ISSN 2518-170X (Online)
ISSN 2224-5278 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ

Satbayev University

ХАБАРЛАРЫ

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ
НАУК РЕСПУБЛИКИ
КАЗАХСТАН
Satbayev University

N E W S

OF THE ACADEMY OF SCIENCES
OF THE REPUBLIC OF
KAZAKHSTAN
Satbayev University

SERIES

OF GEOLOGY AND TECHNICAL SCIENCES

1 (457)

JANUARY – FEBRUARY 2023

THE JOURNAL WAS FOUNDED IN 1940

PUBLISHED 6 TIMES A YEAR

ALMATY, NAS RK

NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

«ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Меншіктеуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).

Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген **№ KZ39VPY00025420** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: *геология, мұнай және газды өңдеудің химиялық технологиялары, мұнай химиясы, металдарды алу және олардың қосындыларының технологиясы.*

Мерзімділігі: жылына 6 рет.

Тиражы: 300 дана.

Редакцияның мекен-жайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., тел.: 272-13-19
http://www.geolog-technical.kz/index.php/en/

Типографияның мекен-жайы: «Аруна» ЖК, Алматы қ., Мұратбаев көш., 75.

«Известия НАН РК. Серия геологии и технических наук».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан **№ KZ39VPY00025420,** выданное 29.07.2020 г.

Тематическая направленность: *геология, химические технологии переработки нефти и газа, нефтехимия, технологии извлечения металлов и их соеденений.*

Периодичность: 6 раз в год.

Тираж: 300 экземпляров.

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, оф. 219, тел.: 272-13-19

http://www.geolog-technical.kz/index.php/en/

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75.

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technology sciences.
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)
Owner: RPA «National Academy of Sciences of the Republic of Kazakhstan» (Almaty).
The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan **No. KZ39VPY00025420,** issued 29.07.2020.
Thematic scope: *geology, chemical technologies for oil and gas processing, petrochemistry, technologies for extracting metals and their connections.*
Periodicity: 6 times a year.
Circulation: 300 copies.
Editorial address: 28, Shevchenko str., of. 219, Almaty, 050010, tel. 272-13-19
http://www.geolog-technical.kz/index.php/en/

Address of printing house: ST «Aruna», 75, Muratbayev str, Almaty.

NEWS of the National Academy of Sciences of the Republic of Kazakhstan
SERIES OF GEOLOGY AND TECHNICAL SCIENCES
ISSN 2224-5278
Volume 1, Number 457 (2023), 177-188
https://doi.org/10.32014/2023.2518-170X.268

UDC 551.04

Ye.V. Ponomareva[1*], M.V. Ponomareva[1], F.M. Issatayeva[1], I.V. Sukhanov[2]

[1]NPJSC «Abylkas Saginov Karaganda Technical University»;
[2]LLP «GEO.KZ».
E-mail: *mv_ponomareva18@mail.ru*

CRITERIA OF PROSPECTING AND EVALUATION WORKS FOR COPPER AND POLYMETALLIC ORES AT THE EAST ATABAY SITE

Abstract. At present, an urgent task is to increase the country's mineral resource base. Since almost the entire territory of the Republic of Kazakhstan to one degree or another has been studied, it is advisable to carry out additional study of previously discovered sites and ore occurrences. From the point of view of the geological structure and stages of ore formation, the East Atabay site located in the Karaganda region is interesting for study. A low state of knowledge of copper ore at the East Atabay site is associated with an insufficiently complete set of geological exploration work performed earlier. In addition, copper mineralization is not dip-detected and has very uneven thicknesses of ore undercuts along the profiles. The above factors were the main reasons for a detailed study of the East Atabay site. According to the results of the entire complex of work performed, the site was recognized as economically inefficient for introduction into development and requiring more detailed additional study. Taking into account how much the approach has changed in the economic justification of the prospects of the territories in the Soviet period and today, it is necessary to re-evaluate and recalculate reserves and predicted resources within the East Atabay site. Since the first two stages of prospecting works in this area have already been completed by the predecessors (regional geological study of the subsoil and prospecting), it is necessary to complete the next stage: prospecting and evaluation works. Based on the data of predecessors and new data obtained, the database on ditches and boreholes has been developed, and a wireframe model has been built for ore zones, bodies and lenses, and criteria for prospecting and evaluation works for copper and polymetallic ores have been identified.

