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Geomorphological analysis of the Stožecká hornatina (Mountains)

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Abstract

This study has been based on the field research carried out in the northwestern part of Trojmezenská hornatina in the mainly structurally based Stožecká hornatina . Its aim was a complex geomorphological analysis of the relief. This region has never yet been object of a more detailed geomorphological research, which enabled to study a large spectrum of macrorelief, mesorelief and microrelief forms. A large and at many placed denuded exfoliation dome with a perfectly developed fissure system became in the Pleistocene an ideal place for cryogenic processes. They have formed there a whole spectrum of cryogenous forms – frost cliffs, pseudo-cirques, cryoplanation plateaux, small cryoplains, rock seas, rock and solifluction streams. Structural relief features and a high number of cryogenous forms give to that territory an original geomorphological character, which is only seldom to be found in our territory. The whole territory was in detail geomorphologically mapped and a generalized geomorphological map forms a part of this study.

Key words: geomorphological analysis of the relief, cryogenous morphosculpture

Orography of the monitored region

In the southeastern part of the Šumava there spreads Trojmezenská hornatina (360 km^2, mean altitude 855.6 m). The principal lenghtwise ridge of northwest--southeast orientation of this fault-fissure hilly region is separated by transversal folding and tectonics into individual mountain groups and basins.

In the northwestern part of Trojmezenská hornatina there are structural ridges of Stožecká hornatina . The highest point is Žlebský vrch (Mountain) 1080 m. Another important point is Stožec (1065 m) lying in the confluence angle of Studená and Teplá Vltava (Rivers), 2.5 km to the north from the Stožec Village. It is a modanock shaped as a large and articulated exfoliation dome with prevailingly steep slopes at the foot of which is situated an erosional-denudational depression – Stožecká kotlina (Basin) – drained by Studená Vltava.

At the north, Trojmezenská hornatina is rimmed by a narrow depression called Vltavická brázda (Furrow) northwest-southeast oriented, 136 km^2. Vltavická brázda (Furrow) is based on directional tectonic faults and delimited by steep, mostly dislocational slopes. Its flat bottom is covered by a thick layer of weathered material and by the Vltava (River) bottomland with frequent peat-bogs.

The Šumava mountain region is a part of the Český masiv (Bohemian Massif) crystallinicum. A great part of the Šumava territory is formed by the northwestern branch of the central Moldanubic pluton. The Moldanubicum is composed there of crystalline slates and migmatites generated by the metamorphosis of different intensity and ofdeep igneous bodies – granodiorites and granites. The Moldanubicum dates probably from the Proterozoic.

According to petrographic documents, the Šumava Moldanubicum is stratigraphically divided into two groups. The oldest part of the territory is probably a uniform series. It covers the larger neighbourhood of Volary, Prachatice and Vimperk. Original rocks of this several kilometres thick series were deposited in the deep parts of a sea depression in a relative tectonic calm and with a significant transport of clayey and sandy material. A repeated metamorphosis of the original sedimentary rock produced then mainly biotitic paragneisses and migmatites of different type.

The younger variegated series differs from the uniform one especially by many intrusions of crystalline limestones, dolomites, erlans, amphibolites, graphitic rocks and quartzites. The series was formed by a transformation of slates and greywackes in the period of tectonic agitation in the shallow parts of the geosyncline. This more feebly metamorphosed series is represented by a thick complex of paragneisses with intrusions of different rocks. The variegated series was several times faulted and its tectonic structure is complicated. It occurs in two more or less continuous regions separated by a large belt of the uniform series – in the neighbourhood of Český Krumlov and Sušice.

The central massif is of Late Varisan age. The oldest rocks there are diorites, the youngest then granodiorites of Weinsberg type and Rastenberg granite, the youngest one the rocks of Eisgarn type and double-mica vein granites. In the central part of the massifs prevail coarse-grained granites, while at the margins appear fine-grained granites. Among the main types of deep igneous rocks of the Moldanubic pluton in Šumava we can mention:

- amphibolitic-biotitic dark middle-grained granite (Rastenberg type) forming an about 100 km^2 large body between Volary and Horní Planá and several small massifs in the neighbourhood of Stožec Mt.;
- biotitic porphyric middle-grained granodiorite (Weinsberg type) is found between České Žleby and Knížecí Pláně at the northwest from Strážný and at northwest and northeast from Prášily. In the southern part of Šumava the Weinsberg type forms a nearly 30 km long border belt between Vítkův kámen Mt. and Horní Dvořiště;
- light coarse-grained double-mica granite to adamellite (Eisgarn type) forms a huge compact massif of Plechý Mt. and Třístoličník Mt. (the so-called Plecnštejn granite). A smaller body of a similar composition appears also westwards from Strážný Mt.;
- muscovitic-biotitic to middle-grained double-mica granite (Číměř type) forms a massif at the south-west from Frymburk;
- double-mica granite to adamellite forms also the about 15 km long Lipno massif;

– double-mica light granodiorite forms a smaller body north-westwards from Kvilda Mt.;
– biotitic granite, adamellite and granodiorite of Srní type build the so-called Vydra massif. A large massif of similar composition is situated in the Křemelná River catchment and eastwards from Špičák Mt.;
– amphibolic-biotitic quartzite diorite forms a smaller body southwestwards from Srní.

