

Brief characteristics of the “Křivoklátsko” region and the České středohoří Mts.

“Křivoklátsko” region

The „Křivoklátsko“ is situated on the boundary of Central and West Bohemia about 50 km to the west of Praha. It is moderately warm hilly area, divided by the Berounka river. Steep slopes and cliffs in the river valley represent remarkable refuges of plant and animal populations.

Geology. High geological diversity is an outstanding feature of the area. The oldest unit is Upper Proterozoic (Barrandien), consisting of both sedimentary (slates, greywackes and siltstones) and volcanic rocks (mainly spilites); Middle Cambrian sediments in the southwestern part of the area rich in fossil fauna, especially in trilobites. Extensive volcanic complex appeared in the succeeding Late Cambrian period. Ordovician rocks occur only in two isolated zones, and include both sediments and volcanic diabases, diabase tuffs and porphyric mandestones. Quarternary strata include alluvial deposits, deluvial clays on hillsides, clay debris, and very interesting spring calcareous tufa.

Climate is characterized as moderately warm (mean annual temperature ranges between 7.5 and 8.5° C) and moderately dry (mean annual precipitation is 530 mm).

Vegetation. The vegetation cover is strongly affected by rich geomorphological diversification and varying geological substrate. The Křivoklátsko region is widely forested, more than 60 % of the total area are covered by semi-natural broad-leaved and mixed coniferous forests. The reason for this dates back to Prehistoric times, when the area was, with a few exceptions, devoid of people. In the Middle Age the forests of Křivoklátsko became a favoured hunting ground for Czech kings and princes and were therefore protected from expansion of agriculture. Most frequent are oak-hornbeam, beech and thermophilous oak forests, local distribution have relic pine forests (as *Hieracio pallidi-Pinetum*). Of outstanding interest is relic vegetation of open screes (*Thlaspietalia rotundifolii*); highly diversified is xerothermous and semixerothermous herb vegetation (*Festuco-Brometea*). It is related to either primary (native) habitats at the rock sites or at secondary ones, created by deforestation and partial blockage of retardation of succession on the shallow soils of the south-exposed slopes. Meadow complexes also contribute to high diversity of the area. They cover first of all the alluvial plain of the Berounka river and valley bottoms of larger streams, and also occur on the plateaux in shallow, spring-filled depressions.

More than 1500 species of vascular plants are reported from the region. From the phytogeographical point of view, following groups should be mentioned: (1) mostly xeric and thermophilous species spreading mostly from the Eastern Europe and Asia, e.g. *Achillea pannonica*, *A. setacea*, *Allium strictum*, *Artemisia pontica*, *Erysimum durum*, *Stipa capillata*, (2) European-subatlantic species, e.g. *Aira praecox*, *Aphanes microcarpa*, *Gentianella baltica*, *Hieracium schmidtii*, *Potentilla anglica*, *Teucrium scorodonia*, (3) Boreal and Boreal-Arctic species, e.g. *Menyanthes trifoliata*, *Potentilla palustris*, *Sparganium minimum*, *Triglochin palustris*, (4) species with the core of their distribution

range in the South Europe (mostly species of thermophilous oak forests and fringes, e.g. *Anthericum liliago*, *Dictamnus albus*, *Lactuca perennis*).

Selected recent literature

- Kolbek J., Mladý F., Petříček V. et al. (1999): Květena Chráněné krajinné oblasti a Biosférické rezervace Křivoklátsko. 1. Mapy rozšíření cévnatých rostlin. [Flora of the Protected Landscape Area and Biosphere Reserve "Křivoklátsko" 1. Distribution maps of vascular plants.]. AOPK ČR and Botanický ústav AV ČR, Praha.
- Kolbek J. et al. (1999): Vegetace Chráněné krajinné oblasti a Biosférické rezervace Křivoklátsko. 1. Vývoj krajiny a vegetace, vodní, pobřežní a luční společenstva. [Vegetation of the Protected Landscape Area and Biosphere Reserve "Křivoklátsko" 1. Development of the Landscape and Vegetation, Aquatic, River Bank and Meadow Communities.]. AOPK ČR and Botanický ústav AV ČR, Praha.
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- Kolbek J. et al. (2001): Vegetace Chráněné krajinné oblasti a Biosférické rezervace Křivoklátsko. 2. Společenstva skal, strání, sutí, primitivních půd, vřesovišť, termofilních lemů a synantropní vegetace. [Vegetation of the Protected Landscape Area and Biosphere Reserve "Křivoklátsko" 2. Plant Communities of the Rocks, Scree, Primitive Soils, Heathlands, Thermophilous Margins and Ruderal Sites.]. Academia, Praha

