ISSN 2713-0290

СПЕЛЕОЛОГИЯ И СПЕЛЕСТОЛОГИЯ

МЕЖДУНАРОДНЫЙ НАУЧНЫЙ ЖУРНАЛ

№1 2021

SPELEOLOGY & SPELESTOLOGY

СПЕЛЕОЛОГИЯ И СПЕЛЕСТОЛОГИЯ №1 2021

УДК 551.44 | Обзорная статья

К ИСТОРИИ ПЕЩЕРЫ-РУДНИКА КАН-И-ГУТ

А. Г. Филиппов[1], В. В. Цибанов[2]
[1]Карст Ресёрч Инс., Эйрдри, Альберта, Канада, andrei_filippov@hotmail.com
[2]Клуб спелеологов МГУ, Москва, Россия, tsibanoff@gmail.com

Кан-и-Гут является одной из наиболее изученных древних пещер-рудников в Средней Азии. Её особенностью является сочетание естественной пещеры, сформированной сернокислотным (рудным) карстом, и гидротермально-метасоматического серебро-полиметаллического месторождения. Наличие богатой серебро-свинцовой руды привлекло человека и обусловило разработку месторождения, начиная с II–III вв. н. э. Пик добычи руды, судя по обилию археологических находок, пришёлся на IX–XI вв. В непосредственной близости от пещеры-рудника обнаружено поселение средневековых горняков, до сих пор не изученное археологами. В XI в. рудник был заброшен и лишь изредка посещался местными жителями. Таинственные, бесконечные, запутанные объёмные лабиринты, мрачные огромные чёрные залы и пропасти, обилие всепроникающей бурой и чёрной пыли породили множество легенд и слухов о сокровищах, духах, драконах, спрятанной библиотеке Тамерлана, пропавших и погибших смельчаках и осуждённых преступниках. После присоединения Кокандского ханства к Российской империи пещера-рудник стала интенсивно изучаться сначала любителями-археологами, а затем профессиональными геологами, академическими экспедициями и отдельными учёными разных специальностей (археология, карстоведение, палеонтология, биология, хироптерология и др.). Геологоразведочные работы были осуществлены в 1933–1935 и 1948–1950 гг. и завершились промышленной добычей руды в 1950–1955 гг. Позднее Кан-и-Гут стал объектом многочисленных спелеологических, научно-исследовательских, геолого-поисковых и ревизионно-оценочных экспедиций. Данная статья посвящена истории исследований и разработок пещеры-рудника. Она содержит наиболее полную библиографию о Кан-и-Гуте, когда-либо опубликованную.

Ключевые слова: *Фергана, Кан-и-Гут, Средневековье, пещера-рудник, археология, геология, полиметаллы, серебро.*

UDC 551.44 | Review Article

TO THE HISTORY OF KAN-I-GUT CAVE MINE

A. G. Filippov[1], V. V. Tsibanov[2]
[1]Karst Research Inc., Airdrie, Alberta, Canada, andrei_filippov@hotmail.com
[2]Moscow University Cavers Club, Moscow, Russia, tsibanoff@gmail.com

Kan-i-Gut is one of the most studied ancient cave mines in Central Asia. Its peculiarity is the combination of a natural cave formed by sulfuric acid karst and a hydrothermal-metasomatic silver-polymetallic deposit. The presence of rich silver-lead ore attracted man and led to the development of the deposit, starting from the 2nd–3rd centuries CE. The peak of ore mining, according to the abundance of archaeological finds, fell on the 9th–11th centuries. A settlement of medieval miners, that has not yet been studied by archaeologists, was discovered in the immediate vicinity of the cave mine. In the 11th century, the mine was abandoned and only occasionally visited by local inhabitants. Mysterious endless, tangled 3D labyrinths, gloomy huge black halls and abysses, an abundance of all-pervading brown and black dust gave rise to many legends and rumors of treasures, spirits, dragons, the hidden library of Tamerlane, the lost and dead brave souls and convicted criminals. After the annexation of the Kokand Khanate to the Russian Empire, the cave mine began to be intensively studied first by amateur archaeologists, and then by professional geologists, academic expeditions and individual scientists of various specialties (archaeology, karstology, paleontology, biology, chiropterology, etc.). Geological exploration work was carried out in 1933–1935 and 1948–1950 and ended with industrial mining in 1950–1955. Later, Kan-i-Gut became the object of numerous caving, scientific research, prospecting and revisory expeditions. The purpose of this article is to outline the history of the studies and developments of the cave mine. It contains the most complete bibliography on Kan-i-Gut ever published.

Keywords: *Ferghana, Kan-i-Gut, Middle Ages, cave mine, archaeology, geology, polymetals, silver.*

Introduction

Kan-i-Gut is one of the most explored cave mines in Central Asia. Information about it is scattered in numerous publications, departmental and other publications, and in some speleological reports. At the same time, due to the fact that a number of publications, especially early ones, in the late 19th — early and mid-20th centuries were

made in local small editions, they became a bibliographic rarity. Geological reports are also scattered among geological funds in Russia, Kyrgyzstan, Tajikistan, and Uzbekistan and none of the archives has a complete set of them. It's worth to note the fact that karstologists and speleologists were not aware of many important works written by exploration geologists and archaeologists. The purpose of this article to put in chronological order the material found and to light bibliographies of studies concerning the cave. Also, we decided to add data on popular books, chapters, articles, fiction and documentary films about Kan-i-Gut. We hope that the following information will be useful not only for future scientific researchers but for anybody who has a desire to understand this incredible cave mine.

A number of data about archaeological finds (ceramics, chirags, tools, coins) in and near the cave, the remains of medieval wooden supports of an ancient mine, inscriptions on stone near the entrance to the cave and inside it, epochs of mining activity are scattered in the scientific literature [1; 17; 18; 40; 41; 60–62; 68; 71; 74; 88; 114].

Biologists and parasitologists have published a number of materials about Kan-i-Gut bats, their parasites and ticks that parasitize other small mammals of the cave mine area [8; 33–34; 44; 56; 78; 98–100].

The beginning of Common Era

There is no exact information about when the mining of ore began in the Kan-i-Gut cave. The first evidence of mining in the cave and in its immediate vicinity dates back to the 2nd–3rd centuries CE. Thus, archaeologists B.A. Litvinsky and E.A. Davidovich of the Institute of History, Archeology and Ethnography of the Academy of Sciences of the Tajik SSR from Stalinabad were able to establish in 1952 that the mine had already been developed in the epoch of the Kushan Empire. They described a ceramic bowl from Kan-i-Gut, characteristic of the Kushan period. It was made on a potter's wheel and is close to the Kushan bowls from Khaidarkan [16, p. 155–156].

On the surface, when examining the remains of a mine settlement located immediately south of the Main entrance, fragments of ceramics were collected, presumably dated to the end of the slave-holding epoch (4th–5th centuries CE) – the period of the 5th–8th centuries CE [16, p. 182–183].

Fragments of ceramics of the 2nd–3rd centuries CE were found in 1965 by Tashkent archaeologists G.Ya. Dresvyanskaya and E.B. Pruger on ancient rectangular ore hand picking sites with pieces of raw ore stretching from the main entrance of the cave [74, p. 38]. At the same time, academician M.E. Masson believed that it is still unclear whether ore was mined at that time, and if it was mined, then to what extent.

Medival period (6th–12th CE)

Geologist A.F. Sosedko discovered in 1933 the remains of a mine settlement in the immediate vicinity to the south of the Kan-i-Gut cave mine [111, p. 62–64; 112]. He collected numerous fragments of ceramic pottery, chirags (oil lamps), which, together with ceramics from the cave mine, allowed the archaeologist M.E. Masson [74] attributed the time of the large-scale functioning of the mine to the 8th–11th centuries CE.

A large collection of ceramics was collected in 1952 by archaeologist B.A. Litvinsky within the limits of the medieval mine settlement that once existed in Zangur-Sai [60]. Glazed ceramics are attributed to the 10th–11th centuries, and a significant part of the remains of unglazed vessels to the period of the 9th–12th centuries. Vessels decorated in the upper half with parallel grooves (flutes) are known since the 7th–8th centuries, but are more common in the 10th–12th centuries. One of the rims of khums is typical for vessels of the 6th–8th centuries [16, p. 182–183].

The finds of coins are important for dating the epoch of the mine's functioning. One of them was found by V.E. von Egert, a member of the 1920 speleoexpedition, at the foot of the second staircase of the First Abyss ("the central passage" according to Masson). This copper Samanid fels of Nuh ibn Nasr (943–954 CE) was minted in 343 AH (954–955 CE) [37; 71, p. 287; 74]. In 1934, the geologist O.S. Vyalov found a bronze Samanid dirhem-musayabi 10 meters from the Main entrance to Kan-i-Gut [16, p. 183; 73]. In the dump of an ancient mine, a leather wallet with three bronze coins was also found, two of which are dated [16, p. 183]. One of them was minted in Fergana on behalf of Nukh ibn Nasr in 340 AH (951–952 CE), the second in Samarkand on behalf of Ismail ibn Ahmed (892–907 CE) [15, p. 40–41]. Another copper coin was discovered in one of the chambers of Kan-i-Gut by the master Barmin. It was minted in the city of Ahsiket in Fergana by Akhmat ibn Asad in 277 AH (890–891 CE) [18, p. 118].

According to Davidovich and Litvinsky [16], archaeological materials and coin finds indicate that the most significant scale of ore mining in Kan-i-Gut occurred in the 9th–10th centuries A.C.

Oblivion period (13th century CE – 1880 CE)

The next part of the history of the Middle Ages and modern times of Kan-i-Gut is covered with a darkness of obscurity due to the lack of manuscript and printed sources and the lack of archaeological finds of this period. As P. Nazaroff emphasized: "A rich and highly developed mining industry had flourished in this place; the spot had once teemed with life, and such a hive of indus-

try as can be seen to-day in England and parts of Belgium. Then suddenly all life ceased; something happened and converted the flourishing industrial district into a desert" [77, p. 188].