1. Stožecká hornatina – flat mountains formed by biotitic Moldanubicum gneisses at the contact with biotitic granodiorite and granite of Moldanubic Pluton.
2. Stožec – 1065 m, modanock situated in Stožecká hornatina is built by granitized Moldanubicum gneisses at the contact with porphyric granite and double-mica light granodiorite of the Moldanubic pluton.
3. Stožecká kotlina (Basin) – erosional-denudational basin at the contact of biotitic gneisses of Moldanubicum with biotitic granodiorite and double-mica granite of the Moldanubic pluton.
4. Trojmezenská hornatina – mountains composed of biotitic Moldanubicum gneisses and double-mica granodiorites and granites and biotitic granodiorite of the Moldanubic pluton.
5. Vltavická brázda (Furrow) – tectonic depression passing through nearly all Moldanubicum rock complexes (biotitic granitized gneisses, orthogneisses, biotitic migmatitic paragneisses, mica schist gneisses of the Kaplice series) and Moldanubic pluton (double mica granodiorite, double mica granite, dark porphyric granite). The flat bottom is covered by a thick cover of weathered materials and fluvial sediments.

Geomorphologic analysis of the territory

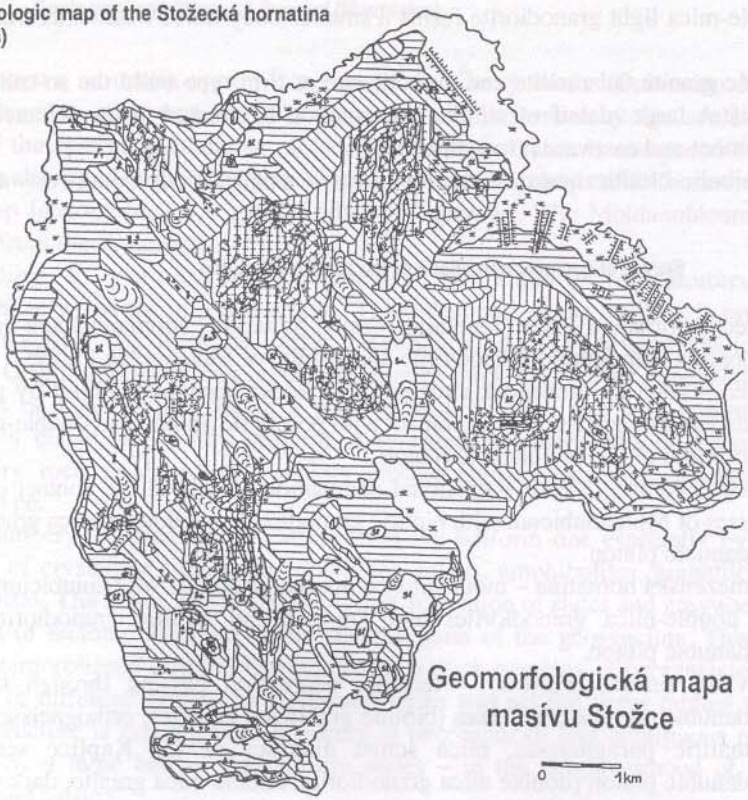
(see geomorphologic map)

Structural forms

This group includes forms conditioned by endogenic factors, mainly by tectonic faults, exfoliation domes, fissures and lithologic properties of rocks.

The largest area is covered by three categories of structural denudational slopes (inclination of 5–10°, 10–20° and over 20°) formed at the remnants of granite exfoliation domes. Structural slopes are the most frequently represented on Radvanovický hřbet Ridge (southwards from Lenora Village) and in the part Stožec, Stožeček and Stožecká skála Ridge (eastern part of the monitored territory). These structural surfaces are largely represented also in Žlebský kopec Mt. (1080 m), Kapradník Mt. (1026 m), Spáleniště Mt. (949 m) and Hamerský les Mt. (832 m). These slopes cover together 17.3% of the monitored territory. These slopes are mostly bound to assumed fault lines that are N-S (or NNE-SSW) and W-E (or NW-SE) oriented. Smaller structural surfaces occur at the district's margin and naturally link up to the tectonic lines of the high parts.

Geomorphologic map of the Stožecká hornatina (Mountains)



Vzhledem k tomu, že mapa pro tisk je značně generalizovaná nezachycuje všechny strukturní a erozní plošiny a některé antropogenní tvary, které jsou uvedené v textu.

Key to the geomorphological map of Stožecká hornatina

structural denudational slopes of an inclination
- 2–5°
- 5–10°
- 10–20°
- over 20°

Erosional denudational forms:
erosional denudational plateaux
- top
- slope
- saddle

erosional denudational slopes of an inclination
- 2–5°
- 5–10°
- 10–20°
- over 20°

Fluvial erosional forms:
- dell
- ravine

Fluvial accumulational forms:
- flood plain

Cryogenous forms:
- cryogenously remodelled dome relics
- frost cliffs
- lonely rock
- mushroom-shaped forms
- rock seas – continuous – discontinuous
- individual boulders

Anthropogenous forms:
- clay pits
- backfill
- cutting, sunken road
- flood control banks
- anthropogenous walls
- consolidated ways
- drainage furrows
- trenches
- defensive forts
- panel way

Other forms:
- source
- pseudothufurs
- peatbog, peat extraction
- water urface

Two intervals, and that 10–20° and over 20°, prevail in the inclination of structural slopes. They occur in all structural surfaces. Their orientation is not pronounced. This relatively high inclination lead to an accelerated erosion and denudation of weathered material and to denudation of exfoliation domes. Therefore we often find on these slopes or in their upper headings cryogenously remodelled rock outcrops mostly accompanied by continuous rock seas, especially at the northern, northeastern and eastern side which documents an impact of cold exposition.

The NE-SW oriented tectonic line is accompanied by structural slopes of Radvanovický hřbet Ridge (936–1030 m) and Žlebský kopec Mt.(1080 m). The slopes are articulated by deep cuttings of Vltava's affluents. Top parts and slopes are covered by frequent rock forms of periglacial weathering and removal. Three steps of bloc accumulation are visible in the continuous rock sees. These steps were probably formed during the periglacial cycles, which accompanied the impact of the mountain glacier in the Plechý Massif. They are the best visible on Radvanovický hřbet northwestwards from the elevation point 1012, NNE from the elevation point 936 and on Žlebský kopec (northwards from the elevation point 1080).

