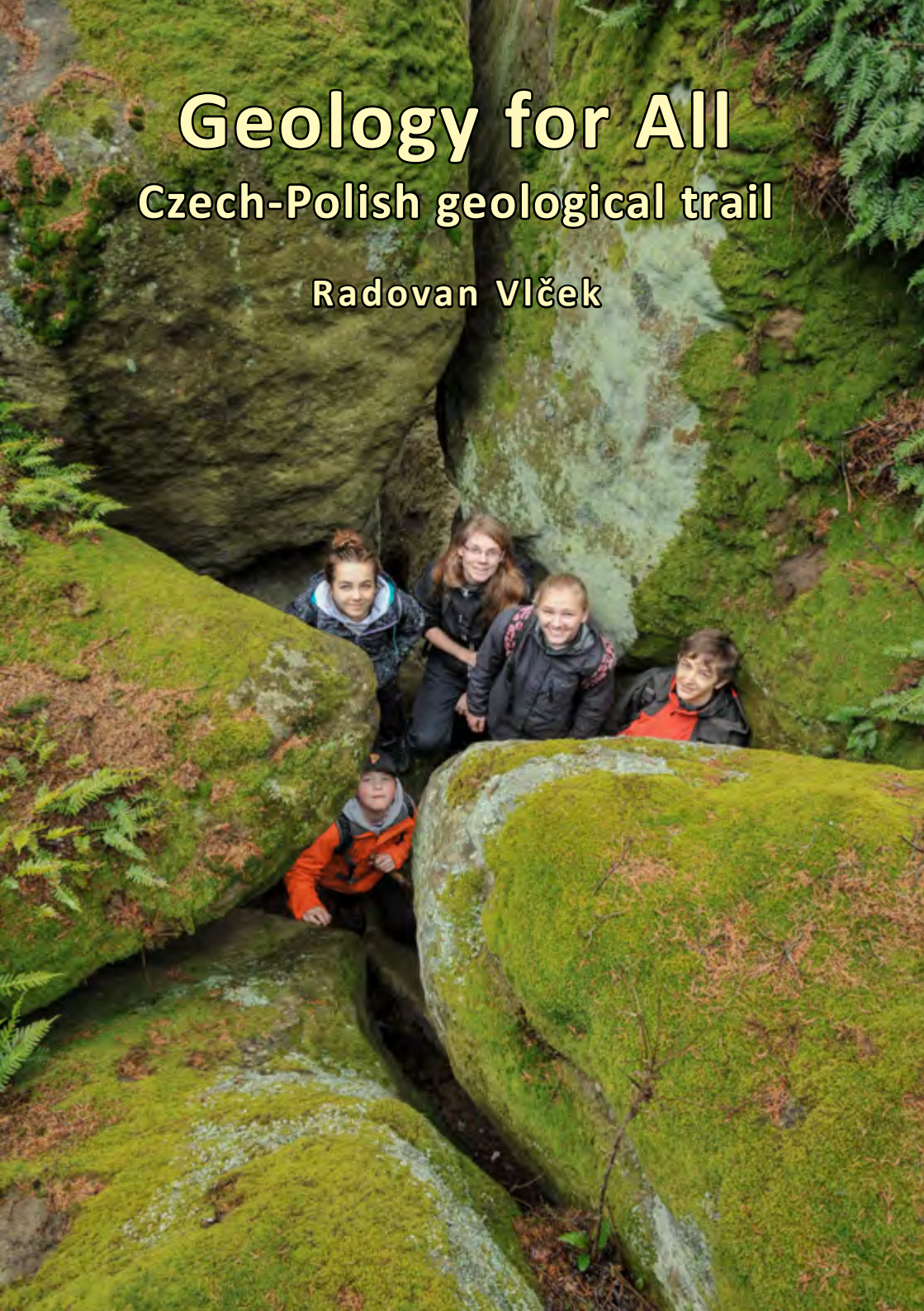


Geology for All

Czech-Polish geological trail

Radovan Vlček





So colourful at first sight, the Žacléř-Lubawka region can take pride in such a diverse landscape thanks to two phenomena that usually go unnoticed: its geological structure and geological development. The “life course” of stone (yes, even rocks are born, develop and die) spreads over such a long time period that most people find it difficult to imagine. However, the geological structure of the landscape, and the processes taking place in it, are important factors shaping the face of local waters, vegetation and climate.

Whether you are at home here or just visiting, I would like to share with you my knowledge of this part of nature to complete your perspective on the region’s environment and history.



Radovan Vlček

Dear friends,

Let me introduce myself. My name is fern – tree fern. I have lived in the Žaclěř area for all my life, even before it got its name – actually, before anything had a name. When the local landscape was still in the process of making, tree ferns along with club-mosses and horsetails grew in tropical swamps between Žaclěř and Lubawka. This was more than 300 million years ago, in an era geologists call Carboniferous. Tens of millions of years later, most of us turned into black coal. A few lucky ones have made it to paleontological collections as fossils – you can find them at the Žaclěř City Museum, or at the local Mining Museum. If you could travel in time, you wouldn't believe how different this place was. It used to be hot and humid – no wonder given the region's location near the Equator. The Krkonoše Mountains were much higher. Every now and then, volcanoes exploded, disgorging lava and ash. Much has changed since those times, but even today, an attentive and learned observer can find traces of all these processes in the nature. Let us take the adventure of discovering the geological history and interesting natural sites in the colourful landscape of Czech-Polish borderland between the cities of Žaclěř and Lubawka.



The Žaclěř-Lubawka Area

The Czech part of the cross-border area consists of the city of Žaclěř and the nearby communities of Bernartice, Královec, Lampertice, Křenov, Černá Voda, Zlatá Olešnice and Libeč, as well as communities on the western side of the Rýchory Mountains – Bystřice, Albeřice and Lysečiny. The Polish part includes the city of Lubawka and the neighbouring communities of Chełmsko Śląskie, Krzeszów, Miskowice, Bukówka, Opawa and Niedamirów. A large part of the area belongs to the Krkonoše Mountains National Park, some places even to the Park's Core Zone or Buffer Zone. Some minor sites on the Polish side have the status of Nature Preserve.

Geological characteristics

The Žaclěř-Lubawka Area has a highly diverse landscape with large differences in altitude. The highest peak of the entire area, Lysečinská Hora/Łysocznina (elevation 1188 metres above sea level), is part of the border ridge north of the Lysečinské Boudy settlement. In the Czech part, Dvorský Les in the Rýchory Mountains has the highest elevation (1033 masl) and the stream of Ličná in Křenov the lowest (425 masl). In the Polish part, the Borowa Mountain is the highest point (1056 masl) and the river of Zadrna above Krzeszów the lowest (450 masl). The area borders the easternmost part of the Krkonoše Mountains and the northwest part of the Broumov Highlands (sharing the border massif of Zawory with the latter). The saddle between the two ridges is called Královecké Sedlo (524 masl) in the Czech Part and Brama Lubawska in the Polish part, and constitutes an important gateway between Bohemia and Silesia. In the centre of the area, between Brama Lubawska and Kotlina Krzeszowska, there is the mountain range of volcanic origin, Vraní Hory/Góry Krucze. While most of the range is located in the Polish territory, the highest peak, Královecký Špičák (880 masl) is in Bohemia.

