

CAVES OF WESTERN KAZAKHSTAN AS PROSPECTIVE OBJECTS FOR THE DEVELOPMENT OF SCIENTIFIC AND EDUCATIONAL TOURISM

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Abstract: The article considers caves as specific geoecosystems with high scientific, cognitive and recreational value. The relevance of the research is due to the growing interest in scientific and educational tourism, as well as the need to develop scientifically sound approaches to the use and protection of cave sites in Western Kazakhstan. The purpose of the study is a comprehensive assessment of the caves of Western Kazakhstan as objects of scientific and educational tourism, as well as substantiation of the possibilities of their rational use, taking into account environmental requirements and scientific significance. The study is based on materials from field speleological surveys of caves in West Kazakhstan and Atyrau regions. Methods of morphological description of caves, analysis of karst relief, photo documentation, fixation of parameters of underground cavities, as well as assessment of anthropogenic impact were used. Additionally, SWOT analysis was used to identify the potential and limitations of tourism development based on cave sites. It has been established that the caves under study (Konyskerey, Kenenbay, Utemis-Kystau) are characterized by a variety of genesis, morphology and microclimatic conditions, which determines their high scientific and tourist value. It has been revealed that they can serve as a base for the development of scientific and educational routes, including geological and speleological research. At the same time, significant environmental risks associated with anthropogenic stress (pollution, vandalism, microclimate disturbance) have been recorded. The SWOT analysis showed the presence of significant tourism potential in the region, while at the same time there are infrastructural, organizational and environmental constraints. The interpretation of the results indicates the need to integrate scientific research, tourism activities and environmental protection measures. The caves of Western Kazakhstan are promising sites for the development of scientific and educational tourism, with high natural and scientific value. A rational combination of tourism and environmental protection is a key factor in preserving caves as natural heritage sites and ensuring their sustainable use.

Keywords: caves, scientific tourism, educational tourism, speleotourism, karst, natural heritage, subterranean ecosystems, Western Kazakhstan

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INTRODUCTION

Geotourism, as defined by Sergeyeva et al. (2022), is a form of nature-based tourism focused on the study and promotion of the geological structure and landscape diversity of territories, the conservation of natural and cultural heritage, as well as the interpretation of the historical and geographical characteristics of regions and the enhancement of their tourism and investment attractiveness. The study examines the potential for the development of paleontological tourism in the region (Yakupova & Akhmedenov, 2025). In contemporary tourism, there is a steady growth of interest in specialized forms of travel aimed at obtaining unique educational and emotional experiences, including scientific and educational tourism. In this context, caves represent particularly valuable natural sites with significant potential for the development of these tourism sectors. They serve as natural “archives” of geological history and as sources of data on speleogenesis, paleogeography, paleoclimate, archaeology, and paleontology, which determines their key importance for scientific tourism and field-based research practices. Speleotourism, which incorporates elements of mountaineering and technical descent, contributes to the development of active forms of recreation and the formation of specialized tourist routes. The use of speleological sites for tourism and recreational purposes is widespread worldwide. Caves have long established themselves as an important component of the tourism resource base in many countries (Dublyansky & Dublyanskaya, 2004; Klimchuk, 2003; Maksimovich, 1978; Khudenkikh, 2003). The relevance of studying the role of caves in scientific and educational tourism is also determined the need for a scientifically grounded approach to their use. The absence of visitation regulations and systematic monitoring of cave ecosystems may lead to disturbances of their natural balance and the loss of valuable

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scientific information. In this regard, a comprehensive study of caves as objects of scientific and educational tourism is of great importance for the rational use, conservation, and promotion of subterranean natural heritage.

The authors consider caves as unique yet extremely vulnerable geoecosystems possessing high scientific, natural, and historical-cultural value. Particular attention is given to the contradiction between the need to protect the cave environment and the growing tourist interest in karst features. The study demonstrates that, with the implementation of scientifically grounded management measures, opening caves to visitors can contribute to their conservation, environmental education, and the sustainable socio-economic development of peripheral regions. The paper also outlines approaches to the management of tourist caves, including the establishment of a network of speleological guides, the implementation of microclimate monitoring programs, and pilot projects aimed at reducing anthropogenic impact (Chiarini et al., 2022).