NW-SE oriented tectonic lines accompany structural ridges of Hamerský les (896 m, northwestern margin of the monitored territory), Kapradník (1026 m, western margin of the monitored territory), Spáleniště (949 m, centre of the monitored territory), parts of Stožec (1065 m), Stožeček (856 m) and Stožecká skála (974 m) – eastern part of the monitored territory. Also there the top parts and slopes are covered by rock forms of periglacial weathering and removal of the same genesis as in the precedent tectonic line.

The most pronounced morphologic ridge of this structural group is undoubtedly Stožec (1065 m). Its slopes are steep (especially the inclinations of 10–20° and over 20° prevail) and with the exception of the western part they fall down to the alluvial plains. On Stožec slopes, especially on those with the inclination over 20°, there appear in all directions by solifluction and gravitation shifted huge plate blocks. Frequent periglacial forms are influenced by cold exposition and also here are evident steps in the accumulation of continuous rock seas, which confirm cyclicity of periglacial processes. Typical for top parts are relics of 3 to 5 m high frost cliffs.

The Stožec Massif ends by a to the north opened pseudo-cirque of Stožeček (856 m) and by a to the east and southeast stretching continuous rock sea. In the central part of the monitored territory there is the morphologically most various area – Spáleniště. This morphologically pronounced structural ridge begins at the west by a classic cryogenously remodelled exfoliation dome. To the east it passes into the top rock sea. At the altitude of 949 m, there is a pseudo-cirque (diameter about 60 m, height of rock walls 5–12 m) opened to the northeast. From the cryogenous depression of the pseudo-cirque, there parts a rock stream with a visible about 3 m high step. After the pseudo-cirque there is a series of frost cliffs opened mostly to the southeast and below them there is a 40 m wide and 150 m long cryoplanation terrace. The ridge ends by a pronounced 15 m high frost scarp from which a continuous rock sea stretches to the south, east and north. The whole ridge is traversed by an aplite 20 to 25 cm wide vein crossing the spine of the whole ridge. Mylonized belts on frost cliffs document a crossing of tectonic lines.

Top parts of structural plateaux with or without relics of cryogenously remodelled rock outcrops are mostly flat. Small plateaux, cryoplanation terraces and larger slope and saddle plateaux are placed quite regularly on Radvanovický hřbet, Žlebský kopec, Kapradník and in the Stožec Massif. There are ten structural plateaux in the mapped territory, seven out of them on Radvanovický hřbet, two on Kapradník and one on Žlebský kopec. Their sizes are much similar, mostly 75 to 125 m in the longer axis and 25 to 75 m in the shorter axis. The longer axis of these two plateaux follows the respective tectonic line, that is NE to SW on Radvanovický hřbet, NW to SE on Žlebský kopec and Kapradník.

On the highest places of denuded granite domes there occur in 90% cryogenously remodelled rock outcrops. Radvanovický hřbet (1030 m) – an about 7 m high rock outcrop, southeastwards oriented. Stožec – top rock sea oriented mainly to the northeast which again documents the impact of cold exposition. Stožeček – pseudo-cirque with 5 to 12 m high rock walls, NE oriented. Žlebský kopec – an about 6 m high top frost cliff, SE oriented with adjacent 10 m high steep rock wall of the same orientation. Kapradník – top continuos rock sea of northern, eastern and southeastern orientation, a pronounced 5 to 7 m high frost cliff situated eastwards immediately below the top (1026 m).

The maximal internal altitudinal span of individual structural plateaux of Radvanovický hřbet, Kapradník and Žlebský kopec is 5 m. This is probably the effect of the same structural development of this part of the relief where the top parts of the granite massif are situated nearly at the same altitudinal level, Radvanovický hřbet (max. 1030 m), Kapradník (1026 m) and Žlebský kopec (1080 m). We can suppose that these structural plateaux are reduced relics of once larger planation surface, which was also identified in the territory of the Plechý massif.

Erosional denudations forms

This group includes the forms formed above all by exogenous processes. It includes slopes and plateaux formed by erosional denudational and accumulation processes and fluvial forms.

Erosional denudational forms fill up 69.2% of the mapped region. They cover the major part of the monitored territory. Four categories of inclination are differentiated in erosional denudational slopes: 2–5°, 5–10°, 10–20° and over 20°. The change of slope inclination is mostly regular, with the exception of the eastern slopes of Radvanovický vrch, Kapradník and parts of slopes lining the left bank of Studená Vltava, where the inclination sharply changes. The most frequently represented are the slopes of the inclination of 5–10°.

Mildly inclined erosional denudational slopes

Mildly inclined erosional denudational slopes (2–5°) cover 23.1% of the mapped area. They are slopes most frequently adjacent to fluvial plains. They are the largest on Krásná Hora – V podkově along the floodplain of Valná and Splavský potok – Jarní hon, 500 m and 2 km southwards from Hliniště, along the flood plain of Žlebský potok course 500 m westwards frome Dobrá Village and along the Studená Vltava flood

plain – Údolská louka, Stožec – at the confluence with Mlýnský potok. They are found also at foot of massifs and often they line slope, saddle and top plateaux. For instance the elevation point 942, NW from České Žleby, elevation point 793, SW from Lenora, elevation point 803 – Nad hájovnou, eastern part of the map territory.

Because of their advantageous position, these slopes were in the past used for agriculture and therefore some remnants of former anthropogenous activities can be found there. Because they largely follow the course of the state borde, there are also traces of the recent military activities, as for instance sand belt, a small fort near Krásná Hora or the panel way near the elevation point 873.

