ACTA UNIVERSITATIS CAROLINAE
1999 GEOGRAPHICA, No. 2, PAG. 69–99

Geomorphologic analysis of the Losenice River catchment area

BOHUMÍRA LOSENICKÁ, FILIP MUSIOL, JAN VOTÝPKA

Charles University, Prague, Faculty of Science,
Department of Physical Geography and Geoecology

Abstract: The paper brings the results of detailed geomorphic research and mapping in the genetically interesting territory of the gold-bearing Losenice River catchment area situated in the marginal part of the Šumavské pláně Plains on the contact with the Svatoborská vrchovina Highlands. The paper characterizes the components of the physical geographical sphere and consequently presents the geomorphologic analysis and classification of landforms with a special respect to the cryogenic ones. Attention is also paid to both present day and historical gold mining in this region.

Keywords: geomorphologic analysis, classification of landforms, Šumava Mountains

1. Basic physical geographical characteristics

1.1 Orographic delimitation

The studied territory was delimited as the catchment area of the Losenice River taking source in peat-bogs near Zlatá Studna (Mezilesní slať Moor) at 1130 m a.s.l. It is 16.8 km long and its catchment area covers 54.4 km^2. The average flow at its mouthing into the Otava River in the village of Rejštejn is 0.65 m^3.s^{-1}. Its main affluents are the Zlatý potok and the Pěnivý potok Brooks.

1.2 Orographic classification

The Losenice River catchment area belongs, according to the geomorphologic classification of the Czech Republic (Loučková in Demek et al. 1987, Balatka 1995), into the Šumava System, Šumavská hornatina Hilly Region, Šumava Mountains and Šumavské podhůří Foothill Units. In the Šumava Mountains Unit, the Šumavské pláně Plains Sub-unit and the Districts of **Kvildské pláně** Plains, **Javornická hornatina** Hilly Region and **Svojšská hornatina** Hilly Region reach into the catchment area. From the Kvildské pláně Plains District, the **Modravské pláně** Plains reach the catchment by its **Churáňov** part. The catchment area includes also the southern projection of the **Sušická vrchovina** Highlands belonging into the **Svatoborská vrchovina** Highlands Sub-unit in the **Šumavské podhůří** Foothill. As far as the Sušická vrchovina Highlands District is concerned, the **Hartmanická vrchovina** Highlands reaches the catchment by its **Kašperské Hory** part.

The whole Losenice River catchment represents the structural denudational and erosional denudational type of relief with a predominance of forms the formation of which has been mainly conditioned by exogenic factors.

1.3 Geology

From the geological viewpoint, the Losenice River catchment area is formed by the moldanubicum with three principal rock series interfering into it (Kodym O. ml. 1961). From the north, it is the various series of the Sušice – Votice – Strážov region (gneisses with more frequent intercalations of different rocks), from the east and the south-east the uniform series of the Volary region (crystalline limestones, erlans and less frequent orthoamphibolites) and from the south and the south-east the series of the Královský hvozd Forest (mica schist, gneisses and migmatites with not frequent intercalations of quartzites, erlans, limestones, graphitic rocks, amphibolites and orthogneisses).

1.4 Tectonics

Regional metamorphosis in the territory went on successively several times and with a different intensity. Rocks were at first metamorphozed before the Palaeozoic times probably through a lower regional metamorphosis connected with faulting. The final regional metamorphosis was complete – catazonal (Buday et al. 1961).

The whole region was also affected by an intensive migmatization of probably anatectic origin. Anatectic processes might have been at the origin of some vein rocks forming bed bodies – mainly smaller lenses. The most intensive migmatization affected the region situated in the south-western part of the territory on the Pěnivý potok Brook left bank (from the Kozí hřbety Ridges to the Zhůří Village). There are pronouncedly migmatized gneisses and migmatites (on some places having even the character of progressive migmatites).

The territory is petrologicly uniform and it is formed primarily by paragneisses, secondarily by orthogneisses, quartzites, vein rocks and small granite bodies. The oldest rocks in this region are paragneisses going from biotitic, biotitic-sillimanitic, quartzitic-biotitic ones to biotic-quartzitic and quartzitic gneisses, occasionally equally quartzites.

Moldanubicum rocks were generally affected by a very intensive faulting in the period of the regional metamorphosis (the so-called forced tectonics). On that occasion, the older structural lines were wiped off and an apparently uniform structure was formed – it is nearly impossible to delimit there pre-metamorphic tectonic units and to distinguish the impact of individual orogenic processes, or phases.

The old tectonic lines of the moldanubicum go in two directions characteristic for the structure of the whole Europe. The most important is the roughly north-eastern direction of structural lines. This direction is predominant in the whole moldanubicum with the exception of its marginal parts and it is conditioned by the principal faulting of the moldanubicum. The second north-western direction is characteristic mainly for the marginal part of the moldanubicum (the Šumava Mountains, the Český les Mountains and the adjacent parts of Austria and Bavaria).

1.5 Hydrography

Nearly the whole Šumava Mountains (their Czech part) as well as their foothills belong to the Vltava River catchment, with the exception of a small territory of the Železná Ruda Basin and its neighbourhood, drained by the Řezná River into the Danube, and a small part at the south of the Českokrumlovská vrchovina Highlands drained by the Mühl River from which the Schwarzenberská stoka Canal leads to the Vltava River. The main European watershed line separating the catchment of the North Sea and that of the Black Sea is running along the flat Šumava ridges.

The most important river of the Šumava Mountains is **Vltava,** which takes its sources at the eastern slope of the Černá hora Mountain (1315 m a.s.l.) near the former hamlet of Bučina at 1172 m a.s.l. The second main Šumava river draining the western part of the Pláně Plains is **Otava.** It originates by the confluence of its source streams **Vydra** and **Křemelná** near Čeňkova Pila.

Losenice takes its sources, as it was already mentioned, in peat-bogs near Zlatá Studna (Mezilesní slať Peat-bog) at about 1.4 km north-north-westwards from Přilba (1219.1 m a.s.l.), and that at the altitude of 1130 m. Its length is 16.8 km and its catchment area 54.4 km^2. The mean flow at its mouthing into the Otava River in the Rejštejn Village is 0.65 $m^3.s^{-1}$. Its upper course runs to the north, under the Valy Mountain (1010.0 m a.s.l.) it turns to the north-west. The main affluents are the **Zlatý potok** and the **Pěnivý potok** Brooks.

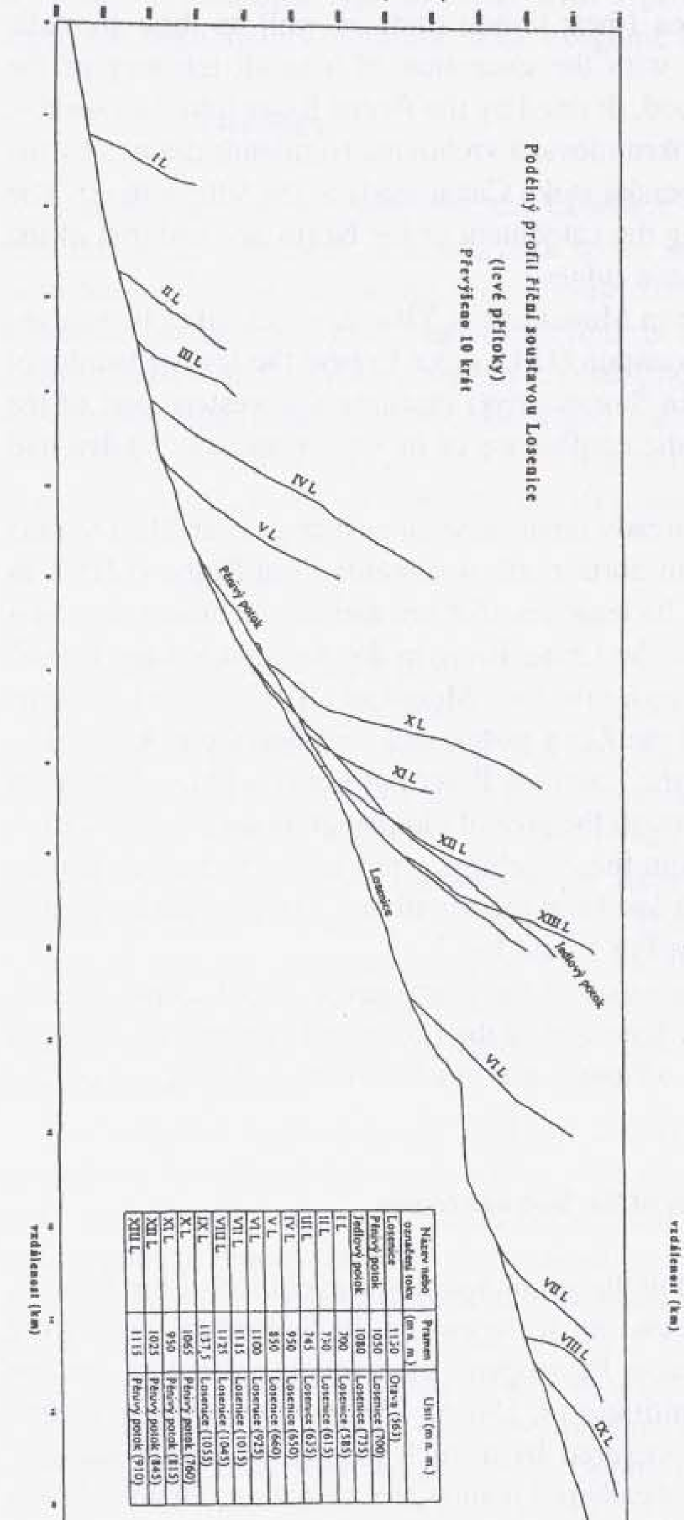
The profile curves make it clear that the Losenice River has not equilibrated gradient conditions. The upper course flowing through the area of old planation surfaces has, from its source down to the kilometre 11.5 from the mouthing, a much lower gradient that its middle course down to the kilometre 4.5 km from the mouthing. The lengthwise profile of the Losenice River system is shown in Fig 1. and Fig 2.

The right-side affluents, with the exception of the Zlatý potok Brook upper course, have a generally a lower gradient approaching that of the Losenice River and their length is shorter. On the contrary, the left-side affluents are much swifter and longer than the right-side ones.

1.6 Geomorphologic evolution of the Šumava region

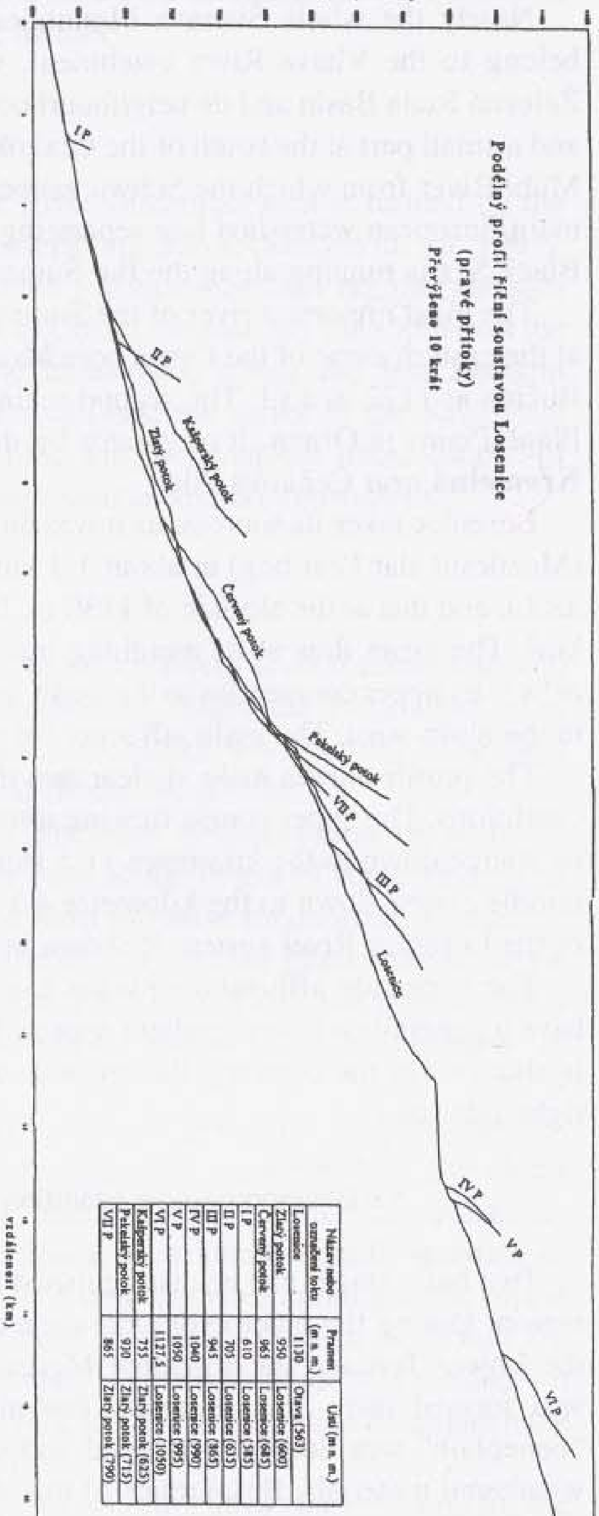
Two basic stages can be distinguished in the geomorphologic evolution of the Šumava region. During the older evolution stage ending at the end of the Secondary and during the Lower Tertiary, the so-called Mesozoic-Palaeogene monotonous planation surface was formed there at a relatively low altitude of 150 to 250 m. The surface of this "peneplain" was deeply weathered and covered by a thick mantle of mainly kaolinic weathered materials. Basal relics of this weathered mantle are maintained in a thickness going from several decimetres to 30 m only in some parts of the former planation surface.