The ruins of stone miner houses around 150 years old were discovered by archaeologists about one kilometer to the North of the cave in 1976 [88, p. 231–232] but no any evidences were published. The archaeologist V.M. Ploskikh from Beshkek concluded that the Kokand people had continued to mine ore through the end of 18th — beginning of 19th centuries CE based on finding 23 copper square coins in one cave mine chamber in 1920. To us, this find is an evidence of visiting the cave mine by people, but not the proof of mining activity. At least, the local Kyrgyz people from the village (*kishlak*) still existed by the end of 19th century in Zangur-Sai (gully) near Kan-i-Gut, never mention such activity to M.C. Andreev and N.G. Mallitsky, the first explorers of the cave mine [2; 68].

According to oral legends, during the Khudayar Khan rule (1845–1858 and 1865–1867), capitally punished criminals were sent into the cave mine, and if they returned without any evidence of treasure finds, they were killed on site [2; 72, p. 56; 77].

The period of initial accumulation of knowledge about the cave mine (1880–1932)

After the Russian conquest of the Khanate of Kokand in 1876, the cave mine was repeatedly visited by Russians. The first known visit of the cave was made by A.I. Vilkins on August 18, 1880 [3, p. 5; 64; 112]. On January 12, 1881, he made a presentation about the Kan-i-Gut and other caves of Isfara district at the annual meeting of the Turkestan Branch of Imperial Society of Devotees of Natural History, Anthropology and Ethnography [64; 123].

In 1893–1894, M.S. Andreev (fig. 1/1) explored one of the passages leading from the Main entrance of Kan-i-Gut, and descended to the upper part of the First Abyss to the base of the first staircase. He first published an explanation of the name Kan-i-Gut and copied the inscription on a stone near the cave, but the drawing of the inscription was lost [2; 51, p. 148].

On February 26, 1896, M.S. Andreev demonstrated a copy of the Arabic inscription on a stone near the entrance of Kan-i-Gut at the meeting of the Turkestan Circle of Devotees of Archaeology [16, p. 11]. On behalf of the circle, M.S. Andreev and N.G. Mallitsky (fig. 1/2) explored the Kan-i-Gut cave on March 1896 [68], and on April 1, 1896, at the meeting of the circle, they made a presentation on results of a trip [13; 16, p. 11; 62, p. 200, 310].

In 1904, the mining engineer V.V. Trifonov studied Kan-i-Gut for three days on the instructions of the Russian-Belgian Society [25, p. 2].

In 1910, the geologist V.N. Veber [124, p. 172] studied some passages of the cave to the depth about 20 m, and performed the first topographic mapping there, from Main entrance to the First Abyss.

Before World War 1, the cave was visited by naturalist, geologist and industrialist P.S. Nazarov [16, p. 15; 74, p. 35; 13] (fig. 1/3). After exploring the recesses of the cavern for two days he has come to the conclusion that the cave is an ancient mine where silver-lead, zink and gold ores were explored [77, p. 189]. No later prospecting work has confirmed the presence of gold-bearing ore in Kan-i-Gut.

In 1914, by the initiative of Prof. V.I. Vernadsky, the Radium Expedition of the Russian Imperial Academy of Sciences was conducted under the supervision of Prof. A.A. Chernov [74; 103]. Geologists of the expedition, I.A. Preobrazhensky (fig. 1/4) and D.I. Shcherbakov, performed geological observations in the vicinity of the cave, developed the first schematic geological map and cross-sections. They also discovered limestone thrusting over conglomerates with friction breccia between them, consisting of limestone and conglomerate clasts [92]. In addition to the geological description of the cave, samples of host rocks, ores and veins were collected to detect radioactive minerals. Widespread gypsum and black dust, consisting of manganese and iron oxides, and the common presence of brown ironstone with admixture of wad were noted. All samples collected turned out to be not radioactive or were only slightly radioactive [92; 103]. D.I. Shcherbakov (fig. 1/5) and geologist S.P. Alexandrov made topographic map of the cave from the Main entrance to the Second Abyss [112], but it was never published.

A.N Snesarev and A.N. Dementiev, participants in the Radium Expedition, carried out observations on the atmospheric electrical conductivity in the "1st dark grotto, 7th and 10th widenings of the cave" with the help of the Gerdien aspirator on July 28 and 29, 1914 [92; 103]. They discovered abnormally high ionization of the cave air but the reason for this phenomenon remained unsolved because no radioactive minerals were found [109]. It was stated that the possibility for the presence of these radioactive substances could have been present in the deeper unexplored layers (passages) of the cave [103].

In 1915, some information about the Kan-i-Gut cave was published in a speleological article by J.-A. Castagné [13, p. 19–21]; no visitors explored cave further the Second Abyss.

In 1918, mining engineer G.B. Leonov published information about the richness of the Kan-i-Gut ores in silver [59].

In June 1920, the Turkestan government organized the Kanigut scientific expedition on the initiative of E.S. Batenin [49] under leadership of G.I. Bokiy. One of its tasks was to check rumors about Tamerlane's library hidden in the cave [89; 107, p. 69–70; 108, p. 39]. The expedition consisted of geologist I.I. Bezdeka, engineer I.G. Belov, archaeologist B.E. von Egert, a chemist, a zoologist, an entomologist, and a botanist [74; 120]. The expedition was guarded by a detachment of foot and horse Red Army men with two machine guns.

Many archaeological artifacts (oil clay miner lamps and fragments of clay vessels for mercury of the 9th-10th centuries, copper coin of the 10th century, etc.) and a full human skeleton with skin remains were collected and transported in Tashkent. For the collections, the former Turkestan People's Museum assigned a special hall, called "Kon-i-Gutskiy", the first speleological exhibition hall in Russia [49; 72; 74, p. 36–37]. Bezdeka studied traces of pickaxe work left by ancient miners on the walls consisting of silver-bearing oxidized ores. He made wax copies of marks imprinted with sharp points of picks. A cave plan and profile was drawn up by Belov and published by M.G. Popov [89].

From 1924 to 1926, the results of the Radium Expedition of 1914 were published [92; 103; 109].

E.S. Batenin published the adventure novel "The Diamond of Kon-i-Gut" in 1926 based on the impressions of the Konigut expedition in 1920 [4].

In 1928, M.E. Masson published a description of the copper coin which was found at the base of the second ladder in the Second Abyss of the cave [71].

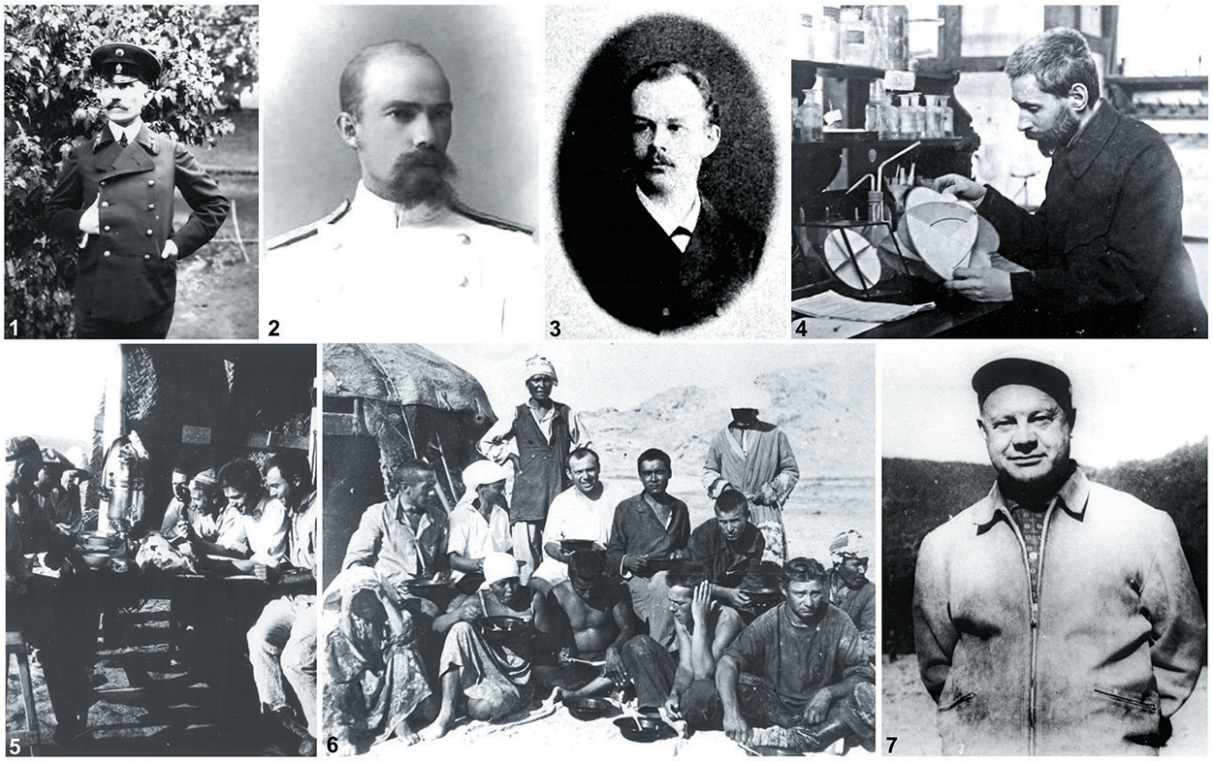

Fig. 1. 1 – Prominent ethnographer and amateur archaeologist M.S. Andreev in Turkestan, 1915. Investigated Kan-i-Gut in 1893–1894 and 1896; 2 – Geographer N.G. Mallitsky, photo 1902. Explored Kan-i-Gut with Andreev in 1896; 3 – P.S. Nazarov, Tashkent industrialist, geologist and naturalist. Examined Kan-i-Gut before the First World War; 4 – Laboratory assistant (later geologist, Doctor Sciences, Professor) I.A. Preobrazhensky in the laboratory, 1910. Studied Kan-i-Gut in 1914 as part of the Radium Expedition; 5 – Geologists D.I. Shcherbakov (third from left) and A.F. Sosedko (far right) at the Tuya-Muyun radium mine in Kyrgyzstan, 1924; 6 – Geologist A.F. Sosedko, in the center, Kyzylkum, 1932. Studied Kan-i-Gut in 1933; 7 – V.I. Smirnov: Academician, Doctor of Sciences, Professor, leader of Soviet economic geologists. As a graduate student, he participated in the study of Kan-i-Gut in 1934–1935

