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MORPHOLOGICAL CHARACTERISTICS OF EAST KAZAKHSTAN AS A FACTOR OF GEOTOURISM DEVELOPMENT

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Abstract: Due to its innovativeness, geotourism is actively developing all over the world. The article discusses the scientific and educational aspects of the development of geotourism in East Kazakhstan thanks to the geomorphological attractiveness of the region. The formation of a national geotourism market based on unique geological and geomorphological objects is relevant because of its innovativeness and possible profit both as a tourist activity and through the creation of a network of global geoparks in Kazakhstan. The article is devoted to the analysis of the recreational-geomorphological attractiveness of the territory and methodological approaches to awareness in domestic and foreign recreational-geomorphological literature. The development of ideas about the importance of the geomorphological structure and dynamics of the relief for recreational activities has been widely developed. It started in Western European tourism practice first and foremost and since the late 1990s of the last century began to develop in the post-Soviet space (in the CIS countries). The paper describes the unique geological and geomorphological natural monuments of the East Kazakhstan region, and the typology of geomorphological features of the region. The author substantiates the possibility of creating a geopark as a backbone tourist territory, contributing to the development of domestic and inbound tourism in the region. The article describes goals and tasks of creating a geopark in the transboundary region of Altai region.

Key words: recreational geomorphology, natural monuments, recreational-geomorphological potential, relief, tourism.

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INTRODUCTION

The expansion of the range of recreational activities, the increase in its scale, the involvement of new territories in the recreational complex requires a scientifically based assessment of the natural recreational potential of the territory. This has become especially important in recent years, when the processes in the worldwide tourism industry have become global (Erdavletov, 2010; Dunets et al., 2020; Dmitriyev et al., 2021). These trends in the development of modern recreational activities meet the diversification of tourist demand. Recreational activity has recently become one of the most important social and economic factors of territorial development. It has emerged as a new branch of economic activity that relies on a certain combination of resources. It also has its own personnel, connections with other industries and gives a tangible social and economic effect. Recreational activity has a systemic, complex character. There are various

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relationships between tourists, or vacationers, acting as individuals or in the form of groups, and natural complexes with their own recreational set of natural components. During the deployment of scientific research in this direction, the problems of "geographical" recreation were clearly identified, since recreational activities are territorially differentiated and organically linked with the properties of the environment (Berdenov et al., 2021; Ozgeldinova et al., 2017).

The current state of tourism forces the organizers of recreational activities to attract all new natural components as natural resources, including the relief of the earth's surface. To solve scientific and applied problems of recreation development, it became necessary to study and assess the relief as a condition and factor in the functioning of various types of tourism (Gray, 2004; Coratza and Giusti, 2005; Faccini et al., 2018). After all, the relief underlies the spatial diversity of the territory, and the existing geomorphological processes create conditions that affect the efficiency and safety of tourism. The need for this type of research arises at the initial stages of designing or creating recreational geomorphological systems of various ranks. From single geomorphological monuments of nature to complex spatial systems, based on which large national parks function (Reynard et al., 2011; Reynard et al., 2016). Only after geomorphological analysis and modern relief-forming processes as a condition for the functioning of tourism infrastructure facilities, it is possible to determine the suitability of the territory for tourism purposes and zone it for recreational development (Doran and Hanss, 2016; Dunets at el., 2019; Dmitriyev at el., 2022; Asmelash and Kumar, 2019).

The existing natural differentiation of the recreational space, on the one hand, creates special conditions for the implementation of various recreational goals of vacationers. On the other hand, it forces recreation organizers to take into account information about the various qualities of natural components for the effective and safe organization of recreational activities and sustainable development of the recreational area. The natural properties of the landscape serve as an integral part of the recreational system and one of the foundations of its functioning. Therefore, it have always been the objects of recreational research. The development of recreational geographical research in this direction will require a detailed consideration of the relief as a separate natural component, since each of the elements of the landscape has its own essential properties (Avila-Robinson and Wakabayashi, 2018; Reynard and Coratza, 2013; Berdenov et al., 2015).

The main goal of the study is to show the organizational role of geomorphological features in recreation in order to optimize recreational activities and develop the territory through the effective use of the relief

MATERIALS AND METHODS

The paper uses the experience of domestic and foreign researchers, which differ in the system of values, views on the problem of formation, and presentation of recreational geomorphological information. The proposed theoretical provisions are based on the results of the authors' own research. Foreign experience. In foreign studies, interest in the recreational properties of the relief manifested itself in connection with the need to create recreational and geomorphological information for the functioning of national parks. Initially, the International Association of Geomorphologists (IAG/AIG)** began to create such information starting in the 1990s. (Reynard and Coratza, 2013). A department for research on geodiversity and geoheritage was created within the organization in 2001. Geoheritage considers natural monuments of various ranks as key recreational objects for their involvement in tourism activities and subsequent protection. Such an experimental group firstly arose in 1999 in Switzerland, a country with the highest density of places of geomorphological interest from tourists, and then spread to other European countries, such as Poland, Portugal, Spain, Great Britain. Subsequently, the work of the group led to the creation of a single network of geoparks in Europe, i.e. parks based on the demonstration of geological and geomorphological heritage (Doran and Hanss, 2019; Rozman et al., 2009). For such areas, research continues on the formation of a perfect set of recreational and geomorphological information materials that meet the needs of various consumers (Cutler et al., 2018; Canteiro et al., 2018).

Almost all research in this direction is carried out according to three main criteria:

1) the development of criteria for the assessment of natural monuments, which will subsequently form the basis for the functioning of parks;

2) the assessment of specific morphological landscapes as the basis for the functional zoning of the territory and the provision of information on the opportunities implemented on them;

3) conservation of natural geomorphological diversity and creation of informational databases about natural monuments and protected objects.