Due to subsequent neotectonic deformations, the original planation surface is now fragmented and dislocated at different altitudes going from 400 m in the foothill to nearly 1400 m in the summit part of the mountains (for instance Blatný 1376 m a.s.l.). Transgression of the Cretaceous sea did probably not affect the Šumava Mountains (Buday et al. 1961). In shallow depressions of the peneplain surface, a river network, different from the present one, was being formed during the Tertiary. A part of the



Název nebo označení toku	Pramen (m n. m.)	Ústí (m n. m.)
Losenice	1130	Otava (563)
Přesný potok	1050	Losenice (700)
Jedlový potok	1080	Losenice (735)
I L	700	Losenice (585)
II L	730	Losenice (615)
III L	745	Losenice (635)
IV L	950	Losenice (650)
V L	830	Losenice (660)
VI L	1100	Losenice (925)
VII L	1115	Losenice (1015)
VIII L	1125	Losenice (1045)
IX L	1137,5	Losenice (1055)
X L	1065	Přesný potok (760)
XI L	950	Přesný potok (815)
XII L	1025	Přesný potok (845)
XIII L	1115	Přesný potok (910)

Fig. 1: Lengthwise profile of the river system of the Losenice catchment area (right affluents)



Název nebo označení toku	Pramen (m n. m.)	Ústí (m n. m.)
Losenice	1130	Otava (563)
Zlatý potok	950	Losenice (600)
Červený potok	965	Losenice (685)
I P	610	Losenice (585)
II P	705	Losenice (615)
III P	945	Losenice (865)
IV P	1040	Losenice (990)
V P	1050	Losenice (995)
VI P	1127,5	Losenice (1050)
Kašperský potok	735	Zlatý potok (625)
Pekelský potok	930	Zlatý potok (715)
VII P	865	Zlatý potok (790)

Fig. 2: Lenghwise profile of the river system of the Losenice catchment area (left affluents)

Šumava territory was drained by streams to the south-east, which is witnessed for instance by wide and shallow valleys of the upper course of the Vltava River.

At the end of the Lower Tertiary (Oligocene), there begins the younger neotectonic stage characterized in its initial stage by faulting of the old planation surface of the crystalline underlayer of the Šumava region (the Šumava megoanticline). During the following transitory stage and mainly in the final stage at the end of the Tertiary and in the Lower Quaternary, the whole Šumava region was involved into younger orogenesis which, as it was proven by levelling and other observations, has not yet come to an end. With the simultaneous impact of vertical movements (the uplift reached there more than 1000 m) and local tectonic compression, there occurred within a period of about 5 million years differently intensive fault-type deformations (Šumava anticline), to a certain extent complicated by the already sooner founded faults and only to a limited extent affected by external geological factors (erosion by water streams, denudation, slope movements, etc.). The original peneplain war separated by these processes into individual mountain groups, some parts were vaulting (especially the main Šumava ridge), the other ones depressing. The Pliocene uplift of the Šumava Mountains sensibly increased the height difference between the upper and the lower erosion base which lead to a vigorous increase of deep erosion activities of water streams.

Very important were also decreases of the water level surface of the lake in the Českobudějovická pánev Basin during its emptying. At higher gradients, slope streams cut themselves deeper into the slope and shifted their sources upstream. In source areas, frequent captures occurred.

Under worse climatic conditions in the Pleistocene, there was a strong impact of external factors in the evolution of the peneplain surface of the Šumava. Particularly important was the deep erosion by rivers and brooks, which disturbed the older flat relief, mainly at the margins of mountains, and in their foothills (Loučková J. in Demek J. 1965).

According to very disputable and little founded opinions presented by A. Kopecký (1983), the principal orographic units of the Šumava Mountains – ridges and valleys – correspond mainly to neotectonic structures, that is to brachyanticlines and to brachysynclines. Similar fissureless deformations were found also in young correlate sediments on slopes of some mountains and in their foothill.

Views on the Šumava glaciation have been frequently changing during the last 100 years and they were often even contradictory, especially as to the extent of glaciation. In 1886, F. Bayberger published a paper in which he supposes that the mildly undulated Šumava relief was covered, above the altitude of 1000 m, by a continuous firn cover or by firn ice. From there, short glacier tongues ran down to river valleys. This hypothesis is backed by the existence of rock smooth surfaces and gravel alluvia on river banks.

However, many researchers rejected this idea about the Šumava glaciation. In 1887, Vienna geographers Penck, Böhm and Rodler made an excursion to the Šumava Mountains and explained some Bayberger's mistakes in determination of glacial relics.

The hypothesis about a larger glaciation of the Šumava appeared again in the years 1928 – 1931. Priehäuser (1927 – 1931 in Kunský J. 1933) based its explanation on the

Šumava glaciation on a detailed mapping of small glacial forms. According to him, the glacier descended on some places down to the altitude of 480 m. Another author, Rathsburg (1928 – 1932), assumed the lowest limit of the largest Šumava glacier (Javorský ledovec Glacier) to be situated at the altitude of 850 – 830 m.

During the Second World War, the research into the Šumava glaciation was interrupted and even after the war was practically not renewed. The majority of specialists support today, because of a relatively long distance of the Šumava Mountains from the ocean and by that a reduced quantity of snowfall, the Rathsburg's opinion of only local low mountain glaciation under the form of small slope and cirque firn glaciers formed in the cryogenically remodelled depressions on mainly to the north-east exposed slopes.

The decrease of mean annual temperatures in the Pleistocene resulted not only into the occurrence of local Šumava glaciation and into a significant enlargement of Alpine glaciers, but also into a large continental glaciation of the whole northern and of a part of the central Europe. In the foreland of these glaciers in the so-called periglacial zone, the climate was very cold and dry. Consequently, permafrost was prevalent in the relief and intensive mechanical frost weathering went on. This was conditioned mainly by phase transformations of water in rock cracks. These processes resulted into characteristic phenomena and into micro-to macrolandforms – cryogenic forms.

Glaciation affected thus the relief modelling in the highest parts of the Šumava Mountains, whereas in lower altitudes the relief was affected mainly by cryogenic processes and by fluvial activities. Frost weathering was going on flat ridges of the Šumava Mountains and in their foothills. In the summit parts, there were formed frost cliffs, stone seas, rock streams, structural soils and other forms. At lower altitudes, mainly solifluction and cryoturbation occurred.

Islands of crystalline limestones and erlans, in which karst phenomena developed (Strašínská jeskyně Cave, Sudslavická sluj Cave and others) were formed on some places by selective erosion.

The present character of the Šumava Mountains is the result of a long-term evolution. The central part of the mountains conserved its old peneplain relief (Šumavské pláně Plains). The impact of the Pleistocene glaciation has remained limited on the highest parts of some mountain groups. Rejuvenation of the relief is mainly the result of water stream erosion, which manifested especially in the Šumava foothill and at the margins of the mountains themselves (Loučková J. et al. in Demek J. 1965).

Old planation surfaces dating form the end of the Secondary form the relics of the oldest relief especially in the southern part of the catchment area. In this region, a great part of the surface is covered by erosional denudational plateaux (2.2 km^2) and by mildly inclined erosional denudational slopes (5.52 km^2).

During the Tertiary and the Quaternary, tectonic uplifts resulted into a sensible intensification of deep activities of water streams, which disturbed the old flat relief. It is evident that tectonic faults and lines from the period of formation of the massif were used. This type of relief fills the whole catchment of the Losenice River, with the exception of its southern part.

2. Geomorphologic characteristics of the catchment area
(Fig. 3 and Fig. 4)

2.1 Forms conditioned by endogenic factors

They are forms conditioned by endogenic factors, mainly by tectonic faults, exfoliation arches, fissuring and lithologic characteristics of rocks. In the mapped territory, there are only structural ridges and perpendicularly inclined structural denudational slopes with an inclination superior to 20°.

Structural ridges occur only in the upper part of the catchment area, and that in the northern part of the Výrovec ridge (865.4 m a.s.l.) in a length of about 600 m. The ridge is formed in its top position by an outcrop of exfoliation arch. There are other structural ridges on the left bank of the Pěnivý potok Brook at 200 m northwards from the Bílý Potok gamekeeper's lodge.

Perpendicularly inclined structural denudational slopes cover in the mapped territory an area of 0.9585 km^2, i.e. about 1.76 %.

Structural slopes are situated especially in the lower part of the catchment, and that roughly in four different areas: the right bank of the Losenice River and of the Zlatý potok Brook, the area situated north-eastwards from the Rejštejn Village, the area situated south-westwards and westwards from the confluence of the Losenice River and the Zlatý potok Brook and the area of the south-eastern slope of the Chlum (962.4 m a.s.l.).

The largest structural slopes occur in the first area i.e. on the right bank of the Losenice River and the Zlatý potok Brook.

2.2 Forms conditioned by exogenic factors

They are forms due to exogenic factors. They are mainly plateaux and slopes formed by denudational accumulational processes. They include also fluvial forms.

2.2.1 Erosional denudational plateaux

Erosional denudational plateaux form parts of relief with an inclination inferior to 2°, which are further divided into summit, slope and saddle ones.

In the Losenice catchment, they cover in total 2.7 km^2, i.e. 4.97 % and they are situated mainly in its lower part. The largest area is covered by slope plateaux (1.14 km^2), which are in the mapped territory above all in its southern part (Ranklovská rovina Plain, Mezilesní slať Peat bog, Zhůřské slati Peat bogs). Saddle plateaux cover about 1 km^2 (Ranklovská rovina Plain, Mezilesní slať Peat bog, Zhůřské slati Peat-bogs, Šafářův vršek Hill). The smallest area is covered by summit plateaux – 0.56 km^2 (U tří jedlí – 1151.5 m a.s.l., spot height 1141.0 m a.s.l., Ranklovská rovina Plain, Lídlovský kopec Hill – 833.9 m a.s.l.). Approximately 75 % of the area of the plateaux in the lower part are situated at the altitude of 700 to 900 m, in the upper part mainly at the altitude of 1000 to 1200 m.