Рис. 1. 1 – Выдающийся этнограф и археолог-любитель М.С. Андреев в Туркестане, 1915 г. Исследовал Кан-и-Гут в 1893–1894 и 1896 гг.; 2 – географ Н.Г. Маллицкий, фото 1902 г. Исследовал Кан-и-Гут с Андреевым в 1896 г.; 3 – П.С. Назаров, промышленник, геолог и натуралист. Обследовал Кан-и-Гут перед Первой мировой войной; 4 – лаборант (впоследствии геолог, д.г.-м.н., профессор) И.А. Преображенский в лаборатории, 1910 г. Изучал Кан-и-Гут в 1914 г. в составе Радиевой экспедиции; 5 – геологи Д.И. Щербаков (третий слева) и А.Ф. Соседко (крайний справа) на Тюя-Муюнском радиевом руднике в Киргизии, 1924 г.; 6 – геолог А.Ф. Соседко, в центре, Кызылкумы, 1932 г. Изучал Кан-и-Гут в 1933 г.; 7 – В.И. Смирнов: академик, д.г.-м.н, профессор, лидер советских геологов-рудников. Будучи аспирантом, в 1934–1935 гг. участвовал в изучении Кан-и-Гута

From 1928 to 1931, A.V. Moskvin, a researcher from the Petrographic Institute of Academy of Sciences of the USSR in Moscow, studied accumulations of ferruginous slags representing traces of an ancient metallurgical activity in different parts of the Alai and Turkestan Ranges. Petrography and chemical composition of slags discovered near Kan-i-Gut were also studied. Moskvin concluded that the Kan-i-Gut mine served "in due time as a small centre of an iron ore industry" [76]. A permanent presence of manganese, of which the quantity sometimes reaches abnormally high levels, is a characteristic feature of the Kan-i-Gut's slag.

The period of geological exploration and industrial exploitation (1933–1955)

It should be noted that geoscientific crews and geological exploration parties during the exploration of the deposit (1933–1951) wrote its name as "Kon-i-Gut". In contrast, since the beginning of industrial production, the mine has been called "Kan-i-Gut" again, as it was before 1920.

In 1933, the Geochemical party of the Tajik-Pamir Expedition of the Academy of Sciences of the USSR under the leadership of geologist A.F. Sosedko (fig. 1/6) was working in the cave as a part of reconnaissance mineral exploration for lead, beryl and tin in the Turkestan Range [125]. He made a report on the results of field work at a conference on October 25–28, 1933 in Stalinabad (now Dushanbe) and published a schematic plan of the cave mine and lithological map of surrounding area [111, p. 62]. In contrast with the conclusions of D.I. Shcherbakov [103] and I.A. Preobrazhensky [92] that the cave was an ironstone mine and Kon-i-Gut had no potential to be a minable ore deposit, Sosedko came to an inference, that Kon-i-Gut was primarily a silver-lead deposit and a still presently very promising one [111]. Besides, he discovered remnants of a medieval mining settlement [16; 111; 112].

In 1934, from July 10 to October 31, the Sredazgeohydrogeodesy Trust, under an agreement with the Kansai mining administration of Kazpolimetall Trust, organized a geological prospecting party under the leadership of I.V. Dyugaev. It conducted a resource evaluation of the Kon-i-Gut deposit and a reconnaissance mineral exploration of the surrounding area. Geology, tectonics, ore mineralization, and ore characteristics in separate cave passages and chambers were studied [25; 54, p. 341–360]. Dyugaev concluded that the ores of Kon-i-Gut were formed during the Upper Paleozoic [94]. That same summer Prof. V.M. Kreiter and the graduate sydent V.I. Smirnov (fig. 1/7) from the Ore crew of the Tajik-Pamir Expedition of the Academy of Sciences of the USSR performed short field work in the cave mine [107; 108]. Geologist O.S. Vyalov found a medieval bronze coin 10 m from the Main entrance to the cave [16; 73].

The activities for the study of the Kon-i-Gut deposit were covered in newspaper and magazine articles in Isfara [110], Tashkent [45; 47; 112; 125], Leningrad [48], and New York [19].

In 1935, the Ore crew of the Tajik-Pamir Expedition of the USSR Academy of Sciences under the leadership of Prof. V.M. Kreiter, with the participation of geologist I.V. Dyugaev retested the Kon-i-Gut ores [54, p. 358]. Kreiter discussed the industrial prospects of Kon-i-Gut deposit in series of publications [52–55].

In 1937, V.M. Kreiter and V.I. Smirnov [54, p. 362] published a plan of the cave, compiled by P.Ya. Slezkov, Chirkin and I.V. Dyugaev in 1934 [25, p. 5]. Geologist A.V. Purkin from Tashkent made a revisory trip to the Kon-i-Gut deposit [82, p. 4].

A popular science book containing a chapter on Kon-i-Gut, published in 1941 with a circulation of ten thousand copies [11, p. 165–170].

In the summer of 1943, paleontological excavations in the cave were performed by a field crew from the Paleontological Institute of the Academy of Sciences of the USSR, Moscow, under the leadership of N.I. Burchak-Abramovich [10].

In 1945, geologists A.V. Purkin and V.V. Merenkov of Sredaztsvetmetrazvedka Trust carried out prospecting work for polymetals in the Kon-i-Gut area [75; 82].

In 1946, the cave mine was visited by karstologist and geographer N.A. Gvozdetsky from Moscow State University during his studies of karst in Central Asia [37, p. 146–147; 38, p. 180].

From 1948 to 1951, the Kon-i-Gutskaya Geological Exploration Party of the Sredazmetrazvedka Trust (Tashkent, Uzbek SSR) implemented geological exploration work on the Kon-i-Gut silver-polymetallic deposit under the supervision of the geologist V.N. Petrov (fig. 2). Adits and drifts with a total length of 462 m were driven into the ancient cave mine. Topographic map of the cave and ancient mine was done by surveyor A.K. Bul'onkov (fig. 3/1, 3/2, 3/3). The geological survey was completed over an area of 5 km^2 at a 1:5000 scale and over an area of 6 km^2 at a 1:1000 scale. Detailed morphology of the cave mine passages and ore bodies description, mineralogy and local hydrogeology characterization, ore resource evaluation and reserve definition were also completed [83–87].

In 1949, the geophysical group of the, on the instructions of the Sredaztsvetmetrazvedka Trust, studied the radioactivity of the rocks and ores of Kon-i-Gut. No significant concentrations of radioactive minerals were found [29; 36].

In 1950, the geophysical crew of the Complex Geological Prospecting Expedition of the Sredazts-

vetmetrazvedka Trust continued the study of the radioactivity of rocks and ores of Kon-i-Gut under the leadership of V. Davydov [29; 43].

In May 1951, a visiting session of the All-Union Committee for Reserves of Mineral Resources approved the reserves of the Kon-i-Gut polymetallic deposit.

S.A. Ostroglyadov, the chief engineer of the Kan-i-Gut Mine, handed over the iron fetters found during the dismantling of the ancient passageway in the cave mine to the Osh Museum [16, p. 181].

In 1953, the Kan-i-Gut cave was described in the popular book "Caves" by F.D. Bubleynikov [12, p. 59-61], published with a circulation of 50 thousand copies.

In 1954, B.A. Litvinsky from the Institute of History, Archeology and Ethnography of the Academy of Sciences of the Tajik SSR, Stalinabad (now Dushanbe) conducted reconnaissance archaeological field work in the vicinity of Kan-i-Gut [60, p. 120].

From 1950 to 1955 construction and operation of the Kan-i-Gut Mine and related geological exploration and reconnaissance work were carried out on the surrounding territory [80; 104–106]. From 1950 to 1954, the mine was operated by the Soyuzsvinetsrazvedka Trust, and from 1954 to 1955 by the Kansai Polymetallic Combine.

In 1955, the exploration and production shaft no. 1 (fig. 3/4) reached the third (the lowest) level (1,471 m a. s. l.). At 1,490 m a. s. l., underground waters were encountered. Below, mining operations slowed down sharply due to a fairly significant water inflow (100–200 m^3 per hour) and the lack of necessary equipment and electricity to pump water. Since August 12, 1955, the bottom of the shaft no. 1 and the third level have been flooded. The Kan-i-Gut Mine was put on wet conservation from January 1, 1956 by Order of the Minister of Non-Ferrous Metallurgy of the USSR no. 594 of December 21, 1955 due to the lack of sufficient proven reserves and significant financial losses [80].

In the summer of 1955, the team from the Geological Institute of the Academy of Sciences of the USSR carried out studies on the topic of «The history and origin of development of geological knowledge in Middle Asia in ancient times and Middle Ages». One of the results was a large collection of mine tools and other objects of material culture, numbering around 1000 items. Among other medieval mining sites, the Kan-i-Gut cave mine was also studied [41].

The period of further study by scientists, geologists and cavers (1956 — now)

In 1957, geochemist N.A. Ozerova from the Institute of Geology of Ore Deposits (IGEM) of the Academy of Sciences of the USSR, Moscow, studied geochemistry of the Kan-i-Gut ores. According to her data, tin is sporadically present in ores and minerals. Some ore samples contain n×0.01 % tin, sphalerite samples have up to 0.1 % tin [81].

In 1965, archaeologists G.Ya. Dresvyanskaya and E.V. Pruger from Tashkent studied traces of medieval mining activities in the vicinity of Kan-i-Gut. They found remains of unroasted ore dumps and also ceramic fragments of the 2nd–3rd centuries [74].