Recreational practice urgently requires the development of a system for assessing the recreational and geomorphological attractiveness of the territory. This is needed for making a decision when choosing a tourist product with given recreational properties by the organizers of tourism activities and potential visitors. On the other hand, the use of the patterns of the structure and development of the relief to identify systemic relationships between the relief and recreation, the identification of new properties, and applied functions of the relief gives an additional impetus to the development of geomorphology. A new direction of applied geomorphological research, aimed at studying the relationship between relief and recreation, arose at the intersection of applied geomorphology and recreational geography. The first one has always been concerned with the application of fundamental geomorphological knowledge to practical life (engineering geomorphology, prospecting geomorphology etc.). Starting with the fundamental work of the team of scientists from the Institute of Geography of the Russian Academy of Sciences, headed by V. S. Preobrazhensky, the relief was one of the natural components included in the natural block of the recreational system. The studies were mainly devoted to issues related to the social and economic aspects of the recreation phenomenon. At the same time, an independent direction of recreational science was developing, affecting largely the natural basis of recreational activities. Eringis and Budryunas (1975) in their works on the recreational assessment of the natural potential of the territory from the position of the landscape as a

whole, proposed an aesthetic assessment of the landscape, in which the relief occupied one of the positions in the landscape with a limited set of properties. Subsequently, V.A. Nikolayev developed this topic in his works (Nikolaev, 1978).

In recent years, scientists started to form ideas about recreational geomorphology as an independent applied area of science (Kuskov, 2008; Evstropeva, 2009), which considers relief as its object as a basic natural component included in the recreational system. The subject of recreational geomorphology is recreational-geomorphological systems and relief functions in them that are manifested in the course of recreational activities and relationships between the relief, TOURISTS and recreation organizers. General geomorphology traditionally considers the main and fundamental properties of the relief, which allow analyzing the relief and describing it. It includes morphology (morphometry and morphography), dynamics, genesis and age. These general basic properties are divided into more particular properties (absolute and relative height, steepness of slopes, dissection, diversity, morphographic severity, type of morpholithogenesis etc.). Some properties have a system of quantitative indicators (morphometric, dynamic, age); others are presented in the form of qualitative characteristics (morphography, origin).

The paper formulated the principles for studying the aesthetic properties of the relief based on the concepts of "morphological landscape" and "morphological scenery". The classification of morphological sceneries was used as a methodological procedure to analyze the territory during recreational geomorphological studies. As the main classification features, we relied on the essential and basic properties of morphological landscapes that determine the diversity of the relief: 1) territorial position, 2) morphology, 3) genesis. As additional features of the classification of morphological sceneries, the features of the visual perception of the territory were: 4) the geomorphological position of the observation deck, 5) the angle and direction of the gaze, which determine the volume and detail of the object (Figure1).

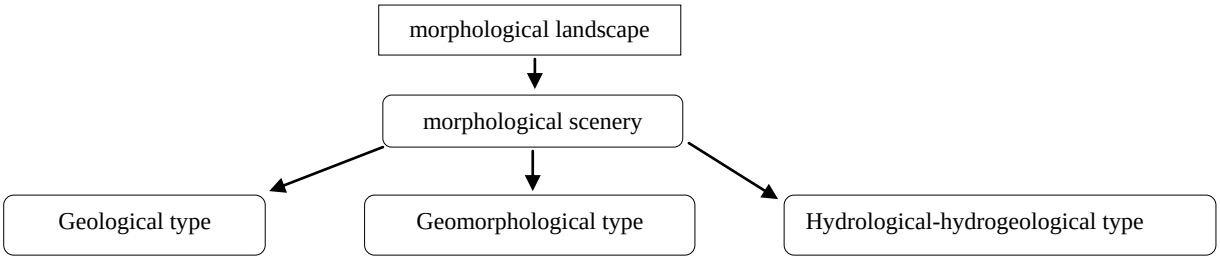

Figure 1. Block diagram of the territory survey method

The study area is located in East Kazakhstan. The territory is part of the Altai Mountain system. The mountainous country called Altai is located between 48° and 53° N, its southwestern part is within our republic and is called the Kazakhstan Altai. Altai is part of the largest mountain system called the Altai-Sayan Mountains, the boundaries of which stretch from Lake Zaisan to Lake Baikal. Kazakhstan includes only its southwestern outskirts. The southern border is the basin of the Black Irtysh River and Lake Zaisan, and the western border is the Kalbinsky Range (Gusev, 2012).

The Kazakh part of Altai occupies almost a tenth of the territory of the entire republic (Figure 2). This is a beautiful region, endowed with amazing natural contrasts. It includes almost all landscape and zonal conditions: from deserted stony peripheral mountains overlooking the Zaysan depression to rocky ridges covered with eternal snows and snowfields, usually hidden under the canopy of clouds circling around them. According to the features of the relief, the Kazakhstan Altai is divided into three parts: the Southern Altai, the Rudny Altai and the Kalbinsky Range.

Southern Altai is located between the Bukhtarma River in the north, Zaisan Lake and the Black Irtysh River in the south. In the west, the Irtysh valley separates it from the Kalbinsky ridge. In the east, the Southern Altai merges with the Ukok plateau. From here, two chains of mountain ranges branch off to the west and southwest. They are separated by the Kurchum and Kargoba rivers. In the south there is a system of ridges Tarbagatai (2739 m), Sarymsakty (3373 m) and Narym (2400 m), which belong to the northern part of the Southern Altai, and its southern part includes the South Altai (3483 m), Kurchum (2644 m), Sarytau (3300 m), and Azutau ridges.

The Markakol depression is located between the Azutau and Sarytau ridges at an altitude of 1449 m. The elevated part of this territory in the east, gradually decreasing to the west, turns into foothills. Between the peaks of the mountains, there are small and shallow depressions - lakes. They lie at an altitude of 2300-2500 m above sea level. The western border of the Southern Altai runs along the Kholzun mountain range. The southern slopes of the mountains are large, strongly dissected. The foothills are relatively flat. Rudny Altai enters the borders of Kazakhstan with western spurs. The main ones are Listvyaga and Kholzun. Rudny Altai also consists of the Ulba (2300 m), Ivanovsky (2775 m) and Ubinsky (2100 m) mountain ranges, which are located in the northeast of the Southern Altai. They extend from the Katun mountain range and the Ukok plateau. The maximum heights are concentrated in the extreme east of the Kazakhstan Altai.