2.2.2 Mildly inclined erosional denudational slopes (2 to 5°)

Cover in total 9.18 km^2, i.e. 16.9 % of the territory. They form mainly large valleys of water streams (Červený potok Brook, the upper course of the Kašperský potok Brook), they also occur on flat watershed ridges, for instance Nicov, Kozinec (884.0 m a.s.l.),

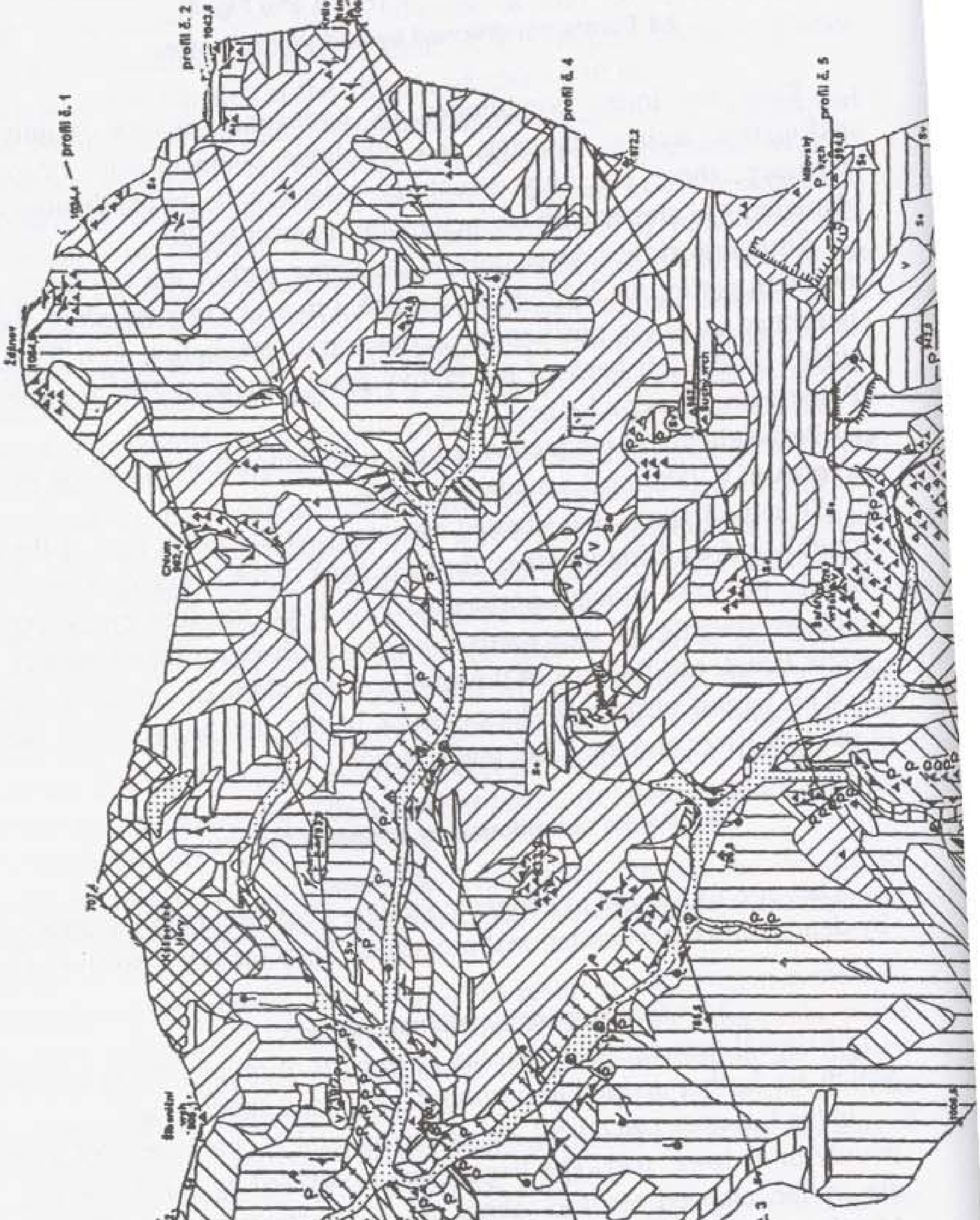
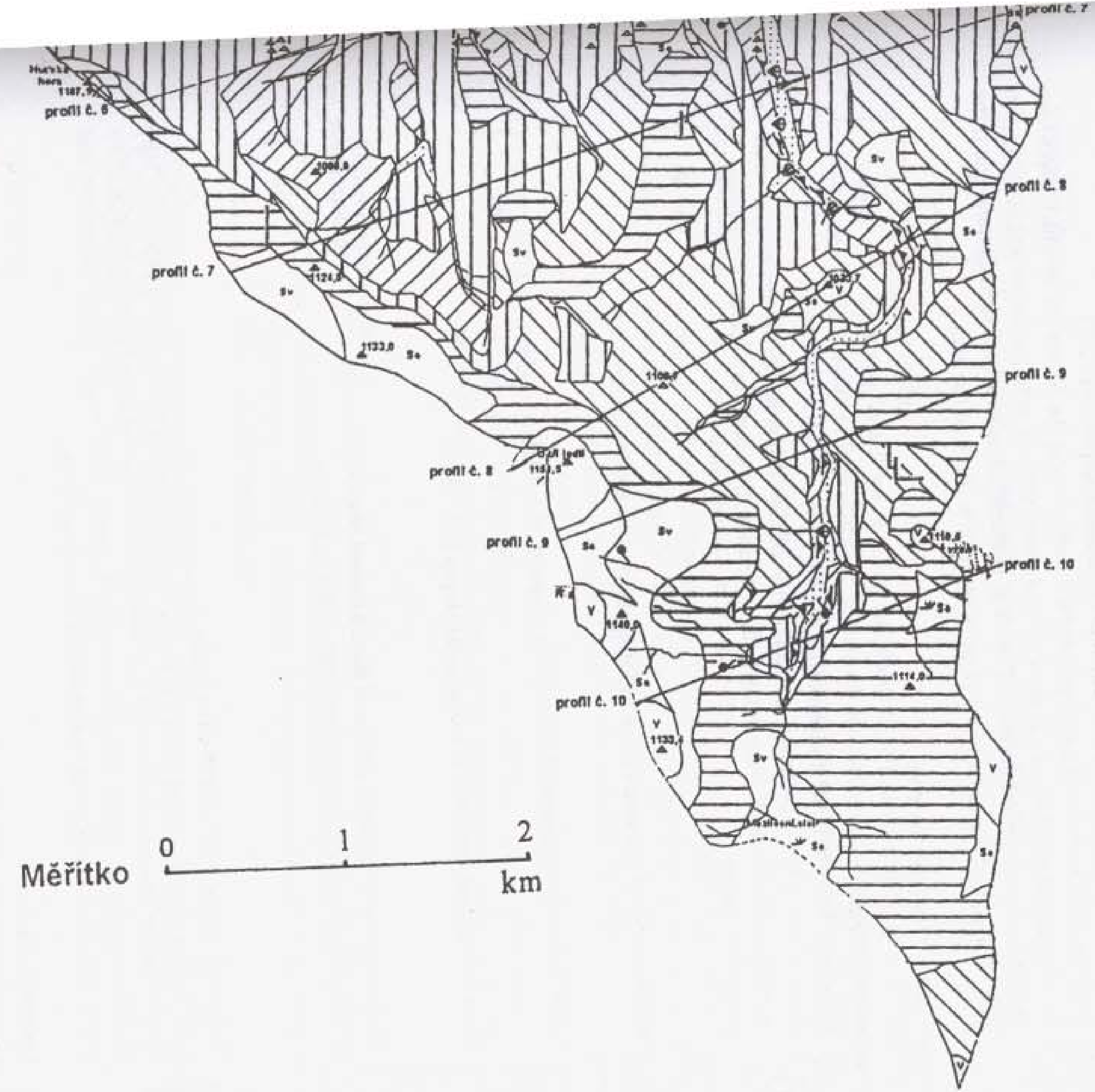


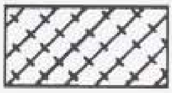
Fig. 3: Geomorphologic map of the Losenice catchment area


profil č. 6
profil č. 7
profil č. 8
profil č. 9
profil č. 10
Sv
Sa
V
Měřítko
0
1
2
km

Key and definition of landforms to the detailed geomorphologic map of the Losenice catchment area

FORMS CONDITIONED BY ENDOGENIC FACTORS

Structural forms

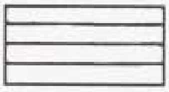


Perpendicularly inclined structural denudational slopes (over 20°)
This category includes those slopes or their parts, during the formation of which deposition conditions and lithological characteristics of rocks, tectonic predispositions and possibly also the crack system came into play . The slope is classified as structural denudational one if the part of structural elements in the slope is superior to 40 % of the area.

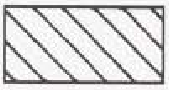
FORMS CONDICIONED BY EXOGENIC FACTORS

Erosional denudational forms

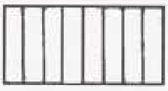
Erosional denudational plateaux (0 – 2°)
Parts of the relief developed independently of the structure of the underlayer with an inclination inferior to 2°. According to their position, they are classified as: V – summit, Sv – slope, Se – saddle.



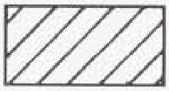
Mildly inclined erosional denudational slopes (2 – 5°)



Medium inclined erosional denudational slopes (5 – 10°)

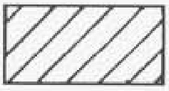


Steeply inclined erosional denudational slopes (10 – 20°)



Perpendicularly inclined erosional denudational slopes (more than 20°) These slopes have developed independently on the structure of the underlayer

Fluvial forms



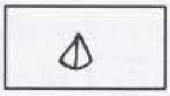
Slope and valley dips – catchment basin
They are depressions spread in the highest parts of the erosional and the valley networks. They mostly line the margins of structural denudational and erosional denudational plateaux. They may also appear on mildly to medium inclined slopes. Their origin and evolution are due mostly to suffusion processes and to surface fluvial activities.

Erosional furrows
The youngest erosional forms developing mostly independently on the rock structure. They are mostly deepened into the soft unconsolidated material (weathered mantle, slope sediments) covering the rock underlayer.

Ravines
Type of valleys with a high inclination of bottom that are elongating quickly by retrogressive erosion. Deep erosion prevails during formation of a ravine. Its cross profile is V-shaped.

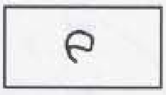
Accumulation fluvial forms

Alluvial plain
Recent accumulation area of a water stream formed by unconsolidated sandy and loamy-sandy sediments.

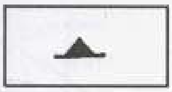


Alluvial cones
Forms constituted by fluvial accumulation activities at mouthing of valleys, erosional furrows and ravines. Their ground plan is usually triangular.

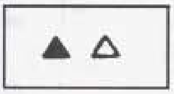
Cryogenic forms



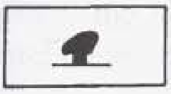
Cryogenically remodelled relics of exfoliation arches



Frost cliffs
Rock step in a slope or at the margin of a plateau formed by frost weathering and removal. Rock walls of frost cliffs are, in dependence on the rock structure (mainly on cracks or layer surfaces) vertical or almost vertical, eventually overhanging. They include also cryogenically remodelled rock outcrops.



Stone seas – continuous – non continuous
Areas covered by a greater quantity of rock blocs and sharp-edged debris separated from rock walls that cover at least 50 % of the surface. During the formation of stone seas, gravitational and slope processes come into play. Continuous stone seas are up to several metres thick. The non continuous ones are formed by irregularly distributed blocs.



Lonely boulders (independent on the rock underlayer)
Rock blocs of larger size lying on weathered rocks. They are individual blocs separated from rock walls and transported, by gravitation and slope movements, into lower positions.

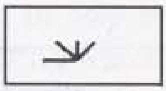
Anthropogenous forms

Agrarian terraces, erosion control walls and accumulated stones
Anthropogenous steps (walls) due to human farming activities. Forms over 1 m of height and 50 m of length are mapped.

Anthropogenously remodelled relief
Larger areas remodelled by any human activity (land development, gold panning, mining, etc.).