Mildly inclined erosional denudational slopes lay at several altitudinal levels. Along the Studená Vltava floodplain they form only a narrow belt at the altitudinal level between 740 m and approximately 760 m and at the altitudinal level 790 to 825 m. This belt gets larger at the place of affluents of Studená Vltava and that up to the altitude of 795 m at Stožecká skála and 820 m at Mlýny.

A larger belt of mildly inclined erosional denudational slope is situated along the state border and its altitudinal span is between 820 and 890 m. Along the Řásnice and Teplá Vltava floodplains the belt of erosional denudational slopes has the altitudinal span from 745 m to 810 m and its situation is quite regularly. Mildly inclined erosional denudational slopes are largely represented in the south of the monitored territory where they form the great part of Tetřev (893 m).

In the middle of the mapped region this slope step rims a saddle plateau which is at the same time the flat watershed of the Studená and Teplá Vltava affluents. The altitudinal span oscillates between 810 and 835 m. Other plateaux are not rimmed by this slope step such widely. There are still some larger slopes rimming the saddle plateau Nad Hájovnou (803 m) with the altitudinal span 770 to 800 m, the saddle plateau near the elevation point 942 (České Žleby) with the altitudinal span 920 to 945 m and the saddle plateau on Hornokrásnohorská cesta with the altitudinal span 915 to 950 m.

Middle inclined erosional denudational slopes

Middle inclined erosional denudational slopes (5–10°) cover 29.6% of the mapped area. Their situation in the territory is nearly uniform. Representation in one orientation is not evident. Exposition does not affect the width of these slopes. The largest belt is situated between the massifs of Radvanovický hřbet and Žlebský kopec. The common feature of the majority of these slopes is the placement of their longer dimension parallel with contour lines. An exception is for instance the northern slope of Tetřev (873 m). Typical for these parts of slopes are headsprings and erosional forms. The great majority of dells (catchment basins) begin exactly at the slopes of this inclination. Similarly as the mildly inclined slopes also these areas were economically used by man.

Steeply inclined erosional denudational slopes

Steeply inclined erosional denudational slopes (10–20°) and sharply inclined erosional denudational slopes (over 20°) are in this group represented only seldom. They mostly take the highest parts of the erosional denudational slopes. In

the lower parts of slopes they form the transition into slopes with smaller or higher inclination.

Plateaux formed by erosional denudational, accumulation and cryogenous processes (inclination up to 2°)

Differently from the structural plateaux erosional denudational plateaux are scattered over the whole monitored territory and their number and size are much greater. According to their position, they are divided into three types: top, saddle and slope plateaux. They cover together 1.53 km^2 of the monitored area.

The great majority of erosional denudational plateaux are bound to slopes of an inclination of 2–5°. Maximal internal altitudinal span of plateaux increases with a decrease of altitudes. This fact is evident also from the geomorphological map

Three largest plateaux (top plateau Na spálenci – includes the elevation point 834, southern margin of the map, slope plateau – SW from Stožec Village and the saddle plateau in the central part of the monitored territory between Radvanovický hřbet and Stožec) are situated at very similar altitudes of about 800 m. Particularly interesting is the last mentioned saddle plateau in the central part of the territory eastwards from České Žleby which is at the same time the watershed between the affluents of Teplá and Studená Vltava.

The position of top erosional denudational plateaux is prominent. The altitudinal span of all of them (Tetřev, Hamerský les, Krásná Hora – elevation point 834, Krásná Hora – near the elevation point 876) is between 820 and 895 m. Because of a strong weathered mantle no relics of cryogenous weathering are visible on any of them.

Fluvial erosional forms

Fluvial erosional forms include mainly the products of recent erosion. They are erosional ravines and dells. In the selected district there are two short erosional ravines. Their formation is conditioned by occurrence of tectonic faults of NW-SE orientation. These ravines are not deepened only into the soft unconsolidated weathered material, but they denude also the rock granite underlayer. Erosional ravines are mostly bound to mildly inclined slopes (5–10°) where also retrogressive erosion largely occurs.

Other erosional denudational forms mostly bound to mildly inclined slopes are dells (catchment basins). In the monitored territory there occur both slope and valley dells. The number of slope dells (21) clearly prevail, they are usually smaller and often of an irregular shape. At the same time they are younger than valley dells.

Fluvial accumulational forms

The group of fluvial accumulational forms is represented there by bottomlands of Teplá and Studená Vltava and of their affluents. Bottomlands close the monitored territory from all the four cardinal pints. Accumulation forms cover 12.9 % (7.56 km^2) of the mapped territory. The width of the bottomland is very irregular. It reaches its maximum (1000 m) at about 2 km below the confluence of Teplá Vltava and Řasnice and in short segments at the confluence of Teplá Vltava and Žlebský potok (1375 m) and of Studená Vltava and Mlýnský potok (1625 m). In other segments, Vltava must

probably develop erosional activities to maintain equilibrated gradient conditions and not to deposit material.

Especially the Studená Vltava's alluvium is very narrow and, similarly as at the contact with the Plechý's massif pluton on the right bank, also on the left bank it has a morphologically evident limit. The Studená Vltava's flood plain gets slightly wider at the places of affluents. An enlargement is evident in Údolská louka (SW from Stožec), at the confluence with Mlýnský potok near the Stožec Village and at the SE margin of the Stožec massif above the near confluence with Teplá Vltava.

NW from the Stožec Village the flood plain intrudes into a slope of an inclination of 2–5°. Its position is influenced by denser hydrographic network with a low gradient in this region. Different arms bring there unconsolidated sediments from slopes of higher inclination (5–10°, 10–20°, over 20°). This region of recent accumulation is closed by the dam of a narrow and small pond, which undoubtedly accelerates the sedimentation.