On August 22–23, 1965, the cavers of an expedition of the Moscow State University speleo club

Fig. 2. 1 – Geologist V.N. Petrov, who led the exploration of the Kan-i-Gut deposit in 1948–1952; 2 – V.N. Petrov and the collectors on the way to Kan-i-Gut, 1949

Рис. 2. 1 – Геолог В.Н. Петров, руководивший разведкой месторождения в 1948–1952 гг.; 2 – В.Н. Петров и коллекторы на пути в Кан-и-Гут, 1949 г.

under leadership V. Galactionov explored the cave mine. They surveyed deep passages below the bottoms of the First and Second Abysses and galleries of the Left Passage. The description of surveyed part was made also [35].

In 1967, geologist K.E. Kalmurzaev from the Institute of Geology of the Academy of Sciences of the Kyrgyz SSR, collected Lower Cambrian trilobites on the left side of the Kanigut Sai [42, p. 61] and mineralogist K.K. Kurmanaliev (fig. 3/5) from the same Institute in the late 1960s studied geochemistry of lead, mercury, antimony and rare elements in sulphide minerals and ores of Kan-i-Gut [57; 58].

In 1970, a popular book about the caves of Kyrgyzstan was published by writer L.B. Dyadyuchenko, one of the chapters of which is dedicated to Kan-i-Gut [24, p. 20–37].

In July 1972, the expedition of the speleo club "Cyclops", Lviv, Ukraine and the Polish club "Dewiator" took place [95].

From 1972 to 1974, cave mine surveys and studies were done by the Speleological crew from the Geological Survey of the Kirghiz SSR [96]. Surveyed length of the cave mine at that time was about 5 km [97].

In 1976, archaeologist V.M. Ploskikh, with colleagues, visited the cave and surrounding area as a part of preparation for the archaeological map of Kirgizia [88].

In 1977, archaeologist and numismatist E.A. Davidovich published the description of the Samanid copper coin which was found in one of the chambers of the Kan-i-Gut Mine [18].

In the seventies, the bats and their ectoparasites from Kan-i-Gut were studied by S.N. Rybin [98–100].

From 1981 to 1985, the Geophysical party of the Middle Asian Geological Exploration Enterprise from Kansai, Tajik SSR, conducted the audit appraisal work in the Kan-i-Gut area, accompanied by electrical profiling above the cave and detailed sampling of the cave walls for creating a model of vertical geochemical variability and erosional truncation evaluation of the deposit [113].

Fig. 3. 1 – The Main entrance of Kan-i-Gut. Mine surveyor A.K. Bul'onkov under the inscription on the wall, carved as a sign of the completion of the topographic survey of the ancient cave mine; 2 – Surveyor A.K. Bul'onkov, kipregel survey near the entrance to the adit no. 1, July 1951. He made a complete theodolite survey of Kan-i-Gut in 1949–1950; 3 – Mine surveyor A.K. Bul'onkov with Tajik workers, 1951; 4 – Laying of the exploration and production shaft no. 1, March 1951. The Main entrance of Kan-i-Gut is on the left; 5 – Mineralogist K.K. Kurmanaliev, Institute of Geology, Academy of Science of Kirgiz SSR, Frunze. Studied mineralogy and geochemistry of the Kan-i-Gut ores in the 1960s

Рис. 3. 1 – Главный вход Кан-и-Гута. Маркшейдер А.К. Бульонков под надписью на стене, выдолбленной зубилом в знак завершения топосъёмки древней пещеры-рудника; 2 – маркшейдер А.К. Бульонков, съёмка кипрегелем рядом с входом в штольню № 1, июль 1951 г. Сделал полную теодолитную съёмку Кан-и-Гута в 1949–1950 гг.; 3 – маркшейдер А.К. Бульонков с рабочими-таджиками, 1951 г.; 4 – закладка разведочно-эксплуатационной шахты № 1, март 1951 г. Слева Главный вход Кан-и-Гута; 5 – минералог К.К. Курманалиев, Институт геологии АН Киргизской ССР, г. Фрунзе. Изучал минералогию и геохимию руд Кан-и-Гута в 1960-х гг.

In 1986, geomorphologist G.N. Pshenin proposed the Late Carboniferous-Early Triassic age of the karst cavities of the mountain Ferghana, including the Kan-i-Gut cave [93, p. 80].

During June 2–10, 1987, a speleoexpedition was carried out from the city of Ferghana (leader V.L. Ogudin, head of the Department of regional Muzeum of Local Lore). Scientific program included: medical and biological examination of cavers (physician G. Khvastunov); psychological testing of participants (psychologist R. Ablimichetov); topographic and archaeological surveys; measurements of the temperature and humidity of the cave air; collecting insects in the vicinity of the cave mine (entomologist A. Dvoinikov). Archaeologist G.P. Ivanov discovered six ancient graves on the surface and excavated one of them [39; 63].

In July 1987, the bats were studied in Kan-i-Gut by parasitologist S.N. Rybin from the city of Osh, Kirghiz SSR, and biologists I. Horáćek and J. Červeny̌ from the city of Praha, Czechoslovakia [101].

In 1988, the Alai Geophysical party, the town of Pulgon, Kirghiz SSR, performed Vertical Electrical Sounding across the Kan-i-Gut deposit with the AB length of 8 km (V.I. Belousov, personal communication, 2013).

On May 17–18, 1990, skeletal remnants originating from eagle owl pellets were collected and studied from a daytime roosting location within a cave mine 5–10 m away from the entrance [78].

In 1990, S. Dudushvili and V.N. Mikhailev published an incomplete plan and section of Kan-i-Gut in the chapter "Kan and Gut — the cave of secrets" in the popular science book "In the labyrinths of the Heavenly Mountains" [22].

A very comprehensive study of the Kan-i-Gut deposit was conducted by the Khaidarkan Geological Exploration Party of the South Kyrgyz Geological Enterprise from Osh, Kirgizia from 1989 to 1992 [65].

In 1999, G.M. Maximov published the results of caving expedition conducted in February 1984 by the Speleo Club "Cascade" from Novosibirsk State University [67].

In 2000–2001, a schematic projection of the Kan-i-Gut cave and the adits opening it on a vertical plane was published by V.N. Dublyansky [20; 21], but the source of the information was not specified.

In 2003, a speleologist V.E. Reis wrote a chapter on the cave mine in the monograph about geological nature reserves of Kyrgyzstan [50].

In 2004, a web site devoted to the Kan-i-Gut cave mine was created by V.V. Tsibanov [115].

From April 20 to May 20, 2006, an international caving expedition (Kyrgyzstan, Russia, Germany) was organized by the Foundation for the Preservation and Exploration of Caves, Bishkek, Kyrgyzstan, under the leadership of S.D. Dudashvili [90].

In October 2008, the TV program "Silver City", addressed to the Kan-i-Gut Mine, was filmed in the series "Seekers" on the First Channel of Russian television [46; 102].

In March 2009, a caving expedition "Kan-i-Gut 40 years later" was held by Moscow and Bishkek cavers under the leadership of V.V. Tsibanov [116].

Preliminary data on the study of Kan-i-Gut on the basis of literary and archival geological and geophysical data were published in 2012–2013 [27–29]. Also, the analysis of the modern morphology of the cave mine, which was dramatically changed by the mining operations of 1951–1955 and by subsequent collapses, was carried out [117]. In 2013, V.L. Ogudin published an extensive chapter on Kan-i-Gut in the book "The Third Tier of the Universe, or the cult caves of Ferghana" [79], containing an esoteric interpretation of the medieval text attributed by many to Avicenna.

During April 4–20, 2014, the international speleological expedition (Russia, Kyrgyzstan, Tajikistan) was organized by the Foundation for the Preservation and Exploration of Caves, Bishkek, Kyrgyzstan, and Karst Research Inc., Alberta, Canada. The research team consisted of geoscientists E.P. Bazarova (mineralogy of secondary formations), V.I. Belousov (stratigraphy, tectonic structure of the cave site), A.A. Semikolennykh (pedology, mineralogy, microclimate and radioactivity) and A.S. Dudashvili (coordination and logistics), biologists (chiropterologists) T. K. Khabilov, D.A. Tajibayeva and A.P. Shumkina (study of bats), cavers V.V. Tsibanov, I.A. Otmakhov (topographic survey), and A.V. Markov [30; 118; 119].

Based on the materials of the expedition, a series of scientific articles and conference abstracts on bats, mineralogy and geochemistry of secondary deposits were published [5–7; 44; 70; 91].

In 2015, from August 28 to September 11, the international speleological expedition (Russia, Kyrgyzstan, Canada) was organized by Karst Research Inc., Alberta, Canada, under the leadership of A.G. Filippov. Observations of karst manifestations, the morphology of collapses within the cave mine, secondary formations, and temperatures of the underground atmosphere were continued, microfossil samples of host rocks were collected, and radon concentrations were measured in different parts of the cave mine [31].

From August 25 to September 11, 2017, international speleological expedition Speleozistan-2017 (France, Kyrgyzstan, USA, Italy, Belgium, Great Britain) was organized by the Foundation for the Preservation and Exploration of Caves, Bishkek,

Kyrgyzstan, under the direction of F. Guillot, France. The released report contains chapters on cave mine description (F. Guillot), 3D plotting, topographic map (J.-P. Bartholeyns, F. Guillot, J. Fouquet, J. Camplo), archaeology (L. Martin), shafts 70 m (РЭШ №1) and 25 m (shaft №2) description (D. Langlois), thermal imaging (D. Langlois), Radioactivity (D. Langlois), geology (T.B. Walker), medical report (F. Guillot) [26].

In 2017, an interview with the surveyor Bul'onkov, who conducted a topographical survey of the cave mine in 1949–1950, was published [32], and the memoirs of N.V. Petrov about the mining town of Kon-i-Gut in 1949–1952 were released in 2018 [121].

