

## THE MOST IMPORTANT GEOSITES OF THE UKRAINIAN CARPATHIANS

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**Abstract.** The Ukrainian Carpathians abounds with objects of great geological interests. The area belongs to the Carpathians mantle-fold system of the Alpine orogeny, formed mainly by the Cretaceous, Palaeogene and Neogene deposits. It is a geomorphological region of denudation-tectonical mountains. Totally selected 15 objects of the geological heritage of Ukrainian Carpathians representing different types of geosites and protection status. All presented geosites are located in four administrative districts of the Western Ukraine.

**Key words:** geosites, natural protection, Ukrainian Carpathians.

**Abstrakt.** W Karpatach ukraińskich znajdują się liczne obiekty o dużej wartości geologicznej. Obszar ten należy do karpackiego systemu fałdowego orogenu alpejskiego, zbudowanego głównie z osadów kredy, paleogenu i neogenu. Pod względem geomorfologicznym jest to region gór denudacyjno-tektonicznych. W sumie wybrano 15 obiektów dziedzictwa geologicznego, reprezentujących różne typy geotopów, mających zróżnicowany status ochrony prawnej. Wszystkie geostanowiska prezentowane w artykule są zlokalizowane w czterech okręgach administracyjnych zachodniej Ukrainy.

**Słowa kluczowe:** geostanowiska, ochrona przyrody, Karpaty ukraińskie.

### INTRODUCTION

The Ukrainian Carpathians is an eastern sector of the Carpathian mountain system located in the western region of Ukraine (in the territory of the Zakarpathia, Lviv, Ivano-Frankivsk and Chernivtsi oblasts or districts). The mountain massif (more than 24,000 km<sup>2</sup> of area) is 280 km long and about 100 km wide. The mountain ranges, divided by longitudinal depressions and intersected by transverse river valleys, extend from north-west to south-east. The basic longitudinal structures are complicated by ring structures here and there. The elevation

of the region varies from 120–400 m a.s.l. at the foothills to 500–800 m in the inner depressions, and up to 1,500–2,000 m on the crests of the main ranges. The highest summits: Goverla (2061 m, the highest mountain summit of Ukraine), Petros (2020 m) and other — are located in the Chernogora massif (Fig. 1).

The longitudinal extension of the Ukrainian Carpathians is conditioned by orientation of the main East-Carpathian tectonical structures. By structural conditions the area belongs to



Fig. 1. Panorama of the mountains Goverla (2061 m) and Petros (2020 m)

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Fig. 2. Distribution of geosites on the geological map of the Ukrainian Carpathians

the Carpathian mantle-fold system of the Alpine orogeny. The Cretaceous, Palaeogene and Neogene deposits are

the most important in the geological structure of the Ukrainian Carpathians, in particular in the Cretaceous–Palaeogene flysch. Jurassic limestones and Palaeozoic crystalline rocks are also known. The Neogene volcanical rocks, represented by andesites, basalts and tuffs, form one of the Carpathian mountain ranges. According to the geomorphological regional division of the Ukrainian territory, the Ukrainian Carpathians belong to denudation-tectonical mountains.

Selection of geosites in the Ukrainian Carpathian area and their monitoring are very difficult to conduct. The data on geosites having a geoprotection status are very confused. About 90 geosites presenting some interest were legally established in 1990s. Up to 1995, 32 geosites had obtained geoconservation status, 23 had been protected within different natural reserves (botanical, landscape, hydrological, etc.) and considered to be the prospective candidates for geoconservation (Ivchenko, Gerasimenko, 1999). Now, only 24 geosites have a geoconservation status in the Ukrainian Carpathian area; one reserve of the State value (Zacharovana Dolyna in the Transcarpathians), the rest are the sites of local value. Such a situation is probably caused, firstly — by legal establishing of four national parks in the Carpathian area in 1996–1999, which absorbed separate geosites; secondly — by abolishment of a geoconservation status of some geosites by local authorities; thirdly — by the appearance of geosites without a geoprotection status.

Information on 75 geosites situated in the Ukrainian Carpathian area is provided in a guide-book “Geological sites of Ukraine”, ready for publication. Some of them will be described below, except for data on 7 geosites published in proceedings of the ProGEO Workshop on representative geosites of Central Europe (Ivchenko, Gerasimenko, 1999). The description will cover 15 geosites of Ukrainian Carpathians situated in four administrative districts (Fig. 2).