The relief of Rudny Altai is very diverse. The eastern parts of the ranges are strongly dissected and have an alpine character. The mountain slopes are mostly covered with coniferous forests. To the west, the mountains go down, their forms become rounded, and the slopes become gentle. In some places, there are plateaus with leveled surfaces.

The Kalbinsky Range is located on the left side of the Irtysh River. Its highest point is Saryshoky (1558 m). To the west, the ridge goes down and merges with Saryarka. The tops of the mountains are oval, the slopes are strongly dissected, and some areas are flat. The Kazakhstan Altai was formed as a result of the Hercynian orogeny. Repeated uplifts alternated with destruction. The region, which turned into a plain at the end of the Mesozoic era, was subjected to new tectonic uplifts in the Neocene and Anthropocene. As a result, the modern mountain relief of Altai was formed.

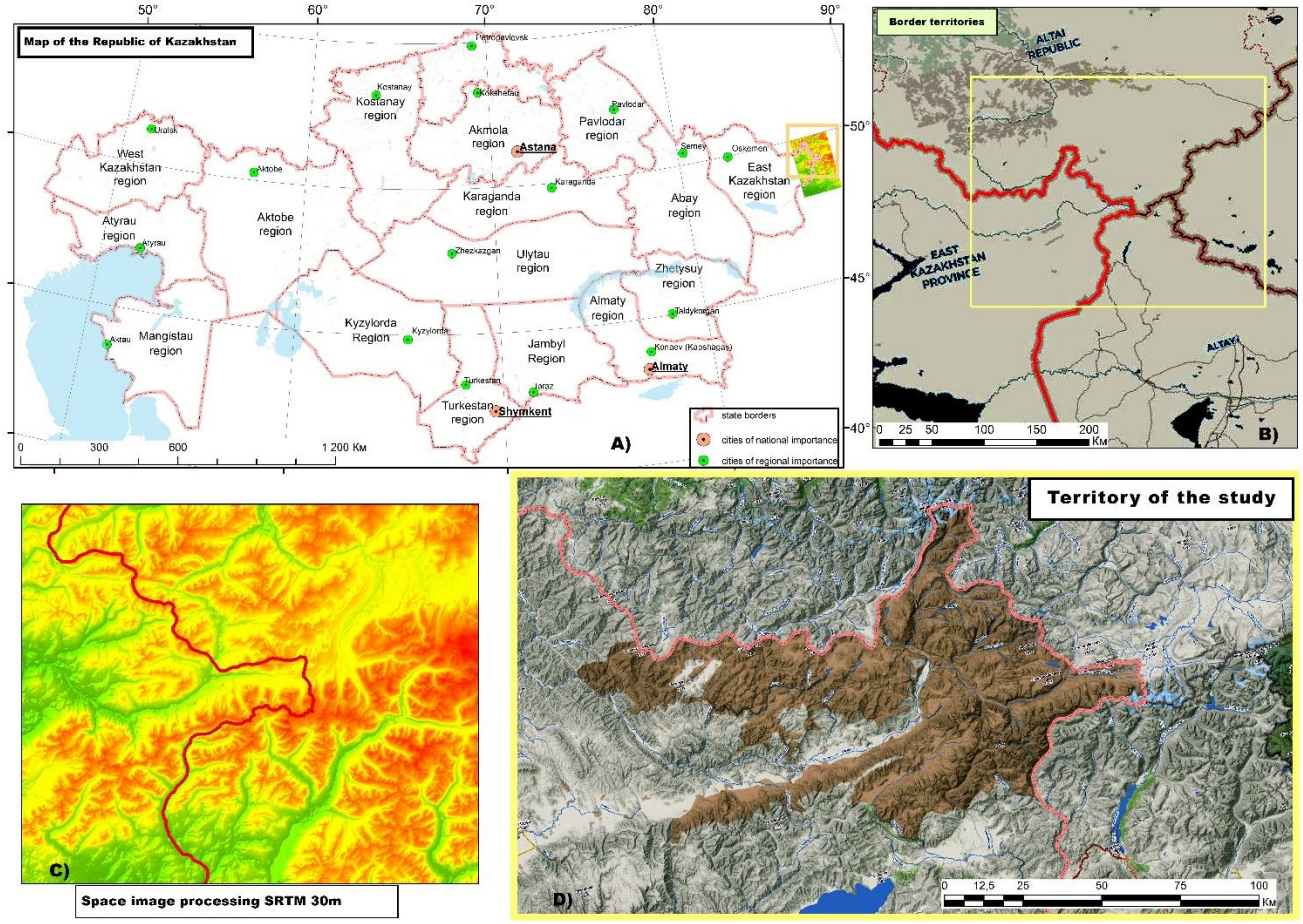

Figure 2. Map of the study area (Source: Author, created in the program ArcGIS.10);
A) map of the Republic of Kazakhstan; B) map of transboundary territories; C) relief wash using SRTM satellite image with a resolution of 30m; D) map of the Altai Mountain range on the territory of the Republic of Kazakhstan

RESULT AND DISCUSSION

The existing natural differentiation of the recreational area creates special conditions for the implementation of various recreational goals of vacationers. Therefore, the natural regional properties of the landscape of the region have always been the objects of recreational research as an integral part of the recreational system and one of the foundations of its functioning. Currently, in the science of recreation, there is a group of questions devoted to the relationship between relief and recreation. A wide range of recreational problems is reflected in the research of various branches of geographical science, including geomorphology, as a scientific direction about the patterns of structure, dynamics, evolution of the relief, and its functions in various types of economic activity. This largely corresponds to modern trends in the development of geomorphology, which consists in considering the relief from the standpoint of the environmental, social and economic life (Pralong and Reynard, 2005). However, the relationship between the relief and recreational activities is currently not fully analyzed and evaluated; the patterns of their mutual influence and development have not been identified. Despite the fact that these relationships are one of the essential foundations for safe, efficient, and sustainable functioning of recreation (Reynard and Panizza, 2005). Occupying a basic position in the landscape, the relief acts as a natural condition that largely determines the structure, condition and evolution of the recreational space.