Other forms

Springs



Peat bogs

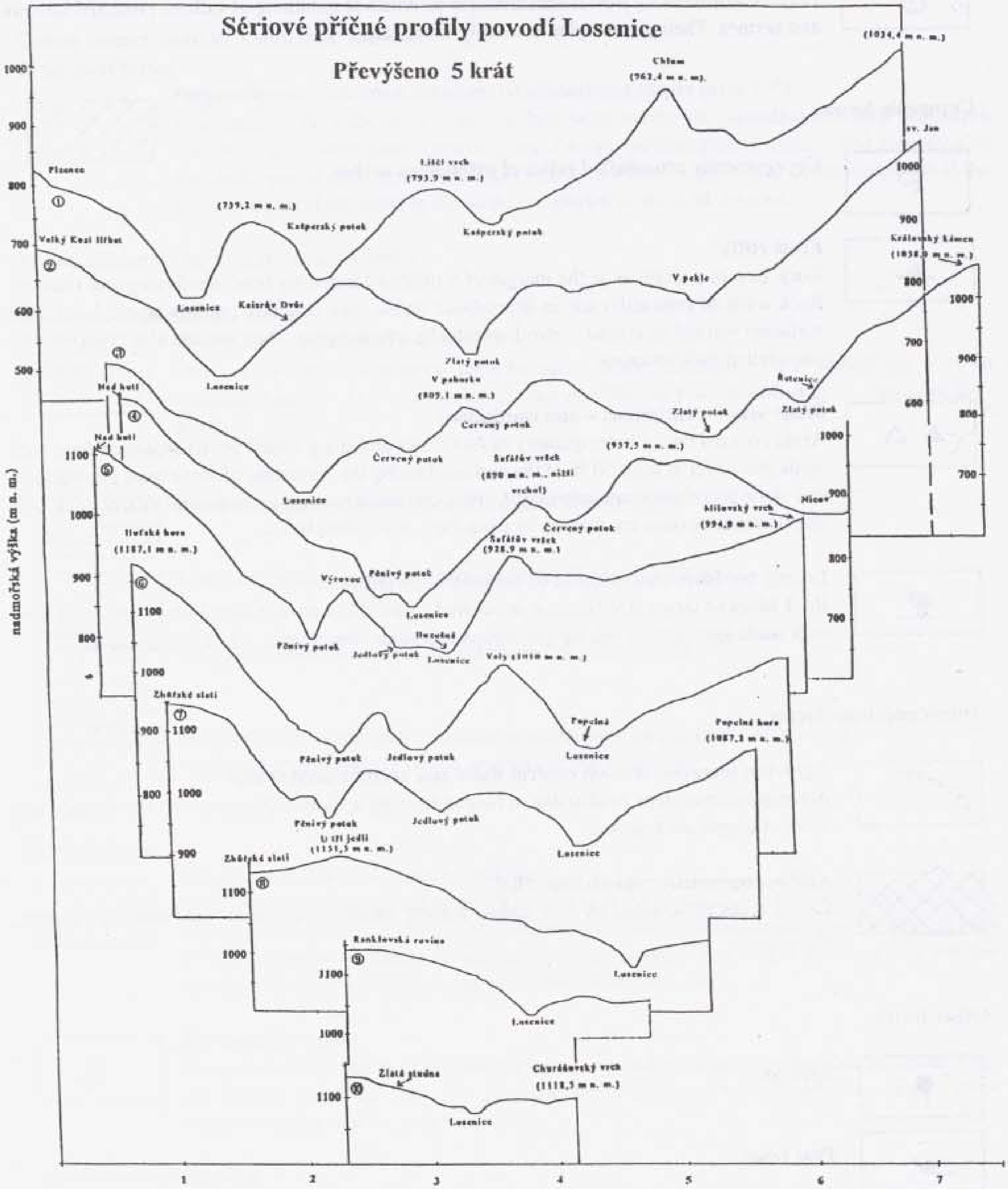


Fig. 4: Series cross profiles of the Losenice catchment area

Milovský vrch Hill (994.0 m a.s.l.), in the summit parts of some spot heights, for instance Suchý vrch Hill (957.5 m a.s.l.), Nad Rejštejnem (847.9 m a.s.l.) and in the area between Zlatá Studna and Přilba (1219.1 m a.s.l.). They mostly pass to medium to steeply inclined erosional denudational slopes.

2.2.3 Medium inclined erosional denudational slopes (5 to 10°)

Cover in the mapped territory an area of 13.86 km^2, i.e. about 25.5 %. They occur mainly between the course of the Losenice River and that of the Zlatý potok Brook (westwards from Červená, westwards from Nicov, westwards from the Popelná hora Mountain – 1087.2 m a.s.l., and in the north-eastern (westwards from the Královský kámen Stone – 1058.3 m a.s.l.) and the south-eastern (north-eastwards from the spot height U tří jedlí – 1151.5 m a.s.l.) part of the mapped territory.

2.2.4 Steeply inclined erosional denudational slopes (10 to 20°)

Cover in the mapped territory 19.35 km^2, i.e. 35.6 %. Slopes of this type are mainly in the south-western part of the mapped territory (slopes on the left bank of the Losenice River between the Rejštejn Village and the Valy spot height – 1010.0 m a.s.l.) and in the northern part of the territory on both banks of the Zlatý potok Brook. This type of slopes occurs the most frequently at the altitudes of 700 to 900 m in the lower part of the catchment and at 800 to 1000 m in the upper part of the catchment.

2.2.5 Perpendicularly inclined erosional denudational slopes (above 20°)

Cover in the mapped territory roughly 6.3 km^2, which is 11.6 %. They are represented proportionally both in the lower and in the upper part of the catchment. In the lower part of the catchment area, their occurrence is generally bound to the course of the Losenice River, Zlatý potok Brook and of their affluents. They are less frequent on hillsides of elevations and ridges. In the upper part of the catchment area, they are mainly on the north-eastern and eastern hillside of the Huťská hora Mountain (1187.1 m a.s.l.) and along the Losenice River course.

They occur at all altitudes, their occurrence is mostly bound to the above-mentioned water streams and they follow the changing direction of those streams. On perpendicularly inclined erosional denudational slopes, there is the majority of frost cliffs and cryogenically remodelled rock outcrops.

2.2.6 Cryogenic modelling of slopes

In cold periods of the Pleistocene, intensive periglacial processes modelled bizarre forms, which we call cryogenic, in the area below the head of the glacier. The main cause of their formation was mechanical frost weathering. A significant factor of frost weathering is precipitation or melted water that penetrates into cracks, fissures or clefts between layers. When transforming into the solid state, the volume of water increases (of about 9 %), ice exercises pressure on walls and cracks are getting larger.

The most frequent cryogenic forms in the mapped territory are frost cliffs and cryogenically remodelled rock outcrops. Under the impact of frost weathering, solifluction, gravitational and other slope movements, continuous and discontinuous stone seas, rock streams and other cryogenic accumulation forms developed under the frost cliffs.

A frost cliff is a rock step in a slope formed by frost (cryogenic) weathering and resulting removal. Walls of frost cliffs are, in dependence on the rock structure (mainly on cracks or layer surfaces) vertical or nearly vertical, possibly overhanging. Their height and length vary, they usually reach several metres or tens of metres.

In general, cryogenic forms (frost cliffs, cryogenically remodelled rock outcrops, stone seas and stone streams) has developed in the studied region in six principal areas:

a. The area of the Královský kámen Stone (1058.3 m a.s.l.), Ždánov (1064.5 m a.s.l.) and Chlum (962.4 m a.s.l.), where there are about 35 frost cliffs at the altitude of 825 to 1065 m a.s.l. On Chlum, rock walls of frost cliffs are mainly oriented from the north to the south.

b. The area of slopes along the course of the Losenice River and the Zlatý potok Brook. It can be divided into two geomorphologically different groups – the left and the right bank of the Losenice River and the Zlatý potok Brook. Slopes on the right bank of the mentioned streams are mostly structural, only locally interrupted by valleys of their affluents, which have no names.
In total, there are about 74 frost cliffs and cryogenically remodelled rock outcrops in that area. Structural slopes are mostly formed by outcrops of the exfoliation arch, the orientation of which corresponds to the direction of the course (west-east) and the wings of the arch are oriented to the south to south-west.

c. The area of the Klostermannův vrch Hill (740.6 m a.s.l.), Vinice (812.2 m a.s.l.) and north-westwards from the Nad Rejštejnem spot height (847.9 m a.s.l.). The area of the Nad Rejštejnem north-western margin is mainly formed by frost cliffs developed on outcrops of the exfoliation arch. On the opposite bank, there are in the localities of the Klostermannův vrch Hill and Vinice not very large structural denudational slopes formed by cryogenically remodelled rock outcrops. There are also about 18 frost cliffs there.

d. The area of the Suchý vrch Hill (957.5 m a.s.l.), the Milovský vrch Hill (994.0 m a.s.l.) and the Lídlovský kopec Hill (839.9 m a.s.l.) which are elevations situated on the NW-SE line between the courses of the Losenice River and the Zlatý potok Brook. In the summit parts of these spot heights, there are about 16 frost cliffs.

e. The area of Valy (1010.0 m a.s.l.) and the Šafářův vršek Hill (928.9 m a.s.l.), where there are about 23 frost cliffs at the altitude of 900 to 1000 m a.s.l., the rock walls of which are mostly N-S oriented. The southern slope of the Šafářův vršek Hill and the eastern and the northern slope of Valy are mostly formed by predominantly continuous stone seas.

f. The area of Výrovec (865.4 m a.s.l.), where there are roughly 44 frost cliffs and cryogenically remodelled rock outcrops, mostly at the altitude of 700 to 900 m. They were formed mainly on the outcrop of the exfoliation arch, which is approximately N-S oriented. With this direction correspond also the prevailing directions of crack surfaces.

Morphologically significant localities of occurrence of cryogenic forms are differently high outcrops of exfoliation arches situated mainly on the left bank of the Losenice River and the Zlatý potok Brook. These arches are mostly oriented in the same direction as the water course (E-W for the Zlatý potok Brook and SE-NW for the Losenice River). The southern and south-western margins of the arches are mostly perpendicular and they form the majority of structural denudational slopes in the Losenice River catchment area.

Cryogenic forms occur in the Losenice River catchment area mainly on steeply and perpendicularly inclined erosional and structural denudational slopes. On medium and mildly inclined erosional denudational slopes, they appear only exceptionally.

2.2.7 Significance of crack systems for the river network formation and the origin of cryogenic forms

An analysis of crack diagrams may contribute to explanation of the origin, orientation and general modelling of rock forms and of the relief. The pressure acting during the solidification or shortly after the solidification, firmly fixed the system of measurable cracks. They form precise systems that mostly define the shape, the size and the arrangement of forms developed on denuded parts of the massif (Votýpka J. 1970). By this way there occur primary landforms (frost cliffs, pseudocirques) which have then a decisive impact on formation of secondary landforms (stone seas, rock streams).

Crack diagrams mostly show two or more crack systems of S and Q cracks (see lower). When evaluating individual systems, the following facts should be considered:

A. existence of the primary crack system originated by slow crystallization of magma, by its contraction and by the simultaneous effect of oriented pressure;

B. existence of the secondary crack system originated by
  a) the effect of endogenic forces on the solidified magma, the pressure may either use he predisposed cracks of the primary system or form a new system;
  b) a change of pressure direction during solidification of magma which is manifested in the solidified parts by formation of a new crack system, whereas the old system is maintained.

In total, 1216 measurements of crack surfaces were done. Measurements of crack directions were done in six localities in the Losenice River catchment area: on the Losenice upper course, on Chlum (962.4 m a.s.l.), on Ždánov (1064.5 m a.s.l.) and on Královský kámen Stone (1058.3 m a.s.l.), on the Losenice right bank upstream of Rejštejn, on the Zlatý potok right bank at the Naděje gallery and on Výrovec (865.4 m a.s.l.). Crack surfaces were measured mainly in biotitic paragneisses, with the exception of Ždánov, where there locally occur outcrops of biotitic granite porphyry.

Measurements were done exclusively on rock forms, because there are no open quarries in the Losenice catchment area. The established data were entered into Cloos rosettes. The classification introduced by H. Cloos (1921) was used for the analysis: S cracks are N-S–oriented cracks with a span of 30°, Q cracks are E-W–oriented cracks with a span of 30° and L cracks are conform with the former surface.