Regional-geological characteristics

The unique mix of rocks in the geological structure of the Žacléř area, which makes it such a diverse and interesting place to see, is a result of a complex process which took hundreds of millions of years. When hiking through the Žacléř area, one comes across all basic genetic types of rock: volcanic, metamorphic and sedimentary. The latter type contains the fossils of us, the ancient woodland flora of the Carboniferous. This guide is going to tell you about ten most frequently occurring rocks and a bunch of interesting natural sites where you can find them.



Geological structure

Žacléř is located right on the verge of two distinct geological units, namely the Rýchory Mountains and the Intra-Sudetic Basin. The history of the Rýchory Mountains is associated with the mountain ranges of Krkonoše and Jizera, something geologists refer to as the Krkonoše-Jizera Crystalline Complex. The geological structure of the Rýchory Mountains mostly consists of metamorphic rocks – different types of mica schist, phyllite and greenschist, but also marble. They formed from volcanic and sedimentary rocks (claystone, siltstone, sandstone, limestone, consolidated lava and ash) during the so-called Variscan Orogeny in the Palaeozoic era, approximately 390–310 million years ago. The resulting vast mountain range included the Krkonoše Mountains as well. Ferns did not exist back then, but we remember pretty well what came afterwards.



geomorphological processes (the effects of water, wind, frost and gravity) polished the mountains, and pieces of disintegrated rocks were transported by rivers and deposited in lake basins under the mountains. Subsequently, the river and lacustrine sediments consolidated into conglomerates, sandstones and other sedimentary rocks that comprise what's today the valley between Žacléř and the Vraní Mountains (a part of the Intra-Sudetic Basin). Volcanic activity that took place simultaneously with the sedimentation process created, for example, the Vraní Mountains that are made of rhyolite (acidic volcanic rocks).

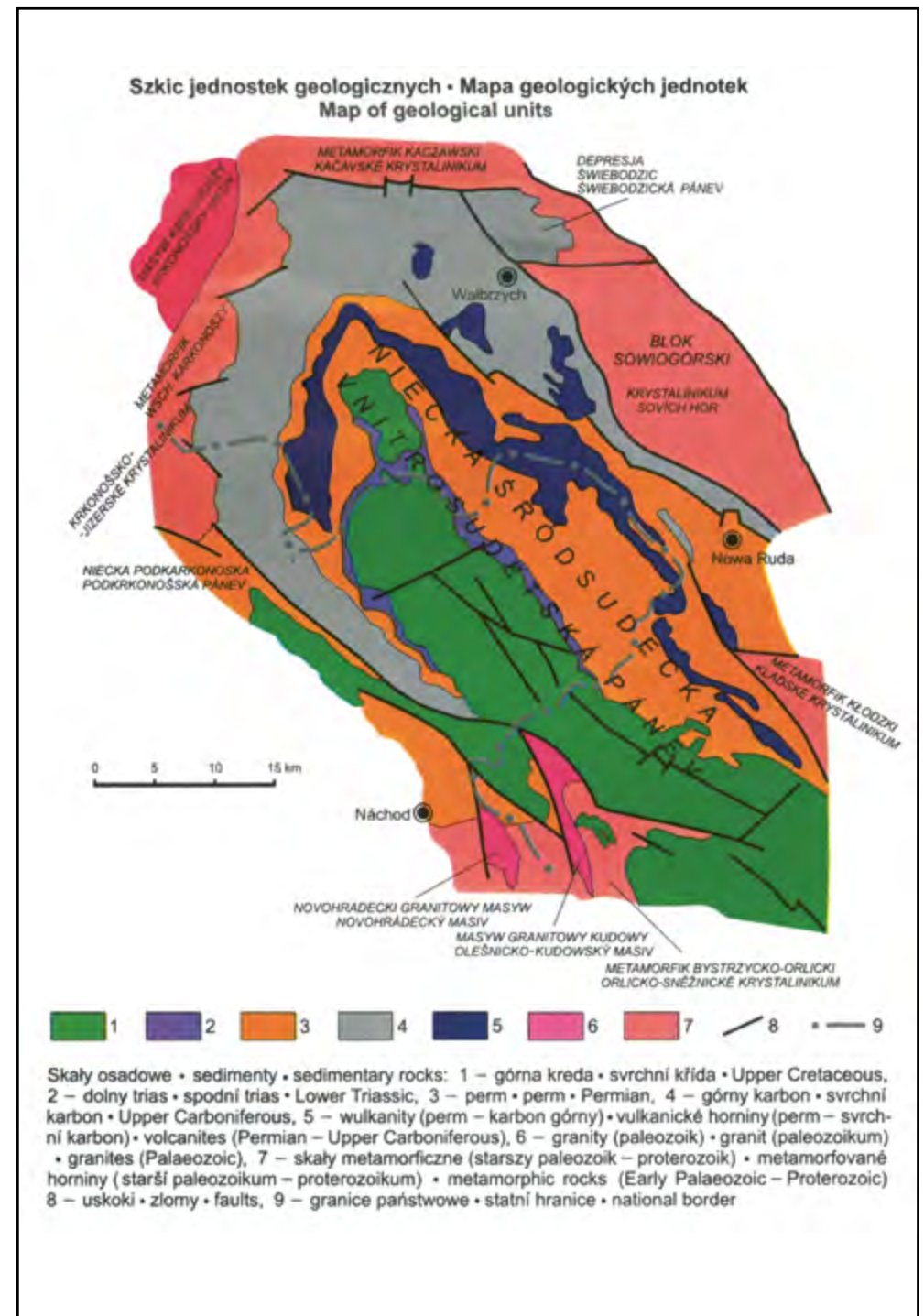
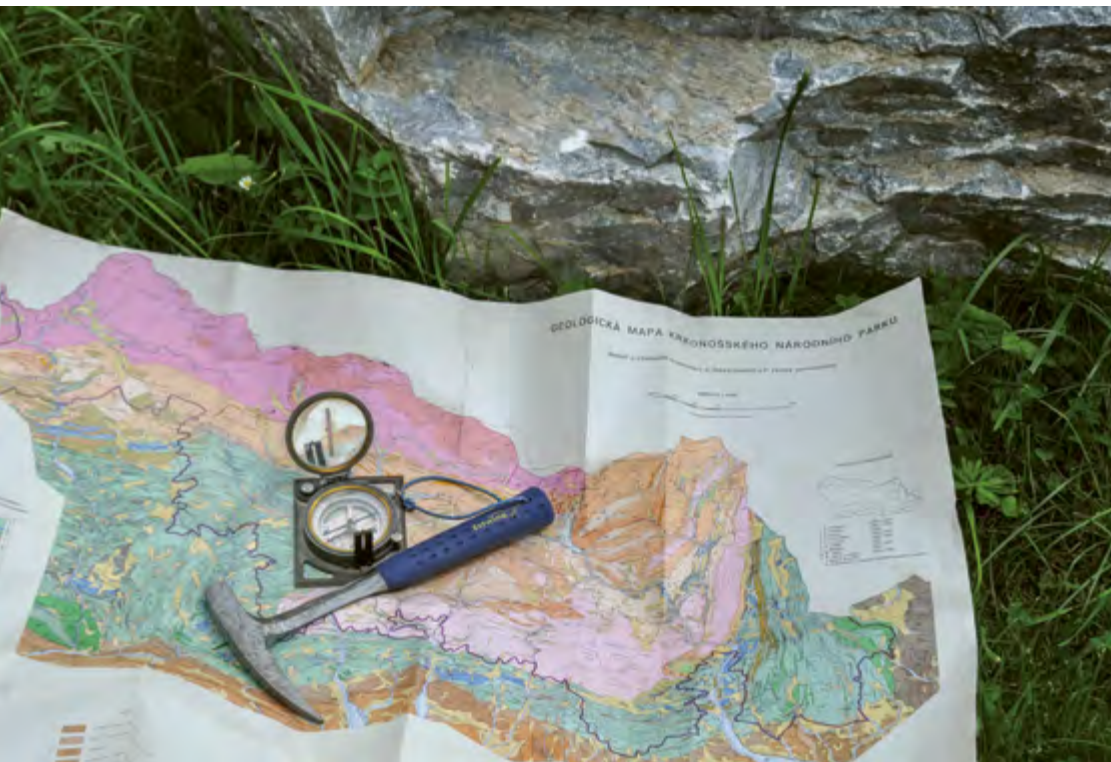
Since the entire region was located near the Equator, the rocks of the Intra-Sudetic Basin deposited in a tropical swamp-like environment with a rich vegetation of ferns, club-mosses, horsetails and others. The dragonflies above us had a wing span of up to 0.5 metre! Our dead bodies covered by layers of mud gradually transformed into banks of coal in order to be excavated by local people for several hundred years. Another type of souvenir are the fossils found in local sedimentary rocks.