Another important aspect of considering the correlation between relief and recreation is the resource aspect, which determines the functional typology of the recreational system. It is observed in many recreational areas of the world, where relief is used as one of the main recreational resources that satisfies the diverse recreational needs of vacationers (Zhensikbayeva and Saparov, 2017). At the same time, the attractive properties of the relief are still poorly used in recreational activities due to the lack of scientifically based and adapted for consumers recreational and geomorphological information that reveals the aesthetic, cognitive and cultural significance of the geomorphological structure of the recreational space. The systemic position of the relief lies in the dual role of it in relation to the recreational system. First, it is included as a basic element in its natural components, acting as a natural and information resource aimed at meeting recreational needs. Secondly, the relief acts as an external element in relation to the recreational system, which determines its functioning and often determines the functional type of the system.

The relief as a basic element of the natural complex largely affects the nature of recreational activities. At the same time, the relief determines the recreational specialization of the territory. In some cases, it is the main natural object on the use of which the recreational system is based. The relief in relation to the recreational system acts in various qualities: 1) a natural condition, 2) a natural resource, 3) an information resource. At the same time, the role of relief in the system of

relations "relief-recreation" changes over time and is determined by the relations "object-subject" and the boundary position of the problem "environment-man-society". The resource value of the relief for recreation is currently underestimated. First, the relief should be considered from traditional resource positions. Mountain slopes with their morphological and morphometric indicators, such as absolute height, shape of the longitudinal profile, slope, length, planned outlines, etc., fully appear to be a recreational resource for ski tourism. These indicators largely determine the specialization of ski slopes and the entire ski resort for various groups of vacationers. The relief properties are important for meeting recreational needs. They represent a set consisting of traditional properties: morphometry, morphology, modern dynamics, diversity, origin, age, and additional ones such as the degree of anthropogenic weariness, aesthetic appeal (scenery), historical and cultural significance, uniqueness. It is more expedient to consider recreational-geomorphological functions of the relief within the framework of recreational systems of a certain type. Two groups of relief functions in recreational systems are distinguished: attractive functions and relief functions in the safety and technological efficiency of recreational activities.

Vast differences in the development of tourism rely on the dependence of geographical location of the mountainous regions. The problems of tourism are especially aggravated in mountainous continental transboundary regions, where there is an increase in risks associated with natural, social, economic, and political factors. Since significant mountainous areas belong precisely to such territories, Altai is one of such transboundary regions. Altai is a mountainous country located at the junction of the borders of Russia, Kazakhstan, China and Mongolia. Due to the high level of biodiversity, this territory is part of one of the 200 global ecoregions of the planet. Five natural areas of the Russian part of Altai have the status of the UNESCO World Natural Heritage Site "Golden Mountains of Altai" as an important and unique center of biodiversity of mountain species of plants and animals in northern Asia, a significant part of which are rare and endemic (Figure 3).