Key words: ore occurrence, wireframe model, prospecting and evaluation works, mineralization, borehole, ditch.

Е.В. Пономарева[1*], М.В. Пономарева[1], Ф.М. Исатаева[1], И.В. Суханов[2]

[1]КЕАҚ «Абылқас Сағынов атындағы Қарағанды техникалық университеті»;
[2]ЖШС «GEO.KZ».
E-mail: *mv_ponomareva18@mail.ru*

ШЫҒЫС АТАБАЙ АУМАҒЫНДАҒЫ МЫС ЖӘНЕ ПОЛИМЕТАЛЛ КЕНДЕРІН БАРЛАУ ЖӘНЕ БАҒАЛАУ ЖҰМЫСТАРЫНЫҢ КРИТЕРИЯЛАРЫ

Аннотация. Қазіргі уақытта еліміздің минералдық-шикізаттық базасын қалыптастыру кезек күттірмейтін міндет болып табылады**.** Қазақстан Республикасының барлық аумағы әр түрлі дәрежеде зерттелгендіктен, бұрын ашылған учаскелер мен кен көріністерді қосымша зерттеуді жүргізген жөн. Геологиялық құрылымы мен кен түзілу кезеңдері тұрғысынан Қарағанды облысында орналасқан Шығыс Атабай учаскесі зерттеу үшін қызықты. Шығыс Атабай учаскесіндегі мыс кендерінің нашар зерттелгені алдында орындалған геологиялық барлау жұмыстар кешенінің жеткіліксіз толықтығына байланысты. Сондай-ақ, мыс минералдануы шөгу бойымен тереңдікке дейін контурланбайды және профильдер бойындағы кен кесінділерінің өте біркелкі емес қалыңдығына ие. Жоғарыда аталған факторлар Шығыс Атабай аймағын жан-жақты зерттеуге басты себеп болды. Алдыңғылар орындаған жұмыстардың нәтижелері одан әрі жұмыс істеу үшін экономикалық тұрғыдан тиімді емес деп танылды. Осы фактіні және кеңестік кезеңдегі және бүгінгі таңдағы аумақтардың болашағын экономикалық негіздеуде көзқарастың қаншалықты өзгергенін ескере отырып, мен Шығыс Атабай ауданы шегіндегі қорларды қайта бағалау және қайта есептеу қажет деп санаймын. Бұл аймақтағы барлау жұмыстарының алғашқы екі кезеңін бұрынғылар (жер қойнауын аймақтық геологиялық зерттеу және іздеу) аяқтағандықтан, келесі кезең – іздеу-бағалау жұмыстарын аяқтау қажет. Алдыңғылардың деректері мен алынған жаңа деректер негізінде арықтар мен ұңғымалардың деректер базасы құрылды, рудалық аймақтар, денелер мен линзалар үшін сым каркас үлгісі салынды, мыс және полиметалл кендерін іздеу және бағалау жұмыстарының критерийлері анықталды.

Түйінді сөздер: кен біліну, қалыпты ұлгі, іздеу-бағалау жұмыстары, кендену, ұңғыма, арық.

Е.В. Пономарева[1*], М.В. Пономарева[1], Ф.М. Исатаева[1], И.В. Суханов[2]

[1]НАО «Карагандинский технический университет имени Абылкаса Сагинова»;
[2]ТОО «GEO.KZ».
E-mail: *mv_ponomareva18@mail.ru*