The Teplá Vltava bottomland is in its whole length along the monitored territory somehow wider with a more equilibrated gradient. This is due mainly to the length of its course. At the confluence with Řasnice, Teplá Vltava is already 32.8 km long. Between the villages of Lenora and Soumarský most there spreads on the bottomland a high moor called Malá Niva. A narrow bottomland (150 m in average) accompanies also the courses of Řasnice and Valná with its affluents. Both naturally delimit the monitored territory at the west and at the north.

Intensive erosional activity and huge transport power of local water streams caused by their high gradient enable the transport of material to the lower parts of the valley. From that reason, alluvial cones do not occur there.

Cryogenous forms

The whole Šumava region is characterized by cryogenous and cryogenously remodelled forms, which were formed there in the Pleistocene when Šumava was situated in a periglacial region. The cryogenous forms represented in the monitored regions can be divided into the following types:

Frost cliffs

Rock forms on which prevail two orientations of fissure surfaces (S, Q) which are getting narrower in the depth are called frost cliffs. Frost cliff walls have mostly a direct course. A retreat of walls forms cryoplanation plateaux. Frost cliffs under a cryoplanation terrace are usually accompanied by a continuos or discontinuous rock sea. Frost cliffs occur mostly in the following localities.

The frost cliff on Radvanovický hřbet (1030 m) is 5 to 8 m high. It is opened towards the southeast and especially in the segment of the eastern to southern direction is accompanied by a continuous rock sea.

Žlebský kopec includes a whole series of cryogenous forms. At both elevation points (1080, 1024) there are frost cliffs on which there is an evident crossing of tectonic lines. The frost cliff at the elevation point 1080 is 10 to 12 m high and again southeast oriented. In its close proximity, there are on the slope two smaller relics of frost cliffs. Both of them are about 3 m high. Northwards from the frost cliff spreads

a smaller cryoplanation plateau, which is followed on the slope by a continuous rock sea, which was probably formed by a total destruction of the higher situated frost cliff. A continuous rock sea forms at the northern side three height steps. The cryogenously remodelled rock outcrop at the elevation point 1024 is opened to the north-west and its height is about 5 m. On both sides of this slope behind this form there are alternately situated a continuous and a discontinuous rock sea.

Another distinctive morphological hill, Kapradník, is characterized by frost cliffs on its slopes. The rock outcrops, situated at 500 m from the elevation point 1026, is 3 m high and in its proximity again spreads a continuous rock sea.

Nivation cirques

Rock walls of Stožeček (856 m) and those of the form marked by the elevation point 949 Na Spáleništi have an arched course. Double organization of the fissure system of the prevailing orientations of fissure surfaces show that it is a pseudo-cirque. A rock stream parts from both pseudo-cirques. The one Na Spáleništi is about 10 to15 m, the one U Stožečku 25 m long.

The height of the pseudo-cirque rock walls (elevation point 949) is 5 to 12 m, its diameter about 60 m. The pseudo-cirque is opened to the northwest. An about 3 m high step is visible on the rock stream parting from this pseudo-cirque.

The rock walls of the Stožeček pseudo-cirque (856 m) are 15 to 20 m high. The pseudo-cirque is also opened to the northeast and a rock stream parts out of it on the reverse slope.

Mushroom-shaped rock forms

A mushroom-shaped form is rare in the mapped territory. The only specimen is situated on a granite outcrop at the north of the elevation point 971 on Krásná Hora. Its formation is bound to a quick change of frequency of L fissures on the "boundary surface". The lower part forming the mushroom's is about 3 m high, its upper part about 1.5 m high.

Rock forms on slopes

They are mainly the relics of cryogenously remodelled granite exfoliation doms. Some parts were transported by solifluction and gravitational movements down the slope at different distances from the top. They can be found in the following regions:

The cryogenously remodelled dome on Radvanovický hřbet is 5 m high. A discontinuous rock sea spreads in its near neighbourhood.

Another cryogenous form situated on Žlebský kopec is a cryogenously remodelled dome. It is about 6 m high and surrounded by a continuous rock sea.

On Kapradník, there is a cryogenously remodelled dome form directly below the top (elevation point 1026). The dome height is 2 to 5 m.

Near the crossing of the Kostelní and Hornokrásnohorská Ways a two-step frost cliff is situated near the elevation point 872. Its total height is about 7 m and length about 20 m. The dome is accompanied by a discontinuous rock sea reaching to the margin of the slope dell.

The Spaleniště structural ridge begins by a cryogenously remodelled exfoliation dome. An aplite vein is well visible on the dome which witnesses about a tectonic impact in this region.

All the cryogenously remodelled exfoliation domes in the Stožec massif are accompanied by a continuous rock sea. A discontinuous rock sea is situated in lower positions of the slopes

Anthropogenous forms

Anthropogenous forms are very frequent in the mapped territory. According to their origin, there are divided into four categories:

Communication anthropogenous forms

One of the oldest ones is the sunken road of the medieval Zlatá stezka, which is visible especially at the southwest from the elevation point Mlaka in the immediate proximity of the state border. Then the still maintained access to the ford over Teplá Vltava in Soumarský most SE from Lenora. Also the remnants of Zlatá stezka in the southern part of České Žleby Village (centre of the mapped territory) are a protected technical monument.

From the end of the 18th century dates the in the Stožec massif maintained wooden Marian chapel with arranged environs. The original stations of the Cross leading to it from České Žleby were restored in 1990 and at the same time a new sand covered way was opened. But erosional activities of running water and torrential rains every year wash out the sand into the neighbouring flood plain.