## GEOSITES OF THE UKRAINIAN CARPATHIANS

### THE ZAKARPATHIA DISTRICT

1. **The Shypit Waterfall**, 9.4 km north of Turia–Poliana village (Perechyn administrative region, 810 m a.s.l.). The waterfall has been a natural site (hydrological) of local value since 1969, area — 0.2 ha. It is situated on the south-western slopes of the Polonyna Runa hill (1479 m), on the Shypit River (left tributary of the Turia River), in the Shypit hollow. It was formed in a riverbed, on the outcrops of the resistant Palaeogene sandstones. Water falls in two streams from the height of 14 m. From geomorphological standpoint such height is a rare case in the Ukrainian Carpathians.

2. **The Volcanical Tuff Pillar** in the north-eastern outskirts of Nevyske village (Uzhhorod administrative region, 230 m a.s.l.). This geosite has been a natural site of local value since 1969, area — 3 ha. On the left side of the Uzh River, on the Zamkova Hill (near the Nevyske castle’s ruins), rises a volcanical tuff pillar, 10 m high. It is a relic of the mouth part of an accessory volcano that functioned during the Neogene Period. It

is composed of lithoclastic tuff of andesite structure that was formed as a result of volcanical activity in the Late Neogene (Fig. 3). The tuff pillar is an interesting object from the scientific-cognitive point of view, therefore, it is visited by tourists.

3. **Rocks on the Soimul Mountain Slopes** in the central part of Kostylivka village (Rakhiv administrative region, 380 m a.s.l.). These rocks have gained a geoprotection status as a natural site of local value since 1969; area — 4 ha. On the left side of the Tysa River, by the Soimul Mountain peak (on its south-eastern slope), near a border with forest, the upper part of this region Triassic deposits are exposed (Fig. 4). The deposits are referred to the Anisian and Ladinian stages of the Middle Triassic: limestones with phyllite interbeds lie in the upper section, dolomites with red and green jasper-like deposits in tectonical breaks, are situated in the lower section (total thickness is 5–8 m). The outcrop is of a scientific value because exposed there deposits of the Triassic age are faunally characterised.

4. **The Sydovets Rocks**, 9.3 km to south-west from small town Yasynia (Rakhiv administrative region, 1880 m a.s.l.).



Fig. 3. The volcanic tuff pillar

A natural rocks site of local value, obtained nature protection status in 1969; area — 5 ha. The rocks are situated on the Svydovets mountain massif ridge, 150–300 m wide, in a near-peak part of the Blyznytsia Mountain (the highest point of the massif — 1883 m). They are composed of massive sandstones with interlayers of argillites and aleurolites with the remnants of Eocene fauna and flora.

#### THE LVIV DISTRICT

5. **The Urych Rocks**, 0.7 km to the north-east of Urych village (Skole administrative region, 650 m a.s.l.). This geosite is situated in the territory of the National Natural Park “Skolivski Beskydy”. An extraordinary scenic assemblage of large precipitous rocks is situated on the left side of a small river, a left tributary of the Styr River (Fig. 5). They are the original large-blocky sandstone exposures of the Yamnenska Suite of the Upper Palaeocene of the Palaeogene that form several separate ledges: Hostryi Kamin (the western part), Kamin (the central part) and Zholob (the eastern part). On the central ledge that rises above the valley for 51 m, remains of the artificial walls (more than 35,000 cuts for fitting of wooden constructions), underground corridors, caves and a pit (2 m in diameter, about 35 m deep), have been preserved. There is a pit on the Hostryi Kamin as well. It is proved that these are the remains of the on-rock protective constructions of the legendary ancient Rus fortress Tustan that was built on the so-called kniazhyi (princely) way. It is a vivid example of sites with nature and history connection.



Fig. 4. Rocks on the Soimul Mountain Slopes

6. **The Hurkalo Waterfall**, 3.3 km to south-west of Korchyn village (Skole administrative region, 500 m a.s.l.). This geosite is situated on the territory of the National Natural Park “Skolivski Beskydy”. On the north-eastern slopes of the Parashka Mountain (1268 m), in a small river bed with pretentious name — Velyka Richka (the Great River), water breaks the grey massive sandstones of the Yamnenska Suite of the Upper Palaeocene. A very scenic waterfall of 5 m high has been formed there.