According to Chiarini et al. (2022) there are still a lot of possibilities for the opening of new show caves, especially in countries with low Gross Domestic Income (GDI), but their management needs to be sustainable, so that caves become a means of sustaining local economies, educating people on these fragile geo- and ecosystems, and protecting contemporarily their scientific and cultural heritage for future generations. Tourism can have a profound social impact on local communities, fostering economic development while enhancing public awareness of the intrinsic value of heritage resources. At the same time, cultural heritage tourism depends on maintaining a delicate balance between economic imperatives and tourism-related pressures in order to safeguard cultural integrity and, ultimately, sustain its long-term tourism value (Piano et al., 2024). Geotourism, which primarily focuses on geological and geomorphological features in land-scapes as tourist attractions, represents an excellent arena to examine the trade-off between the impacts caused by tourism on cultural heritage and social outcomes (Antic et al., 2020; Frey, 2021). Show caves officially defined as ‘any cavity for which an entrance fee is charged, are natural caves that have been made accessible to the public, where groups of paying visitors can tour them at any time (Cigna, 2016). In this study, the research focuses on the investigation of the unique natural characteristics of the Philippines Cave System (Nueva Vizcaya). The findings indicate that the extensive length of the cave, its multiple entrances, and its remarkable subterranean formations attract both geologists and tourists.

The study also reveals that existing precautionary measures are insufficient, highlighting the need for enhanced safety provisions and improved communication systems (Balangatan et al., 2025). The aim of the study is to provide a comprehensive assessment of caves as objects of scientific and educational tourism and to substantiate the possibilities for their rational use, taking into account environmental protection requirements and scientific significance.

MATERIALS AND METHODS

The material of the study was based on the results of field surveys of the cave system of Western Kazakhstan carried out during speleological expeditions. The block diagram of the research stages is shown in Figure 1. The results of this study are consistent with the United Nations Sustainable Development Goal No. 15, “Conservation of terrestrial ecosystems”. In the course of the research, the morphological characteristics of the cavities, elements of karst relief, as well as the current state of caves such as Konyskerey, Kenenbay, Utemis-Kystau were examined.

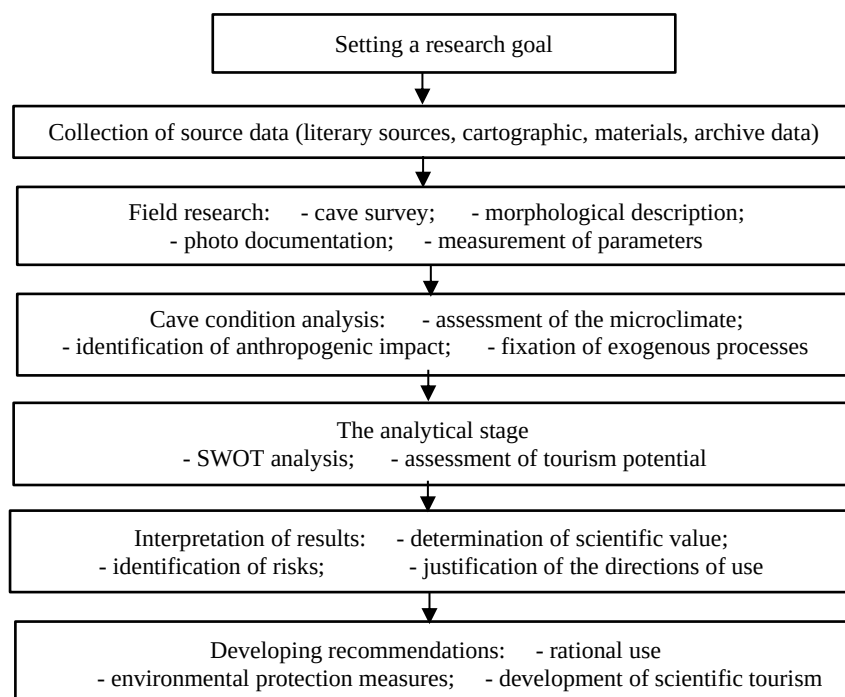


Figure 1. Block diagram of the research stages

Field investigations included a visual description of cave forms, measurement and recording of the parameters of chambers and passages, photographic documentation, and the compilation of route maps. Particular attention was paid to

the condition of speleothems, traces of anthropogenic impact, and signs of contemporary exogenic processes. The West Kazakhstan and Atyrau regions have a high potential for the development of the tourism industry, as the Caspian Lowland contains many scenic and unusual sites. The strategic measures proposed in the State Concept for the Development of the Tourism Industry of the Republic of Kazakhstan for 2023-2029 will make it possible to create the necessary tourism infrastructure in this area and, consequently, to attract a greater number of domestic and international visitors.

Within the West Kazakhstan and Atyrau regions, three sites have been identified as suitable for the development of guided excursion activities. In the Burlinsky District of the West Kazakhstan Region, this is the Konyskerey Cave, which represents an artificial niche formed within a gully – ravine network. In the Kurmangazy District of the Atyrau Region, the Kenenbay Cave is located on the Besshoky hill, while in the Inder District, the Utemis-Kystau Cave is situated on the Inder hill.

The Atyrau Region is a key region of Kazakhstan. To the north it borders the West Kazakhstan Region (regional center is Uralsk), to the southeast the Mangystau Region (center is Aktau), to the east the Aktobe Region (center is Aktobe), and to the west the Astrakhan Region of the Russian Federation. The area of the region is 118,631 km², and the population was 659,074 people (website of Atyrau region, 2025). Administratively and territorially, the region comprises seven districts – Kurmangazy, Issatai, Makhambet, Inder, Kzylkoga, Makat, and Zhylyoi is a town of regional subordination (Kulsary), and 16 urban-type settlements (Knizhnik, 2017).