The most evident in the local terrain is the dense network of asphalt ways. They are approximately 4 to 6 m wide. Similarly as in the other regions along the border, also in the mapped territory there is a panel way leading directly to the state border (Krásná Hora, elevation point 873).

Military anthropogenous forms

After forty years of frontier guard activities there remained abandoned "defensive" equipments and other forms of military activities. They are historically young forms of recent human activities.

Little noticeable is a small defensive fort on Krásná Hora, NW from the elevation point 887 V podkově and a one metre deep trench on Žlebský kopec (elevation point 1024). The defensive fort is buried 2 m under the terrain level and is situated approximately 500 m from the state border. It is mainly constructed from concrete prefabricated parts. The upper part is masked by piled up stones, soil and artificially planted trees.

Both former sand belts following the "iron curtain" are getting progressively covered by grass and natural regeneration.

Economic anthropogenous forms

This category is mainly represented by agricultural anthropogenous forms, which were built there before the Second World War or before the transfer of the German

population. Especially erosional denudational slopes mostly of an inclination of 2–5° and 5–10° are divided by stone walls to narrow terrace fields. All walls are about 1 m high. Their length differs according to their situation on the slope. The longest ones are on Krásná Hora and between the Radvanovický hřbet and Žlebský kopec. This position witnesses again about the history, because there were once the villages of Radvanovice, Horní Cazov, Dolní Cazov, Krásná Hora and others. Only few walls are perpendicular to the contour lines, the great majority are built askew to the fall line mainly to prevent erosional activities on slopes and to enable an easier cultivation. For the same reason the majority of these walls are situated on the S, SW and SE part of the massifs.

This group of forms also includes economic activities of the army documented by a great quantity of sunken roads, cuttings and backfillsl. Backfills are formed mainly by gravel and stones. The most of this material is found on the plateau with the elevation point 942 northwards from České Žleby. Other backfills – Dolní Cazov, Horské louky, Dobrá, SE from Hliniště are smaller – about 25 m².

A mining locality is a claypit, 1 km SE from Lenora. It is about 20–25 m long and 5–8 m deep. To the depth of 1.5–1.8 m under the surface is visible an intensive Pleistocene solifluction. In the denuded parts there are also huge boulders (up to 0.5 m in diameter) that have been transported to that place where the inclination of the slope changes by slope movements and solifluction. This is documented by the stream structure of the upper part of the exposure.

A backfill is well visible in the terrain some 750 m southwards from Lenora. It contains glass wastes and is probably due to the activities of the Lenora glassworks.

This group includes also the past and present activities of the forest management. In the terrain there are especially well visible 0.5–0.75 deep gullies due to heavy machinery which progressively transform into erosional cuttings.

Anthropogenously remodelled relief of settlements

The Stožec castle was built in the mapped region to protect Zlatá stezka . Now, only the remnants of the watchtower are maintained on Stožecká skála.

The dense network of villages which was typical for the whole Šumava region is today remembered in the terrain only by ruins and memorial tables. At present, such tables are in Krásná Hora, Horní and Dolní Cazov and Radvanovice. Their placement is going on.

These anthropogenous forms include also the by construction and growing remodelled relief of inhabited settlements and of their near neighbourhood. The following settlements are concerned: Stožec, České Žleby, Dobrá, Lenora and Hliniště.

Other constructive elements of human activities in the mapped region are the drainage furrows of Teplá Vltava, flood control banks on Řasnice (especially in Hliniště and its neighbourhood). The height of banks is 2 to 3 m, their length up to 750 m.