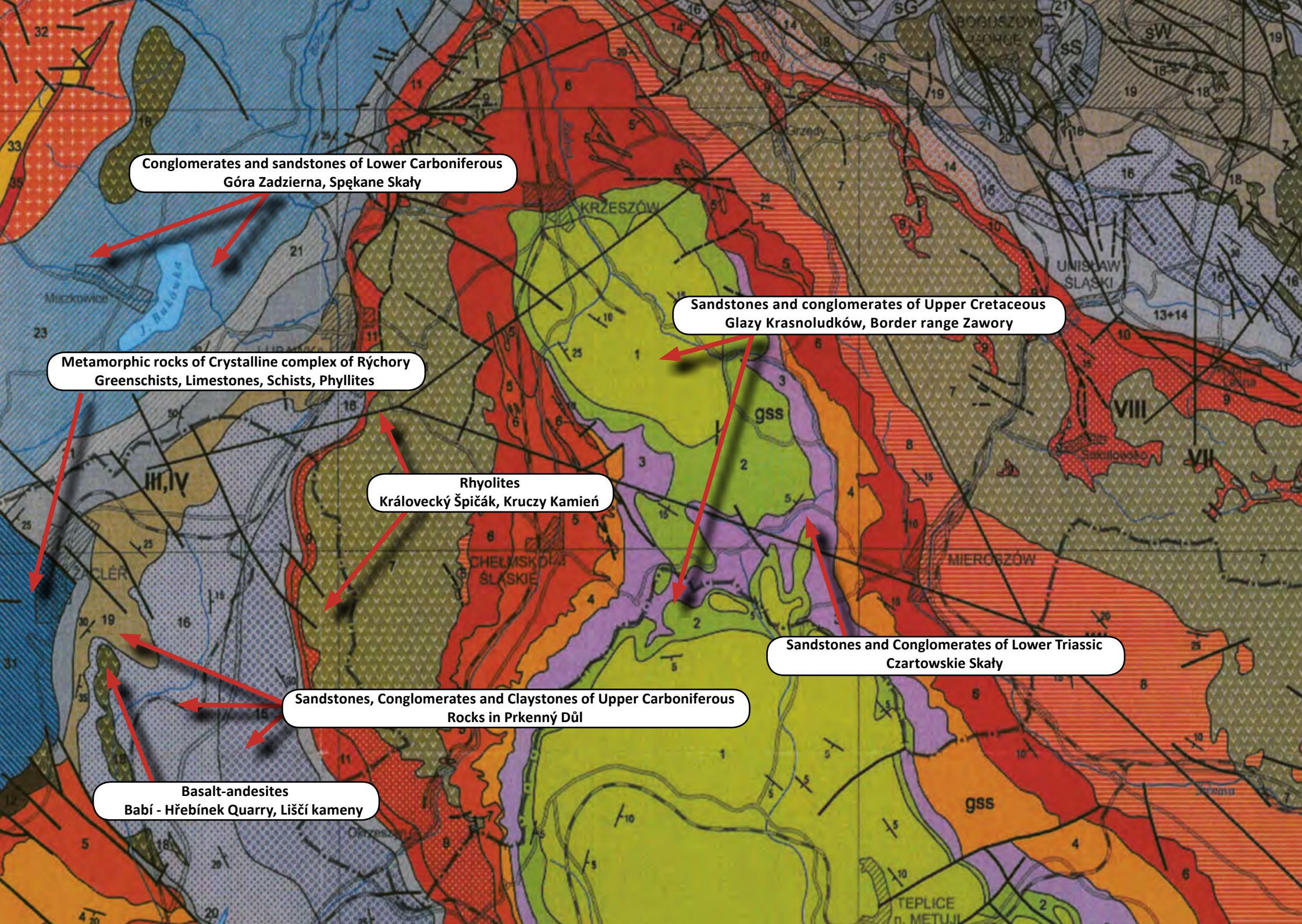


Volcanic range of Vraní hory rises about 350 m above the surrounding land
Left: Flooded quarry in Libeč, where the basalt-andesite was previously mined

Geological map

A geological map is the most important source of information about the geological structure of a region. It marks the occurrence of different rocks in the landscape as areas of different colours. In order to make a good use of a geological map, one first needs to learn how to work with a topographic map such as a common trail map. In a mountainous terrain like the one between Žacléř and Lubawka, there is usually an abundance of rock outcrops. These, along with working or disused open pit mines, are important for a geologist because they show the different kinds of rocks that would normally be buried under the soil. By playing a kind of hide-and-seek with the rocks, the geologist eventually draws a geological map. But first he or she has to grab a rock hammer and set out for a thorough walking trip through the landscape, one that will take at least tens of kilometres. That is precisely why geologists often have a very nice relationship with the landscape – because they are so well acquainted with it.