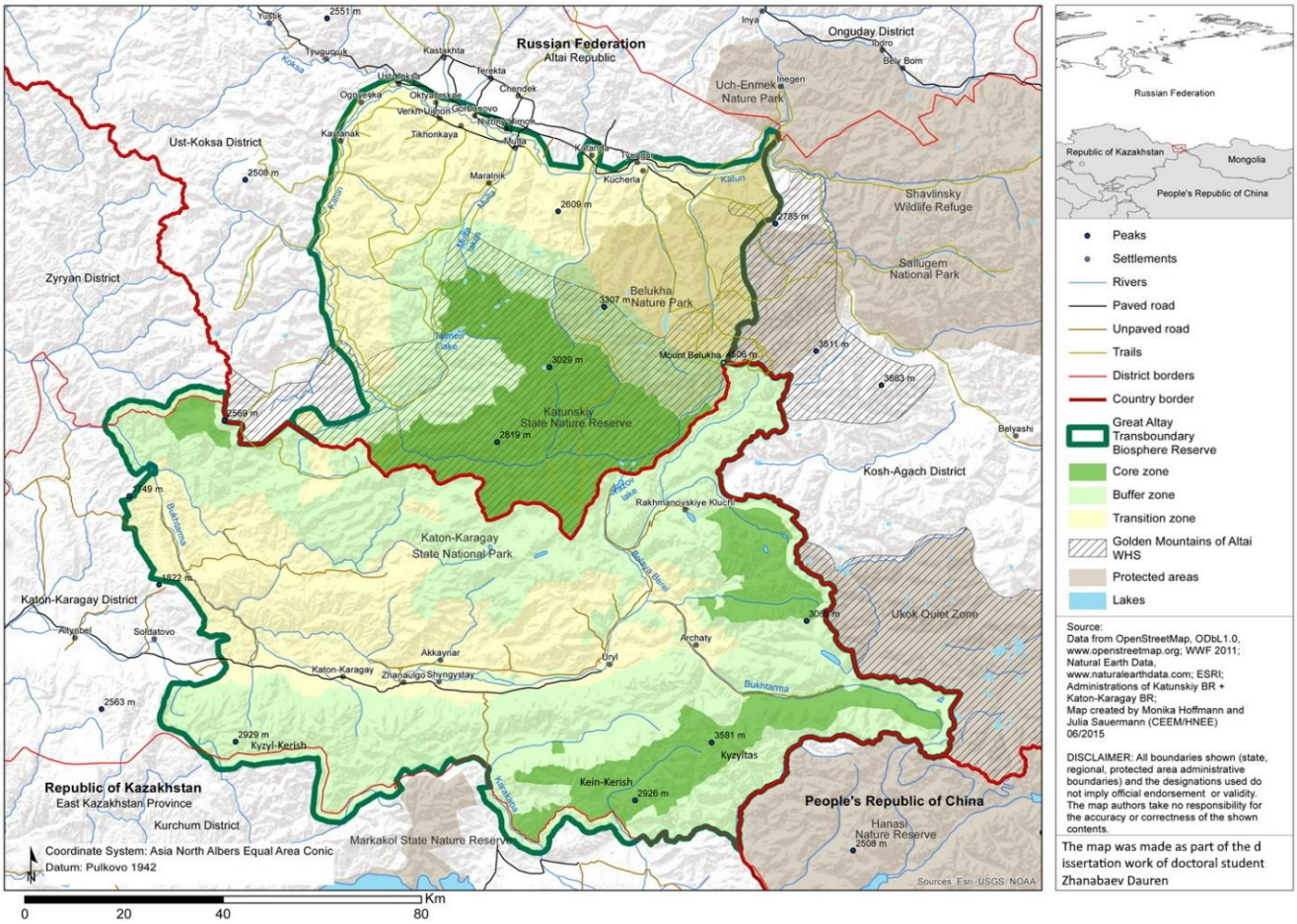

Figure 3. Map of the natural diversity of the Altai Mountains (Source: Author, created in the program ArcGIS.10)

Altai is also a powerful knot of various borders: natural, political, ethno-cultural, and religious.

The cognitive functions of the relief are implemented through geomorphological objects of two types. The first is a geomorphological monument of nature – a geomorphological phenomenon (landform or process). It is unique in its structure or manifestation, origin, location, often associated with cultural and scientific history, has an important cognitive, aesthetic value, and has a compact spatial position. Tourists can perceive a geomorphological monument simultaneously from different distances. Such objects are achievable during one more or less long trip (excursion, trip, etc.). As examples of geomorphological monuments of great cultural significance, one can cite "Kein-Kerish", "Kyzyl-Kerish", "Kyzyltas" located in the Kurchum region of the East Kazakhstan region (Figure 3).

The second is a geomorphological natural monument – a natural or anciently changed type of relief (morphological landscape), which has a special scientific or cultural interest, as well as social (often global) significance, allocated (or

conscious, traditional) as a protected area. Usually this is a vast territory with a unique structure, origin, location, often associated with cultural and scientific history, which has an important cognitive, aesthetic value. As a rule, such a territory cannot be observed simultaneously. In order to be acquainted with such monuments, tourists need a lot of time (specialized tours, multi-day routes). To present recreational-geomorphological information about geomorphological natural monuments, it is necessary to identify them, study their recreational properties, and map based on a classification that takes into account spatial position, genesis, and special attractive properties (uniqueness, cultural significance, etc.). An example of complex objects - recreational and geomorphological natural monuments is the Katon-Karagai natural and recreational area (Figure 2).

No less significant for recreational activities, along with the cognitive function, is the aesthetic function of the relief. The aesthetic properties of natural objects have always attracted people. They become especially important when considering the issue of the aesthetics of the place in recreational research. The beauty and virginity of nature in the conditions of today's strongest anthropogenic pressure on the territory become a scarce aesthetic resource. When assessing the recreational potential of the territory, recreational zoning and zoning of the territory, creating information recreational databases, including recreational GIS of the territory, one of the necessary procedures is the formalization of the aesthetic qualities of the place. The concept of "aesthetics of a place", used in this kind of research, reflects the ability of the territory to influence the psycho-emotional sphere of a person with some of its qualities and is a factor that determines the emergence of positive emotions in a tourist. Tourism is also one of the main links of cooperation in cross-border areas. Regardless of the political system of the country, these territories face specific environmental, social and economic, cultural and political problems. The Russian-Kazakh transboundary biosphere reserve "Bolshoi Altai" was established in 2017, after 19 years of discussions and design of various transboundary initiatives in the Altai region. It includes biosphere reserves "Katunsky" (Russia) and "Katon-Karagai" (Kazakhstan), on a total area of over 1.5 million hectares. In accordance with the principles of the Man and the Biosphere Program, two countries proposed functional zoning of the territory, created a mechanism for managing and coordinating activities, and developed a cooperation strategy for the period up to 2025. Both sides take part in joint activities; however, work aimed at the sustainable development of local communities is not carried out systematically due to gaps in national legislation (Figure 3).

Despite this, cooperation is expanding. The Directorate of Protected Areas of the Mongolian Altai and the Karatal-Zhapyryk State Reserve (Kyrgyz Republic) have joined it. Thus, a model for the development of transboundary cooperation in the field of conservation of natural and cultural values based on specially protected natural areas has been proposed and tested. In addition, the UNESCO biosphere reserves serve as both initiators and “platforms” for the practical implementation of programs and projects of environmental and humanitarian cooperation (Tseng et al., 2018).

In 2017, UNESCO officially approved the creation of Asia's first transboundary biosphere reserve "Great Altai" based on the Katunsky Reserve and the Katon-Karagai National Park (Fig.3). The following types of ecosystems have been identified on the Great Altai territory: mountain-taiga (26% of the area), alpine-type and subalpine meadows (24%), mountain-tundra (17%), nival- glacial (10%), forest-steppe and steppe slopes of mountain ranges (8%) and in intermontane basins (9%) (Mukayev et al., 2020; Tokpanov et al., 2021).Today, new points of attraction appear on the tourist map of the world, which form the tourist interest of society for many years and, as a result, tourist flows. At the end of the XX – beginning of the XXI century, geoparks became such points. Tourist areas that are currently actively developing within the framework of the UNESCO Worldwide Project Global Geoparks Network (GGN). The first geoparks in the world were created in the 90s of the XX century in Germany, later they began to appear in other countries of Europe. By the year of 2002, UNESCO developed a program to create a worldwide network of geoparks.