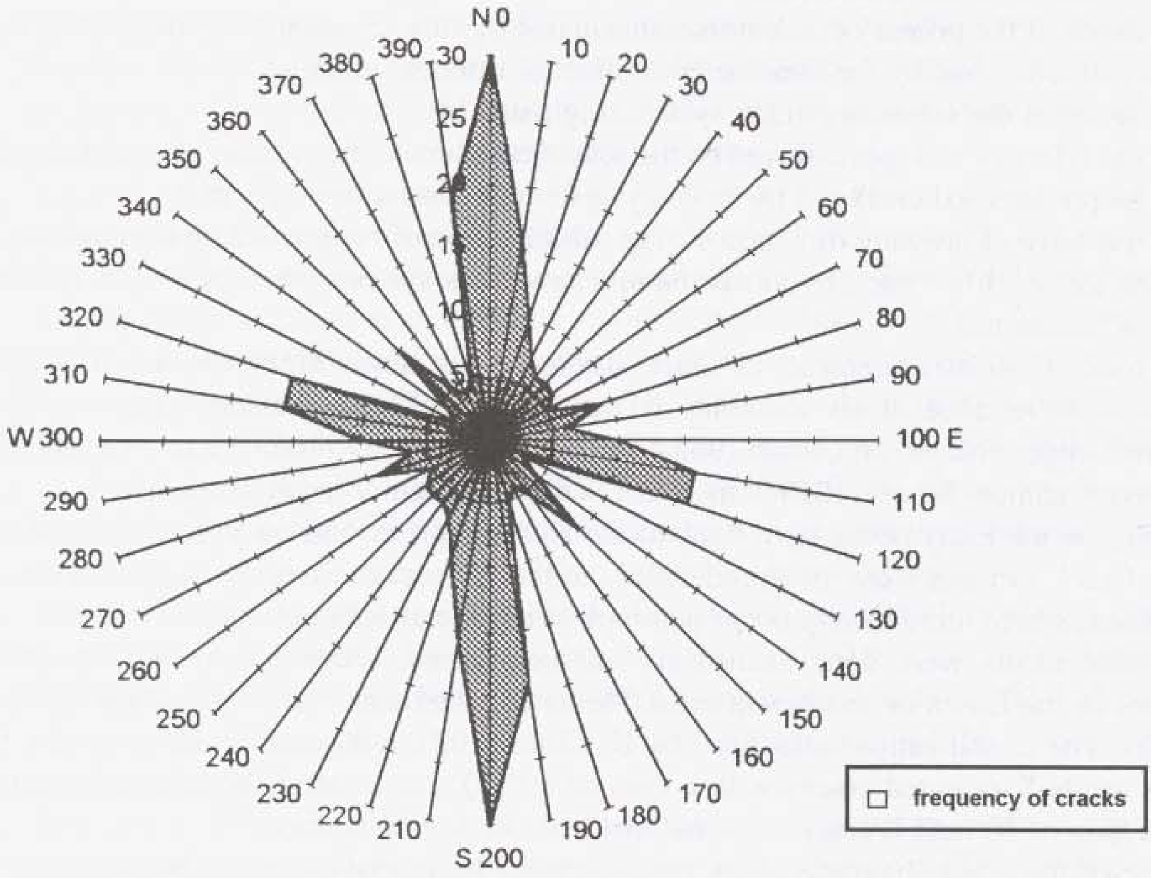
Five of the crack diagrams show two systems (the primary one and the secondary one) of crack surfaces S and Q. Only in the case of the Losenice upper course we can presume from the diagram that there are probably three systems of crack surfaces S and Q. Besides the two precedent systems, the tertiary system as well can be distinguished there.

In the case of the Losenice right bank near Rejštejn and the Zlatý potok right bank at the Naděje gallery, Q cracks significantly prevail (orientation of 90 to 110 grades) over S cracks (orientation of 190 grades). The direction of Q cracks is identical with the prevalent direction of the course of the Zlatý potok Brook and the lower course of the Losenice River.

On Výrovec, there prevail S cracks (190 to 200 grades) over Q cracks (110 to 120 grades), also here the dominant direction of Q cracks coincides with the direction of the course of the Pěnivý and the Jedlový potok Brooks. The secondary crack system in this locality is clearly determined by the directions of 80 and 150 grades.

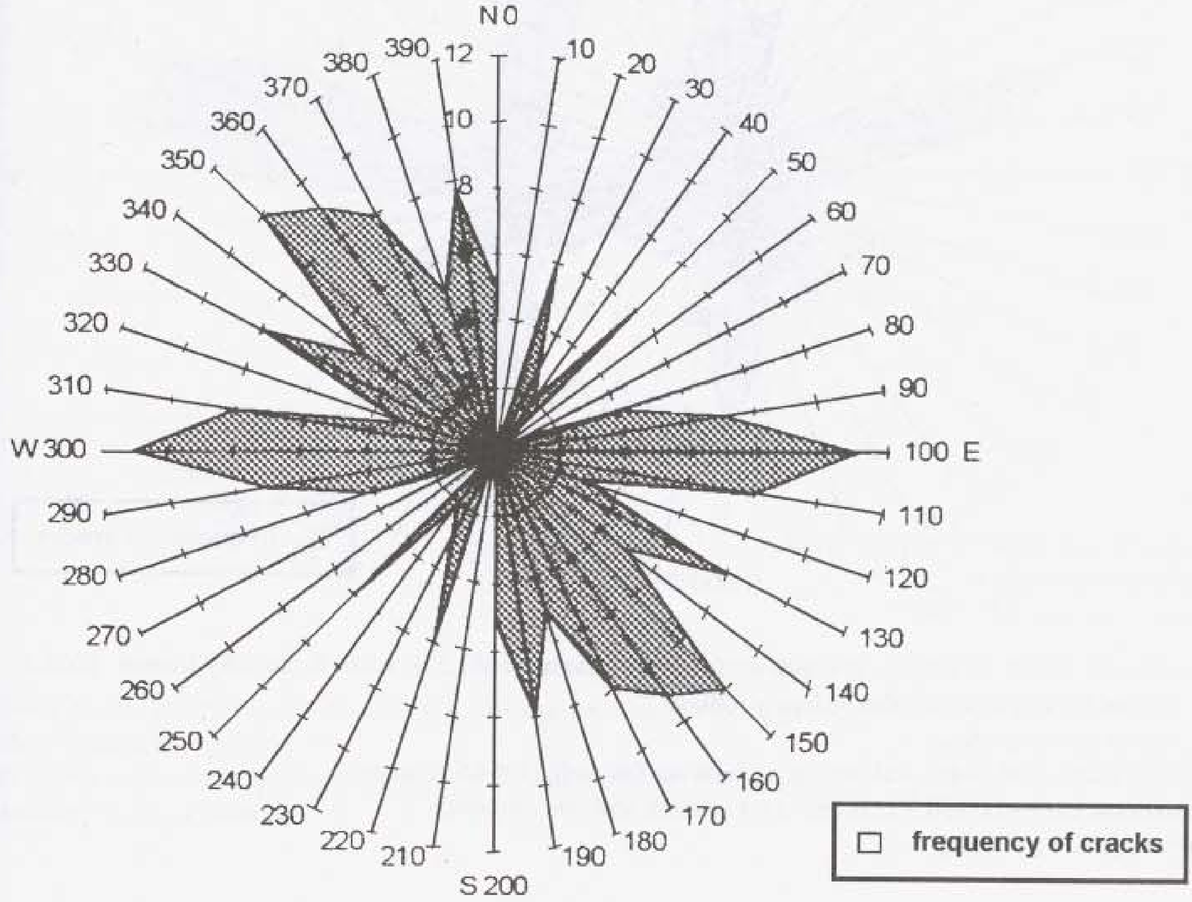
The best developed primary crack system in the Losenice catchment can be found in the Ždánov area (1064.5 m a.s.l.) and mainly on Chlum (962.4 m a.s.l.). Q cracks (100 to 130 grades) prevail there over S cracks (0 to 20 grades). The secondary crack system is more developed in the Ždánov area, in the Chlum area it is developed only minimally. It is formed by the directions of 150 to 160 grades and 40 to 60 grades.

Differently from the precedent localities, neither the primary nor the secondary crack system can be clearly determined in the area of the Losenice upper course. In the crack spectrum, there prevail the directions of 20, 50, 90 to 110, 130, 150 to 170 and 190 grades. These six directions obviously indicate that there are at least three crack systems.



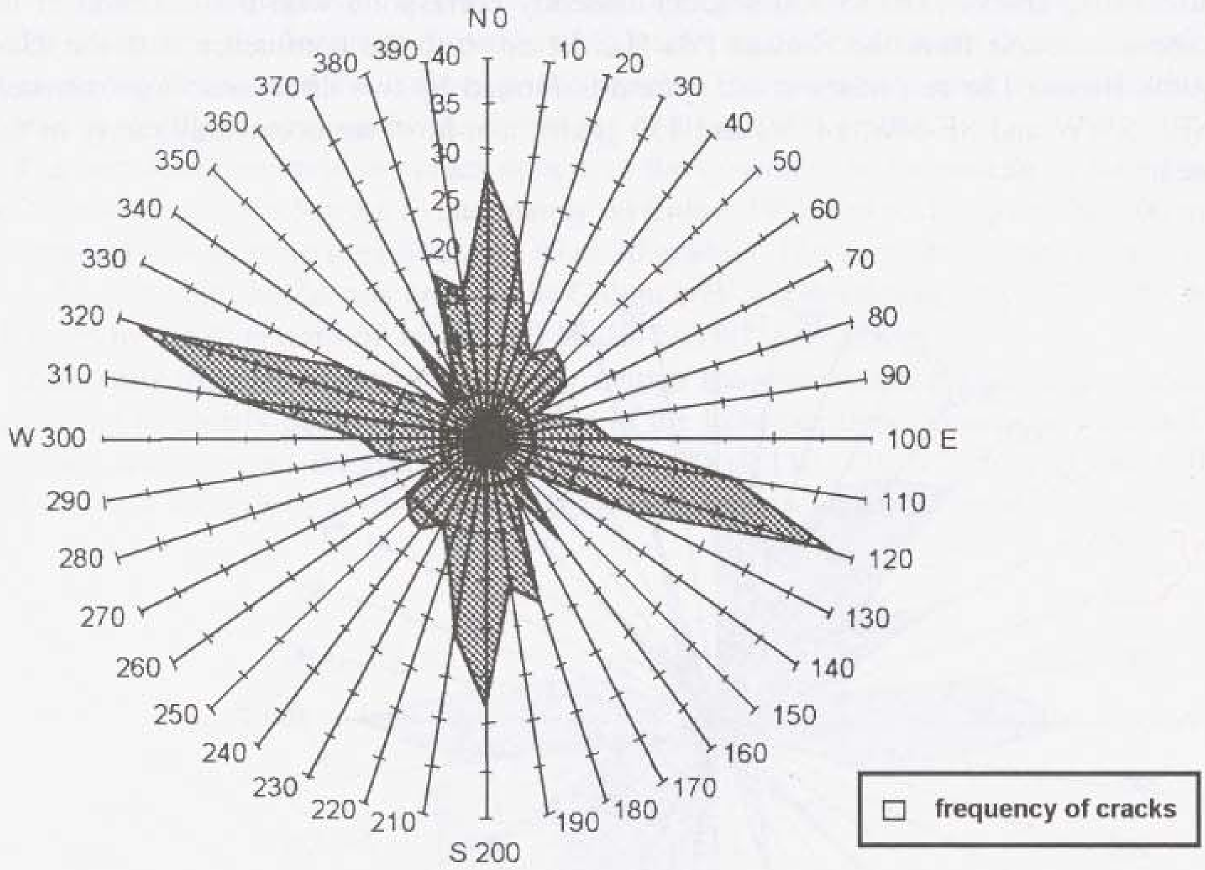
Cloos rosette of 193 directions of crack surfaces on Výrovec (865.4 m a.s.l)
(the values are in grades)
Cloosova růžice 193 směrů puklinových ploch na Výrovci (865,4 m n. m.)
(hodnoty jsou v grádech)

The diagram shows clearly the predominance of cracks in two directions. The N-S oriented cracks determine the direction of longer axes of rock forms as well as that of the Výrovec ridge and of the course of the Pěnivý and the Jedlový potok Brooks. The E-W oriented Q cracks (110 to 120 grades) evidently correspond with the direction of the Losenice course from the Karlina Pila Hamlet down to the confluence with the Zlatý potok Brook. The secondary crack system is formed by two directions: approximately NEE-SWW and SE-NW, i.e. 80 and 150 grades that however occur only rarely in this area.



