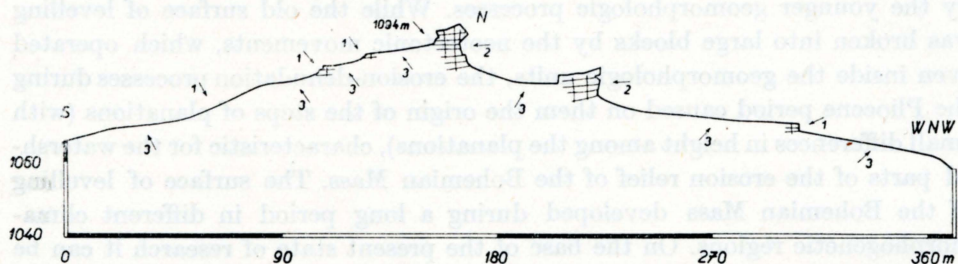


Fig. 4 Frost-riven cliffs (1), tors (2) and altiplanation terraces (3) in the summit part of the Hill Žárový vrch, WSW of the town Vrbno p. Pradědem in the Hrubý Jeseník Mts., which are according to J. Skácel petrographically built by alternating layers of chloritic migmatites and orthogneisses. (Measured by J. Vařeka, J. Malínek, T. Czudek).

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