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Objects of Geological Heritage in the Kirovohrad Region as Basis for Geotourism Development

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Objects of Geological Heritage in the Kirovohrad Region as Basis for Geotourism Development. — Manyuk, V. V. — The article materials are presented on the basis of geotourism's definition given by Thomas Jose. It was determined that the Kirovohrad Region is not only situated in the central part of Ukraine, but also in the central part of the Ukrainian shield, which explains the significant concentration of geological sites on its territory, among which typical Precambrian sites predominate. A brief description of the region's geological structure is represented. It was determined that the Kirovohrad Region is one of the leading regions in mineral deposits. These results suggest that significant outcrop rocks of different ages, picturesque landscapes and various terrains give rise to numerous natural and artificial rock outcrops, most of which are considered as potential objects of geological heritage, worthy to be included to the state list of geological heritage of Ukraine.

Key words: geosite, geotourism, geoparks, geological heritage, the Kirovohrad Region.

Introduction

As early as 1752 within what is now Kirovohrad Region, a military settlement Nova Serbia was established, and two years later the city of Elisabethhrad was founded. During its long existence the city was renamed Zinovievsk (1924–1934), Kirove (1934–1939) and, finally, Kirovohrad [8]. One might wonder what this historical digression might have to do with geotourism, but geotourism, like the geoparks connected with it, covers far more than only geological objects.

This definition goes beyond the limits of the geological component of the environment and is orientated towards the use of any object, or more commonly, a group of objects of geological heritage of a given region, as a tourist attraction. These might be ethnic and cultural, archeological, sacral, botanical, historical and architectural, or other objects, which taken together, will inevitably be interesting for the average tourist.

And before moving to the main material, there is another important point that should be made. We strongly object to the definition of geotourism, conveyed from one article to another, which states that “geotourism in Ukraine is a term that is used to describe a journey that is characterized as a return to the unique culture and original history of the places the tourists visit” [6]. This is the worst way of describing it.

Thomas Jose, who was first to use the term “geotourism” in 1995, points out that “geotourism is such provision of knowledge and services that a tourist, apart from aesthetic impressions, receives an understanding of the geology and geomorphology of the place he/she is visiting, including its role in the development of Earth Sciences” [10].

Objects and Methods

Kirovohrad Region is not only situated in the central part of Ukraine, but also in the central part of the Ukrainian shield, which explains the significant concentration of objects geological heritage on its territory, among which typical Precambrian geosites dominate.

The far west part of the region is situated within the Rosinsko-Tikychskiy mega-blocks of the Ukrainian Shield, mostly the Inhulskiy mega-block with the Shield's largest Novoukrainskiy and Korsun-Novomirhorodskiy intrusive blocks. The first has plutons consisting of trachytoid granites; the structure of the second is characterized mostly by anorthosite-rapakivi-granite formations.

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The Kirovohradsko-Bobrinetskyi, Dolinskyi, Mitrofanivskyi and Bokovyanskyi granite massifs form the basement of the eastern part of the Inhuletskyi mega-block and are situated, like the above-mentioned objects, among gneiss-dome structures.

The territory west of the Sinyukha River belongs to the Rosinsko-Tikichivskyi mega-block of the Ukrainian Shield, which consists of two-pyroxene crystalline schists of the Dniester-Bug geoseries and crystalline schists of different compounds, gneiss, quartzite and calciphire of the Bug Neoproterozoic.

The crystalline basement is more complex due to frequent cataclasis with manifestations of alkaline metasomatism, basite and ultrabasite dikes of the Mesoproterozoic Era.

The crystalline basement rocks are often exposed by erosion of rivers and their tributaries. Among 40 geological monuments (geosites), 35 are characterized by the structure of Precambrian basement [7].

Sedimentary cover, despite its insignificant competence and limited distribution, mostly within paleo-depressions on the surface of Ukrainian Shield, forms a significant part of the geological structure of the region. Paleogene deposits are represented by rocks of coal-bearing formations of the Buchak geoseries, glauconite-quartz sands, aleurites and Eocene and Oligocene clays within the Kyiv, Obukhiv, Mezhygir and Bereka suites.

Older Triassic, Jurassic and Cretaceous sedimentary rocks have a limited distribution in the north-east part of the Ukrainian Shield on the slopes of ancient relief and are not outcropped.

Neogene deposits were formed under continental conditions and are represented by a layer of Novopetrivska suite - sand and clay; mottled and red brown clay of Miocene and Pliocene.