RESULTS AND DISCUSSIONS

Konyskerey Cave: At the top of Mount Yessenamantau, there is a rounded crater-like structure, which is the entrance to the Konyskerey Cave (Figure 2). On the vast Yessenmantau Plateau, stretching for several kilometres from the village of Yegindikol in the Karatobe district in the south to the village of Segizsai in the Shyngyrlau district of West Kazakhstan region in the north, for thousands of years, nomads erected hundreds of kurgans – grandiose ancient burial mounds.

A chain of nearly 350 burial mounds and rectangular crypts-sanctuaries of the Lebedevka II complex stretches across the Yessenamantau Plateau from west to east for over 3 km. The Yessenamantau mountain range is named after the great-grandson of the Karabatyrbugenbay, a native of the village of Segizsay.

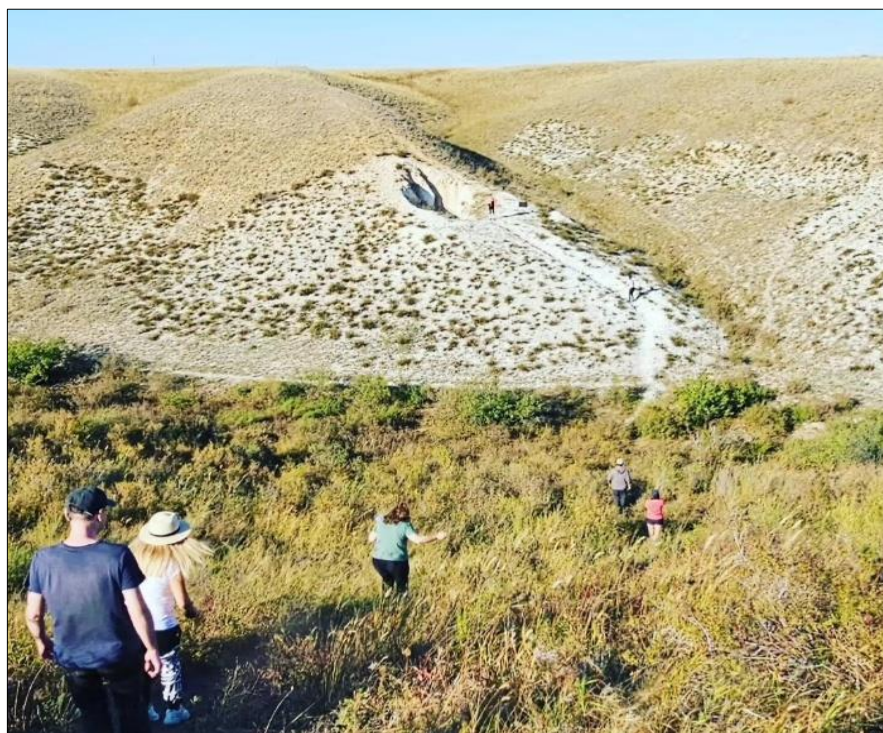


Figure 2. Descent to the Konyskerey Cave (Source: Authors, 2022)

The Yegindikol spring is located near Mount Yessenamantau and emerges in close proximity to the settlement of Yegindikol. Travelers can rest on benches beneath willow trees and enjoy the surrounding views. The Konyskerey Cave is known due to Konyskerey Kozhakhmetov, whose name became widely recognized in the West Kazakhstan and Atyrau regions. He was born in 1895 and, during the Soviet period, served as the chairman of a village council. In 1923, in order to protect his guest who was a fugitive labeled an “enemy of the people”, he was compelled to shoot a police officer, after which Konyskerey was branded a bandit (thug). It should be clarified that in Kazakh usage the term “bandy” does not denote criminals in general, but specifically refers to individuals who offered armed resistance to Chekist officers (security officers).

Following this incident, Konyskerey remained in hiding from law enforcement authorities for a long period. It is believed that under the name Abilkhair Zhamanov he lived until 1968 (Sources, No. 16 (1606), April 17, 2025). The Kenenbay Cave is located on the northeastern margin of the Besshoky hill in the Kurmangazy District of the Atyrau Region (Figure 3). It was first described very briefly by I. B. Auerbach and was later examined in greater detail by Astrakhan

speleologists in 1997-1998. The cave derives its name from a wealthy local bai (a wealthy person) who, according to oral traditions of local Kazakh residents, took refuge in this cave during the turbulent revolutionary years (Golovachev, 2010).