Conglomerates and sandstones of Lower Carboniferous
Góra Zadzierna, Spękane Skały

Sandstones and conglomerates of Upper Cretaceous
Glazy Krasnoludków, Border range Zawory

Metamorphic rocks of Crystalline complex of Rýchory
Greenschists, Limestones, Schists, Phyllites

Rhyolites
Královecký Špičák, Kruczy Kamień

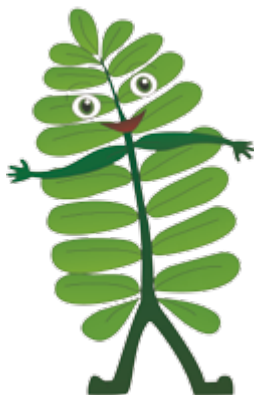
Sandstones and Conglomerates of Lower Triassic
Czartowskie Skały

Sandstones, Conglomerates and Claystones of Upper Carboniferous
Rocks in Prkenný Důl

Basalt-andesites
Babí - Hřebínek Quarry, Liščí kameny

Rocks of the Žacléř-Lubawka area

Given the complex geological structure and the existence of two different geological units, there are more than twenty different types of rock in the area, with at least one representative for almost every genetic type. We chose ten basic types of rocks that are relatively easily distinguished from one another and that were formed in different geological processes.



Rocks of the Krkonoše-Jizera Crystalline Complex

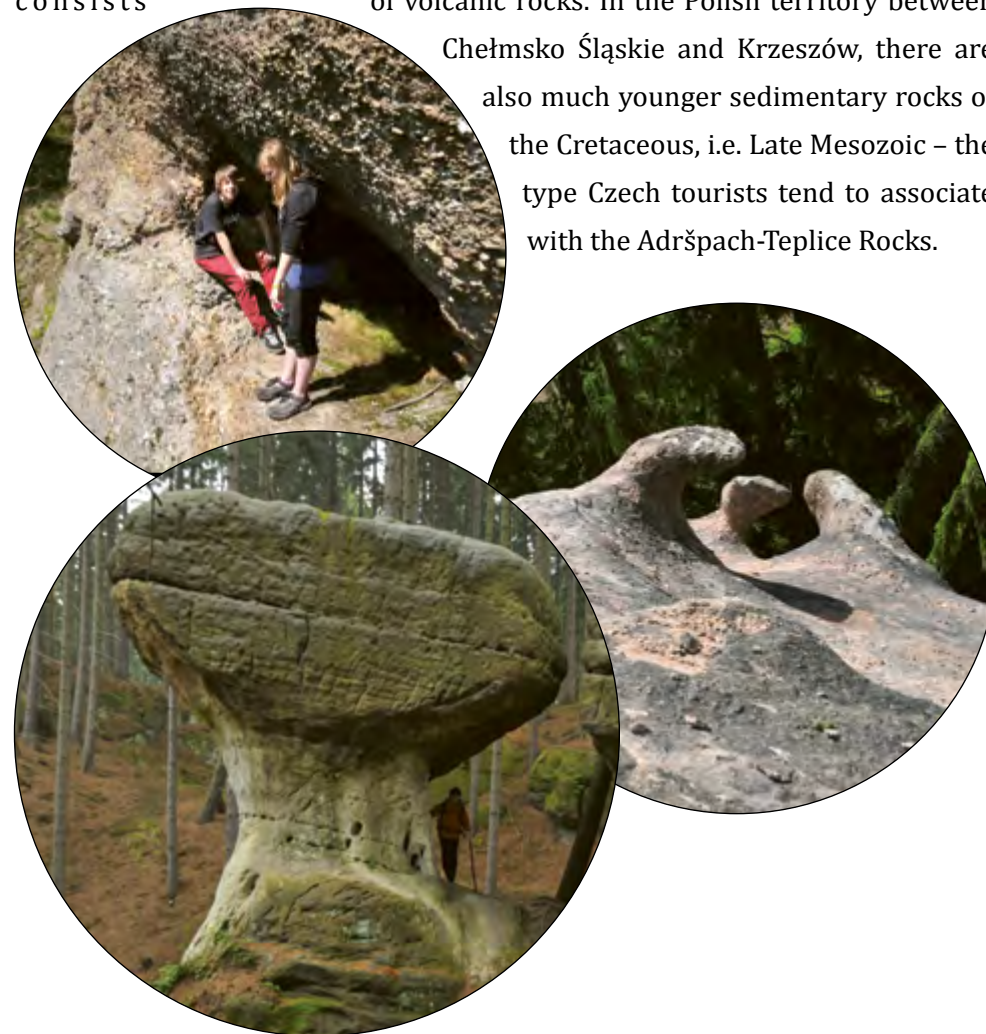
This rich mix of metamorphic rocks comprises the Rýchory massif west, south-west and north-west of Žacléř, and the Grzbiet Lasocki massif in the Polish territory. They formed during Variscan orogeny from originally sedimentary and volcanic rocks. They include mica schist, phyllite, greenschist, porphyroid, and crystalline limestone & marble.



Rocks of the Intra-Sudetic Basin

These rocks occur in the eastern part of the Žacléř-Lubawka area, roughly east and south-east of Žacléř. They comprise the basin which formed during the final stage of the Variscan orogeny in the Upper Carboniferous. In the south-west, they are divided from the Krkonoše Piedmont Basin by a tectonic boundary entitled “Hronov-Poříčí Fault Zone”. The Intra-Sudetic Basin comprises primarily of Carboniferous rocks in the Žacléř area, and also of Late Permian rocks in the eastern part of Vraní Hory/Góry Krucze. The Vraní massif itself consists of volcanic rocks. In the Polish territory between

Chełmsko Śląskie and Krzeszów, there are also much younger sedimentary rocks of the Cretaceous, i.e. Late Mesozoic – the type Czech tourists tend to associate with the Adršpach-Teplice Rocks.