České středohoří Mts. (Böhmisches Mittelgebirge)

The České středohoří Mts. lies in NW Bohemia. It stretches in the SW-NE direction from Louny and Most in the SW to Česká Kamenice in the NE, highest peak is Mt. Milešovka (Donnersberg, 836,5 m). It is a volcanic range in an advanced stage of development consisting of many isolated volcanic bodies. It is divided into two part, namely the northern and southern part. The former is a denudation plateau dissected by the Labe (Elbe) and Bílina river valleys, the latter is formed by numerous sharp cones and domes representing, for the most part, stripped volcanic necks and laccoliths.

Geology. The region belongs to the Bohemian Massif, an ancient block of continental crust. The crystalline complex of Saxothuringiacum is developed below almost the whole of the České středohoří Mts. However, crystalline rocks are exposed on the surface at only few places (Bílina area, Oparno Valley and Bohemian Gate). They are represented by orthogneisses, partly also by paragneisses and migmatites. A shallow sea penetrated into the Bohemian Massif from the north and south some 97 million years ago and left here for approximately 12 million years. Large amount of marine sediments deposited in Turonian and Coniacian forms Czech Cretaceous basin, adjacent to the České středohoří Mts; these are represented almost by calcareous claystones, marlstones, clayed

limestones, and sandstones. Tertiary volcanism is associated with the Ohře (Eger) Rift – a volcano-tectonic zone formed as a response of then already stabilized part of the continent to Alpine orogenic processes. The deformations of continental crusts reached such depths that molten masses could penetrate to the surface. The most intensive volcanic activity falls into the period from Eocene to Miocene (with the peak in the Oligocene). Later on, extensive erosion started in the Late Tertiary and is acting till the present. An intensive frost weathering occurred under the cold climate of glacial periods. Various kinds of basalt prevail, less common are phonolites and trachytes. Although these landscapes are often mistaken for true volcanoes, their present shape is a result of long-lasting geological history, in which erosion (see above) was one of the most prominent processes.

Climate. The České středohoří Mts. is characterized (1) by a climate gradient from SW to NE, and (2) by vertical gradient (vertical amplitude is ca 600 m). Mean annual temperatures are 8-9° C in the SW part and in the Labe river valley, and 7° C in the N and NE parts. Annual precipitation ranges from about 450 mm in SW corner to ca 700 mm in the NE.

Vegetation. Different geological substrates, a variety of landscape forms and often small-scale differences in microclimate cause an intricate mosaic of habitats. The most important plant communities can be divided into three major categories: (1) forest communities, (2) grasslands, and (3) vegetation of stony debris and cliffs.

Forests. Thermophilous oak forests with *Quercus pubescens* (*Quercion pubescenti-petraeae*) are limited almost exclusively to middle part of the mountains. They are developed on sunny, warm, but not extremely dry slopes (therefore the lack in the "continental" SW corner of the mountains). The stands are characterized by an open tree layer, well developed shrub layer, the field layer is composed of e.g. *Centaurea triumfettii*, *Dictamnus albus*, *Geranium sanguineum*, *Lathyrus pannonicus* subsp. *lactaeus*, *Lithospermum purpureocaeruleum*, *Muscari tenuiflorum*, *Scorzonera hispanica*. Oak forests with *Potentilla alba* (*Potentillo albae-Quercetum*) occur on flat relief or moderate slopes with heavier soils. Species rich beech forests prevail (or rather prevailed, they were often converted to spruce plantation) in the N and NW parts of the area, in the middle part they are confined to either north- and northeast-facing slopes in higher altitudes or lower parts of deep valleys. They understory slightly changes in SW-NE direction; some species (e.g. *Dentaria bulbifera*, *D. enneaphyllos*, *Lunaria rediviva*) are lacking at the left bank of the river Labe (Elbe). Widely distributed are well developed oak-hornbeam forests (*Carpinion*, as. *Melampyro nemorosi-Carpinetum*). Their distribution relies on the local climate and landscape form. While in the "continental" SW part they mostly occur on north-facing slopes, in the middle part of the mountains they represent prevailing vegetation on east- and west-facing slopes. Relic pine forests (*Cytiso ruthenici-Pinion sylvestris*) occur between Litoměřice and Ústěk, just outside the České středohoří Mts.