The cave is the most famous and visited underground cavity in the north-eastern part of the Beshoky hill (Golovachev, 2010). The cave is of karst origin and is located in the Lower Permian gypsum of the Kungur stage, which has a slight dip angle (12°) in the north-western direction and a slight slope (3°) to the north-east. The cave is of the corrosion-erosion type. It is a large underground hall with a horizontal floor. The air temperature in the cave is about $+10^\circ\text{C}$. The relative humidity is about 79%. However, due to the large size of the entrance, the temperature and humidity in the cave change significantly throughout the year. The entrance to the cave is blocked in the central part by large blocks of gypsum. The walls and ceiling of the cave are richly decorated with white secondary gypsum crystallization. The cave is easily accessible and has long been visited by local residents. The cave suffers greatly from vandalism by visitors. The walls are covered in graffiti and smoke marks, and household waste is left behind. During scientific expeditions, the cave is regularly cleaned up.

According to author (Akhmedenov, 2017), the power level of the individual equivalent dose $H_p(10)$ (MED) of continuous and pulsed X-ray and gamma radiation in the Kenenbay cave ranged from 0.03 to 0.11 $\mu\text{Sv/h}$, with the current standard of 20 $\mu\text{R/h}$ and the permissible value of 30 $\mu\text{R/h}$, i.e., no excess radiation background was detected and it is not dangerous to be in the cave. The Kenenbay Cave is an interesting natural formation and deserves the status of a geological natural monument. The authors measured the chemical indicators of atmospheric air in the cave area (Akhmedenov & Zhumagaliyeva, 2017). According to the results of the studies, all chemical indicators were within the norm.



Figure 3. Karst sinkhole with the entrance to the Kenenbay Cave (Source: Golovachev, 2025)



Figure 4. Entrance to the Utemis-Kystau cave (Source: Kalmenov, 2022)

The caves in the Inder district of the Atyrau region are located mainly around the salt lake Inder, in an area of karst formations. One of the most famous is the Utemis-Kystau cave, which attracts visitors with its salt structure and unique microclimate. The Utemis-Kystau Cave (Figure 4) (from Kazakh 'Otemis qystau' - 'Otemis' wintering), which is mentioned in the materials of Z.V. Yatskevich (1937). The cave is located in the centre of a large karst basin with a

diameter of about 400 m, located in the eastern part of the Inder hill. The cave is of a corrosion-erosion type, passable, and located near the surface. It is horizontal and was developed in gypsum deposits of the caprock of a salt dome (eIP2-Q). These deposits are highly dislocated and karstified along the strata. The gypsum rock is heterogeneous in its granulometric composition, consisting of alternating layers of dense, fine-grained and coarse-grained material.

The cave has the following parameters: length – 70 m, area – 60 m², volume – 120 m³. Utemis-Kystau is a passage cave. It has two entrances, different in size and morphology. The main entrance to the cave faces north and is large: height – 3.7 m, width – 3 m. The second entrance faces south-southeast and is more modest in size: height about 2 m and width about 1 m. Through it, bypassing a low, short passage, you can enter the entrance chamber, triangular in plan, with an area of about 12 m². The second entrance is located almost 1.7 – 1.8 m above the level of the main entrance. The cave is a large, well-lit underground hall with an area of 24 m², a volume of 45 m³ and a height of up to 1.8-2 m. The hall is connected to a system of cracks and channels of various sizes and morphology. The floor deposits in the cave entrance hall are represented by fine dusty sand covering coarse gypsum debris. In 2025, Astrakhan speleologists collected bone material in the cave for further species identification. The hall is well lit during daylight hours through the entrance and it is easy to find your way around without a torch. Due to its accessibility, the cave has long been frequently visited by people (Rall, 1935).

However, it should be noted that there are no inscriptions or drawings on the walls. But there are car tires, scraps of wire and other rubbish lying around in the cave hall. The overall ecological condition of the cave is satisfactory. Due to the large size of the entrance, the microclimate in the cave is very dependent on surface weather conditions. We conducted a SWOT analysis of tourism development in the region, using caves as the main tourist attractions (Table 1).