Each geopark is a public-private project aimed at preserving and improving the value of the Earth's heritage, its landscapes and geological formations, which are the main witnesses of the history of our planet. A geopark should include an area that reflects the entire geographic setting of the region, and should not exclusively include places of geological significance (Feuillet and Sourp, 2010). The geological formations of the Altai territory represent a spectrum of geological phenomena and processes that took place in a wide time interval from the Riphean to the Holocene. They were expressed in oceanic, island-arc, riftogenic, intraplate sedimentation, magmatism, mineralization, karst, etc. A long and complex history of the development of the earth's crust determined the heterogeneity and great complexity of its geological structure, and led to the formation of various minerals. Therefore, minerals of igneous and metamorphic origin (ore metals, ornamental stones) characterize the area of the proposed geopark. Large and medium-sized deposits of iron, copper, lead, and zinc are concentrated here. In the bowels, there are reserves of ores of nickel, cobalt, mercury, molybdenum, tungsten, beryllium, gold.

Based on the existing classifications (Dunets, 2009; Gusev, 2012), compiled taking into account genetic features, their characteristic geological processes and scientific and cognitive significance, natural objects in the region under study can be divided into the following types and subtypes.

Geological type. It includes objects that reflect the geological structure of the territory, its tectonic, stratigraphic, petrographic, mineralogical features, manifestations of finds of paleontological remains, etc. (Figure 4).

Mineralogical subtype. Separate outcrops, old quarries, mine working dumps, where you can collect a good collection of minerals (Figure 4a) represent it. Gold and rare metals are mined in the Narym and Kurchum ridges, tin and tungsten are mined in the Kalbi. For the processing of minerals, metallurgical plants were built in Ust-Kamenogorsk, Ridder, Zyryanovsk. In quarries and dumps of gold-sulfide barite-polymetallic deposits, one can find predominant pyrite ores, pyrrhotite with galena, sphalerite, chalcopyrite, bornite, chalcocite, malachite, azurite, chrysocolla. Sometimes such crystals give bizarre intergrowths. Several generations give pyrites, galena, chalcopyrites. There are also iron hydroxides – hematite, goethite in the form of regular concentric zonal banded Liesegang rings in

tuff sandstones and tuffs. It creates iridescent transitions of multi-colored bands from ultraviolet through blue and green to red and yellow (Figure 4B). The sizes of such objects range from five to fifty cm in diameter.

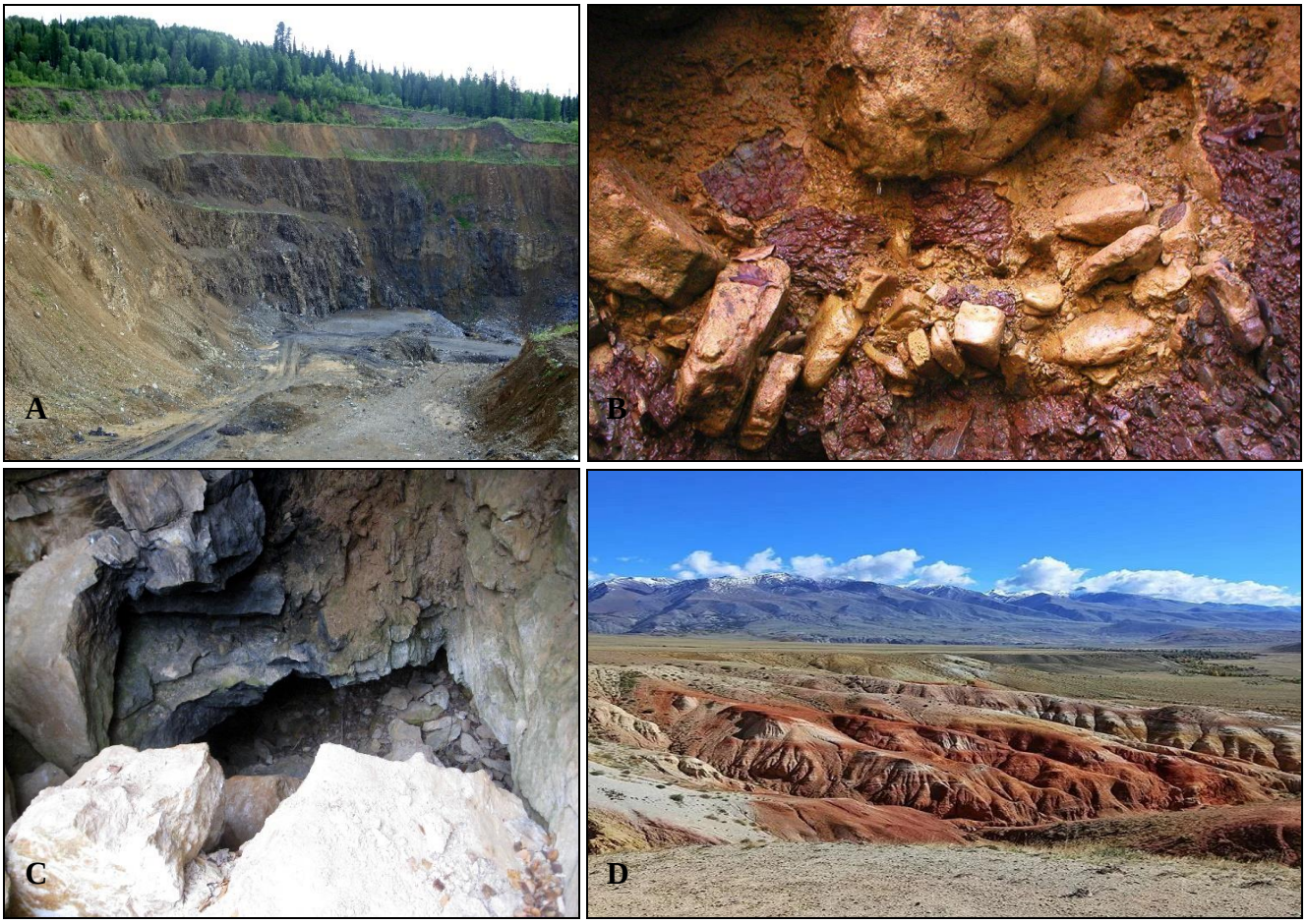

Figure 4. Geological features and finds in the study area (Author's photo) A) gold mining quarries;
B) iron hydroxide deposit - hematite, goethite; C) gold-quartz-sulfide deposits; D) ones and fault areas in natural outcrops