Greenschist

Greenschist is perhaps the most frequently encountered rock when one is hiking in the Rýchory Mountains. As a metamorphic rock, greenschist formed from originally alkaline volcanic rocks. In the field, it can be seen at a number of both artificial and natural outcrops. Typically dark green to blue-green rocks with distinct bedding (cleat), greenschist can be examined, for example, from a horse trail along Sněžný Potok in the Prkenný Důl valley, opposite to the Arrakis Ski Resort, or from the unblazed "Snake Trail" (Hadí Cesta) which descends the Boberská Stráž from the Hubertus Cottage to Žacléř. Among greenschist sites in the Polish territory, the peak of Białe Skały is accessible on a blazed trail from Jarkowice and offers a good view of the countryside.



Crystalline limestone & marble

Limestone and crystalline dolomitic limestone typically occurs as small- to medium-sized bodies west of the Rýchory Mountains summit. These north-to-south lenslike bodies surface east of Horní Maršov, in the vicinity of Dolní Lysečiny, Horní Albeřice and the Rýchorská Bouda. They are easy to distinguish from neighbouring mica schist and phyllite. They are white, light grey to pinkish in colour. Thanks to a limited number of well-preserved fossils, we have been able to trace the origins of the Rýchory Mountains limestone back to Lower Cambrian. There used to be several limestone and marble quarries in the area, primarily for the lime industry. In contrast, gravel is produced by the only operational limestone quarry today, Suchý Důl.



Schist

In the expert community, there has been a heated debate on the topic of Žacléř area schist, with some geologists differentiating between chlorite-muscovite-albite schist and chlorite-muscovite-albite-quartz schist. Needless to say, the two are hard to tell apart in the field, even for experts. Schist are metamorphic rocks which formed from different sedimentary rocks. Their colour is typically brown to grey, sometimes yellowish or greenish. They have pronounced bedding as a result of grain elongation that occurred under pressure. They can be best examined around the limestone quarries of Dolní Albeřice and Suchý Důl.



Phyllite

Like schist, Žacléř area phyllite also occurs in two different forms: chlorite-sericite phyllite and graphite-sericite phyllite. Again, these are hard to tell apart for a layperson. Even the boundary between schist and phyllite is merely conventional, based on the size of silica grains. Phyllite, too, is a metamorphic rock which formed from sedimentary rocks. Generally speaking, the colour of phyllite is grey to dark grey, and it is more fine-grained and has more pronounced bedding than schist. Thanks to the latter quality, graphite-sericite phyllite is highly fissible and used to be mined to obtain roofing slate. Small disused quarries can be found on both sides of the Military Trail (the footpath from Bystřice to Rýchory Mountains blazed in blue) above the Protective Chapel.



Sedimentary rocks of the Intra-Sudetic Basin

Finally, we are getting to the rocks in which fossils originate. The sedimentary rocks that fill up the valley between the Rýchory and Vraní Mountains comprise an entire category of different types of rocks. They deposited here during late Palaeozoic, between Lower Carboniferous and Lower Permian, i.e. 310 to 290 million years ago – and ferns remember those times. The building material for these rocks came from a new mountain range nearby, the ancient Krkonoše. You would be surprised by their appearance: they were much higher and sharper than today, a little like the Alps – in short, a young mountain range. Solid products of weathering were transported by rivers and deposited in a lake basin. This process gradually formed the local mix of sedimentary rocks as we know it. The pebbles that are found in local conglomerates consist not only of the highly resistant silica but also of limestone, phyllite and mica schist that did not fall apart during their short transport. The different beds of sedimentary rocks can be divided into four formations.



The Žacléř Formation deposited first, followed by the Odolov, Chvaleč and Broumov Formations. Rocks of different grain size can be found in each formation: conglomerate (which consists of cemented larger-sized cobblestone), sandstone, siltstone and claystone (with consolidated clay comprising more than two-thirds of the latter). A large majority of the valley belongs to the Žacléř and Odolov Formations in which the remains of our bodies have been transformed into banks of coal. Sediments of the Chvaleč and Broumov Formations are only found in the foothills of the Vraní Mountains.

There are relatively few natural outcrops of sedimentary rocks in the Žacléř area. One rock wall oversees the left bank of Sněžný Potok in the Prkenný Důl valley, opposite to the Bret Ski Resort, and a few smaller ones can be found along the right side of the road between Prkenný Důl and Křenov, opposite to the pond. The Polish side of the border is much richer in these rock outcrops. The entire Szczepanowski Ridge above the Bukówka Lake consists of coarse-

grained conglomerate. Its peak, Zadzierna (724 masl), is worth seeing for two reasons: the large rock outcrop on the top, and the beautiful view it provides. Those who are not hard-core climbers can conveniently reach the rock wall of Spękane Skały near Miskowice which is covered with old beech woods. The trail starts in the vicinity of the school.



Andesite

Volcanic rocks can be found here as well because the sedimentation process in the Intra-Sudetic Basin was accompanied by volcanic activity. Andesite, sometimes referred to as basaltic andesite, are alkaline volcanic rocks. In the Žacléř area, they mostly occur as massive dark grey-brown or red-brown rocks that are compact, highly fine-grained and sometimes with bubbles formed by volcanic gasses. The bubbles are filled with silica, sometimes in the form of agate which, however, is rare in Žacléř area andesite. Andesite rocks can be found, for example, at a disused quarry in Libeč or at a quarry in Babí, about 2.5 km south-south-east of Žacléř, where gravel excavation still goes on. The quarry was founded before WWII for the construction of an artillery base at nearby Stachelberg. Smaller bodies can be found between Křenov and Prkenný Důl. In the closest vicinity of Žacléř, andesite can be found in a small quarry off the road, on the slope under the château, about 300 metres south of the square. The colour of these rocks is beige to grey. Liščí Kameny is a beautiful, up to 20 metres high rock wall west of Křenov. It is easily accessible on an unblazed trail which starts in Žacléř behind the former hospital facility. Andesite lava was disgorged simultaneously with the forming of the sedimentary rocks of the Žacléř Formation, approximately 300 million years ago, mostly as surface or shallow subsurface intrusions.