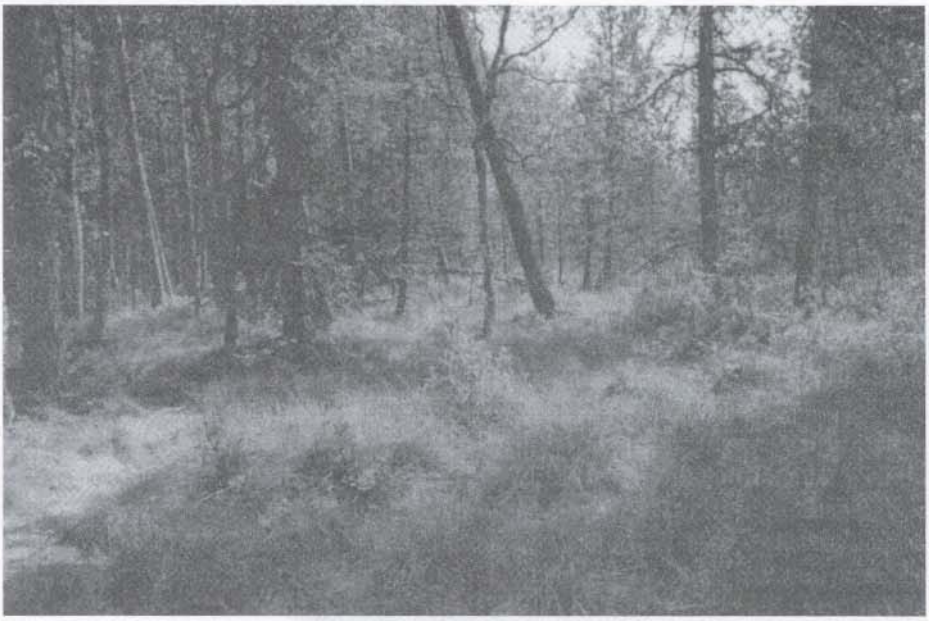


Photo 1 High moor Malá Niva

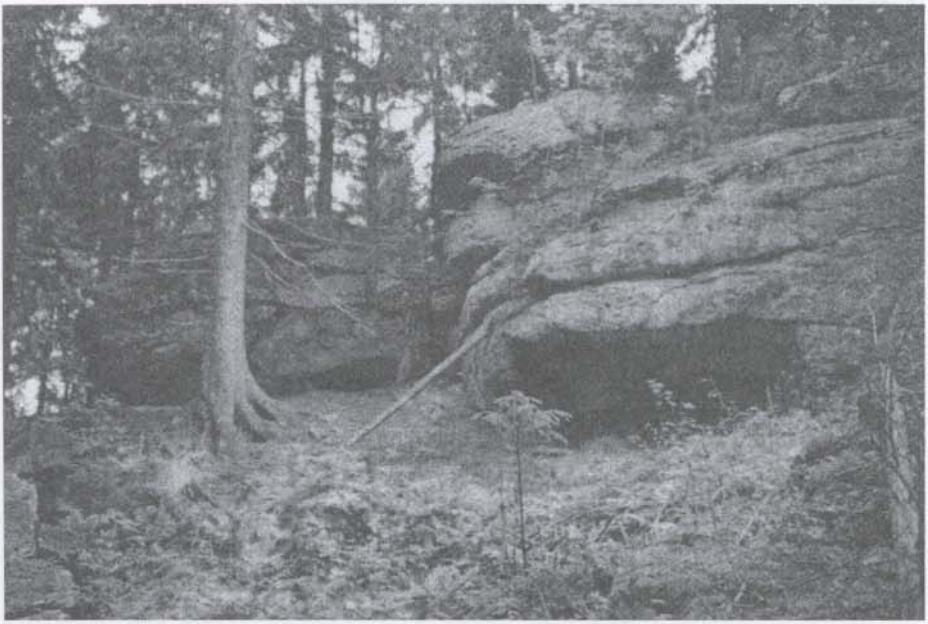


Photo 2 Frost cliff on Žlebský kopec (1024 m)