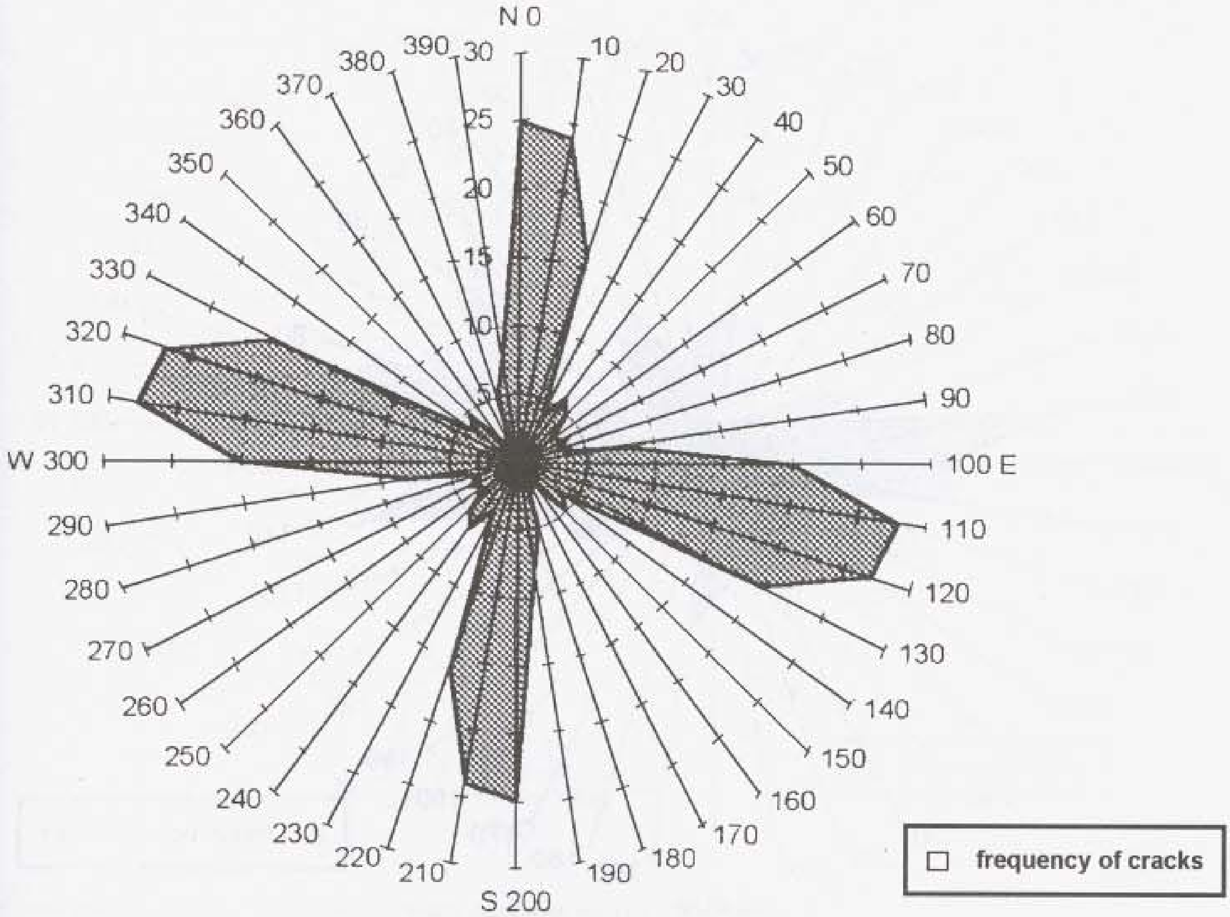
Cloos rosette of 109 directions of crack surfaces on the Losenice upper course at the altitude of about 980 m (the values are in grades)
Cloosova růžice 109 směrů puklinových ploch na horním toku Losenice v nadmořské výšce kolem 980 m n. m. (hodnoty jsou v grádech)

Neither the primary, nor the secondary crack systems can be unambiguously determined in this area. The most frequent direction of the cracks is E-W (100 grades) which corresponds neither to the Losenice course direction nor to the orientation of the neighbouring slopes. The second most frequent orientation, roughly SE-NW (150 to 170 grades), is already near to the direction of the Losenice course, but only at a short segment, because Losenice forms here a meander. Its course turns from the northern direction at first to the east, then to the west and finally continues nearly to the north again.



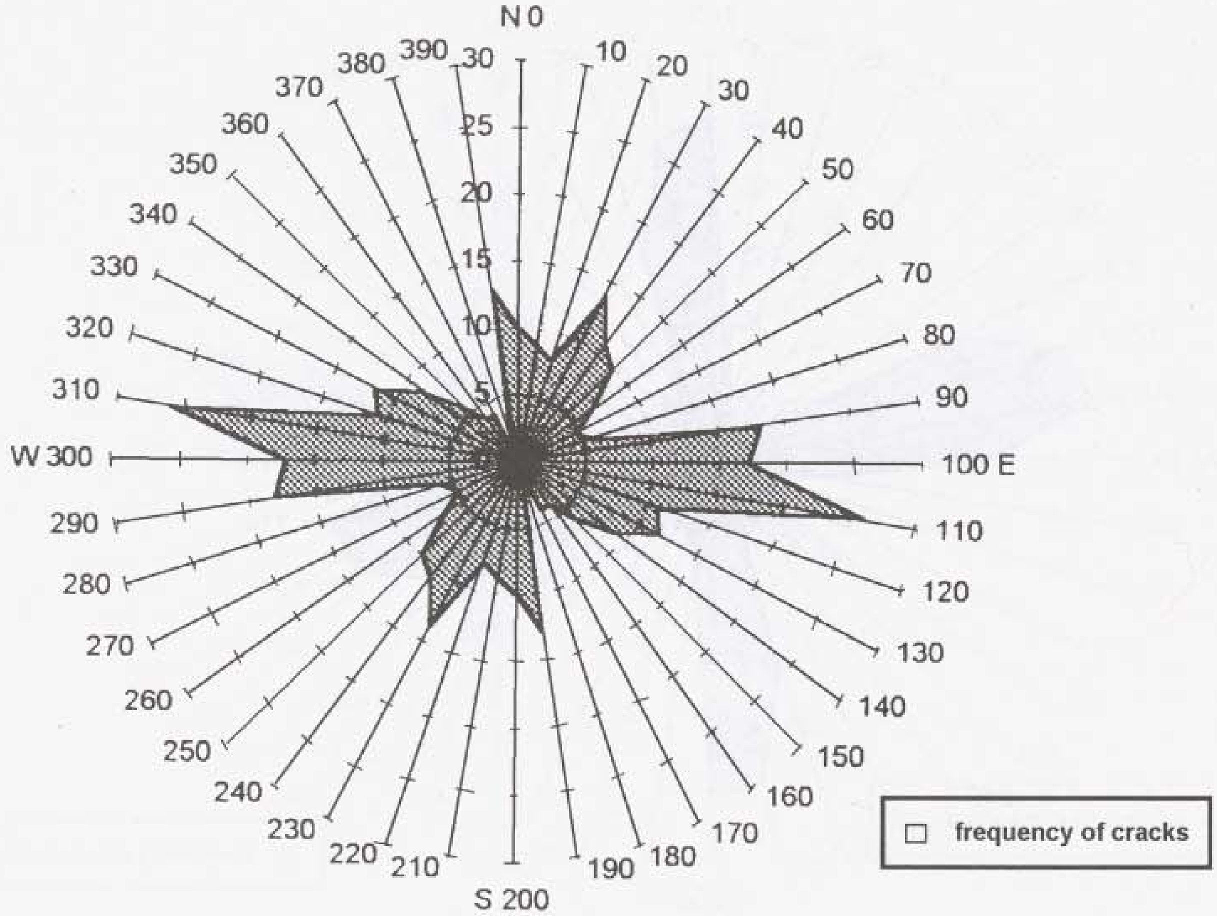
Cloos rosette of 290 directions of crack surfaces on Ždánov (1064.5 m a.s.l), Královský kámen 1058.3 m a.s.l. and on slopes above the Řetenice Village (the values are in grades)
Cloosova růžice 290 směrů puklinových ploch na Ždánově (1064,5 m n. m.), Královském kameni (1058,3 m n. m.) a na svazích nad obcí Řetenice (hodnoty jsou v grádech)

The primary crack system, which locally developed in granite porphyry, has S cracks in the direction of 180 to 210 grades and Q cracks in the direction of 110 to 130 grades. The latter ones are also decisive for the orientation of rock walls of frost cliffs and rock outcrops, which are mainly W-E to NW-SE oriented (100 to 150 grades). The secondary crack system has cracks in the direction of 30 to 60 grades and of 160 grades. The frequency of these cracks is significantly lower than in the primary system, so that it does not much affect the modelling of the relief. The crack diagram is much similar to that of the Chlum locality. In this locality however, the secondary crack system is much more developed than on Chlum.



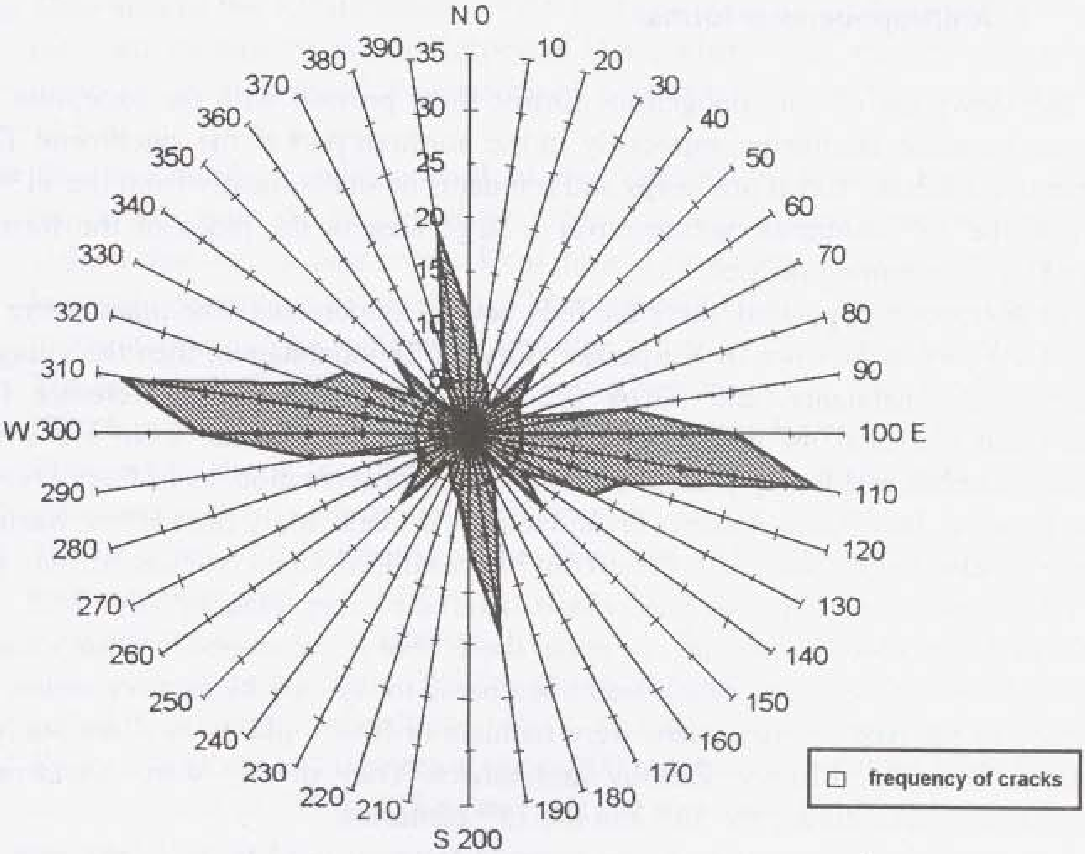
Cloos rosette of 218 directions of crack surfaces on Chlum (962.4 m a.s.l)
(the values are in grades)
Cloosova růžice 218 směrů puklinových ploch na Chlumu (9962,4 m n. m.)
(hodnoty jsou v grádech)

The area of Chlum (962.4 m a.s.l.) is formed by paragneisses with a distinctive crack system. The primary crack system clearly prevails over the secondary one. S cracks have the direction of 0 to 20 grades, Q cracks of 100 to 130 grades. In the relief, this system is manifested by ashlar separation of rock blocks. The secondary crack system is formed by cracks in the direction of 40 and 150 grades, they are however much less frequent than the primary cracks, so that they do not much influence the modelling of the relief.



Cloos rosette of 201 directions of crack surfaces on the left bank of the Zlatý potok Brook at the Naděje gallery (the values are in grades)
Cloosova růžice 201 směrů puklinových ploch na pravém břehu Zlatého potoka u štoly Naděje (hodnoty jsou v grádech)

The diagram shows the predominance of Q cracks of the direction of 90 to 110 grades. These cracks have the same direction as the course of the Zlatý potok Brook. S cracks have the direction of 30 grades. They are much less frequent than Q cracks. The secondary system of cracks cannot be clearly identified as it has probably nearly the same direction as the primary one, the tectonics having there probably used the old cracks from the time of formation of the massif.



Cloos rosette of 205 directions of crack surfaces on the right bank of the Losenice River upstream of Rejštejn (the values are in grades)
Cloosova růžice 205 směrů puklinových ploch na pravém břehu Losenice nad Rejštejnem (hodnoty jsou v grádech)

As it can be seen on the diagram, Q cracks of the direction of 100 to 110 grades clearly prevail in this area over S cracks of the direction of 190 grades. These two main directions of the primary crack system also condition the directions of valleys and by that also the direction of the Losenice and the Otava Rivers courses. The secondary crack system has in this area the direction of 50 and 150 grades and it is clearly visible on the diagram.