Discussion

In the entire history of the study of Kan-i-Gut, only three archaeologists have explored this dungeon for a considerable length, namely: von Egert in 1920 [74], G.P. Ivanov in 1987 [63] and M. Lucas in 2017 [26]. The most complete underground collections were made by von Egert, but, unfortunately, they are still only partially published [60; 71]. According to M. Lucas, the participants of the Speleozistan-2017 expedition collected in the cave mine only fragments of ceramics no older than the 11th – 12th centuries C.E. Archaeological excavations or fixation of finds in the cave mine have never been carried out. Other archaeologists (B.A. Litvinsky, G.Ya, Dresvyanskaya, E.B. Pruger, V.M. Ploskikh) focused on observing and collecting artifacts on the surface.

Geologist A.F. Sosedko discovered the remains of six foundations of the disappeared small buildings of an ancient mine settlement in Rudny Sai, at a distance of 50 to 90 m south and southwest of the Main Entrance [111]. Near one of the foundations, he dug a trench that revealed an ancient garbage pit, rich in ash, bird, sheep and horse bones and archaeological artifacts attributed by the archaeologist M.E. Masson to the 8th, 9th, 10th and 11th centuries C.E. [112]. Traces of ancient structures were also found opposite the cave mine on the eastern bank of the Zangur-Sai and 300–400 m to the south. Later, in 1949, when the adit no. 1 was driven into the western bank of the Zangur-Sai, the stonework of the foundation of an ancient building was uncovered, 40 m below the Main Entrance of Kan-i-Gut [83; 84; 86]. We tried to find this foundation but without success. Most likely, it was destroyed during the construction of the adit.

In addition to the remains of ancient buildings, Sosedko mapped 25 ancient workings (trenches, dug holes) that exposed outcrops of oxidized ores on the bare surface of limestones [112]. During detailed exploration of the deposit in 1948–1950, 45 such workings were recorded [84; 86]. It is possible that some of them are buried entrances to the cave mine.

Despite the fact that there are many maps of both the ancient cave mine Kan-i-Gut and underground workings of 1949–1955, made in the 20th century, most of them are now of little use, or rather, can be used only partially. There are two reasons for this. One of them is that during the excavation of underground mine workings in 1949–1955, a huge amount of chipped rock was poured into the pre-existing cavities of the ancient cave mine that they crossed. As a result, some ancient passages were filled, the First Abyss and the Giant Labyrinth were separated, steeply inclined passages under the bottom of the First Abyss and under the lower section of the Bottom of the Second Abyss disappeared, the volume of the First Abyss itself greatly decreased, etc.

The second reason is the significant collapse that occurred, probably under the influence of earthquakes in areas where the rocks are weakened by the latest mine workings. Thus, impressive collapses occurred in the area of the Vestibul' and adjacent parts, which completely changed the morphology of this part of the ancient cave mine. As a result, the maps of I.G. Belov (year 1920), I.V. Dugaev (year 1935) and A.K. Bul'onkov (year 1950) for this part of the cave mine do not correspond at all to the current configuration of the passages. The Passages with Skeletons, the Dextral Passage have disappeared, a hole gapes in the place of the grotto Hall as a result of the collapse of the deeper chambers no. 20 and no. 21, etc.

Over the past 120 years, numerous geological and speleological expeditions have been carried out to study Kan-i-Gut, but no karstological and speleogenetic observations have been published. Geologist and speleologist V.E. Reis, who explored the cave mine in 1972–1974, estimated the length of the karst passages at 500 m with the length of the artificial workings at 4.5 km, i.e. 10 % of the surveyed passages [97]. But neither he nor the best expert on Kan-i-Gut, geologist V.N. Petrov, went into the details of the karstological description. Petrov only briefly noted the areas of distribution of karst passages [84, 86].

Facts on the configuration of ore bodies published by mining geologists [54; 111] and confirmed by our observations of the morphology of voids in limestone in 2015, allow us to assert that the karst cavities of Kan-i-Gut were formed in two different phases, separated by an interval of many tens of millions of years. The first phase is pre-ore, during which steeply inclined tube-shaped, branching cavities of hypogenic karst with a diameter of tens of centimeters were formed. Many of them later, during the epoch of hydrothermal ore

deposition, were completely filled with sulfide ore. The second phase is post-ore, which arose after the deposit was involved in the activity of infiltrating underground waters rich in oxygen, and caused the formation of the oxidation zone of the sulfide deposit, the gossan cap. The emerging of sulfuric acid waters led to the development of numerous cavities of epigenic sulfuric acid karst.

Conclusions

Being a bright, fairly well-preserved monument of ancient mining, Kan-i-Gut, at the same time, is clearly insufficiently studied archaeologically. A large gap in knowledge about the history of the functioning of the ancient mine is the lack of professional archaeological excavation work on the surface, on the remains of the mine settlement in Rudny Sai.

It would also be necessary to study the remains of residential stone buildings and another old cave passage one kilometer north of Kan-i-Gut to test the hypothesis (still very poorly substantiated) of the archaeologist V.M. Ploskikh on the functioning of the mine during the period of the Kokand Khanate [88].

A useful addition to the available data would be the publication of the observations made by G.Ya. Dresvyanskaya and E.B. Pruger in the expedition of 1965.

The hydrochemical characteristics of the infiltration waters of the cave-mine, which accumulate in small amounts in several hard-to-reach places, remain completely unexplored.

One of the time-consuming but interesting tasks is to evaluate and map changes in the morphology of the cave mine for the period since the end of the mine operation (i.e. since 1955).

It is long overdue to prepare and publish a generalizing work on Kan-i-Gut, which would sum up the results of more than a century of study of this unusual monument of nature and mining.

References

1. Agoshkov M.I., Boyarsky V.A., Chernegov E.Yu. Istoki razvitiya gornoy nauki i tekhniki [The origins of the development of mining science and technology]. Moscow, 1984. 180 p.

2. Andreev M. Mestnosti Turkestana, interesnye v arkheologicheskom otnoshenii [Localities of Turkestan, interesting in archaeological terms]. Middle Asian Bulletin. Protocols of the Turkestan Circle of Archaeology Devotees, year 1. Tashkent, 1896. P. 10–13.

3. Baruzdin Yu.D., Brykina G.A. Arkheologicheskie pamyatniki Batkena i Lyaydyana (yugo-zapadnaya Kirgiziya) [Archaeological sites of Batken and Lyadyan (southwestern Kirgizia)]. Frunze: AS Kirghiz SSR Press, 1962. 127 p.

4. Bateny E. Brilliant Kon-i-Guta [Brilliant of Kon-i-Gut]. Novel. Moscow-Leningrad: Land and Factory Press, 1926. 288 p.

5. Bazarova E.P. Rotsenitovaya mineralizatsiya v peshchere-rudnike Kan-i-Gut [Rozenite mineralization in the Kan-i-Gut cave mine (Kyrgyzstan)]. 15th All-Russian scientific readings in memory of the Ilmen mineralogist V.O. Polyakov. Miass: IM UB RAS, 2014. P. 71–75.

6. Bazarova E.P., Markova Yu.N. New data on secondary minerals of Kan-I-Gut cave mine (Central Asia) // Proc. of the 8th International Siberian Early Career GeoScientists Confer., IGM SB RAS, IPPG SB RAS, NSU. Novosibirsk, 2016. P. 137.

7. Bazarova E.P., Markova Yu.N., Zolotarev K.V., Rakshun Ya.V., Uschapovskaya Z.F. Pervye rezul'taty geokhimicheskogo issledovaniya rykhlykh otlozheniy peshchery-rudnika Kan-i-Gut (Srednyaya Aziya) metodom RFA s ispol'zovaniyem sinkhrotronnogo izlucheniya [The first results of a geochemical study of loose deposits of the Kan-i-Gut cave mine (Middle Asia) by XRD using synchrotron radiation]. Surface. X-ray, synchrotron and neutron research, 2016a. № 3. P. 109–112.

8. Benda P., Hanák V., Červený J. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 9. Bats from Transcaucasia and West Turkestan in collection of the National Museum, Prague. Acta Societatis zoologicae bohemicae, 75, 2011. P. 159–222.

9. Bobrinsky N.A. Materialy dlya fauny letuchikh myshey Turkestanskogo kraya [Materials for the fauna of bats of the Turkestan region]. Bulletin MOIP, dep. biol., new series. Vol. XXXIV, 1925. P. 300–308.

10. Bodylevskaya I.V. Akademik A.A. Borisyak i Paleontologicheskiy institut v gody voyny. 1941–1943 gg. [Academician A.A. Borisyak and the Paleontological Institute during the war. 1941–1943]. Moscow: PIN RAN, 2008. 126 p.

11. Bubleinikov F.D., Shcherbakov D.I. Zamechatel'nye geologicheskie yavleniya nashey strany [Remarkable geological phenomena in our country]. Moscow-Leningrad: AN USSR, 1941. 171 p.

12. Bubleinikov F.D. Peshchery [Caves]. Moscow: Goskultprosvetizdat, 1953. 112 p.

13. Castagné J.-A. Sovremennye uspekhi speleologii i moi speleologicheskie poezdki po Turkestanu v 1913 i 1914 gg. [Modern successes of speleology and my speleological trips around Turkestan in 1913 and 1914]. Proc. of the Turkestan dep. Imper. Russian geograph. society. Vol. XI, issue 2, part 2. Tashkent, 1915. P. 3–51.

14. Chikishev A.G. Karstovye peshchery SSSR [Karst caves of the USSR]. Speleology and Karst Science. Moscow, 1959. P. 7–40.

15. Davidovich E.A. Iz oblasti denezhnogo obrashcheniya na territorii Fergany [From the area of money circulation in the territory of Fergana]. Proc. of the Museum of History of the Uzbek SSR, issue 2. Tashkent, 1954. P. 39–52.

16. Davidovich E.A., Litvinsky B.A. Arkheologicheskiy ocherk Isfarinskogo rayona [Archaeological sketch of the Isfara region]. Proc. of the AS Tajik SSR. Vol. 35. Stalinabad: AN Tajik SSR Press, 1955. 231 p.