Table 1. SWOT analysis

Strengths	Weaknesses
The recreation and tourism sector is listed in the socio-economic development documents of the West Kazakhstan and Atyrau regions as one of the priority areas for regional economic development, which provides institutional support and forms the basis for long-term strategic planning. A positive factor is the steady growth in tourist flows, which indicates growing interest in the region from domestic and inbound tourists and creates the conditions for expanding the tourist infrastructure and the range of services provided.	A significant limiting factor remains the insufficient funding of programs for the development of the tourism and recreation sector of the economy in the West Kazakhstan and Atyrau regions, both from regional budgets and through public-private partnership mechanisms. Limited investment resources, fragmented projects and low involvement of private business are holding back the pace of infrastructure modernization, the introduction of innovative tourism products and the improvement of the regions' competitiveness in the domestic and international tourism markets.
The presence of unique and diverse natural and cultural-historical landscapes and resources, such as the therapeutic Lake Inder, the Saraishik Museum-Reserve in the Atyrau Region, the chalk mountains, the "Khan Ordasy" (Khan's Horde) Museum-Reserve in the West Kazakhstan Region and other sites, creates favorable conditions for the development of a wide range of tourism activities. The potential of the territory allows for the development of recreational, cultural and educational, medical (health and wellness), ecological, rural, scientific and educational, and event tourism, as well as combined tourist routes aimed at different target audiences.	A key weakness is the lack of a clearly defined tourist attraction or 'anchor' project that could serve as a source of sustainable basic tourist traffic and create the conditions for the formation of a full-fledged tourist cluster (e.g., a comprehensive ecological-educational or cultural-historical tourist route). Additional problems remain, such as the unsatisfactory condition of a significant portion of historical and cultural heritage sites, littering of certain natural sites, including caves, and the lack of systematic sanitation and improvement of the territories. Another significant limitation is the underdevelopment of 'soft infrastructure' for tourism, such as navigation, information and visitor centers, excursion and service support, trained guides, digital services, and interpretation of tourist sites.
Gradual resolution of transport accessibility issues in the region through the implementation of major infrastructure projects, including the reconstruction of sections of the Uralsk – Atyrau national highway in 2025 – 2027, the reconstruction of the Uralsk railway station, and the modernization of Atyrau airport, planned for 2026. These measures contribute to increased tourist mobility, improved logistics and greater investment attractiveness in the region. An additional advantage is the intensification of tour operators' activities in developing tourist routes and including them in the official register of tourist routes, which forms the basis for the systematic development of domestic and inbound tourism.	A significant weakness remains the lack of a unified project for the comprehensive development and recreational development of the territory, as well as insufficient coordination of actions by regional authorities in matters relating to the formation of a tourist space. The potential of rational spatial planning, including the development and implementation of comprehensive spatial development and nature conservation schemes, is not being fully exploited. In addition, there is irrational and fragmented use of the unique natural resources of the Caspian Lowlands and other areas of natural tourist interest, which limits the potential for sustainable tourism development and creates risks of degradation of natural ecosystems.
The availability of government support measures for the tourism industry, including subsidies for tour operators' expenses, contributes to increasing the investment attractiveness and sustainable development of the region's tourism sector. A significant competitive advantage is the well-developed roadside infrastructure along the Uralsk – Atyrau national highway, as well as in the cities of Atyrau and Uralsk and the village of Inderbor. This infrastructure includes accommodation facilities, catering, medical services, tourist and excursion services, and related services, which provide the basic conditions for receiving and serving tourist flows.	Key weaknesses include insufficient and not always effective promotion of regional tourism products on international and domestic tourism markets by the Ministry of Tourism and Sports of the Republic of Kazakhstan, the Department of Entrepreneurship and Industrial and Innovative Development of the West Kazakhstan Region, and the Department of Physical Culture, Sports and Tourism of the Atyrau Region. The lack of a comprehensive marketing strategy, poor coordination between authorized state bodies, and limited use of modern digital promotion tools reduce the region's visibility and its competitiveness in the tourism market.
Opportunities	Threats
Financing the tourism cluster in the region from the republican budget, allocated for state capital investments in the form of subsidies, creates the conditions for the formation of economic growth points, the development of interregional ties and an increase in the investment	The existence of unresolved problems with transport accessibility to tourist sites in the region remains a significant threat. These include high airfares and a limited route network, long train journeys, and underdeveloped road infrastructure, including the lack of asphalt

attractiveness of the territory. The implementation of these measures contributes to the revitalization of small and medium-sized businesses, the creation of new jobs and the expansion of the range of tourism services. Additional opportunities are linked to existing and prospective mechanisms of state support for the industry, including subsidies for tour operators in the field of inbound tourism for each foreign tourist attracted, reimbursement of up to 10% of the costs of construction and reconstruction of tourist facilities, compensation for the purchase of tourist buses, and other measures to stimulate investment activity in the tourism industry.	pavement on certain sections, which reduces the tourist appeal of the area. In order to minimize these threats, it is necessary to expand state support measures, including increasing the share of reimbursement for the purchase of tourist buses to 50% from local budgets, developing and subsidizing small aviation and water transport, as well as comprehensively developing the region's transport and logistics infrastructure.
There is sustained interest on the part of developed tourist clusters in the Russian Federation in creating and developing international tourist clusters in the region. This direction opens up opportunities for cross-border cooperation, joint implementation of investment and infrastructure projects, exchange of experience and best practices in the field of tourist area management, as well as the formation of a competitive international tourist product.	The likely redistribution of tourist flows from residents of border regions of the Russian Federation in favour of alternative tourist destinations and clusters with more developed infrastructure and active marketing policies, which may slow down the growth of tourist flows to the West Kazakhstan region. An additional threat is the high level of competition from neighboring tourist regions, as well as the dependence of cross-border projects on foreign policy, economic and transport and logistics factors.
The development of the recreation and tourism sector based on the principles of rational nature management is considered one of the priority areas for the development of science, technology and engineering in the Republic of Kazakhstan. This direction is consistent with strategic government documents in the field of sustainable development, environmental protection and economic diversification. Projects in the field of ecotourism, cultural and educational tourism, and scientific tourism receive funding from various sources, including grant programs from the Ministry of Science and Higher Education of the Republic of Kazakhstan, state target programs, and public-private partnership mechanisms. Additional opportunities are created by the growth of domestic tourism, the digitalization of the tourism industry, and the integration of scientific developments into the management of tourist areas.	One of the main threats is insufficient promotion of tourism products on international and domestic tourism markets, which reduces their competitiveness and investment attractiveness. A significant limiting factor is the lack of sustainable partnership and coordination between the scientific community, government agencies and business structures. In addition, the weak development of tourism infrastructure in certain regions, the shortage of qualified personnel, and the risks of degradation of natural and cultural sites due to non-compliance with the principles of sustainable and rational nature management have a negative impact.

