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**THE RESULTS OF KARSTOLOGICAL AND SPELEOLOGICAL
OBSERVATIONS CARRIED OUT ON THE TERRITORY OF WESTERN KAZAKHSTAN
DURING THE EXPEDITION OF THE M. UTEMISOV WKU IN MAY 2022**

Annotation. The article presents some results of field karstological and speleological studies included in the list of tasks assigned to the complex scientific and educational expedition "Natural Heritage of the Northern Caspian Sea". During the expedition work, scientists examined and mapped the artificial Imankara cave (aka Nobel Cave) on the slope of Mount Imankara and the newly found Makhambet cave on the Aktolagai rise. A section of karst relief on the northeastern shore of Lake Inder was also surveyed to give the status of a specially protected natural area in order to preserve it.

Keywords: sulphate karst; karst landscape; karst relief; karst rocks; Western Kazakhstan; Northern Caspian, Inder Lake; Imankara Mountain, Imankara Cave (Nobel), Makhambet cave, Aktolagai uplift.

Introduction

On the territory of the Northern Caspian there are small scattered karst areas. They are associated with the appearance on the daytime surface of ancient Late Paleozoic rocks, represented, as a rule, by strongly dislocated Lower Permian gypsum in the cores of salt domes. The tops of some salt diapirs were brought to the surface of the earth and exposed ancient sedimentary rocks of Paleozoic and Mesozoic age. The raised rocks are actively exposed to various exogenous processes.

Various scientists and research organizations have been engaged in the study of these disparate karst areas to varying degrees. Since the XVIII century, many famous scientists have conducted their research on the salt-dome uplifts of the Northern Caspian: I.I. Lepekhin, I.G. Gmelin, P.S. Pallas, M. Tausher, I.F. Erdman, I.B. Auerbach, G.P. Fedchenko, I.G. Glushkov, A.A. Bobyatinsky, I.V. Musketov, F.N.. Chernyshev and many others [1]. However, even today these territories attract the attention of researchers of various scientific fields.

In the period from April 25 to May 10, 2022, an international scientific and educational expedition "Natural Heritage of the Northern Caspian Sea" was held, dedicated to the celebration of the 90th anniversary of the Makhambet Utemi-sov West Kazakhstan University. The purpose of the expedition was a comprehensive study of the natural heritage of the Northern Caspian Sea within the framework of the implementation of a set of activities under the projects: "Tuganger", "Central geography of Kazakhstan" of the program "Rukhani Zhangyru". The tasks of the expedition included:

- identification and inspection of natural monuments in the study area;
- taking photos and videos of natural objects along this route;
- zoological, botanical, paleontological, geological and geomorphological studies;
- identification of the aesthetic appeal of the studied area;
- development of recommendations and methodological guidelines for the creation of a territory aimed at the development of tourist recreation and the creation of protected areas.

The expedition team consisted of 11 specialists, including: ornithologists, herpetologists, paleontologists, botanist, karstologist. Scientists gathered from different cities of Russia (Astrakhan, Tolyatti, Kazan, Orenburg) and Kazakhstan (Uralsk). In 16 days, more than 4,000 km were covered on the territory of 4 regions of Western Kazakhstan.

Materials and methods of research

The methodological basis of the study was the published works of domestic and foreign authors in the field of research on the development of karst processes, as well as the author's own research. The article used the following methods: analysis of literary sources, historical, deduction, statistical, field field studies.

Research results

One of the objects of the study was the Aktolagai chalk plateau, the length of which is about 90 km with a width of up to 5-10 km. Its maximum height reaches +302 m (Nartobe). It is located in the Bayganinsky district in the west of the Aktobe region of the Republic of Kazakhstan. The plateau is composed of Upper Cretaceous and Lower Pleistocene deposits. The relief surrounding the plateau is an alternation of salt domes, expressed on the surface by groups of hills and ridges up to 60-80 meters high, with co-rami and takyrs located in the inter-dome spaces. Four salt domes adjoin the plateau: Kuldy-Kuduk, Tolagai, Chili-Sai and Alasha-Kazgan. Salt cu-floors are uplifts of various shapes, often limited by faults.

During the fieldwork, expedition member Mikhail Shpigelman discovered a new small cave cavity on the Aktolagai chalk plateau (Coordinates: N=47°31'04.6"; E=055°07'07.7"). The cave is embedded in the Cretaceous rocks composing the Aktolagai plateau.