2.2.8 Accumulation forms

Are represented in the Losenice catchment area by alluvial plains and dejection cones. They were formed on those parts of the valley bottom where sedimentary activities of water streams prevail over the erosional activities. The total area of accumulation forms is 1.5 km^2, i.e. about 2.76 %. Alluvial plains are not much developed, on the lower course near Rejštejn they are maximally 200 m wide. This is evidently due to gradient conditions of water streams, which do not enable a larger deposition of sedimentary material. Dejection cones are frequent in the Losenice catchment, especially along the course of the Losenice River and the Zlatý and the Pěnivý potok Brooks. The cause of their frequent formation is a sudden change of gradient conditions at mouthing of short consequent affluents, where the by erosion washed out material is deposited in a delta shape. In total, 17 dejection cones were described in the Losenice catchment area.

3. Anthropogenous forms

From the viewpoint of anthropogenous forms, there prevail, with the exception of urban forms, montane landforms, especially in the northern part of the catchment. The most distinctive montane forms are heaps and remnants of shafts mostly from the 11^{th} to 14^{th} or from the 18^{th} centuries, which cover a large area in the place of the former Kašperské Hory ore mining district.

The area is scarcely populated, there are only several settlements. The main centre of the mapped territory is the town of Kašperské Hory (1528 inhabitants), then the villages of Rejštejn (202 inhabitants) and Nicov (72 inhabitants), hamlets of Řetenice (11 inhabitants) and Červená (44 inhabitants). Besides these settlements, there are some smaller ones (hamlets and lonely places) used above all for recreation, as Lídlovy Dvory, Churáňov, Popelná, Bílý Potok, Kaisrův Dvůr, Hotěšín, Podlesí, Malý Kozí Hřbet, Karlina Pila, Bajerov, Nebe, Peklo (Ramajzl), Prostřední Mlýn Mill, Mlýn na rybníce (Mill on the pound) , Pila (Sawmill) na Červené, Václavíkova továrna Factory, Plánský Mlýn Mill.

Besides these settlements, there are, or rather there were in the mapped territory many already disappeared settlements, which are remembered today only by ruins or names on map. Already in the past century, there were hamlets or lonely places as Zlatá Studna, Zhůří, Mates, Buzošná, Milovy, Ždánov and others. They mostly were glassworks settlements disappeared during the 18^{th} and the 19^{th} centuries.

As it has been already mentioned, the mapped territory used to be in the past an important gold mining district. The original way of obtaining gold was panning, particularly on the Zlatý potok Brook and the Losenice River. Outside the mapped territory, gold was panned in the Otava River, the Opolenecký, the Rýžovní potok Brooks and on all other streams in the area.

After depletion of all gold reserves in streams at the end of the 13^{th} century, gold had been also deep mined since, although panning went on as well. At the times of John of Luxembourg, there were about 300 gold ore mills. At the pre-Hussite times, the local mining district was, together with that in Jílové u Prahy, the most important in the Kingdom of Bohemia. In 1426, there were 37 mines or pits (operating or abandoned) . The mining district spread from Ždánov (1064.5 m a.s.l.) to the Křemelná Mountain (1125.2 m a.s.l. at about 5 km south-westwards from Rejštejn), it was 2 to 3 km large with its centre on the Zlatý potok Brook.

In the 15^{th} to 17^{th} century, the mining district knew a continuing decline, which was not overcome even by occasional findings of pure ore nuggets. In the 18^{th} century, mining activities were developing several times for short periods, but in 1777 they were definitely terminated. In the 19^{th} and at the beginning of the 20^{th} century, attempts were made to start mining again, but in 1930 they were definitely abandoned.

In the 1970^{th} to 1990^{th}, prospecting was being made in the Naděje gallery situated at 600 m SSE from the Suchý vrch Hill (823.0 m a.s.l.) on the right bank of the Zlatý potok Brook. At present (1999), after litigation between the town of Kašperské Hory and the TVX Bohemia důlní Company about gold mining (prospecting) in this gallery, all work has been stopped.

During all the time of mining and prospecting gold, the works went on mainly in the following areas:

a. Thee area of the Klostermannův vrch Hill (740.6 m a.s.l.), Vinice (811.6 m a.s.l.) to the south eastern margin of Kašperské Hory, where there are now only traces of pits under the form of small depressions of a diameter of 1 to 5 m and a depth of 0.5 to 12.5 m and spoils heaps.

b. The area in the neighbourhood of the Václavíkova továrna Factory. In the slope northwards from the factory, there is the half-buried entry into the Františkova štola Gallery that was the best known local mine. This gallery contained ore with a relatively high gold content (up to 50 g Au/t). Other traces of mining (remnants of pits) are situated on the northern slope southwards from the factory at the altitude of 650 to 740 m.

c. The area on the left bank of the Losenice River westwards from the Dvorský vrch Hill (700.6 m a.s.l.) and the right bank of the Losenice River from the mouthing of the Zlatý potok Brook in a distance of 1.6 km upstream. In this area, there are several galleries, remnants of pits and spoil heaps.

d. The area on the right bank of the Zlatý potok Brook from its mouthing into the Losenice River up to the Plánský Mlýn. This area, together with the valley of the Kašperský potok Brook (Lohlbach), Liščí vrch Hill (793.9 m a.s.l.) and its western and south-western slope called Spannreifl, the Suchý vrch Hill (823.0 m a.s.l) – also called Dürrenberg), Friedholz (739.2 m a.s.l., at 1.2 km south-westwards from Kašperské Hory) and the area at about 900 m southwards from Chlum (962.4 m a.s.l.) at the altitude of 775 to 825 m a.s.l. are the most affected by mining activities in the mapped territory.

There are maintained galleries on the right bank of the Kašperský potok Brook at about 150 m northwards from its mouthing and also in the Zlatý potok Brook valley on its right bank. Among other important galleries, let us mention Kristina and Naděje. In the Kristina Gallery, a seismographic station was founded in 1960 in the framework of research into seismic activities in Czech countries. The devices – seismometers – are installed on solid rocks in the lateral branches of this nearly 380 m long and 70 m deep gallery. By the quantity of registered data, this station ranks among the most important in Europe.

There are spill heaps in places when mining was very intensive. They are mainly in the area on the left bank of the Kašperský potok Brook at about 600 m north-eastwards from its mouthing at 675 to 700 m a.s.l., where there is an about 40 m long and 10 m wide spoil heap formed by debris of a size of 5 to 15 cm. Other larger spoil heaps can be found mainly on the right bank of the Zlatý potok Brook from its mouthing upstream to the Mlýn na rybníce.

e. The area of the southern and south-western slope of Ždánov (1064.5 m a.s.l.). There are mainly remnants of pits and spoil heaps. The remnants of pits have a diameter of 1 to 4 m and a depth of 1 to 2.5 m. The principal mining area on Ždánov was nevertheless situated on its northern and north-eastern slope outside the mapped territory.

f. The area of the Suchý vrch Hill (957.5 m a.s.l.), V pahorku (809.1 m a.s.l. westwards from the Červená Hamlet) and westwards (about 300 m) from the Lídlovy Dvory lonely house. In the area of Suchý vrch, there are remnants of pits mainly at about 400 m north-westwards from its summit at 880 to 925 m a.s.l. and they form today a depression of a diameter of 1.5 m to 6 m and a depth of 1 to 2 m in the relief.

Along the courses of Losenice, Zlatý potok and Červený potok, there are heaps which are small, usually 1 to 2 m, exceptionally even 4 to 5 m high heaps of gravel and sand piled up as wastes by panning gold from river or brook alluvia. They occur mostly on a large scale so that they form a mildly undulated relief along the water stream, the so-called heap fields.

4. Conclusion

The Losenice River catchment area belongs, according to the geomorphologic classification of the Czech Republic (Balatka 1998), into the Šumava System, Šumavská hornatina Hilly Region and Šumava Mountains and Šumava Foothills Units. It is a structural denudational and erosional denudational relief with predominance of forms the development of which is mainly conditioned by exogenic factors.

From the geological viewpoint, the Losenice River catchment area is formed by the moldanubicum with interference of three principal rock series. From the north, there interferes the Sušice – Votice – Strážov region various series (gneisses with more frequent intercalations of different rocks), from the east and south-east the uniform series of the Volary region (crystalline limestones, erlans and less frequent orthoamphibolites) and from the south and south-west the Královský hvozd series (mica schists, gneisses and migmatites with not frequent intercalations of quartzites, erlans, limestones, graphitic rocks, amphibolites and orthogneisses).

The relics of the oldest relief occurring mainly in the southern part of the catchment area are formed by planation surfaces from the end of the Secondary. In that area, a significant part of surface is covered by erosional denudational plateaux (2.2 km^2) and mildly inclined erosional denudational slopes (5.52 km^2).

During the Tertiary and the Quaternary, tectonic uplifts caused a significant intensification of deep activities of water streams, which disrupted the old flat relief. It is evident that water streams used the tectonic faults and lines from the period of formation of the massif. This type of relief covers the whole catchment of the Losenice River, with the exception of its southern part.

In the southern and eastern part of the Losenice catchment, there prevail mildly and medium inclined erosional denudational slopes (9.18 km^2 and 13.86 km^2), whereas in the western part steeply inclined erosional denudational slopes (19.35 km^2) are prevalent. In this part, there is also the majority of perpendicularly inclined structural denudational slopes (0.95 km^2).

Cryogenic forms are in the mapped territory mainly along the courses of the Losenice River and the Zlatý and the Pěnivý potok Brooks as well as in the summit parts of Chlum (962.4 m a.s.l.), Ždánov (1064.5 m a.s.l.) and Královský kámen (1058.3 m a.s.l.). These forms originated in places of outcropping of the rock underlayer, which was denuded by erosional denudational processes, and by deep erosional activities of water streams.

Morphologically noticeable places of occurrence of cryogenic forms are differently high outcrops of exfoliation arches situated predominantly on the right bank of the Losenice River and the Zlatý potok Brook. These arches are mainly oriented concordantly with the water course direction (E-W in the case of Zlatý potok and SE-NW in the case of Losenice). The southern and south-western margins of arches are mainly perpendicular and they form the majority of structurally denudational slopes in the Losenice catchment area.

Cryogenic forms have developed in the Losenice catchment area mainly on steeply and perpendicularly inclined erosional and structural denudational slopes. On medium and mildly inclined erosional denudational slopes, they are only exceptional.

Accumulation forms are represented in the Losenice catchment area by alluvial plains and alluvial cones. Alluvial plains are not much developed, they reach the maximal width of 200 m on the lower course at the Rejštejn Village. This is probably due to gradient conditions of water streams, which do not enable a larger deposition of sedimentary material. Alluvial cones are frequent in the Losenice catchment area, especially along the courses of the Losenice River and of the Zlatý and the Pěnivý Brooks. The cause of their frequent formation is a sudden change of gradient conditions at the mouthing of shorter consequent affluents.

As to anthropogenous forms, there are dominating, besides the urban shapes, the montane landforms, mainly in the northern part of the catchment. The most noticeable montane forms are heaps and remnants of galleries mainly from the period of 10th to 14th and of the 18th centuries covering a large area in the places of the former Kašperské Hory ore mining district.

References

Atlas podnebí Československé republiky, 1958: Hydrometeorologický ústav a Ústřední správa geodézie a kartografie. Praha, 1. vydání.

BALATKA, B. (1995): Podrobné regionální členění reliéfu. ZMČR 1 : 100 000 21–4 Nýrsko. Katedra fyzické geografie a geoekologie PřF UK, Praha.

BAYBERGER, F. (1886): Geographisch – geologische Studien aus dem Böhmerwalde. Peterm. Mitteil. Ergänz., Heft 81.

BENDOVÁ, J. (1994): Geomorfologické poměry Stožeckého masívu. [MP.] Praha, katedra fyzické geografie a geoekologie PřF UK, Praha.

BUDAY, T. et al. (1961): Tektonický vývoj Československa. Ústřední ústav geologický, Praha, 1. vydání, 254 str.

DEMEK, J. et al. (1965): Geomorfologie Českých zemí. Nakladatelství ČSAV, Praha, 1. vydání, 336 str.

DEMEK, J. et al. (1987): Zeměpisný lexikon ČSR – Hory a nížiny. Academia Praha, 1. vydání, 584 str.

DEMEK, J. (1988): Obecná geomorfologie. Academia Praha, 1. vydání, 480 str.

Geologická mapa ČR, list 22–33 Kašperské Hory, měřítko 1 : 50 000. Český geologický ústav, 1. vydání, 1994, Praha.

Hydrologické poměry ČSSR, 1965, díl III, HMÚ, Praha, 1. vydání, 414 str.