Rhyolite

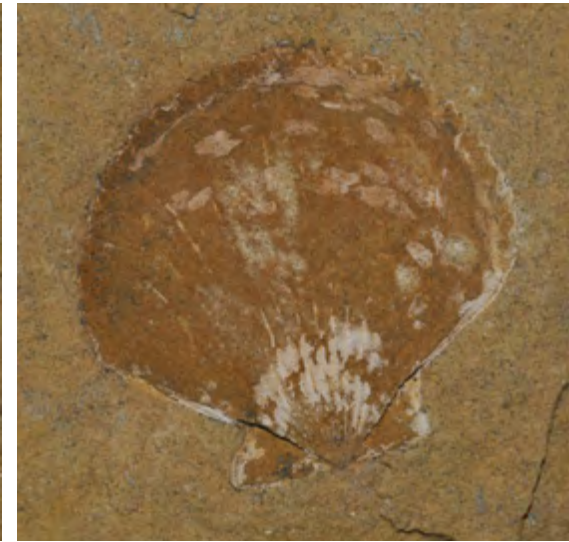
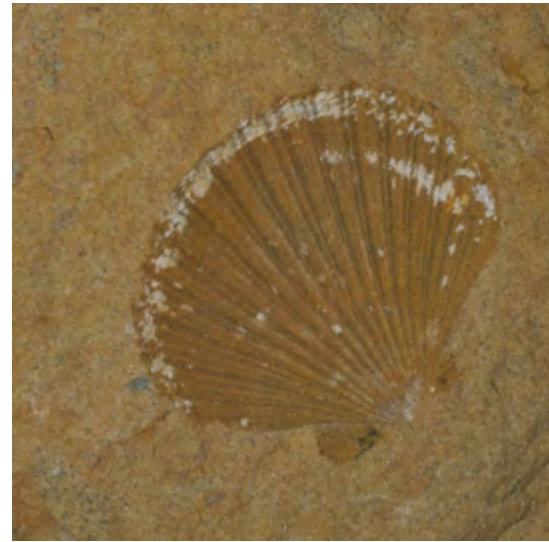
Rhyolite is an acidic volcanic rock of brown-pink to purple colour. It is mostly fine-grained; large grains of silica and feldspar rarely occur in the groundmass. Rhyolite lava flows were disgorged simultaneously with the sedimentation of the Nowa Ruda Member of the Broumov Formation. A rhyolite body is up to 400 metres thick and clearly dominates the landscape. Rhyolite comprises the entire Vraní Massif which rises steeply, up to 350 metres above the surrounding landscape, and peaks at Královecký Špičák (elevation 880 masl). The Vraní Mountains rhyolite is the largest body of a vast system of volcanic rocks which formed in the Intra-Sudetic Basin during early Permian (290 to 270 million years ago). Královecký Špičák was probably one of the main channelways for rhyolite magma. Rhyolite excavation still goes on at Královec, the largest quarry of the Žacléř area. Although the peak is located in the Czech territory, most of the massif is found in Poland. Interesting natural outcrops of rhyolite can be seen at the Kruczy Kamień Nature Preserve south of the town of Lubawka, above the valley of Brama Lubawska. There is a stunning outlook of the entire valley and the Krkonoše Mountains in the background.





Sandstones and conglomerates of the Mesozoic

All of the rocks mentioned above were formed between 500 and 270 million years ago. During the subsequent repose period which was almost 200 million years long, the Krkonoše Mountains were severely “levelled” by erosion and a shallow Mesozoic sea reached the foothills. Robust beds of sandstone and conglomerate deposited in the sea during Upper Cretaceous, i.e. 100–65 million years ago. While these sediments are not located directly in the Žacléř area, they formed one of the most intricate “rock towns” of Europe, the Adršpach-Teplice Rocks, in its close vicinity. The border massif of Zawory is so close and the rocks in its northern part so interesting and beautiful that they cannot be ignored by this publication. The sedimentary sandstones and conglomerates of Upper Cretaceous consist almost entirely of cemented grains of pure silica. The hardness of each bed depends primarily on the characteristics of the binding agent, and so does its colour: from whitish to grey, from yellow and rusty to grey-red. The differences in hardness are responsible for the uneven effects of weathering that shaped the rocks in some of the most picturesque ways.



Fossils of marine bivalves in the cretaceous sandstones, Libná Quarry, Broumov area.



Triassic sandstones forms the uppermost layers of precretaceous sediments.

Touring the Geological Treasures of the Žaclěř-Lubawka Area

There are dozens of sites in the area where one can investigate the secrets of the geological development and geological structure of its landscape. Any attempt to describe them all would exceed the limited scope of this publication. In order to acquaint you with the geological history of the Žaclěř-Lubawka Area, we chose a few representative sites. Our selection was guided by two goals: to illustrate the different typical geological features of this diverse landscape, and to ensure a valuable travel experience even for those who are not that excited about geology. Students of geology are referred to the online portal of the Czech Geological Survey (<http://www.geology.cz/extranet-eng/geology-for-all/geological-localities>), our partner in the Geology for All Project which gave rise to this publication.



Each site is numbered so that you can find it in the detailed topographic map on the centre spread of this publication. Some can be reached by car, most by blazed or unblazed walking trails or bicycle trails. They are divided into three thematic units (tours). Most trips can be planned so that places on both sides of the border can be visited. Whether you have come to our region to examine its geological features in detail or you are just looking to spice up your hiking experience, you should definitely visit the outdoor geology exhibition in Žaclěř. Like this publication, the exhibition was created under the Geology for All Project and in collaboration with the Žaclěř Primary School Geology Club of 2012–2013. It is located in front of the school



Tour of Ancient Volcanoes

Volcanic activity accompanied almost all the geological processes that formed the local landscape as we know it. Most ancient volcanic rocks were transformed by subsequent geological processes into metamorphic rocks (see below). However, pure volcanic rocks can be found here as well. They are among the youngest: they were expelled from the depths of the Earth at the time when the sedimentary rocks were depositing in the Intra-Sudetic Basin. Some of these lava flows solidified under the ground, while others came out on the surface and formed important objects that dominate the landscape. Since local lava is the source of high-quality gravel, there are many quarries in the area. While most of them are disused, excavation still goes on at two sites.



1. Babí-Hřebínek Quarry (N 50° 37' 30"; E 15° 54' 41")

The quarry at Hřebínek Comb above the village of Babí is located 0.5 km south of the Stachelberg artillery base, and both places can thus be visited in one trip. After all, the andesite quarry was founded in the 1930s precisely for the construction of the frontier fortification. The site can be reached on a trail blazed in green and blue, and most of it can be observed directly from the trail.



2. Liščí kameny (N 50°38'40"; E 15°55'00")

Comprised of andesite lava, these impressive rock walls are up to 20 metres high. They are located in the forest, left of an unblazed trail between Rehamedica (former hospital) in Žacléř and Křenov.

3. Královec Quarry (N 50°39'56"; E 15°59'28")

The rhyolites of the Vraní Hory Mountains can be spotted in several places on both sides of the border. On the way from Žacléř, the open pit quarry can be seen from large distance as it cuts deep into the landscape. It can be reached on a blue-blazed trail from Královec. Alternatively, take a walk from Žacléř via Černá Voda, which is highly recommended provided good weather.