17. Davidovich E.A. V Isfare. Arkheologi rasskazyvayut [In Isfara. Archaeologists tell]. Stalinabad, 1959. P. 135–166.

18. Davidovich E.A. Novye dannye po istorii Samanidov (klad mednykh monet IX–X vv. iz Samarkanda) [New data on the history of the Samanids (treasure of copper coins of the 9th-10th centuries from Samarkand]. Central Asia in antiquity and the Middle Ages: history and culture. Moscow, 1977. P. 112–125.

19. Denny H. Soviet finds ores in huge old cave // The New York Times, Section Editorial, 1934, July 8. P. E3.

20. Dublyansky V.N. Zanimatel'naya speleologiya [Entertaining speleology]. Yekaterinburg: Ural Ltd, 2000. 527 p.

21. Dublyansky V.N., Dublyanskaya G.N., Lavrov I.A. Klassifikatsiya, ispol'zovaniye i okhrana podzemnykh prostranstv [Classification, use and protection of underground spaces]. Yekaterinburg: URO RAS, 2001. 195 p.

22. Dudashvili S.D., Mikhalev V.N. V labirintakh nebesnykh gor [In the labyrinths of heavenly mountains]. Frunze: Kyrgyzstan, 1990. 279 p.

23. Dudashvili S. Turistskie resursy Kyrgyzstana [Tourism resources of Kyrgyzstan]. Bishkek, 2004. 279 p.

24. Dyadyuchenko L.B. V peshcherakh Kirgizii [In the caves of Kirgizia]. Frunze: Mektep, 1970. 163 p.

25. Dyugaev I.V., Yazbutis E.A. Otchet o geologo-poiskovykh rabotakh v rayone Kon-i-Gutskogo svintsovogo mestorozhdeniya v 1934 godu [Report on geological prospecting works in the area of the Kon-i-Gut lead deposit in 1934]. Khojent: Sredazgeogidrogeodesy, 1935. 51 p.

26. Expédition Spéléozistan: Expédition spéléologique internationale au Kirghizistan (25 août au 11 sept. 2017, Kan-i-Gut). 2017. 88 p. URL: https://rapports-expeditions.ffspeleo.fr/2017-014.pdf (accessed on 10.03.2021).

27. Filippov A.G., Tsibanov V.V. Nabroski k istorii issledovaniy peshchery-rudnika Kan-i-Gut [Historical sketches of Kan-i-Gut cave mine exploration]. Speleology and Spelestology. Naberezhnye Chelny, 2012. P. 43–49.

28. Filippov A.G., Tsibanov V.V. Kan-i-Gut Cave Mine in Kyrgyzstan / La Grotta Miniera di Kan-i-Gut in Kyrgyzstan // Mine Caves / Grotte di Miniera. Memorie Instituto Italiano di Speleologia, s. II, 28, 2013. P. 79–95.

29. Filippov A.G., Mavlyanov G.N. Issledovanie radioaktivnosti v peshchere-rudnike Kan-i-Gut i ego okrestnostyakh v 1949-1950 gg. [Study of radioactivity in the Kan-i-Gut cave mine and its surroundings in 1949–1950]. Caves. Perm, 2013. P. 123–136.

30. Filippov A.G., Bazarova E.P., Belousov V.I., Dudashvili A.S., Semikolennykh A.A., Khabilov T.K., Tsibanov V.V., Shumkina A.P. Speleoekspeditsiya "Kan-i-Gut – 2014" [Speleo Expedition "Kan-i-Gut – 2014"]. Caves. Perm, 2014. P. 95–101.

31. Filippov A.G., Tsibanov V.V. Dnevnik ekspeditsii Kan-i-Gut – 2015 [Diary of the Kan-i-Gut – 2015 expedition (27.08–11.09.2015)]. URL: http://kani-gut.narod.ru/kig-2015diary1.htm (accessed on 10.03.2021).

32. Filippov A.G. Kan-i-Gutskiy katekhizis marksheydera Bul'onkova [Kan-i-Gut catechism of mine surveyor Bul'onkov]. Journal of the Association of Cavers of the Urals. № 30. 2017. P. 47–53.

33. Filippova N.A. Iksodovye kleshchi podsem. Amblyomminae [Ixodid ticks subfamily Amblyomminae]. St. Petersburg: Nauka, 1997. 436 p.

34. Filippova N.A., Panova I.V., Musatov S.A. Taksonomicheskaya struktura politipicheskogo vida Haemaphysalis erinacei (Ixodidae) [Taxonomic structure of the polytypic species Haemaphysalis erinacei (Ixodidae)]. Parasitology, 1993. Vol. 27. P. 193–215.

35. Galaktionov V. Otchet ob ekspeditsii v Zapadnyy Tyan'-Shan' [Report on the expedition to the Western Tien Shan]. Moscow, 1965. 13 p. URL: http://www.tlib.ru/zip/02/92/029279.zip URL: http://kani-gut.narod.ru/galakt.htm (accessed on 10.03.2021).

36. Germanova E.P. Otchet po revizionnym rabotam za 1949 god na mestorozhdeniyakh Kon-i-Gut, Almalyk i dr. [Report on revision works for 1949 at the Kon-i-Gut, Almalyk and other deposits]. Tashkent: Sredaztsvetmetrazvedka, 1950. 17 p.

37. Gvozdetsky N.A. Karst: Voprosy obshchego i regional'nogo karstovedeniya [Karst: general and regional karst studies]. 2nd ed. Moscow: Geografgiz, 1954. 352 p.

38. Gvozdetsky N.A. O rasprostranenii karstovykh yavleniy v pustynyakh i gorakh Sredney Azii [On the distribution of karst phenomena in the deserts and mountains of Central Asia]. Problems of geography, coll. 40. Moscow, 1957. P. 173–190.

39. Ilyasova I. Tayny Kaniguta [Secrets of Kanigut]. Pravda Vostoka. Tashkent, 1987, Aug. 12.

40. Islamov O.I. Iz istorii gornogo dela i geologicheskikh predstavleniy u narodov Sredney Azii s drevneyshikh vremen do XVIII v. [From the history of mining and geological concepts among the peoples of Central Asia from ancient times to the 18th century]. Essays on the history of geological knowledge, issue 4. Moscow, 1955. P. 42–68.

41. Islamov O.I. Razvedka pamyatnikov gornogo dela v respublikakh Sredney Azii [Exploration of monuments of mining industry in the republics of Central Asia]. Proc. of the Institute of the History of Natural Science and Technology. Vol. 33. Moscow, 1960. P. 192–200.

42. Kalmurzaev K.E., Amatov S., Gryzlov Yu.D. K stratigrafii drevnikh tolshch Sarytagskogo rayona Turkestano-Alaya (Yuzhnyy Tyan'-Shan') [On the stratigraphy of ancient strata of the Sarytag region of Turkestan-Alai (South Tien Shan)]. Geology and mineral resources of Kirgizia. Frunze, 1974. P. 55–65.

43. Karelin A.G. Otchet o provedenii revizionnykh rabot na mestorozhdenii Kon-i-Gut v 1950 godu [Report on the audit work at the Kon-i-Gut deposit in 1950]. Tashkent: Sredaztsvetmetrazvedka, 1950. 26 p.

44. Khabilov T.K., Tadjibaeva D.E., Shumkina A. O letuchikh myshakh peshchery Kani-Gut (yuzhnaya Kirgiziya) [About bats of the Kani-Gut cave (southern Kyrgyzstan)]. Transactions of the acad. B. Gafurov Khujand State University. Natural and economy science series. № 4. Khujand, 2016. P. 135–142.

45. Kin V. Raskryta tayna Kon-i-Guta [The secret of Kon-i-Gut is revealed]. Pravda Vostoka. Tashkent. № 228 (3885). Sept. 30, 1935. P. 4.

46. Kiyanitsa A. Serebryanyy gorod. Tsikl Iskateli na Pervom telekanale [Silver city. Cycle "Searchers" on the First TV channel]. URL: https://bartang.livejournal.com/33114.html (accessed on 10.03.2021).

47. Klyavin H. Razgadka tayn peshchery Kon-i-Gut [Solving the secrets of the Kon-i-Gut cave]. Socialist science and technology. № 20, 1934.

48. Klyavin H. Zagadki peshchery Kon-i-Gut [Mysteries of the Kon-i-Gut cave]. Bulletin of knowledge. № 9, 1936. P. 708–709.

49. Kon-i-Gutskaya ekspeditsiya [Kon-i-Gutskaya expedition]. Military thought. Vol. 1. Tashkent, 1920. P. 411.

50. Kozhobaev K., Almakuchukov O., Matychenkov V., Reis V. Geologicheskie zakazniki i turizm Kyrgyzskoy Respubliki [Geological reserves and tourism of the Kyrgyz Republic]. Bishkek: MOK Press, 2003. 164 p.

51. Krasnodembskaya N.G., Soboleva E.S., Kislyakov V.N. Mikhail Stepanovich Andreev i ego vklad v indiyskie kollektsii Muzeya antropologii i etnografii RAN [Mikhail Stepanovich Andreev and his contribution to the Indian collections of the Museum of Anthropology and Ethnography of the Russian Academy of Sciences]. St-Petersburg: MAE RAN, 2018. 220 p.

52. Kreiter V.M. O nekotorykh geneticheskikh osobennostyakh polimetallicheskikh mestorozhdeniy Sredney Azii [On some genetic characteristics of polymetallic deposits in Central Asia]. Scientific results of the Tajik-Pamir Expedition. Moscow; Leningrad, 1936. P. 508–544.

53. Kreiter V.M. Promyshlennye perspektivy nekotorykh polimetallicheskikh mestorozhdeniy Kirgizskoy SSR [Industrial prospects of some polymetallic deposits of the Kirghiz SSR]. Problems of the Kirghiz SSR. Vol. 1. Proc. of the 2nd confer. on the development of natural resources of the Kirghiz SSR (Feb. 8–12, 1935). Moscow; Leningrad, 1936a. P. 97–106.