Fig.1. Entrance No. 1 to Makhambet cave
photo by M.I. Shpigelman)

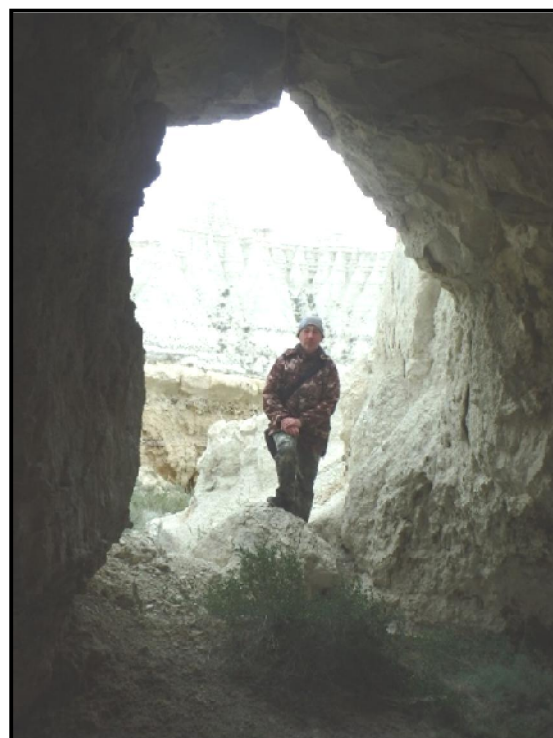


Fig.2. View from the cave
(photo by I.V. Golovachev)



Fig. 3. Entrances No. 2 and No. 3 to the cave
(photo by I.V. Golovachev)

Fig.4. Entrances No. 2 and No. 3 view from the cave
(photo by I.V. Golovachev)

It has an erosive-gravitational origin. No obvious traces of the karst process were found. At the base of the pack of Cretaceous rocks at the level of the cave floor there is a layer of loose sandy sediments, which is eroded by a temporary flow of meltwater and rainwater flowing through the cave. As a result, the collapse of the cretaceous rocks located above occurs. The cave has three entrance openings (Fig.1-4). The largest entrance has the dimensions: the height is 3 m, the width is 2 m. Due to the large size of the entrance hole, the cave is well lit inside. You can visit the cave in the daytime without having a flashlight. The height of the cave hall reaches up to 1.7-2 m. The average length is 9.3 m, and up to a maximum of 12 m. The width of the cave is up to 3.3 m. According to the topographic survey, the cave area is 50 m², the volume is 81 m³, the total length is 18 m. The expedition participants Ilya Golovachev and Mikhail Shpigelman examined and mapped this cave cavity (Fig.5). Since the cave did not have its own name, it was decided to name it "Makhambet" in honor of Makhambet Utemisov.