The results obtained provide important information for the further development of a system of marketing activities aimed at overcoming threats, eliminating weaknesses, strengthening strengths and developing opportunities in the tourism and recreation sector in Western Kazakhstan. Employees of the West Kazakhstan Tourism Association have laid out tourist and excursion routes through the caves under study, along which tourist groups are accompanied on excursions (Figure 5).

The development of the tourist and scientific route “Uralsk – Yegindikol village – Konyskerey cave” is aimed at studying and popularizing little-explored natural sites in the West Kazakhstan region, as well as developing scientific and educational tourism in the steppe zone of the region. The route is focused on a comprehensive study of the geomorphological and landscape features of the Karatobe District.

Geographical location and territorial boundaries

The route begins in Uralsk, the administrative center of West Kazakhstan Region, and runs southeast through the Karatobe District, ending in the village of Yegindikol. The Konyskerey Cave is located in the vicinity of the settlement and is associated with a natural massif formed in a dry steppe climate. The route area is characterized by flat terrain, a slightly dissected surface and a predominance of steppe landscapes, which creates specific conditions for the formation of karst and pseudokarst landforms.

Route length and logistics

The total length of the route is on average 240 – 260 km (one way). Most of the route is along asphalt roads, with the final section along local dirt roads. The last stage of the route involves walking to the research site.

The recommended duration of the route is 1 – 2 days. The most favorable period for completing the route is from April to October, due to the climatic conditions of the region.

Stages of the route

The first stage: Uralsk – regional center of Zhympity.

This section of the route is used as a transit route and allows for initial landscape and geographical observations to be made, recording changes in vegetation cover and anthropogenic impact as one move away from the regional center (sanitary stop and petrol station).

The second stage: Zhympity, Yegindikol village.

This section of the route focuses on local history. Visitors can observe the characteristics of rural settlement, traditional land use and the adaptation of the population to the conditions of the steppe zone.

The third stage: Yegindikol village – Konyskerey Cave.

The final stage involves visiting the natural site of the study. Accessing the cave requires orientation in the terrain and preliminary reconnaissance, which makes this site important from the point of view of field research.

Brief scientific description of the Konyskerey Cave (route 1, Figure 5)

The Konyskerey Cave is a local natural feature formed as a result of geological processes characteristic of the flatlands

of Western Kazakhstan. The cave is one of the least studied and insufficiently described features, which determines its scientific value. The site is of interest for: geomorphological research; studying karst formation processes; analyzing the natural heritage of the Karatobe District. The cave's significance is further enhanced by its reflection in local toponymy and oral traditions, which allows the site to be viewed in the context of the natural and cultural landscape.