Petrographic subtype. Represented by outcrops and massifs of distinctive, rare or unique rocks and their associations with a visible manifestation of composition, structure and texture; reference deposits of minerals; specific forms of emplacement, occurrence and relationships between products of intrusive and effusive magmatism; places with rare mineral complexes, individual minerals, their associations and aggregates.

More than 900 endogenous manifestations (large, medium, small deposits and ore occurrences, non-ferrous metals) are known in the Rudno-Altai polymetallic belt, stretching in the northeast. Gold was mined in East Kazakhstan even before the revolution from the richest areas of primary and alluvial deposits. Currently, quartz-vein, stockwork, gold-quartz, metasomatized gold-quartz-sulfide deposits are concentrated in Kalba (Figure 4C).

Gemological subtype. Gemology (from Latin Gemma - gemstone) is a collection of information about precious and semi-precious stones, mainly physical properties, chemical composition, decorative and artistic qualities of minerals and mineral aggregates used in jewelry and stone-cutting production.

On the Altai Territory there are deposits and manifestations of colored stones, which can be attributed to:

a) jewelry stones of the I order – emerald; II order – noble green beryl; III order – demantoid, cordierite, polychrome tourmaline, aquamarine, topaz; IV order – chrysoprase, zircon, kunzite, almandine, cacholong;

b) jewelry and ornamental stones of the I order – amethyst-like quartz, carnelian, jade, jadeite, malachite; II order – rhodonite, amazonite, hematite-bloodstone, sapphirine, ordinary opal;

c) ornamental stones – jasper, chalcedony, marble onyx, stichtite, cacholong, serpentine, decorative, colored marble, fluorite.

Tectonic subtype. Includes fault zones and areas in natural and artificial outcrops, as well as folded dislocations (Figure 4 D). Stratigraphic subtype. In this subtype, one should consider the detailed studied stratotypes of individual stratigraphic units, which are important for understanding the general issues of stratigraphy and the nature of the development of the Altai region. Paleontological subtype. Various locations of paleontological remains of animal and plant origin represent this subtype.

Geomorphological type. Individual landforms or complexes of landforms that most clearly reflect the interaction of endogenous and exogenous processes, as well as landforms that have a special aesthetic, educational, and attractive recreational value (Figure 5) represent it.

Karst subtype. It includes objects with a characteristic manifestation of karst formation processes: surface and underground karst in the form of funnels, wells, caves, grottoes, passages, etc. The study of the area is filled with a wide variety of caves. The outlines of the caves are directly dependent on the tectonic jointing of karst-forming carbonate rocks (limestones, marbles, and dolomites) (Figure 5A). The Konyr-Auliye cave is located at an altitude of 738 meters above sea level in the western part of the Kanchingiz ridge on its western slope in the Abay district of the East Kazakhstan. The cave has a lake 18 meters wide and 25 meters long, the depth is 1.8-2.5 meters, the water is clear (Fig.5B). The lake is deep and the water is amazingly clear. There is a legend that in the 18th century, Kabanbay Batyr took refuge in a cave with a detachment of several thousand people, and after some time suddenly hit the rear of the Dzungar troops. One of the legends says that there is a secret door under the fifteen-meter water column at the bottom of the cave. Therefore, the main cave hides behind this door. That cave became a crypt - the last resting place of the mysterious khan.

Figure 5. Geomorphological recreational zones (Author's photo)
A) Konyr-Auliye cave; B) lake in the cave Konyr-Auliye; C) Markakol lake

Deluvial catastrophic subtype. Includes types of landforms of the deluvial morpholithic complex. The most interesting example of the subtype on the Altai Territory is the geological and geomorphological evidence of catastrophic outbursts of giant ice-dammed lakes of the last ice age. Lake Markakol is one of such places (Figure 5C). This is the largest alpine lake in Kazakhstan. To the north of the lake, there is the high-mountain Sarym-Sakty ridge, the maximum height of which is 3373 m. Along the northern coast of the lake there is a medium-altitude Kurchum ridge, in its middle part a massif with a height of 2645 m rises. Along the southern shore of the lake, there is the Azutau ridge with an absolute height of 1800-2300 m.

In the Markakol depression with a lake in the center, surrounded by the mountains of the Kurchum ridge and the Azutau ridge, there is a reserved land. Alpine lake Markakol (1449 m.) is one of the most beautiful in Altai. 2-3 thousand TOURISTS visit every year the Markakol lake area and the Kaldzhir River (during the summer-autumn season). The origin of the lake is tectonic. The southern shore is steep, formed by the edges of the ridge falling directly into the lake. The northern coast is low, formed by the newest deposits. The length of the lake is 38 km, the width is 18 km, and the maximum depth is 27 m. The catchment area is 180 km^2. The mirror of the lake is located at an altitude of 1485 m. The landscapes of the area are picturesque. Larch forests are predominated, on the northern slopes there is cedar, fir and aspen taiga, and on the southern slopes there are many rocks, between which there are steppe lawns. The Markakol State Nature Reserve was formed on August 4, 1976 on the territory of the Markakol natural and recreational region of the East Kazakhstan region in order to preserve the unique Markakol Lake and its surrounding landscapes.