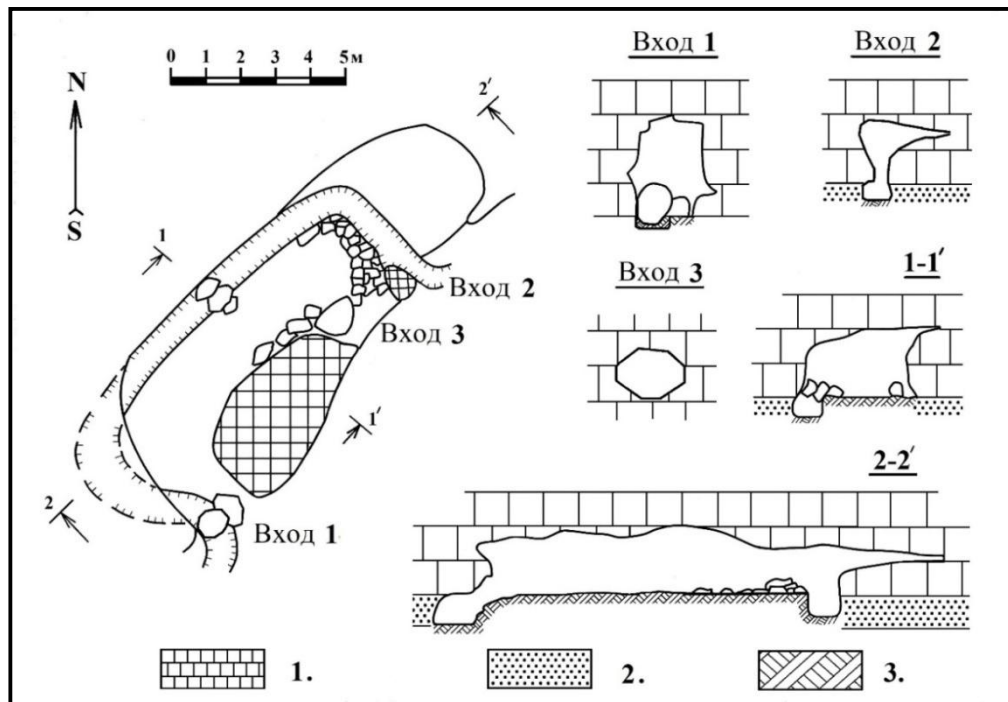


Fig.5. Topography of Makhambet cave
(Shooting: I.V. Golovachev, M.I. Shpigelman, May 2022)
Symbols: 1. – chalk; 2. - sand; 3. – deluvium.



Fig.6. View inside the Makhambet cave (photo by I.V. Golovachev)

Another interesting underground object, which was examined by the members of the expedition, was discovered on the western slope of Mount Imankara, a low salt dome elevation located in the north-east of the Caspian lowland, on the territory of the Zhylyoy district of the Atyrau region of the Republic of Kazakhstan. The rise of the Imankara has a radius along the sole of about 8-10 km, with an absolute height of up to 200 m. In the western slope of Mount Imankara there is an entrance to the cave of the same name, which, judging by the information plate located next to the entrance, is a monument of the early Iron Age and is protected by the state (Fig.7, 8).



Fig.7. Information plat
(photo by I.V. Golovachev)



Fig.8. Entrance to the cave of Imankar (Nobel)
(photo by I.V. Golovachev)

Expedition members Ilya Golovachev and Serik Ramazanov examined and mapped the Imankara cave (Coordinates: N=47⁰24'16.8"; E=054⁰27'29.5"). This is a subhorizontal cavity of rectangular cross-section, cut artificially in sedimentary sandy-clay deposits. The host sedimentary rocks lie monoclinally with a fall to the east at an angle of 20⁰. The main course of this underground mine has a length of up to 12 m. And branches branch off from it in both directions. The entrance opening is 2.2 m wide, with a height of up to 1.6 m. Through such a large hole, the central passage is well illuminated during daylight hours. In cross-section, the passages have the shape of a trapezoid (Fig.9). In the vaulted part, they are slightly narrower than in the lower part, located at floor level. The walls and ceiling are uneven. On the walls of the cave, the traces of chopping tools with which the cave itself was cut down are clearly visible, as well as a large number of scratched inscriptions left by numerous visitors (Fig.10). The walls are blackened with

torches and bonfires. Traces of the remains of the fire are in the depths of the cave. Cracks in the walls and in the vault are made with a six-sided (selenite-like) gypsum, which was deposited from solutions rich in calcium sulfate and circulated through cracks in the array. The thickness of such gypsum layers is about 3-5 mm. The floor is not smooth and is covered with loose deposits that have fallen from the vault and brought from the surface by temporary flows of meltwater and rainwater. There are rare streaks of small bird droppings on the walls and the vault, and an old swallow nest was found in the entrance fork on the vault.



Fig.9. View inside the mine
(photo by I.V. Golovachev)

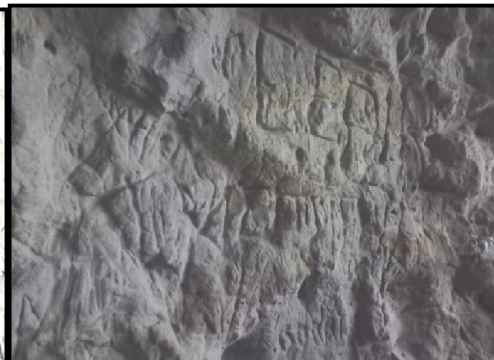


Fig.10. Inscriptions on the walls
(photo by I.V. Golovachev)