4. Královecký Špičák 880 masl (N 50°39'27"; E 15°59'18")

If you are fresh and want to see the peak of the Vraní Mountains, stay on the blue-blazed trail and climb up. From the other side, you can get to Královecký Špičák via Dlouhé Údolí. Check out rhyolite lava outcrops on the way up. From the top of the mountain, there is a beautiful view of the Rýchory Mountains, the saddle called Královecké Sedlo, and the Krkonoše Mountains with their highest peak, Sněžka (1603.3 masl)..



5. Kruczy Kamień (N 50°41'18"; E 16°00'32")

The only part of the Vraní Mountains that enjoys statutory protection is in Poland. With a total area of 10.21 hectares, Kruczy Kamień was declared in 1954 to recognize a number of unique geological and landscape features, and especially the tens of metres high rocks of red-brown rhyolite above the valley of Krucza Dolina. Besides many heat-loving or drought-tolerant plant species, one can admire the Mountain Apollo, a rare butterfly specie that was introduced successfully by Wrocław entomologists in 1995, after more than 100 years. Start in the southern part of Lubawka and take a blue-blazed trail through the valley, or a green-blazed trail up the hill to enjoy the view of the entire valley. The two trails combined form a circle which is 5.5 km long.



Tour of Rocks from Different Eras

As explained in the chapter on local geological structure, rocks undergo different changes in the course of hundreds of millions of years. The effects of pressure and temperature transform sedimentary and volcanic rocks into metamorphic ones. All types of rocks are exposed to outer geomorphological processes (atmospheric agents, different types of water erosion, organisms). Pieces of disintegrated rocks are transported by rivers and deposited in lower-elevation areas to form sedimentary rocks. This constitutes a slow but eternal circle of life of rocks, referred to by geologists as the rock cycle. The following tour presents two different geological worlds. The metamorphic rocks of the first three sites were formed as part of a large mountain range which underwent erosion over the course of hundreds of millions of years. Mouldered stone chips were carried down the river into the lake basin. Nowadays, we find them in the form of sedimentary rocks,



Greenschists rocks and growth of Hollowroot birthwort alongside Snake Trail (Hadí cesta) at the hillside of Boberská stráň.

6. Horse Trail (N 50° 39' 03"; E 15° 53' 44")

Greenschist is the most frequently occurring rock of the Rýchory Mountains. Nowhere else in Krkonoše is there a better outdoor place to see greenschist than on the well-accessible rocks around the Horse Trail (Jezdecká Spojka). This rarely used but very nice path between the Château of Žacléř and the road to the Ozon Cottage is blazed in yellow in the map (but blue in the field). Besides locals, it is primarily used by geocaching lovers looking for one of the containers hidden in the rocks. Some of the greenschist here has been actually identified as blueschist (keep calm, they are impossible to tell apart by an amateur geologist). This is why the Czech Geological Survey has officially recommended the site for educational visits..



7. Snake Trail (N 50° 40' 09"; E 15° 52' 53")

Additional small outcrops of greenschist can be found in the forest above the unblazed Snake Trail (Hadí Cesta). Start at a sign-post above Žacléř and walk up the steep slope of Boberská Stráň (part of the Core Zone of the Krkonoše Mountains National Park). In the spring, you can admire not only the rock outcrops but also a myriad of yellowish and red-purple flowers of the species *Corydalis cava*, Spring Snowflake, and Nine-leaved Toothwort. Later on, check out one of the largest populations of Perennial Honesty in Krkonoše.

8. Białe Skały (N 50°43'39"; E 15°51'49")

The greenschist on the top of Białe Skały might be less impressive than the Czech sites, but after climbing up from Jarkowice (2 km long, elevation gain 240 metres), you will be rewarded with a nice view of the landscape. The yellow-blazed trail starts near the former kiln. It is 10 km from Žacléř via the border crossing at Bobr and Niedamirów, or 16 km from Lubawka via Bukówka and Paczyn..



The top of Białe Skały offers excellent panoramic view, this picture shows the view to NE towards the village Klatka.





9. Prkenný Důl Conglomerates (N 50° 38' 39"; E 15° 54' 35")



While most natural outcrops of sedimentary rocks can be found on the Polish side of the border, some conglomerate and sandstone outcrops occur in the Czech territory as well. Take a walk to the Prkenný Důl pond. Across the road from the pond, there are some small rocks with a cave. On the opposite side of the valley, above Sněžný Potok, there is a consecutive series of larger rock outcrops called cuesta. Walk through the forest on a trail from Rehamedica (former hospital) in Žacléř. The trail is not only unblazed but also ignored by all maps. After passing Rehamedica, take the first right to a narrow path slightly down the hill. There is a small cave at this site as well. One of the possible explanations is a trial pit dug by ancient gold miners.



10. Zadzierna (N 50° 43' 19"; E 15° 57' 35")

Conglomerates dominate the landscape right across the border, near Bukówka and Miskowice. They comprise the entire Szczepanowski Ridge with two outstanding mountains, Zameczek (596 masl) and Zadzierna (724 masl). The latter can be reached on a red-blazed trail from Bukówka. The approximately two kilometres' walk and 250 metres of elevation gain are really worth it. There is not only the conglomerate rock wall on the steep slope above the Bukówka Lake, but also an amazing view of the eastern part of Krkonoše from the top of the mountain.



11. Spękane Skały (N 50° 43' 24"; E 15° 54' 26")

If you aren't fond of climbing, there is one more place to admire outcrops of highly coarse-grained conglomerate – with pebbles of 0.5 metre in diameter or even larger. Take a short walk or drive from Bukówka to Miskowice. Left of the local school building, there is a small comb covered with old beech woods. The fractured rock wall under the trees is several hundred metres long and up to 15 metres high.





Spékane Skály next to Miszkowicze

Tour of Mining Monuments

The geological diversity of the region is reflected in the range of minerals that have been excavated here since time immemorial. Black coal was definitely the most important resource. Study the history of coal mining at the Mining Museum located in the former mining facility, or at the Žacléř City Museum. In Bečkov, a village under the Vraní Mountains, uranium was excavated for a short time period in the 1950s. Other mineral resources included gold, limestone and roofing slate. Last but not least, local people used to excavate building stone in a number of small quarries, most of which are now completely overgrown with vegetation.