Fig. 5. The Urych Rocks





Fig. 6. The Nadvirna Rocks

7. **The Oriv Skyba** in the outskirts of the small town Verchnie Syniovydne (Skole administrative region, 440 m a.s.l.). This geosite is situated in the territory of the National Natural Park “Skolivski Beskydy”. By confluence of the Stryi and Opir rivers, locally on their sides, is exposed a part of the Oriv Skyba sequence — a typical structure of the Skyba Zone of the Carpathians. This zone consists of the original structures (skyba) limited by regional breaks and thrusts over one another. They are broken by the smaller thrusts — luska (scales). Different areas of the Oriv Skyba contain from two to four scales. On the right side of the Stryi River, massive sandstones of the Yamnenska Suite of the Upper Palaeocene are exposed in form of the precipitous rocks of above 20 m height. Upstream, exposures of the middle-rhythm flysch of the Maniava Suite of the Lower Eocene occur. And on the right side of the Opir River, massive thick-layered sandstones of the Vyhoda Suite of the Middle Eocene are exposed. Further to the south, exposed are mainly clayey strata: dark grey clay of the Vyhoda and green clay of the Bystrytsia Regiostages of the Upper Eocene, as well as dark coloured Lower Menilite deposits of the Lower Oligocene.

8. **The Place of the Scolite Mineral Finding** on the northern outskirts of the Skole town (Skole administrative region, 450 m a.s.l.). This geosite is situated in the territory of the National Natural Park “Skolivski Beskydy”. On the left side of the Opir River (right tributary of the Stryi River), a large quarry was opened more than 100 years ago (now they are ceased) where massive sandstone of the Yamnenska Suite, of the Upper Palaeocene was extracted, used in the construction of auto- and railways. In 1936, a Polish geologist K. Smulikowski found in sandstones a new mineral (a slightly ferruginous variety of glauconite), named after the town — scolite.

#### THE IVANO-FRANKIVSK DISTRICT

9. **The Dovbush’s Rocks**, 2.0 km west of Bubnysche village (Dolyna administrative region, 600 m a.s.l.). The nature protection status — natural site (complex) of state value, since 1981; area — 100 ha. Among the picturesque forest in the Zalamy hollow, on the left slope of the Sukel river valley, rises a chimerical

conglomeration of rocks (up to 20–30 m high) composed of sandstones of the Yamnenska Suite, of the Upper Palaeocene with fissures of block jointing. The rocks (Monakh, Pika, Vedmid, Odynets) are placed semi-circularly. They were a good natural fortification and protection against enemies and bad weather. Ancient inhabitants of these places cut three artificial caves in the rocks. In places where rocks were absent, they made a ditch and a bank. Many different legends are connected with these rocks and caves. They aroused interest of scientist already 200 years ago. The Dovbush’s Rocks are, therefore, very interesting historical and geological objects for tourists.

10. **The Nadvirna Rocks**, in the northern outskirts of the Nadvirna town (Nadvirna administrative region, 510 m a.s.l.). The nature protection status of a natural site of local value since 1996; area — 5.3 ha. Marvellous grand rocks, covered by trees in places, located on the left side of the Bystrytsia Nadvirnianska River. The outcrop (up to 400 m long and above 80 m high) represents a wing of a turned fold formed by the flysh-like shallow-water deposits (argillites, aleurolites, sandstones) (Fig. 6). The Nadvirna rocks are considered to be a key site of deposits of the Stebnytska Suite of the Lower Neogene.

11. **The Tuidiv Wall**, 0.5 km to south-west from Tuidiv village (Kosiv administrative region, 410 m a.s.l.). There is no nature protection status for this geosite. On the left side of the Cheremosh River (by the riverbed’s winding), in an abrupt precipice, exposed are sandy-clay flysh deposits of the Stryi Suite of the Lower Palaeocene–Upper Cretaceous (sandstones and aleurolites), Yamnenska Suite of the Upper Palaeocene, Vyhodska Suite of the Middle Eocene and Menilite Suite of the Oligocene (argillites and shales) (Fig. 7). The flysh deposits are cut by dykes of unknown origin. The outcrop forms an extremely marvellous and gorgeous (almost vertical) wall of nearly 500m long and above 100 m high that rises above the Cheremosh River and the Vyzhnytsia–Putyla road.



Fig. 7. The Tuidiv Wall

## CHERNIVTSI DISTRICT

12. **The Petrashi Stinka (Wall)** in the northern outskirts of the Petrashi village (Putyla administrative region, 450 m a.s.l.). The nature protection status of a natural site of local value since 1979; area — 2 ha. On the right side of the Cheremosh River, in an abrupt precipice, thick sandstone layers of the Yamnenska Suite of the Upper Palaeocene are exposed. They are notable for the abrupt fall (up to 80°) in the northern direction that reflects peculiarities of geological structure of the Carpathians Skyba zone.