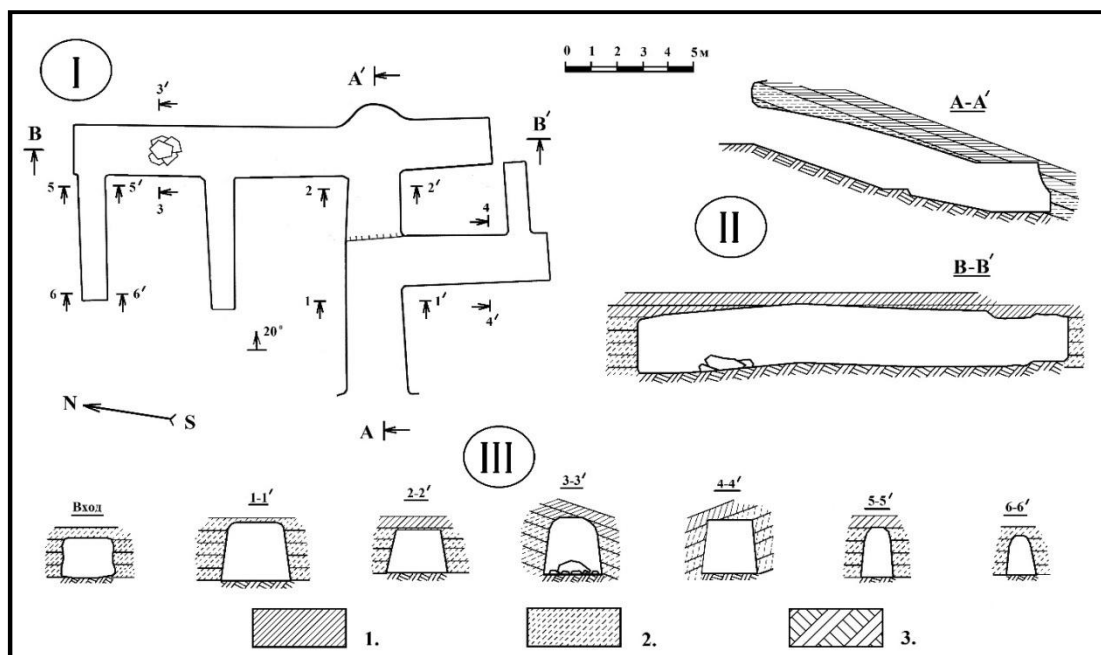


Fig.11. Topography of the Imankara cave
(Shooting: I.V. Golovachev, S.K. Ramazanov, May 2022)

I.-Plan; II.- Sections; III.- Sections.

Symbols: 1. – loam; 2. - sandy loam; 3. – deluvium

In the right entrance fork, the rocks composing the walls and the conditions of their occurrence are clearly visible. From the bottom up, the rocks are represented by: red-colored fine-grained sandstones (0.55 m), light yellow-brown loose sandy loams (0.55 m), brown dense sandy loams (0.40 m), light brown loose sandy loams (0.45 m), yellow-brown heavy loams overlap them.

According to the topographic survey, the area of this artificial cavity is 75 m², the volume is 150 m³, the total length is 55 m. The air temperature in the central part of the underground cavity is +15.6⁰, and the air humidity is 58.9%. In the distant parts, a dangerous degree of radioactivity up to



1.3-1.5 mSv was detected. Apparently, it is associated with the presence and accumulation of radon gas. This is also supported by the fact that these areas have very weak natural ventilation. However, the red-colored fine-grained marine sandstones exposed before the entrance also showed a high level of radiation up to 0.5 mSv.

Imankara Cave has another popular name - Nobel Cave. According to local residents, this Swedish entrepreneur bought a concession for the development of Emba oil fields in 1911 and was engaged in oil prospecting. During the hot summer period, this man-made cavity was used by its workers as a warehouse and as a place of rest. It is not known for certain by whom and for what the underground cavity itself was cut down. But probably there was originally a natural deep niche at this place, which served as a parking lot for our ancestors back in the Early Iron Age.

The cave of Imankar (Nobel) is also popularly known for the fact that in this cave in May 1944, a fascist sabotage group from among the soldiers of the Turkestan Legion, abandoned in the Kazakh steppes in order to organize sabotage in the oil fields, was destroyed by the chekists.

One of the most interesting geomorphologically is the area around Lake Inder, which is located on the left bank of the Ural River and represents a salt dome uplift in the form of a plateau-like elevation, raised 20-25 meters above the surrounding steppe. The arched part of the Inder salt dome is composed of Lower Permian deposits of the Kungur tier (rock salt with anhydrite, potassium-magnesia salts) and has an area of about 250 km². On top of the ancient Permian deposits, there are keprock deposits with a thickness of about 60 m, represented by a thickness of eluvial gypsum (eIP2-Q). The northern and northeastern shores of Lake In-der are actively karst. The sulfate karst is widely developed here.