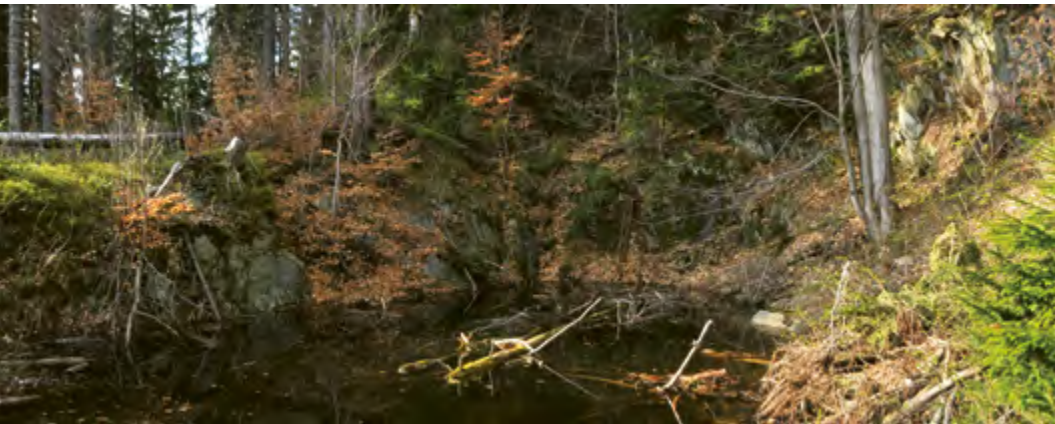
12. Bártův Les (N 50° 37' 34"; E 15° 51' 03")

The history of gold mining in the Rýchory Mountains is mysterious and blurry. According to local chronicles, it started as early as in the 11th century. However, the first credible written account comes from the year 1542. Traces of gold mining are still visible because of the massive amounts of material removed, so massive that the amount of gold in the books cannot account for them. This is why we believe gold mining started long before the first written account was made. After more than five centuries, the gigantic pits and ditches in Bártův Les remind us of the hard work the miners did with their relatively primitive equipment. On the right bank of the Golden Brook (Zlatý Potok), under the curve of the road north of Bystřice, there is a well-preserved portal of the Klinge Drainage Adit. Even these days, anyone lucky and skilled enough can wash some free gold particles directly from sediments in the brook.



13. Phyllite Quarries (N 50° 38' 23"; E 15° 50' 26")

Take the blue-blazed Military Trail (Vojenská Cesta) from Bártův Les toward Rýchory. Near the sign post, there is a small renovated building called the Protective Chapel. It is one of the few objects that remained of Glassendorf, a community abandoned after WWII. A bit further up the trail, you can observe small disused quarries camouflaged by vegetation. Given its distinct cleavage, local phyllite was excavated for roofing slate.



14. The Quarries of Albeřice (N 50° 41' 46"; E 15° 50' 46")

Limestone (or more specifically, crystalline limestone and marble) is another important mineral resource of the Rýchory Mountains. Its excavation continues to the present day. It is centred in the picturesque mountain community of Albeřice, which is worth seeing irrespective of its geology. There are several disused limestone quarries in the northern part of Albeřice. The three best-known ones are called Bischof, Celní and Krakonoš. Limestone bodies in the area are marked by interesting karst caves uncovered in the process of open pit mining.



On the margin of the Bischof Quarry, one can enter the Albeřice Cave. With its 250 metres of paths, it is the longest cavern in the Krkonoše Mountains National Park. The ruin of a former kiln houses a small but very nice exhibition telling stories from the 700-year history of human settlements in the Albeřice Valley. The keys can be obtained from the Veselý Výlet branch at Temný Důl.



Active limestone quarry Suchý Důl

15. Lysečinská Jehla (N 50° 40' 42"; E 15° 49' 59")

Like a needle that's eight metres long, this unique rock form is located on the top of a small rocky comb above the confluence of Lysečinský Potok and Albeřický Potok. It consists of grey- to beige-white crystalline limestone. You should definitely check it out even if it has nothing to do with limestone mining.



Tour of the Cretaceous Sea

Disintegrated material continued to deposit and form sedimentary rocks in the Intra-Sudetic Basin during the Early Mesozoic. The diverse sandstones of Lower Triassic came first (the oldest period of the Mesozoic, 250–240 million years ago). We do not have any rocks from the lengthy repose period which followed. In the Late Mesozoic (almost 150 million years later), most of the region was covered by a shallow and warm sea. The sandstones and cobblestones that deposited on the seabed formed what we know as “rock towns” today. One of the most attractive “towns”, the Adršpach-Teplice Rocks, does not belong to the Žacléř-Lubawka area even if located just 15 km away from both cities. In any case, make sure to check it out when you are visiting the region. Sedimentary rocks of the Triassic are quite rare in the Czech territory. In Poland, they can be found, e.g., at the base of the Zawory massif, but above all at the beautiful site of Czartowskie Skały between the villages of Różana and Łączna.



Grey and yellow-grey cretaceous sandstones lies directly on the 150 millions years older layers of rose-red Triassic sandstones. Erosion caused the formation of rock windows.

16. Czartowskie Skały Nature Monument (N 50° 40' 34"; E 16° 09' 05")

Undoubtedly one the best-known and most attractive rock outcrops in the Zawory Massif, Czartowskie Skały, became a tourist destination before WWII, long before it was declared a Nature Monument. Located in the north-eastern tip of the massif, the outcrop consists of red Triassic sandstone covered by yellow and light-grey sandstone of the Upper Cretaceous. There is a series of beautiful openings or “windows” in the upper part of one of the rocks. Get here conveniently by car or on bicycle – the outcrop is right off the road between Chełmsko Śląskie and Mieroszów – or take a walk on the blue-blazed trail (8.6 km from Chełmsko Śląskie).



17. Zawory Massif (N 50° 39' 39"; E 16° 05' 00")

The border massif of Zawory is another option, although less accessible and not that highly attractive. It can be reached from Przelecze Chełmska (571 masl), or on a 12 km educational trail from the town of Chełmsko Śląskie. Unfortunately, the blazing is hard to find, especially on the steep slope under the top. There are some nice views of the heart of the Broumov Highlands. From Zawory, you can continue to the sandstone quarries of Libná (less than 3 km away from the saddle of Przelecze Chełmska). There are some outstanding fossils of Mesozoic clams in the local sandstone (see page 23).



18. Glazy Krasnoludków Nature Preserve (N 50° 41' 40"; E 16° 06' 02")

Make sure to visit this small but well-accessible nature preserve located south of Gorzeszów. Take a walk on blazed hiking trails from Chełmsko Śląskie, Gorzeszów or Olszyny, or drive on a dirt road from Chełmsko Śląskie or Gorzeszów. The preserve was declared to recognize its unique forms of sandstone which weathered into forms resembling hammers, bastions, towers, mushrooms etc. Neither Glazy Krasnoludków nor Czartowskie Skały can be compared with the intricate "rock town" of Adršpach-Teplice; then again, you won't be overwhelmed by traffic jams, tourist crowds or souvenir vendors.



Opposite site:

The top part of Zawory massif is formed by sandstone affected by rectangular cracks. Lower picture shows view from border range towards the NW to township Chełmsko Śląskie.

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EVROPSKÁ UNIE
EVROPSKÝ FOND PRO REGIONÁLNÍ ROZVOJ
PŘEKRAČUJEME HRANICE



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