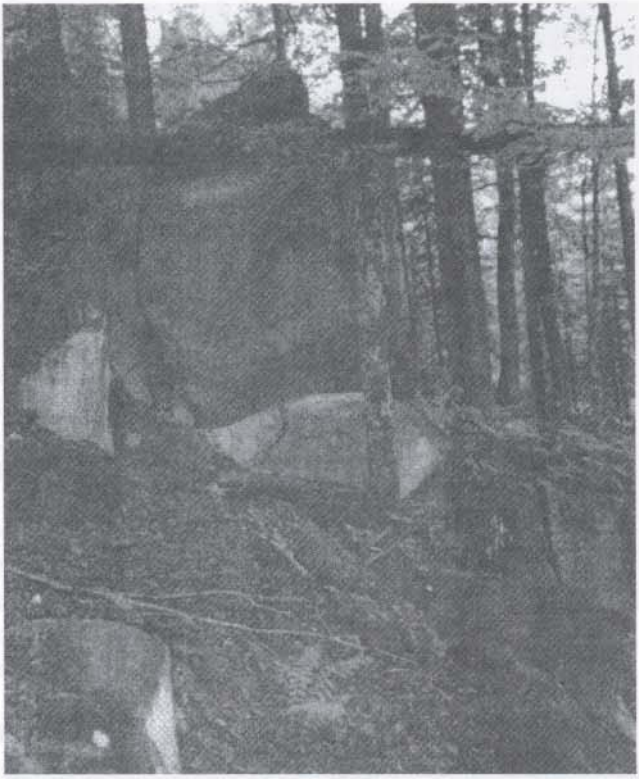


Photo 3 Slope frost cliff on Kapradník

Photo 4 Top frost cliff SW from Krásná Hora

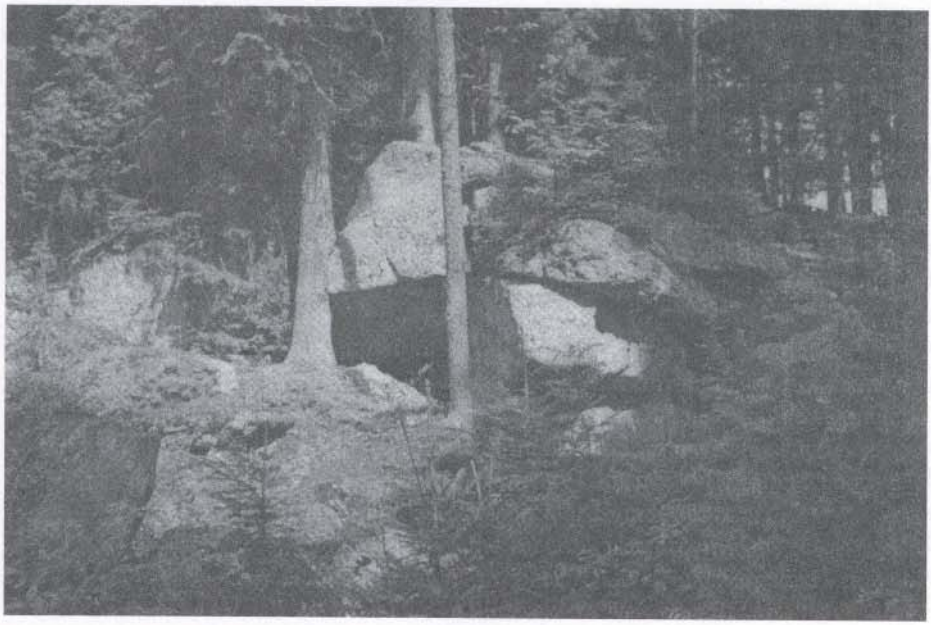


Photo 5 Denuded exfoliation dome on Radvanovický hřbet

Photo 6 By solifluction transported boulders on Kamenná hlava

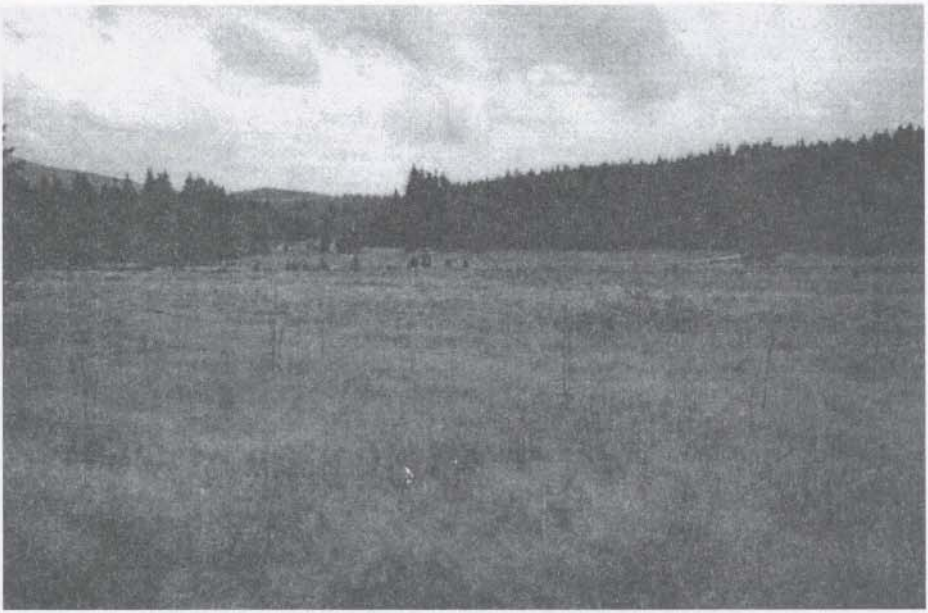


Photo 7 Údolská louka – Studená Vltava flood plain

Photo 8 Mountain peatbog Spálený luh near the elevation point Na spálenci

Other relief forms

This group includes springs, peat-bogs and pseudothufurs. Peat-bogs are concentrated especially into wet parts of alluvia and erosional denudational slopes of an inclination of 2–5°. On Radvanovický hřbet and in Hamerský les, the peat-bogs are situated also higher on the slope of 5–10°, especially at places of dells – elevation point 802, about 2 km SE from Hliniště, 500 m SE from České Žleby. Directly on the slope is situated a peatbog 2.5 km SE from Lenora.

The most famous peat-bog is the high moor Malá Niva (746–760 m), 6 km westwards from Volary. Its area is 90 ha, peat reserves 2.5 mil. m^3, maximal depth 6.4 m. Another protected natural form – high peatbog – lays in the basin of Valná (860 m). Its area is 46 ha, depth 3 m, peat reserves 550 000 m^3. In the southern part of the territory near to the elevation point 805 Na spálenci is the large mountain peat-bog Spálený luh.

Special forms in the mapped region are the pseudothufurs. They occur in the places where the 2–5° inclined slope passed into the bottomland of Teplá Vltava, 750 m SSE from Lenora. Their formation is connected with the waterlogged surface and repeated freezing and melting. It causes a swelling up of the surface and transport of soft matters to upper positions. Grass then grows better here and consolidates these forms.

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GEOMORFOLOGICKÁ ANALÝZA STOŽECKÉ HORNATINY

Résumé

Za předpokladu, že poslední rozsáhlá tektonika, která postihla Šumavu už jako pohoří, byla saxonská, můžeme předpokládat, že peneplenizace horotvorně dotvořeného pohoří probíhala za tektonického klidu vcelku nerušeně od svrchní křídy až do miocénu.

Tektonické zdvihy probíhající v miocénu a začátkem pliocénu na česko-rakousko-německém rozvodí měly rozhodující morfologický význam pro vývoj současného reliéfu. Došlo k rozdělení trupové části Šumavy na jednotlivé horské komplexy a jejich zdvihem byla jednotná zarovnaná úroveň posunuta podle starých ale i nově vzniklých tektonických zón do různých výšek. Zvětšením výškového rozdílu mezi horní a dolní místní erozní bází dochází k oživení erozní a denudační činnosti, což vede na mnoha místech k odkrytí skalního podkladu. Na něm v chladnějších obdobích pleistocénu probíhá intenzivní kongelifrakce vedoucí ke vzniku rozsáhlého kryogenního reliéfu.

Pro vývoj makro a mezoreliéfu reliéfu Stožecké hornatiny mají největší význam tektonické poruchové linie směru SSV-JJZ a SZ-JV. Zřejmě nejstarší (saxonské) je široké zlomové pásmo, v němž se nachází morfologicky výrazná deprese Vltavická brázda orograficky oddělující masív Stožce.

V místech kde došlo k odkrytí exfoliačních kleneb probíhalo v pleistocénu periglaciální zarovnávání (kryoplanace) vyvolané a závislé na řadě procesů – kongelifrakčních, soliflukčních, segregačních a nivačních. Tyto procesy probíhaly především v místech, kde byly dobře vyvinuté puklinové systémy L, Q, S. V menší míře se ve vývoji kryogenního reliéfu uplatnily rovněž petrologické vlastnosti hornin.

Pro posouzení intenzity denudačních, erozních a soliflukčních procesů od pliocénu mohou být dobrým vodítkem morfologicky výrazné kryogenně přemodelované horninové výchozy. Podle jejich rozložení a velikosti v plochých ale i různě sklonitých částech reliéfu, můžeme přibližně rekonstruovat rozsah terciérního zarovnaného reliéfu a jeho snížení exogenními procesy v rozpětí osmi až dvanácti metrů.