54. Kreiter V.M., Smirnov V.I. Konigut [Konigut]. Polymetallic deposits of Central Asia. Proc. of Tajik-Pamir Expedition, 97: Energy and Mineral Resources. Moscow; Leningrad, 1937. P. 311–362.

55. Kreiter V.M., Smirnov V.I. Predgor'ya Turkestanskogo khrebta [Foothills of the Turkestan ridge]. Polymetallic base of Central Asia. Proc. of Tajik-Pamir Expedition, 83: Energy and Mineral Resources. Moscow; Leningrad, 1937a. P. 69–73.

56. Kudryashova N.I. Zametki o rode Willmannium n. stat. s opisaniem novykh vidov i mest nakhodok [Notes on the genus Willmannium n. stat. with a description of new species and places of finds]. Zoological Journal, 1992. Vol. 71, issue 3. P. 33–46.

57. Kurmanaliev K.K. Elementy-primesi v sul'fidakh mestorozhdeniya Kanigut [Trace elements in sulfides of the Kanigut deposit]. Proc. of Academy of Sciences of the Kirgiz SSR, 1968. № 2. P. 58–61.

58. Kurmanaliev K.K. O nekotorykh osobennostyakh geokhimii svintsa i sur'my v rudakh Kan-i-Gutskogo mestorozhdeniya [On some features of the geochemistry of lead and antimony in the ores of the Kan-i-Gut deposit]. Geology and geochemistry of mercury and antimony in Kirgizia. Frunze, 1972. P. 165–168.

59. Leonov G.B. Blagorodnye metally v Turkestanskom krae i ikh dobycha [Noble metals in the Turkestan region and their extraction]. Proc. of the Turkestan dep. of Russian geograph. society, Tashkent, 1918. Vol. XIV, issue. 1. P. 21–34.

60. Litvinsky B.A. Iz arkheologicheskikh materialov po istorii srednevekovoy gornoy tekhniki Sredney Azii (preimushchestvenno IX–XII vv.) [From archaeological materials on the history of medieval mining technology in Central Asia (mainly IX–XII centuries)]. Materials on the history of Tajiks and Uzbeks in Central Asia. Stalinabad, 1954. P. 119–171.

61. Litvinsky B.A. Iz arkheologicheskikh materialov po istorii srednevekovoy gornoy tekhniki Sredney Azii [From archaeological materials on the history of medieval mining technology in Central Asia]. Materials of the 2nd conference of archaeologists and ethnographers of Central Asia (Oct. 29 – Nov. 4, 1956, Stalinabad). Moscow; Leningrad, 1959. P. 47–48.

62. Lunin B.V. Iz istorii russkogo vostokovedeniya i arkheologii v Turkestane [From the history of Russian oriental studies and archeology in Turkestan]. Tashkent: AN Uzbek SSR Press, 1958. 318 p.

63. Lurie M. Po labirintu, v glub' zemli [Along the labyrinth, deep into the earth]. Fergana Pravda, 1987, June 10. № 113; June 12. № 115; June 13. № 116; June 16. № 117; June 19. № 120; June 20. № 121; June 23. № 122; July 1. № 128, July 2. № 129; July 9. № 133.

64. Lykoshin N.S. Ocherk arkheologicheskikh izyskaniy v Turkestanskom krae do uchrezhdeniya Turkestanskogo kruzhka lyubiteley arkheologii [Essay on archaeological research in the Turkestan region before the establishment of the Turkestan Circle of Archaeology Devotees]. Central Asia Bulletin. Tashkent, 1896. № 7, 9. P. 27.

65. Machulin V.V., Kuleshov V.A., Ovsyannikov L.S. Rezul'taty poiskovykh rabot v Kan-Karatauskom rudnom rayone [Results of prospecting works in the Kan-Karatau ore region]. Vol. 1. Khaidarkan: South Kirgiz Geol. Exped., 1992. 144 p.

66. Maksimovich G.A. Stratigraficheskoe raspredelenie dlinneyshikh peshcher SSSR [Stratigraphic distribution of the longest caves in the USSR]. Caves, issue 5 (6). Perm, 1965. P. 32–41.

67. Maksimov G.M. Kan-i-Gut – mify i real'nost' [Kan-i-Gut: myths and reality]. Spelestological yearbook of ROSI. Moscow, 1999. P. 81–90.

68. Mallitsky N.G. Rudnik Pogibeli (peshchera Kan-i-Gut) [The Mine of Doom (Kan-i-Gut Cave)]. Protocols of the Turkestan Circle of Archaeology Devotees, year 2, (appendix to the minutes of Dec. 11, 1896). Tashkent, 1897. P. 1–18.

69. Mamatkulov M.M. Nekotorye morfometricheskie pokazateli peshcher Sredney Azii [Some morphometric indicators of the caves of Central Asia]. Caves. Perm, 1978. № 17. P. 34–37.

70. Markova Yu.N., Bazarova E.P., Zolotarev K.V., Rakshun Ya.V. Predvaritel'nye rezul'taty geokhimicheskikh issledovaniy rykhlykh otlozheniy peshchery-rudnika Kan-i-Gut v predgor'yakh Turkestanskogo khrebta (Kyrgyzstan) metodom RFA SI [Preliminary results of geochemical studies of loose sediments of the Kan-i-Gut cave mine in the foothills of the Turkestan ridge (Kyrgyzstan) by the XRF SI method]. XLIX PNPI School of Condensed Matter Physics. Gatchina, 2015. P. 95.

71. Masson M.E. Monetnye nakhodki v Sredney Azii 1917–1927 gg. [Coin finds in Central Asia 1917–1927]. Proc. of Sredazkomstaris, issue 3. Tashkent, 1928. P. 280–293.

72. Masson M.E. Iz istorii gornoy promyshlennosti Tadzhikistana. Bylaya razrabotka poleznykh iskopaemykh [From the history of the mining industry of Tajikistan. Former mining]. Leningrad: AN USSR, 1934. 108 p.

73. Masson M.E. Neopublikovannye monetnye nakhodki, zaregistrirovannye na territorii Kirgizskoy SSR do 1947 goda [Unpublished coin finds registered on the territory of the Kyrgyz SSR before 1947]. Proc. of the Institute of Language, Literature and Art of the Kyrgyz Branch AN USSR, issue 2. 1948. P. 141–145.

74. Masson M.E. Rudnik Pogibeli [The Mine of Doom]. Frunze: Kyrgyzstan, 1971. 48 p.

75. Merenkov V.V., Myasnikova O.P. Otchet Yuzhno-Ferganskogo poiskovogo otryada za 1945 god [Report of the South Fergana reconnaissance crew for 1945]. Tashkent: Sredaztsvetmetrazvedka, 1945. 97 p.

76. Moskvin A.V. Tefroit iz drevnikh shlakov [Tephroite from ancient slags]. Proc. of the Petrographic Institute, 1933, issue 4. P. 45–52.

77. Nazaroff P. Kuh-i-Sim: the treasure of Turkestan // Blackwood's Magazine, 1929. Vol. 226. P. 184–196.

78. Obuch J. & Rybin S.N. Food of the eagle owl (Bubo bubo zaissanensis Chachlov) in Southern Kirgizia (Osh district) // Folia Zoologica, 1993, 42. № 1. P. 19–31.

79. Ogudin V.L. Tretiy yarus mirozdaniya, ili kul'tovye peshchery Fergany [The third tier of the universe, or the cult caves of Fergana]. Bishkek: Raritet, 2013. 356 p.

80. Ovchinnikov A.G., Maksimova V.P. Otchet po geologo-razvedochnym rabotam Kan-i-Gutskogo rudnika za 1955 god [Report on geological exploration work in the Kan-i-Gut mine for 1955]. Kansai: Glavtsinksvinets, 1956. 31 p.

81. Ozerova N.A. K voprosu o genezise rtutno-sur'myanykh mestorozhdeniy Yuzhnoy Fergany [On the genesis of mercury-antimony deposits in South Fergana]. Geochemistry, 1960. № 3. P. 251–260.

82. Petrov V.N. Geologicheskiy otchet za 1948 god Kon-i-Gutskogo poiskovogo otryada Choyrukh-Dayronskoy geologo-razvedochnoy partii [Geological report for 1948 of the Kon-i-Gut reconnaissance crew of the Choirukh-Dayron prospecting party]. Tashkent, Sredaztsvetmetrazvedka, 1948. 33 p.

83. Petrov V.N. Otchet po geologo-razvedochnym rabotam Kon-i-Gutskoy geologo-razvedochnoy partii po polimetallicheskomu mestorozhdeniyu Kon-i-Gut v 1949 godu [Report on the prospecting work of the Kon-i-Gut prospecting party for the Kon-i-Gut polymetallic deposit in 1949]. Kon-i-Gut: Sredaztsvetmetrazvedka, 1949. 18 p.

84. Petrov V.N. Geologicheskoe opisanie i podschet zapasov po polimetallicheskomu mestorozhdeniyu Kon-i-Gut po sostoyaniyu na 01.01.1951 god [Geological description and calculation of reserves for the Kon-i-Gut polymetallic deposit as of 01.01.1951]. Tashkent: Sredaztsvetmetrazvedka, 1951. 264 p.

85. Petrov V.N., Khalmatov A.Kh., Purkina Z.A. Kratkoe opisanie mineralov peshchery-rudnika Kan-i-Gut [Brief description of the minerals of the Kan-i-Gut cave mine]. Speleology and Karstology. Simferopol, 2014. № 13. P. 54–59.

86. Petrov V.N. Nadpis' na drevney peshchere Kan-i-Gut [Inscription on the ancient Kan-i-Gut cave]. Journal of the Association of Ural Cavers, 2015. № 25. P. 49–53.

87. Petrov V.N. Marshrutnoe opisanie vyrabotok drevnego rudnika Kan-i-Gut [Route description of the workings of the ancient mine Kan-i-Gut]. Speleology and Spelestology. Naberezhnye Chelny, 2015a. P. 199–204.