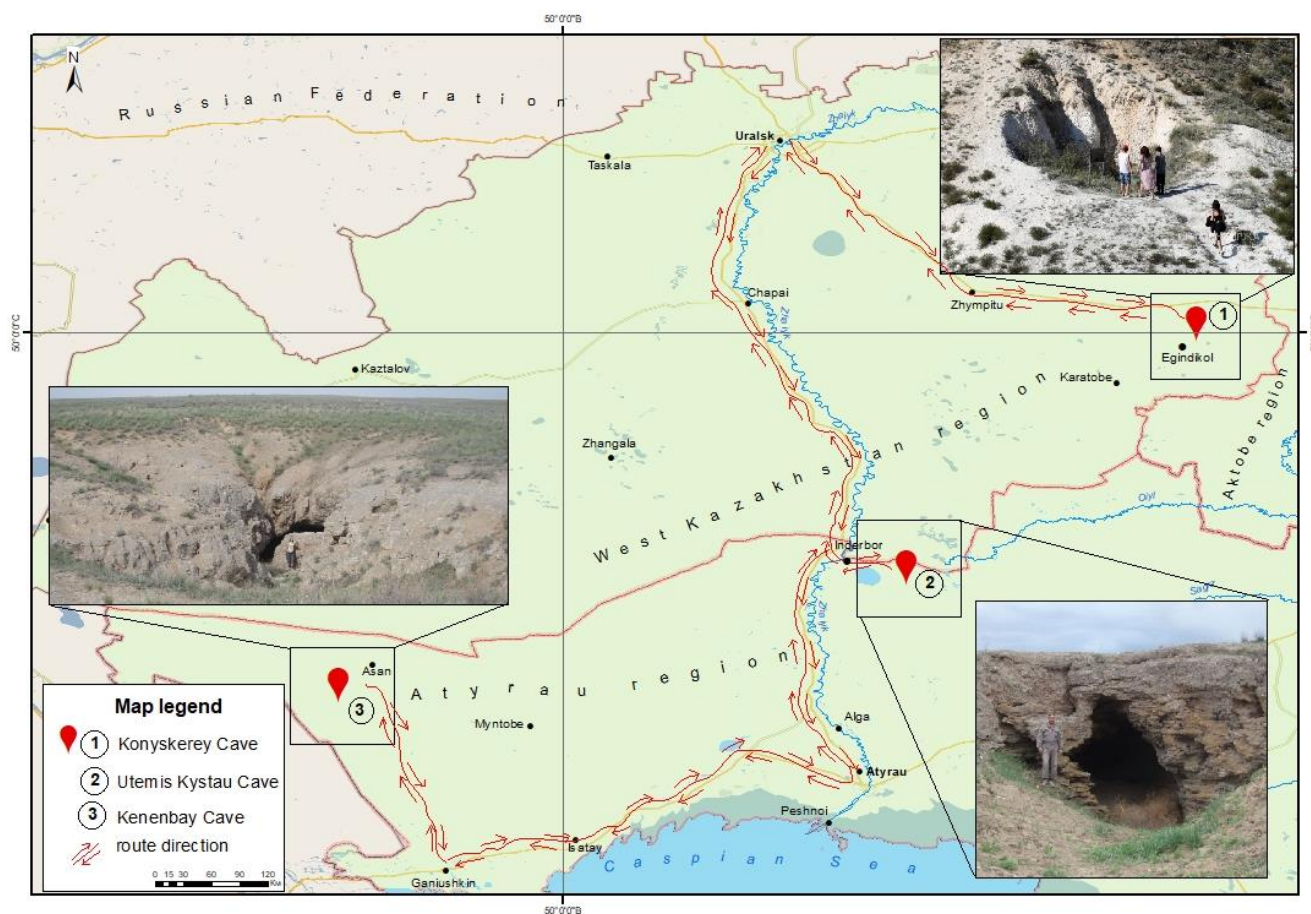


Figure 5. The map-scheme of localization of cave sites in the territory of Western Kazakhstan (Author A. Kishibekova)

General description of the route to the Kenenbay Cave (route 3, Figure 5)

In order to develop scientific, educational, ecological and geological tourism in Western Kazakhstan, a tourist and excursion route has been developed: “Uralsk – Atyrau – Kurmangazy – Assan – Besshoky – Kenenbay Cave – Assan – Kurmangazy – Atyrau – Uralsk”, focusing on the study of karst landforms, cave sites and related geomorphological structures of the Caspian Lowlands. The route is of interest to specialists in the fields of Geography, Geology, and Speleology, as well as to tourists interested in scientific, educational, and expeditionary forms of travel.

The total length of the route is approximately 700 – 750 km (circular route). The approximate travel time is 8 – 10 hours without stops. The recommended duration of the route is 2 – 3 days, depending on the research objectives, the scope of field observations, and the degree of detail of the inspection of natural objects.

Geographical location and transport accessibility

The route begins in the city of Uralsk, the administrative center of the West Kazakhstan Region. It then continues south and southwest through the Atyrau region, passing through the cities of Atyrau and Kurmangazy, before reaching the village of Assan and the Besshoky hills, where the Kenenbay cave is located.

The Kenenbay Cave is located in the salt dome and gypsum-bearing structures of the north-eastern part of the Caspian Depression, in an area of karst processes. The route is considered to be reasonably accessible by transport: most of the route runs along asphalt-covered roads of republican importance; access to the Besshoky site and the Kenenbay Cave is via dirt and country roads; at the final stage, it is recommended to use off-road vehicles; the optimal season for the route is from April to October, with stable weather conditions.

Natural and scientific characteristics of the route area

The route passes through the Caspian Lowland, which is characterized by flat terrain, a slightly dissected surface and the development of salt dome structures. The geological structure of the territory has led to the widespread distribution of karst and pseudokarst landforms, including caves, sinkholes, swallow holes and suffusion lowlands.