13. **The Zakamianila Bahachka Rock** in the south-eastern outskirts of the Ust-Putyla village (Putyla administrative region, 510–540 m a.s.l.). The nature protection status of a natural site of local value since 1979; area — 0.1 ha. On the right side of the Putyla River, 200 m below the Biskiv river estuary, in an abrupt slope turn into vertical position, is exposed 20 m high rock, resembling statue of a woman. Wind erosion smoothed and underlined the thickly rhythmical sandstone beds of the Middle Eocene Vyhoda Suite. The rock is very scenic, especially against a surrounding background of green slopes (Fig. 8). According to a folk legend, a stingy rich woman had turned into the rock. She had not given alms to a beggar-woman and she had cursed her.

14. **The Try Chekysty Rock**, 1.3 km to the north of Dykhtynets village (Putyla administrative region, 530 m a.s.l.). The nature protection status of a natural site of local value since 1979; area — 0.5 ha. At the foot of the Putyla river steep left side (the Cheremosh River right tributary), rocks are exposed. They are composed of thick layers of thickly bedded massive sandstones with interlayers of argillites and aleurolites of the Middle Eocene Vyhoda Suite that fall towards the highway by an abrupt wall (Fig. 9). One of these rocks is named the Try Chekysty Rock. A monument of three collaborators of the Commissariat of Internal Affairs of the USSR, that perished in September 1944 during a battle with soldiers of the Ukrainian insurgent army (in other words — the Ukrainian bourgeois nationalists), is situated there. Nearby, in a rock's wall in the Putyla riverbed, petroglyphs, i.e. bottom traces of the Eocene marine fauna have been well preserved.

15. **The Dykhtynets Stinka (Wall)**, 0,4 km to the east of Dykhtynets village (Putyla administrative region, 580 m a.s.l.). The nature protection status of a natural site of local value since 1979; area — 1 ha. An original outcrop is situated on the abrupt left slope of the Putyla River (right tributary of the Cheremosh River), 0.2 km above the estuary of the Dykhtynets stream. Its layers, represented by medium-rhythmical clay-sandstone flysch of the Krosnensk Suite of the Upper Oligocene–Lower Miocene, form an ideal steep symmetrical anticlinal fold. The outcrop presents a good example of a typical anticline.

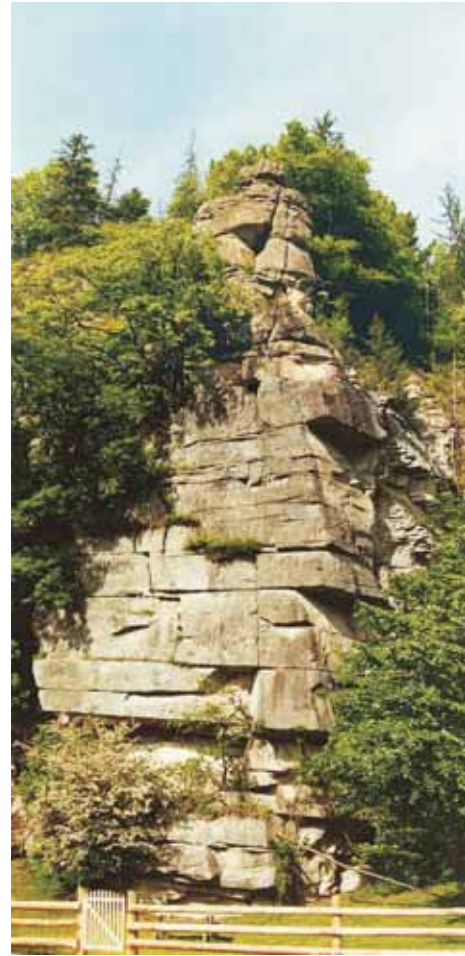


Fig. 8. The Zakamianila Bahachka Rock



Fig. 9. The Try Chekysty Rock

## CONCLUSIONS

Fifteen selected objects of the Ukrainian Carpathians geological heritage are formed mainly of the Cretaceous, Palaeogene and Neogene deposits. They are situated in four administrative districts (Zakarpattia, Lviv, Ivano-Frankivsk and Chernivtsi) of the Western Ukraine. 14 geosites have already

obtained natural protection status: state value (1), local value (9), inside the territory of the National Natural Park “Skolivski Beskydy” (4) and one of them is considered as prospective candidate for geoconservation.

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