Typical rocks of the Quaternary system are the great variety of genetic types and wide distribution in watersheds, river valleys, ravines and their slopes. Among the subaerial types these are loams, loess and fossil soil; among subaqueous — sand, clay, aleurite, peat.

Kirovohrad Region is one of leading regions in minerals. Here are located Ukraine's richest Kapitanka silicate nickel deposit, the Lipovenke chrome deposit, the Michurinske uranium ore deposit, the Klinty gold deposit, the Zavallia and Petrivske graphite deposits, the Bovtyshka oil shale deposit, around 30 brown coal deposits (Moroziivske, Novomyrhorodske), deposits of construction materials, ornamental stones, mineral water, etc. (Fig. 1).

All this, together with significant outcrop rocks of different ages, picturesque landscapes and variety of terrain gives rise to numerous natural and artificial rock outcrops, most of which are considered as potential objects of geological heritage, worthy of inclusion in the state list of geological heritage of Ukraine.

Results and its discussion

The guidebook "Geological Monuments of Ukraine", published in 1984, describes 16 objects of geological heritage in Kirovohrad Region [4]. The later four volume edition "Geological Landmarks of Ukraine", published in 2006–2011, describes 29 geological relics for the region [5]. Also, according to the data of "Atlas of Objects of the Nature Reserve Fund of Ukraine" only three geosites are actually under protection, having received conservation status in 1971 ("Kaskady") and in 1989 ("Slony" and "Inhuletska Zhyla") [1].

The list of potential objects of geological heritage can be enlarged and ought to represent at least 50 geological monuments worthy of inclusion on the state list of protected natural resources.

According to their types there are petrographic (28), stratigraphic (8), geomorphic (12), mineralogical (1), paleontological (1) sites. Classification to one or another type is mostly relative and is based upon the role of the geological sites. Most petrographic geosites can be considered as mineralogical or geochronologic, some of them are tectonic and practically all are geomorphic. Kirovohrad Region is characterized by many active and abandoned quarries, where 21 geosites of a geoeconomic character are situated.

It is reasonable to group the scattered geological monuments in the following geological routes:

1. Water shed of Sinyukha River. The river is a tributary of the South Bug River, which crosses the west part of Kirovohrad Region in Novoarchangelsk and Vilshanka districts, and cuts into

Precambrian crystalline rocks. There are 6 geological monuments (geosites) in the submeridional-oriented area along a 50 km stretch of the river (Fig. 2, 3). They make the landscape of the area picturesque and are characterized by a crystalline basement structure. There are enderbites of the Gyavoron Paleoproterozoic complex in a quarry near the small town of Novoarchangelsk, granite outcrops on the right bank of the Suhyi Tashlyk River near Dobryanka village with fine tourmaline crystals, the rocky canyon north from Ternivka village, outcrops of porphyroblastic granite of the Kirovohrad complex with veins of pegmatite near Kalmazove village, with rocks up to 40 meters high and other objects.

The route through the geological sites of the Syniukha River can be completed by a visit to the only place in Ukraine where a quarry has broken through a crust of weathered ultramafic nickel-bearing rock, which provides the raw material for the Pobuzkiy nickel plant.

2. The outcrops and quarries of the South Bug between the villages of Haivoron and Zavallia. In this area of the South Bug natural and artificial outcrops are wonderfully juxtaposed to one other. They give us an impression of the structure of the largest Zavallia graphite deposit in Europe (Fig. 4) and allow us to see the picturesque enderbite rocks near Salkive village and quartzite outcrops of the Khashuvatka-Zavallia rock formations, practically all types of rocks of the Dniester-Bug geoseries and the Haivoron complex in the town Haivoron (Fig. 5). The uniqueness of the geological structure, geological variability and picturesque landscapes create good conditions for planning a geopark here.

3. The Upper Pletenyi and Chornyi Tashlyk rivers. On a relatively small territory between Pischianyi Brid and Voronivka there are 7 geosites, one of which, Kaskady, has nature protection status [6, 7].

All geological sites are of the petrographic type and allow us to study the peculiarities of the compound of the Novoukrainskyi and Kirovohradskyi complexes in natural rock outcrops. The rocks exposed by erosion of the rivers Pletenyi and Chornyi Tashlyk adorn the steppe landscape and belong not only to the petrographic type of geosite, but also to the geomorphic. The dominant types of rock in this complex are trachytoid granites with aplite-pegmatite veins and monzonite. Apart from natural outcrops, there are such good potential objects of geotourism as old quarries on the slopes above the Chornyi Tashlyk River and in Buzinna ravine, the abandoned Kapustianskyi quarry north of Kamyanyi Brid village and the Adabaskyi quarry, which is still being exploited, on the left bank of the Pletenyi Tashlyk River in the north-east part of Novoukrainka village (Fig. 8). The monzonites exposed by the quarry are considered to be monzonite petrotype of the Novoukrainskyi complex [7].