CHÁBERA, S. et al. (1987): Příroda na Šumavě. Jihočeské nakladatelství, České Budějovice, 1. vydání, 182 str.

KODYM, O. jun. et al. (1961): Vysvětlivky k Přehledné geologické mapě ČSSR 1:200 000, M-33-XXVI Strakonice. Ústřední ústav geologický, Praha, 1. vydání, 149 str.

KOMÍNEK, E. (1958): Okolí Kašperských Hor – mapovací zpráva s použitím podkladů dr. Urbana a Ing. Kyntery. Západočeský rudný průzkum n.p. Praha.

KOPECKÝ, A. (1983): Neotektonický vývoj a stavba Šumavské horské soustavy. Sborník geologických věd, Antropozoikum, 15, ÚÚG, Praha, s. 71–159.

KUNSKÝ, J. (1933): Zalednění Šumavy a šumavská jezera. Sborník ČSZ 39, Praha, s. 1–38.

KUNSKÝ, J. in ZOUBEK, V. et al. (1968): Československá vlastivěda I, Příroda, svazek 1. Praha, Orbis, s. 35–43, 60–74, 242–245, 354–360, 375–386, 448–450.

LHOTKOVÁ, D. (1984): Geomorfologická analýza a genetická klasifikace tvarů pískovcového reliéfu střední části CHKO Kokořínsko. [MP.], Katedra fyzické geografie a geoekologie PřF UK, Praha.

Listy Topografické mapy GŠ ČSLA 1 : 25 000, M-33-100-C-a Kašperské Hory, M-33-100-C-b Stachy, M-33-100-C-c Kvilda, obnovené v roce 1989.

Mineralogicko-petrografický rozbor rudního materiálu z lokality Kašperské Hory. Ústav pro výzkum rud, výzkumné středisko Kutná Hora, 1956.

Oblastní surovinová studie pro účely perspektivního plánování geologického průzkumu – oblast č. 10 – Šumava. České Budějovice, 1960.

Podrobná turistická mapa, č. 65, Šumava Povydří. KČT, VKÚ Harmanec, 1. vydání, 1991, měřítko 1 : 50 000.

PECH, J. (1970): Orografické poměry západočeské části Šumavy. Zpravodaj CHKOŠ, č. 11, KSPPOP Plzeň a České Budějovice, s. 3–7.

PREHÄUSER, G. (1930): Die Eiszeit im Bayerischen Wald. Abh. d. Geol. land. d. Bayr. Oberbergamtes, München, Heft 2.

RATHSBURG, A. (1928): Die Gletscher des Böhmerwaldes zur Eiszeit. Berchte der natur. Gesellschaft 22, Chemnitz, Heft 65–161.

RUBÍN, J., BALATKA, B. et al. (1986): Atlas skalních, zemních a půdních tvarů. Academia, Praha, 1. vydání, 388 str.

Statistický lexikon obcí ČR, 1992: Český statistický úřad a Ministerstvo vnitra ČR, Praha.

ŠTEFEK, V. (1966): Geologicko – ložiskové poměry jižně od Kašperských Hor. [MP], PřF UK, Praha.

VLČEK, V. et al. (1984): Zeměpisný lexikon ČSR – Vodní toky a nádrže. Academia Praha, 1. vydání, 316 str.

VOTÝPKA, J. (1970): Ukázky zvětrávání žul Českého masivu. Acta Universitatis Carolinae, Geographica, 5, 2, Praha, s. 75–91.

VOTÝPKA, J. (1974): Vznik a vývoj mezoreliéfu a mikroreliéfu Sedmohoří. Acta Universitatis Carolinae, Geographica, 9, 2, Praha, s. 17–34.

VOTÝPKA, J. (1979): Geomorfologie granitové oblasti masívu Plechého. Acta Universitatis Carolinae, Geographica, 14, 2, Praha, s. 55–83.

VOTÝPKA, J. (1984): Geomorfologický výzkum CHKO Kokořínsko. Acta Universitatis Carolinae, Geographica, 19, 2, Praha, s. 31–46.

GEOMORFOLOGICKÁ ANALÝZA POVODÍ ŘEKY LOSENICE

Résumé

Článek obsahuje podrobnou charakteristiku a genetickou klasifikaci reliéfu zlatonosného povodí řeky Losenice pravého přítoku Otavy. Rozkládá se v okrajové části Šumavských plání na styku se Svatoborskou vrchovinou.

Vstupní část zahrnuje základní faktory fyzickogeografické sféry – orografické vymezení povodí, orografické členění, geologickou stavbu, tektonický vývoj, hydrografii a přehled geomorfologického vývoje širší šumavské oblasti.

Stěžejní částí práce je geomorfologická analýza povodí Losenice. Strukturní tvary podmíněné endogenními činiteli (tektonickými poruchami, exfoliačními klenbami a litologickými vlastnostmi hornin) jsou zastoupené především strukturními hřbety a strmě ukloněnými strukturně denudačními svahy. Z tvarů vzniklých působením exogenních činitelů jsou zachycené erozně denudační plošiny (vrcholové, sedlové, svahové), škála erozně denudačních svahů o sklonitosti od 2° až přes 20°. Zvláštní pozornost byla věnována vzniku a vývoji zde hojně zastoupených kryogenních tvarů. Pro vysvětlení jejich tvarů, rozložení v terénu a směrovém uspořádání bylo provedeno více než 1200 puklinových měření, která jsou prezentována na šesti diagramech. Měření také ukázala přímou závislost směrového vývoje převážné části údolní sítě povodí na hlavních tektonických směrech a puklinatosti skalního podkladu.

Z antropogenních transformací reliéfu převládají na území urbální tvary. Ovšem v severní části povodí dominují montánní tvary vzniklé těžbou zlatonosných rud v Kašperské oblasti.

V závěru jsou vyzdviženy nejdůležitější faktory, které se podílely na formování současného stavu reliéfu celého povodí Losenice.

Photo 1: View on Kašperské Hory from the Liščí vrch Hill (793.9 m a.s.l.)
Foto 1: Pohled na Kašperské Hory z Liščího vrchu (793.9 m n. m.)

Photo 2: Regulation reservoir on the Zlatý potok Brook
Foto 2: Regulační nádrž na Zlatém potoce

Photo 3: Entry to the Naděje gallery on the right bank of the Zlatý potok Brook
Foto 3: Vchod do štoly Naděje na pravém břehu Zlatého potoka

Photo 4: Summit frost cliff at 450 m north-north-eastwards from the Valy summit (view to the east)
Foto 4: Vrcholový mrazový srub 450 m zsv. od vrcholu Valů (pohled k východu)

Photo 5: Rock window in the northern part of Valy (view to the west)
Foto 5: Skalní v severní části Valů (pohled k západu)

Photo 6: Relics of a summit frost cliff at about 350 m north-north-eastwards from the Valy summit (view to the north)
Foto 6: Zbytky vrcholového mrazového srubu asi 350 m ssv. od vrcholu Valů (pohled k severu)

Photo 7: Continuous stone sea on the southern slope of the Šafářův068 vršek Hill (928.9 m a.s.l.)
Foto 7: Souvislé kamenné moře na jižním svahu Šafářova vršku (928,9 m n. m.)

Photo 8: Summit frost cliff on the northern summit of the Šafářův vršek Hill (view to the south)
Foto 8: Vrcholový mrazový srub na severním vrcholu Šafářova vršku (pohled k jihu)

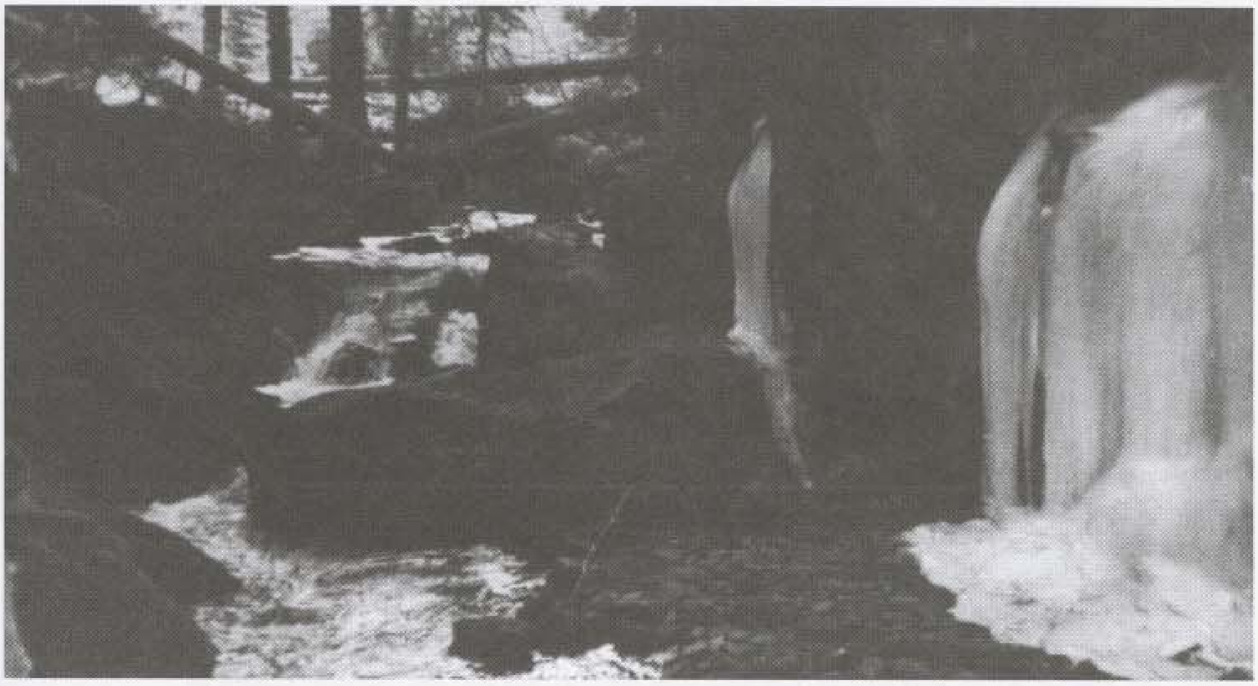


Photo 9: Intensive frost weathering on the upper course of the Losenice River at the altitude of about 1000 m
Foto 9: Intenzivní mraz. zvětrávání na horním toku Losenice v nadm. výšce asi 1000 m n. m.

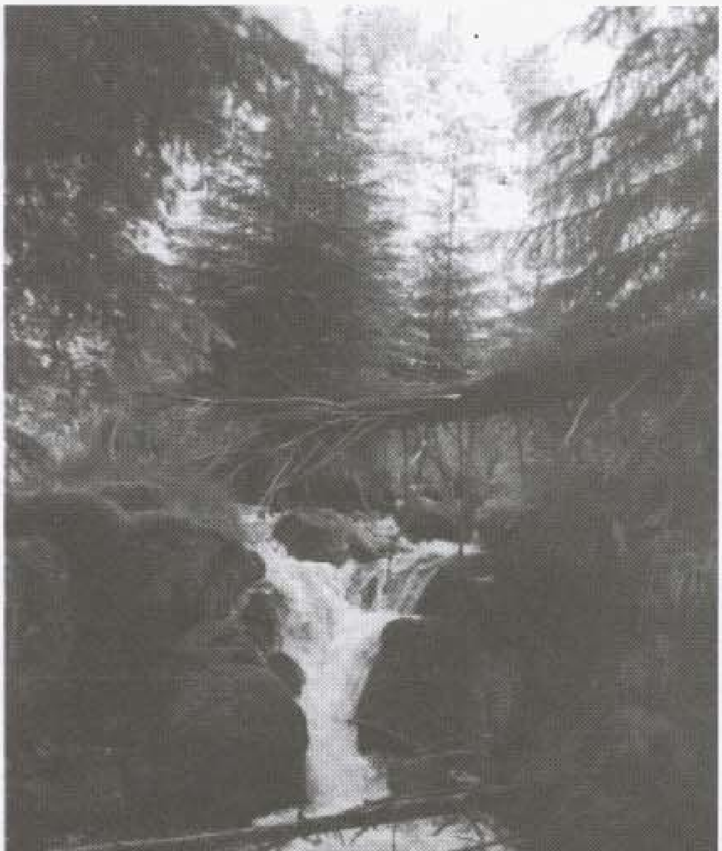


Photo 10: Waterfall on the upper course of the Losenice River at the altitude of about 1000 m
Foto 10: Peřej na horním toku Losenice v nadmořské výšce asi 1000 m n. m.