During the survey of the surroundings of the Inder salt Lake in previous expeditions, a large section of the karst land shaft located on its northeastern shore was not disturbed by anthropogenic factors[2-4]. During the expedition operations in May 2022, this site was examined in detail by specialists of various scientific fields and unanimously recognized by all as worthy of giving it the status of a specially protected natural area. On this site there are technogenically untouched gypsum mounds with huge discontinuous karst basins of natural genesis, there are mounds raised, but not yet collapsed, there are a large number of various karst craters, open discontinuous faults in gypsum rocks are observed, nests of various birds, including the steppe eagle, are noted. In addition, there are five caves of various genesis, morphology and morphometry on this site. It is recommended to allocate the site to the very coast of Lake Inder, then the change of micro-landscapes and relief will be clearly visible. The total area of the proposed landscape (complex) nature reserve will be about 20.0 km².

Conclusion

As a result of the conducted field studies, new data were obtained that allow us to revise existing ideas about the prospects for the creation of specially protected natural territories in the salt-dome territories of Western Kazakhstan within the boundaries of the Caspian Depression. In karstological and speleological terms, the Northern Caspian is still rather poorly studied and its further systematic study is required. Natural and man-made caves and workings require identification, accounting and mapping. Many underground objects still do not have topographic surveys and morphometric characteristics, despite their wide popularity and mass attendance as tourist sites. It is also necessary to continue work on identifying speleological, speleostological objects and karst landforms that are valuable in natural and (or) historical and cultural significance, which need to be given a conservation status.

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Головачев И.В.

**2022 ЖЫЛҒЫ МАМЫРДА М.ӨТЕМІСОВ АТЫНДАҒЫ БҚУ
ЭКСПЕДИЦИЯСЫ КЕЗІНДЕ БАТЫС ҚАЗАҚСТАН АУМАҒЫНДА ЖҮРГІЗІЛГЕН
КАРСТОЛОГИЯЛЫҚ ЖӘНЕ СПЕЛЕОЛОГИЯЛЫҚ БАҚЫЛАУЛАРДЫҢ
НӘТИЖЕЛЕРІ**

Аннотация. Мақалада "солтүстік Каспийдің табиғи мұрасы" кешенді ғылыми-білім беру экспедициясының алдына қойылған міндеттер тізбесіне енгізілген далалық карстологиялық және спелеологиялық зерттеулердің кейбір нәтижелері келтірілген. Экспедициялық жұмыс барысында ғалымдар Иманқара тауының баурайындағы жасанды Иманқара үңгірін (сонымен қатар Нобель үңгірі деп те аталады) және жақында табылған Ақтолағай төбесіндегі Махамбет үңгірін зерттеп, картаға түсірді. Сондай-ақ, Индер көлінің солтүстік-шығыс жағалауындағы карст рельефінің учаскесі оны сақтау мақсатында ерекше қорғалатын табиғи аумақ мәртебесін беру үшін зерттелді.

Кілт сөздер: сульфатты карст; карсттық ландшафт; Карсттық рельеф; карст жыныстары; Батыс Қазақстан; Солтүстік Каспий, бұғы көлінде; Иман-қара тауы, Иманқара үңгірі (Нобель), Махамбет үңгірі, Ақтолағай көтерілісі.

Головачев И.В.

**РЕЗУЛЬТАТЫ КАРСТОЛОГИЧЕСКИХ И СПЕЛЕОЛОГИЧЕСКИХ
НАБЛЮДЕНИЙ, ПРОВЕДЁННЫХ НА ТЕРРИТОРИИ ЗАПАДНОГО КАЗАХСТАНА
В ХОДЕ ЭКСПЕДИЦИИ ЗКУ ИМЕНИ М. УТЕМИСОВА
В МАЕ 2022 ГОДА**

Аннотация. В статье изложены некоторые результаты полевых карстологических и спелеологических исследований, входивших в перечень задач, поставленных перед комплексной научно-познавательной экспедицией "Природное наследие Северного Прикаспия". В ходе экспедиционных работ учёными были обследованы и закартированы искусственная пещера Иманкара (она же пещера Нобеля) на склоне горы Иманкара и вновь найденная пещера Махамбет на поднятии Ақтолағай. Также был обследован участок карстового рельефа на северо-восточном берегу озера Индер, для придания статуса особо охраняемой природной территории в целях его сохранения.

Ключевые слова: сульфатный карст; карстовый ландшафт; карстовый рельеф; карстующиеся породы; Западный Казахстан; Северный Прикаспий, озеро Индер; гора Иманкара, пещера Иманкара (Нобеля), пещера Махамбет, поднятие Ақтолағай.