The true pearl of this geotourist complex is surely Kaskady Rocks north of Zlinka village, the ghostly weathered forms of which are appealing to those who enjoy the beauty of the natural environment. Gigantic pink porphyroblastic granite blocks of the Kirovohrad complex resemble icy erratic rocks and form an elongated bank from south to north, adorned by numerous small picturesque waterfalls.

4. Granitoid and gneiss rock outcrops on the banks of the Upper Sugokleia and Inhul rivers. Two geosites along the Inhul near Lozuvatka village (Fig. 10) and four geosites along the Sugokleia form only a fraction of the rock outcrops that are almost continuously spread along the banks of the Sugokleia and Inhul rivers (Fig. 9). Outcrops of gneiss and pegmatite in the mouth of the Ternovatka Balki and porphyroblastic granites near Sofiyivka village are well worthy of conservation through the creation of a geological reserve.

5. The Kirovohrad complex of geological sites. This consists of 10 objects of geological heritage, five of them are close to Kirovohrad (2–3 km), and the others are further (16–19 km and 30 km from the regional capital). Seven of the ten objects are of the petrographic type and are natural outcrops in the valleys of the Adzhamka, Inhul, Sugokleia and Kamianka rivers, abandoned and active quarries (Fig. 12). They are the granitoids of the Kirovohrad and Ukrainian complex, metasomatites in Pokrovske village among aplitoid granite with xenolites of biotite gneiss; diabase dikes in the south of Subotsi village, where in the large quarry we can observe the contact of different types of rocks which had undergone intense processes of epidotization, chloritization, ferruginization. Erosion from the Sugokleia River



Fig. 1. Verbolozske brown coal deposit.
Рис. 1. Верболоське родовище бурого вугілля.



Fig. 2. Cliffs on the shore of the river Syniukha [11].
Рис. 2. Скелі на узбережжі р. Синюхи.



Fig. 3. The picturesque river Syniukha.
Рис. 3. Мальовнича річка Синюха.



Fig. 4. Zavallivsky quarry for the extraction of graphite.
Рис. 4. Завалівський кар'єр з видобутку графіту [3].



Fig. 5. Southern Bug rocks at Haivoron.
Рис. 5. Скелі Південного Бугу у Гайвороні.



Fig. 6. Rocky ledges of Kaskady geosite [9].
Рис. 6. Скелясті виступи геосайту Каскади.



Fig. 7. Kaskady geosite. Waterfall [9].
Рис. 7. Геосайт Каскади. Водоспад.



Fig. 8. A rocky coast of Inhulets near the village Voinovka
Рис. 8. Скелястий берег Інгульця біля с. Войнівка



Fig. 9. Trachytoid granites output.
Рис. 9. Відслонення тархітоїдних гранітів.



Fig. 10. Pegmatites outcrop in the Lozuvatka [2].
Рис. 10. Відслонення пегматитів в Лозуватці.



Fig. 11. Granit quarry in Sokolivske village.
Рис. 11. Гранітний кар'єр у с. Соколівське.



Fig. 12. The picturesque river Sugokleia.
Рис. 12. Мальовнича річка Сугоклея.



Fig. 13. The rock near the village of Polumiane.
Рис. 13. Скеля біля с. Полум'яного.



Fig. 14. Quarry for the extraction of brown coal.
Рис. 14. Кар'єр з видобутку бурого вугілля.

has exposed the rock outcrops and smoothed boulders of trachytoid granites in Shevchenkove village and the pink porphyroblastic granites in the quarry located in Sokolivske village (Fig. 11).

A potentially good attraction is the outcrop of vein quartz in Arsenivka village, which apart from geological significance, has also historical significance. It is situated on the territory of the museum and former country estate of the Ukrainian playwright and actor I. K. Karpenko-Karyi (Tobilevich). A quartz vein lies among the porphyraceous granites of the Korsun-Novomyrhorodskyi complex. Stratigraphic objects that include a section of Paleogene and Quaternary deposits in Obiznivskiy quarry, fire clay on the left bank of the Hruzka River, and, unique for Ukraine, the artificial outcrops of rotten stones of the middle Eocene Kyiv rock formation exposed by Konoplanskyi quarry in Pervozvanivka village on the right bank of the Inhul River also have great scientific significance. The petrified plants in the Buchak sandstones near Adzhamka are famous beyond Ukraine. Here many excellently preserved imprints of soft parts of plants have been discovered in the giant block of Buchak sandstones.