88. Ploskikh V.M. Kirgizy i Kokandskoe khanstvo [Kirgiz People and the Khanate of Kokand]. Frunze: Ilim, 1977. 365 p.

89. Popov M.G. Peshchera Kon-i-Gut v Ferganskikh gorakh [Kon-i-Gut cave in the Fergana mountains]. Proc. of the Turkestan dep. of Russian geograph. society, 1924. Vol. 17. P. 179–184.

90. Potapov S.S. Srednevekovaya peshchera-rudnik Kon-i-Gut (Kyrgyzstan) [Medieval cave mine Kon-i-Gut (Kyrgyzstan)]. Geological and archaeological research in the Timan-Severouralsk region. Syktyvkar, 2006. P. 81–85.

91. Potapov S.S., Parshina N.V., Bazarova E.P., Maksimovich N.G. Nakhodka kristallogidratov sul'fatov zheleza i magniya – rotsenita, starkiita i epsomita v peshchere-rudnike Kon-i-Gut [Finding hydrated iron and magnesium sulfates – rozenite, starkeyite and epsomite in the Kon-i-Gut cave mine]. Problems of mineralogy, petrography and metallogeny, issue 18. Perm, 2015. P. 95–101.

92. Preobrazhensky I.A. Mestorozhdeniya radioaktivnykh mineralov Zapadnoy Fergany [Deposits of radioactive minerals in Western Fergana]. Transactions on the study of radium. Vol. 2. Leningrad, 1926. P. 73–120.

93. Pshenin G.N. Drevniy karstovyy rel'yef gornoy Fergany i nekotorye voprosy metodiki paleomorfostrukturnogo analiza gornykh stran [Ancient karst relief of mountainous Fergana and some questions of the methodology of paleomorphic structural analysis of mountainous countries]. Geomorphology, 1986. № 4. P. 78–87.

94. Radkevich E.A. Lyakhanskoe polimetallicheskoe mestorozhdenie v Yuzhnoy Fergane i ego genezis [Lyakhan polymetallic deposit in South Fergana and its genesis]. Moscow: AN USSR Press, 1938. 80 p.

95. Rajwa A. W jaskiniach Pamiro-Ałaju // Biuletyn Speleoklubu Tatrzańskiego Dewiator. № 18. Russian translation: URL: http://kani-gut.narod.ru/deviator.htm (accessed on 10.03.2021).

96. Reis V.E., Kilin V.L. Izuchenie gidrogeologicheskikh i inzhenerno-geologicheskikh usloviy gornykh vyrabotok, peshcher i drugikh estestvennykh polostey v gornykh porodakh i poiskovye marshruty [Study of hydrogeological and engineering-geological conditions of mine workings, caves and other natural cavities in rocks and prospecting routes]. Frunze, 1974. 85 p.

97. Reis V.E. Karst i peshchery Kirgizii [Karst and caves of Kirgizia]. Development of geographical sciences in Kirgizia. Frunze, 1980. P. 108–114.

98. Rybin S.N. Fauna letuchikh myshey i ikh ektoparazitov v Yuzhnoy Kirgizii [Fauna of bats and their ectoparasites in southern Kirgizia]. Rare species of mammals and their protection. Moscow, 1977. P. 60–62.

99. Rybin S.N. Rukokrylye Yuzhnoy Kirgizii [Bats of Southern Kirgiziya]. Bats (Chiroptera). Problems of theriology. Moscow, 1980. P. 87–95.

100. Rybin S.N. Gamazoidnye kleshchi rukokrylykh i ikh ubezhishch v Yuzhnoy Kirgizii [Hamazoid mites of bats and their refuges in southern Kirgizia]. Parasitology, 1983. Vol. 17. № 5. P. 355–360.

101. Rybin S.N., Horáćek I., Červenỳ J. Bats of Southern Kirghizia: Distribution and Faunal Status // European bat research, 1987. Praha, 1989. P. 421–441.

102. Serebryanyy gorod. Sokrovishcha drevney Kirgizii [Silver City. Treasures of ancient Kirgizia]. URL: https://www.youtube.com/watch?v=mDndfclHqoY (accessed 10.03.2021).

103. Shcherbakov D.I. Mestorozhdeniya radioaktivnykh rud i mineralov Fergany i zadachi ikh dal'neyshego issledovaniya [Deposits of radioactive ores and minerals in Fergana and the tasks of their further research]. Materials for the study of the natural productive forces of Russia. № 47. Leningrad, 1924. 59 p.

104. Sheina N.P. Otchet po geologo-razvedochnym rabotam Kan-i-Gutskogo rudnika za 1952 god [Report on geological exploration at the Kan-i-Gut mine for 1952]. Kan-i-Gut: Soyuzvinetsrazvedka, 1953. 55 p.

105. Sheina N.P. Otchet po geologo-razvedochnym rabotam Kan-i-Gutskogo rudnika za 1953 god [Report on geological exploration at the Kan-i-Gut mine for 1953]. Kan-i-Gut: Soyuzsvinetsrazvedka, 1954. 82 p.

106. Sheina N.P., Maksimova V.P. Otchet po geologo-razvedochnym rabotam Kan-i-Gutskogo rudnika za 1954 god [Report on geological exploration at the Kan-i-Gut mine for 1954]. Kan-i-Gut: Glavtsinksvinets, 1954. 58 p.

107. Smirnov V.I. V geologicheskikh ekspeditsiyakh [In geological expeditions]. Science and Life, 1970. № 12. P. 69–79.

108. Smirnov V.I. Tropoyu geologa [By the path of the geologist]. Moscow: MSU Press, 1992. 208 p.

109. Snesarev A.N. Materialy po rasprostraneniyu radioaktivnosti v zapadnoy chasti Ferganskoy Oblasti [Materials on the spread of radioactivity in the western part of the Fergana Region] // Transactions on the study of radium. Vol. 2. Leningrad, 1926. P. 121–200.

110. Sosedko A.F. Kon-i-Gut [Kon-i-Gut]. Isfara na stroyke [Isfara is on development]. 1933. № 19 (26), 11 Sept. P. 1.

111. Sosedko A.F. Poleznye iskopayemye Turkestanskogo khrebta [Mineral resources of the Turkestan ridge]. The Tajik-Pamir expedition of 1933. Leningrad, 1934. P. 53–66.

112. Sosedko A.F. Kon-i-Gut [Kon-i-Gut]. Socialist Science and Technology. Tashkent, 1935. № 12. P. 17–24.

113. Sterlin A.D., Khalyandra V.G. Otchet o revizionno-otsenochnykh rabotakh na polimetallicheskikh mestorozhdeniyakh Kan-i-Gut, Karaotek, Eskikan i dr. v gorakh Maydantau, Ferganskiy Karatau i Guzan (po rabotam Geofizicheskoy partii za 1981–1985 gg.) [Report on revision and appraisal works at polymetallic deposits Kan-i-Gut, Karaotek, Eskikan and others in the mountains of Maidantau, Fergana Karatau and Guzan (based on the work of the Geophysical Party for 1981–1985)]. Kairakkum, 1985. 197 p.

114. Trudy Instituta istorii [Proceedings of the Institute of History]. Frunze, 1956, issue 2. P. 112.

115. Tsibanov V.V. Kan-i-Gut. 2004. Main page. URL: http://www.kani-gut.narod.ru (accessed 10.03.2021).

116. Tsibanov V.V. Kan-i-Gut: "Rudnik Pogibeli" zhdet issledovateley [Kan-i-Gut: "The Mine of Doom" awaits researchers]. 10th Scientific seminar "Mineralogy of Technogenesis – 2009" (Miass, June 25–27, 2009). Miass, 2009. P. 188–202.

117. Tsibanov V.V., Filippov A.G., Dudashvili A.S. Morfologiya i trekhmernye izobrazheniya rudnika-peshchery Kan-i-Gut [Morphology and three-dimensional images of the Kan-i-Gut cave mine]. Speleology and Karstology. № 10. Simferopol, 2013. P. 5–15.

118. Tsibanov V.V. Kan-i-Gut – 2014. Illyustrirovannyy dnevnik ekspeditsii [Kan-i-Gut – 2014. Illustrated diary of the expedition]. 2014. URL: http://kani-gut.narod.ru/kig-2014diary1.htm (accessed on 10.03.2021).

119. Tsibanov V.V., Otmakhov I.A., Filippov A.G. Issledovanie nizhnikh gorizontov Kan-i-Guta v 2014 godu [Study of the lower levels of Kan-i-Gut in 2014]. Speleology and Spelestology. Naberezhnye Chelny, 2014. P. 273–286.

120. Tsibanov V.V., Filippov A.G. Kviton – uchastnik (uchastnitsa?) Kan-i-Gutskoy ekspeditsii 1920 g. [Kviton: the participant of the Kan-i-Gut expedition in 1920]. Journal of the Association of Cavers of the Urals, 2016. № 29. P. 43–45.

121. Tsibanov V.V., Filippov A.G. Kan-i-Gut: shtrikhi k proshedshim vremenam [Kan-i-Gut: the touches to the foretime]. Journal of the Association of Cavers of the Urals, 2018. № 35. P. 34–38.

122. Tsykin R.A. Poleznye iskopayemye karsta [Mineral resources of karst]. Caves. Perm, 1990. P. 68–72.

123. Turkestanskie Vedomosti [Turkestan Gazette]. Tashkent, 1881. № 1.

124. Veber V.N. Geologicheskaya karta Sredney Azii. List VII-6 (Isfara), severnaya polovina [Geological map of Central Asia. Sheet VII-6 (Isfara), northern part]. Trans. of the United Geol. and Prospecting Service of USSR, issue 194. Leningrad-Moscow-Novosibirsk: ONTI-NKTP, 1934. 277 p.

125. Vorobiev V.A. Peshchera Kon-i-Gut [Kon-i-Gut cave]. Pravda Vostoka. № 148. Tashkent, 1934. P. 2.