Dry grasslands. Several types of dry grasslands can be recognized in the area. Of outstanding interest are xeric grasslands with dominating *Stipa* species (often named "Central European steppes" or "steppe grasslands"), well developed at dry steep southwest- to south-facing slopes. Their occurrence is caused by low precipitation, relatively high annual temperature (about 8° C), and considerable heating of dark volcanic substrates. The core of their distribution is located in the SW corner of the

mountain system (in the area named "Lounské středohoří"). Many "continental" species occur in these patches, e.g. *Astragalus austriacus*, *A. danicus*, *Adonis vernalis*, *Helictotrichon desertorum*, *Oxytropis pilosa*, *Verbascum phoeniceum*, *Viola ambigua*; some of them approach the western limit of their distribution range here. Towards to the northeast, the climate becomes less dry and a bit cooler. The forests are interspersed with patches of dry grasslands (*Festucion valesiaceae*) and rock-outcrop vegetation (*Alyssso-Festucion pallentis*). The former are confined to south-(southwest- or southeast-) facing rather steep slopes with mineral rich soils. Both vegetation types harbour many interesting species, e.g. *Allium senescens* subsp. *montanum*, *A. strictum*, *Carex humilis*, *Erysimum crepidifolium*, *Pulsatilla patens*, *Pulsatilla pratensis* subsp. *bohemica*, *Sedum reflexum*, *Seseli hippomarathrum*. Remarkable xerotherm grasslands with e.g. *Coronilla vaginalis*, *Ophrys insectifera*, *Globularia punctata*, *Linum tenuifolium* (alliance *Bromion erecti*) are located along the E border of the České středohoří Mts., between the towns of Litoměřice and Ústěk. The bedrock is formed by Cretaceous group – mare- and sandstones.

Stone debris and cliffs are outstanding habitats with exceptional physical properties and microclimate. Basal parts of debris have often cold microclimate allowing survival of mountain species in such a low altitudes. Some debris are covered by open-canopied vascular plant communities, most interesting are those with *Saxifraga decipiens*, *Woodsia ilvensis* (*Woodsia ilvensis-Asplenietum septentrionalis*) and *Ribes alpinum* and *Rosa pendulina*. However, stands of the latter community can also be found in clearings, shaded rocks and ravine forests. Worth mention is the occurrence of mountain mosses, e.g. *Polytrichum alpinum*, *Rhacomitrium lanuginosum*, *Lophosia sudetica*. Interesting phenomenon is air circulation in debris and cracks of volcanic hills. Air temperature remains more or less stable over they year; in winter, the warmer air rises out of the hill (ventarols), and is responsible for occurrence of extremely rare thermophilous taxa such as South European liverwort *Targionia hyphophylla* and fern species *Asplenium adiantum-nigrum*. In contrast, ice holes with in summer season accumulated cold air often occur in bottoms of debris. Many types of debris vegetation are of relic nature.

Cliffs provide refuges for dealpine species, such as *Aster alpinus*, *Saxifraga paniculata*, other interesting species is e.g. *Dianthus gratianopolitanus*.

Interesting habitats are also meadow complexes, which history goes back to the Medieval times (e.g. meadows near the village of Babiny). They were known for their species richness (e.g. many orchid species). However, species composition have changed considerably and many taxa have become extinct. Species-rich are also forest fringes (e.g. *Artemisia pontica*).