Interesting geotouristic objects of historical and mining type are spoil tips of the uranium mine near Konoplanskyi quarry and the structures of the mine located in the village with an unusual name — Neopalymivka.

6. The Oleksandriya complex of geological sites. The basis of the complex is formed by four geological sites, two of which are characterized by the structure of the Cenozoic basin within brown coal quarries; the rest belong to the Precambrian basement (Fig. 13). The abandoned Baidakivka quarry located near Oleksandriya town has great scientific and tourist value. The quarry exposes 45 m thickness of rocks, among which there is a full section of Quaternary subaerial deposits with a great variety of genetic types, with typical alternation of loess and fossil soil horizons. In the upper loam teeth and bones of mammoths and cranium of aurochs have been found. In the boulder loams of Dnipro moraine teeth and bones of *Rhinoceros* sp. and a deer have been found. There is an important Neogene and Paleogene section where rocks of the Poltava, Kharkiv and Buchak geological series have been found. Their variegated lithology is highly informative of the central part of the Ukrainian shield. Together with the brown coal quarry near Morozivka village located north-west of Oleksandriya village, this provides a unique opportunity to see outcrops of brown coal in artificial outcrops (Fig. 14).

Apart from its geological significance, Baydakivka quarry has also historical significance, for in this quarry the mechanized mining of brown coal was used for the first time.

Near Kukolivka village on the right bank of the Kamianka River, there is an outcrop of great pegmatitic veins, the largest of which was named Chervonyi Kamin' (Red Stone). It rises above the surface and has one of the largest capacities within the Ukrainian shield.

South of Velika Skeliova village and 28 km north of Oleksandriya town there is the most distant object in this complex of geotouristic objects. It is an outcrop of the Inhul-Inhuletska Paleoproterozoic geological series within the West-Inhul interblock zone. In the rocks of modest height (maximum 7 m) near the Oblomivka River there are outcrops of barren quartzites with runs of pegmatoid granite and quartz [7].

Summary

Thus there are distinguished six complexes of geological sites within Kirovohrad Region. They provide good potential for establishing and developing geotourism. The great variability of types of geological objects and the wide stratigraphic range of rock assemblage and the attractiveness made by the landscapes and composition of geological, sacral, geobotanic, and technological and other components create a fine environment for geotourism.

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Об'єкти геологічної спадщини Кіровоградщини як основа розвитку геотуризму в регіоні. — **Манюк, В. В.** — Матеріали статті подаються на основі визначення терміну геотуризм, даного Томасом Хосе. Зазначено, що Кіровоградська область не тільки знаходиться в центральній частині України, але й Українського щита (УЩ), що визначає значну концентрацію на її території об'єктів геологічної спадщини, серед яких переважають такі, що характеризують докембрійський кристалічний фундамент. Проаналізовано особливості геологічної будови регіону. Встановлена провідна роль Кіровоградщини у формуванні мінерально-сировинної бази України. Все це у поєднанні з гарними відслоненнями порід різного віку, мальовничими ландшафтами і різноманітністю рельєфу зумовлює наявність значної кількості природних виходів гірських порід та штучних відслонень, більшість з яких розглядаються як перспективні об'єкти геологічної спадщини, гідні включення до державних реєстрів геологічних пам'яток України.

Ключові слова: геосайт, геотуризм, геопарки, геологическое наследие, Кіровоградська область.

Объекты геологического наследия Кіровоградщины как основа развития геотуризма в регионе. — **Манюк, В. В.** — Матеріали статті подаються на основі визначення терміна екотуризм, даного Томасом Хосе. Указано, що Кіровоградська область не тільки знаходиться в центральній частині України, але й Українського щита (УЩ), що визначає значительную концентрацію на її території об'єктів геологического наследия, среди которых преобладают те, которые характеризует докембрийский кристаллический фундамент. Проанализированы особенности геологического строения региона. Установлена ведущая роль Кіровоградщины в формировании минерально-сырьевой базы Украины. Все это в сочетании с хорошей обнаженностью пород разного возраста, живописными ландшафтами и разнообразием рельефа обуславливает наличие значительного количества природных выходов горных пород и искусственных обнажений, большинство из которых рассматриваются как перспективные объекты геологического наследия, достойные включения в государственные реестры геологических памятников Украина.

Ключевые слова: геосайт, геотуризм, геопарки, геологическое наследие, Кіровоградська область.

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