The Besshoky hill is a local salt dome uplift with outcrops of gypsum and salt-bearing rocks, which created favorable conditions for the formation of various types of underground cavities.

The territory is characterized by a low degree of anthropogenic transformation and is one of the least studied karst areas, which increases its scientific and environmental value.

Stages of the route

The first stage: from Uralsk to Atyrau.

This is a transit section of the route, used to travel between regional centers. At this stage, it is possible to observe the change in natural conditions from steppe to desert landscapes.

The second stage: from Atyrau to Kurmangazy.

The third stage: Kurmangazy – Assan – Beshoky.

This section of the route has a distinct scientific and field focus. Manifestations of salt dome tectonics and karst landforms are recorded.

The fourth stage: from Besshoky to Kenenbay Cave.

The final stage involves a hike to the research site. The return trip follows the same route in the opposite direction.

Brief scientific description of the Kenenbay Cave

The Kenenbay Cave is a natural karst formation created in gypsum-bearing and salt-bearing rocks. The cave is one of the little-studied and insufficiently described speleological sites in Western Kazakhstan. The cave is characterized by: the development of underground cavities in conditions of salt-gypsum karst; the presence of morphological signs of active and relict karst processes; potential microclimatic contrasts; high vulnerability to anthropogenic impact.

Cave is of interest for speleological and geomorphological research; studying karst formation processes in arid climates; and developing scientific, educational and ecotourism activities. It is recommended that the site be inspected in the company of specialists, with mandatory compliance with safety requirements and principles of natural heritage protection.

General description of the route to the Utemis-Kystau (route 2, Figure 5)

In order to develop scientific, educational, eco and geotourism in Western Kazakhstan, a tourist and excursion route ‘Uralsk – Inder District of Atyrau Region’ was developed, focused on studying karst caves and geomorphological objects of the Inder Plateau. The route is of interest to specialists in the fields of geography, geology, and speleology, as well as to tourists interested in scientific and educational travel.

The total length of the route is ~360 km, the approximate travel time is ~4 hours 30 minutes, and the duration is 1 – 2 days, depending on the format of the study and the depth of exploration of natural objects.

Geographical location and transport accessibility

The route begins in the city of Uralsk (Oral), the administrative centre of the West Kazakhstan Region, located in the north-western part of the Republic of Kazakhstan. The route then continues southwards along national and regional motorways towards the Atyrau Region, ending in the Inder District. The route’s transport accessibility is rated as satisfactory: most of the route is on paved roads; the last 5 – 10 km to the karst sites in the Inder district are on dirt roads, which require the use of off-road vehicles; the route can be used during the warm season (from April to October).

Natural and scientific characteristics of the Inder district

The Inder district is located within the Caspian Lowland and is characterized by a complex geological structure. Formed as a result of salt-dome tectonics, the Inder Plateau exhibits active karst processes and therefore constitutes an area of considerable scientific significance. The main natural attractions along the route are: karst caves of varying depths and lengths; karst sinkholes and chasms; the salt lake of Inder; and mineral formations associated with salt and gypsum rocks.

This area is one of the least studied karst territories in Western Kazakhstan, which increases its scientific value.

Karst caves in the Inder district as a destination for scientific tourism

The karst caves of the Inder district are formed mainly in salt and gypsum deposits. They are characterised by: underground cavities up to 20 – 30 metres deep; sharp temperature contrasts, including areas with lower air temperatures; ice and crystal formations of interest for mineralogical research; signs of active and relict karst processes.

Caves can be used as objects of speleological research; sites for studying geomorphology and palaeoclimate; resources for the development of scientific and educational tourism.

It is recommended that caves be explored in the company of specialists and in compliance with safety requirements.

CONCLUSION

The study found that caves Konyskerey, Kenenbay, Utemis-Kystau are unique natural objects of high scientific, educational and recreational value. Their importance for the development of scientific tourism is determined by the opportunity to study geological structures, speleogenesis processes, palaeogeographical and palaeoecological conditions, as well as traces of ancient biota and human activity preserved in the underground environment.

It is shown that caves constitute a promising basis for the development of educational tourism, as they are characterized by morphological diversity, varying degrees of accessibility, and specific natural conditions. This contributes to the expansion of the range of active forms of tourism and enhances the tourist attractiveness of regions with well-developed karst systems. At the same time, it has been identified that cave ecosystems are highly vulnerable to anthropogenic impacts. Uncontrolled visitation and the absence of scientifically substantiated regulations for use may lead to the degradation of the subterranean environment and the loss of valuable scientific information. In this regard, the necessity of a comprehensive

approach to cave utilization is substantiated, including scientific monitoring, zoning, limitation of recreational pressure, and the development of visitation guidelines. Thus, the rational use of caves for the development of scientific and educational tourism is possible only through the integration of tourism activities with conservation and protection measures for subterranean natural heritage, thereby ensuring their long-term scientific and socio-economic significance.

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