Hydrological-hydrogeological type. It includes unique and rare natural groundwater outlets (sources) of various chemical composition and natural surface water reservoirs. The Rakhmanovskie mineral springs are located in the amazingly beautiful basin of the Rakhmanovskoye Lake (area 1.14 km^2), on its northeastern shore, on the right side of the Arasan River valley. Thermal springs flow from under the northern side of the site from cracks at the contact of granites with slates in the direction from east to west and almost all along the same line with a total length of about 80 m.

Rakhmanov's springs deserve special state protection, since they are typical representatives of siliceous waters of hydrocarbonate-potassium composition, established in a number of areas of the East Kazakhstan region. The spring water has a temperature of 34° to 43° C and has the lowest mineralization among all the mineral waters of the high mountain regions of Kazakhstan, with 10% of it being silicic acid. In addition to silicic acid, water contains free carbon dioxide (up to 0.03 g/l) and radon (10–35 eman) (Erdavletov and Aktymbayeva, 2012). Rakhmanov springs are widely known both in Kazakhstan and abroad due to the balneological sanatorium "Rakhmanovskie Klyuchi", which has been operating for a long time on their basis. The sanatorium is located on the territory of the Katon-Karagay botanical and mineralogical reserve and the Katon-Karagay State National Natural Park. The Arasan waterfall is one of the largest in the east of Kazakhstan. It has aesthetic value and educational interest as an example of natural formations created by the geological activity of rivers. It is an object of cognitive, ecological tourism. The Arasan waterfall is formed by the Arasan River flowing from the Rakhmanovsky lake. This is a two-stage cascade of five and six meters in height.

After passing through the Small Arasan Lake (1734 m above sea level), the river acquires a rapid character and rushes among shale rocks and huge boulders. Six kilometers below the resort village of Rakhmanovskie Klyuchi, at the eighth kilometer from its source, the hanging valley of the Arasan River opens into the trough valley of the Belaya Berel, the bottom of which lies 250-300 m below the first. Here, approximately on a three-hundred-meter section, the elevation difference reaches 200 m. The Rakhmanovsky waterfall is located 1.8 km southeast of the resort village of Rakhmanovsky Klyuchi. The waterfall forms an unnamed stream, located on the right slope of the basin of Rakhmanovsky Lake. This stream starts from a small alpine (2265 m above sea level) moraine lake and flows into Rakhmanovsky Lake. The stream flows in a deeply incised hollow that separates two nameless mountains with absolute elevations of 2400 and 2280 m, respectively. The stream bed is filled with fluvioglacial deposits. The bottom of the hollow in the upper part is strongly sloping (up to 15 degrees), and in the lower part it is slightly steep (15-20 degrees). On the sides, the steepness of the slopes reaches 35 degrees. The hollows are covered with dense larch forest, reaching here the upper limit of its distribution. The vegetation of alpine meadows and riverbed phytocenoses occupy the treeless territory. In the middle course of the stream, at the very beginning of the cascades, dense rocks come to the surface in the form of rocky remnants.

The Kokkol waterfall is one of the highest in Altai. In the extreme northeast, it is the most attractive (along with the Belukha massif) among the objects of educational and ecological tourism. The waterfall is located in the lower reaches of the Bolshoy Kokkol river (left tributary of the Belaya Berel), 23 km northeast of the resort village of Rakhmanovskie Klyuchi.

Thus, East Kazakhstan region, Kazakhstan Altai has rich natural recreational resources. The presence of attractive mountain, water, excursion zones play crucial role for organizing various tours. The rivers of the Southern Altai, the tributaries of the Irtysh Kurchum, Bukhtarma are not only sources of energy, but also areas for the development of extreme tourism.

CONCLUSION

In general, the analysis of the functions of the relief in the recreational system showed that in the process of the interaction of the relief between the individual components and the entire recreational system, the field of geomorphological properties familiar to science expands. The results of the analysis revealed new, recreational properties of the relief - attractiveness (uniqueness, aesthetic appeal, cognitive value, historical cultural significance, natural preservation, recreational diversity). Based on the above aspects of considering the importance of the geomorphological factor for recreation, information about it and its properties is necessary for tourists. At the initial stage of the implementation of the target settings, tourists have a need for information support for making decisions on choosing a place of rest and laying a route. This information can be presented in various forms (booklets, information stands, audio guides, etc.), and it can be called “recreational and geomorphological”. Information represents a set of properties of geomorphological phenomena, objects, processes in their relationship with the recreational needs of tourists from the standpoint of relief functions. It is necessary to present this information to the subject in an adjusted form and help meet his target needs.

Well-inventory information is essential for tourism development. It can be used to create geographic images of a territory and then apply them for tourism marketing or geographic branding. The development of geoparks based on a foreign concept might play an important role, which in the future will serve as a system for managing and preserving the diversity of natural components in the territory. Geoparks are an intensive and low-cost way to develop tourism in Kazakhstan and solve problems identified as priorities by the President of the Republic of Kazakhstan.

In connection with the above, this research confirms the importance of the role of geoparks in the development of the tourism industry in Kazakhstan. The geopark will allow uniting rather diverse tourist sites in the mountainous part of the south of the Altai territory into a single system, which will bring the formation and promotion of the tourist product to a higher level due to its complexity. Moreover, it will significantly increase the flow of visitors. The prospects for the development of the planned geopark are also clearly visible. The Republic of Altai (the basin of the Chuya River, the application has already been sent to UNESCO), Mongolia, is planning to create similar structures.

The creation of a local (Altai) network of geoparks will give an additional impetus to the development of integration processes in the Greater Altai region, including in the field of tourism through the possible partial consolidation of geopark resources and popular routes, which will increase inbound tourism to the Altai Territory

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** Travel community. By car in Gorny Altai. http://galt-auto.ru/photo/785

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