КРИТЕРИИ ПОИСКОВО-ОЦЕНОЧНЫХ РАБОТ НА МЕДНЫЕ И ПОЛИМЕТАЛЛИЧЕСКИЕ РУДЫ НА ПЛОЩАДИ ВОСТОЧНЫЙ АТАБАЙ

Аннотация. В настоящее время актуальной задачей является наращивание минерально-сырьевой базы страны. Поскольку практически вся территория Республики Казахстан в той или иной степени изучена, целесообразно проводить доизучение ранее обнаруженных участков и рудопроявлений. С точки зрения геологического строения и этапов формирования руд интересным для изучения является участок Восточный Атабай, расположенный в Карагандинской области. Малая изученность медной руды на участке Восточный Атабай связана с недостаточно полным комплексом геологоразведочных работ, выполненных ранее. Кроме того, медное оруденение не законтурено на глубину по падению и имеет очень неравномерные мощности рудных подсечений по профилям. Вышеизложенные факторы явились основными причинами для детального изучения площади Восточный Атабай. По результатам всего комплекса выполненных работ участок был признан экономически неэффективным для введения в разработку и требующим более детального доизучения. Учитывая, насколько изменился подход в экономическом обосновании перспективности территорий советского периода, и в наши дни необходимо произвести переоценку и пересчет запасов в пределах площади Восточный Атабай. Поскольку первые две стадии геологоразведочных работ на данной территории уже выполнены предшественниками (региональное геологическое изучение недр и поисковые работы), необходимым является выполнение следующей стадии – поисково-оценочные работы. На основе данных предшественников и новых полученных данных создана база данных по канавам и скважинам, а также отстроена каркасная модель по рудным зонам, телам и линзам, а также выделены критерии поисково-оценочных работ на медные и полиметаллические руды.

Ключевые слова: рудопроявление, каркасная модель, поисково-оценочные работы, оруденение, скважина, канава.

Introduction. From the point of view of the geological structure and stages of ore formation, the East Atabay site located in the Karaganda region is interesting for study. From the 40s of the XX century, this area was studied by various researchers until the end of the 80s. However, according to the results of the entire complex of work performed, the site was recognized as economically inefficient and requiring more detailed additional study.

A characteristic feature of the East Atabay site is the presence of both copper and polymetallic mineralization. Polymetallic ore (lead and zinc) is inherently associated with the so-called pyrite rhythmites. At the site, ferro-manganese ores are also quite widely developed and represented by quite serious in terms of thickness bodies (undercutting by wells from 20 to 100 m), and similarly to pyrite rhythmites, they have access to the daylight surface. Copper mineralization that is less studied than iron-manganese ore and pyrite rhythmites is the most interesting there (Avdonin, 2007).

The purpose of the study is to substantiate the criteria of prospecting and evaluation works for copper and polymetallic ores in the East Atabay site, the Karaganda region.

The tasks of the study are as follows: to study the structure and characteristics of ore deposits in the East Atabay area, to compile a database of boreholes and ditches in the Micromine program, to identify the main criteria of prospecting and appraisal works for the complete understanding of the morphology of ore bodies in the area of the site, to develop a 3D model of ore body frameworks and lenses in the Micromine program, to identify the most promising areas for detailed study, to make recommendations for the further detailed study (Baibatsha, 2008).

Materials and basic methods. The area of the works is located in the east of Central Kazakhstan and is an administrative part of the Karkaraly district of the Karaganda region (Figure 1).

The surface of the work area is characterized by low-mountain and low-hill terrain and is determined by its belonging to the eastern part of the Kazakh upland and the Irtysh-Balkhash watershed (Bekzhanov, 2000).

The low-mountain relief is represented in the east of the region by the Kent mountains, in the north by the Karagaily mountains, and by the Kyzyladyr and Dugulinsky mountains in the central part of the region. The rest of the territory is a typical hilly area separated by more or less wide river valleys. The maximum absolute elevations are noted in the Kent mountains (1290 m), the minimum ones in the Taldy River valley (830 m), the highest relative elevations do not exceed 450 m.

The river network of the region is represented by the Taldy River and its shallow low-water tributaries, most of which dry up in the summer. The Taldy River has a continuous flow throughout the year. It is mainly fed by the fissure waters of the Kent granite massif, to a lesser extent by atmospheric precipitation. Alluvial waters of the Taldy River is used for drinking and technical water supply of the Karagaily settlement (Herron, 1998).

Sedimentary, sedimentary-volcanogenic and effusive formations of various ages are developed within the described area. Deposits of the Devonian system, Carboniferous, Neogene systems and Quaternary formations stand out in the described territory.

Devonian deposits represented mainly by sedimentary, rarely tuffaceous formations, are quite widely developed. In terms of age, they are subdivided into the Givetian-Fransian undivided stages and the Famennian stage.

Deposits of the Givetian-Fransian stages are insignificantly developed in the described area and are exposed in the central part of the territory between the areas of the Duga Mountains and the Atabay-Dugulinsky structure (Baibatsha, 2008).

They are everywhere represented by gray, dark gray and greenish gray siltstones, sandstones with lenses and interlayers of conglomerates and limestones. The described deposits are in most cases exposed in tectonic blocks separated from each other, which makes it difficult to draw up the sections and trace the sections along the vertical (Khromykh, 2020).

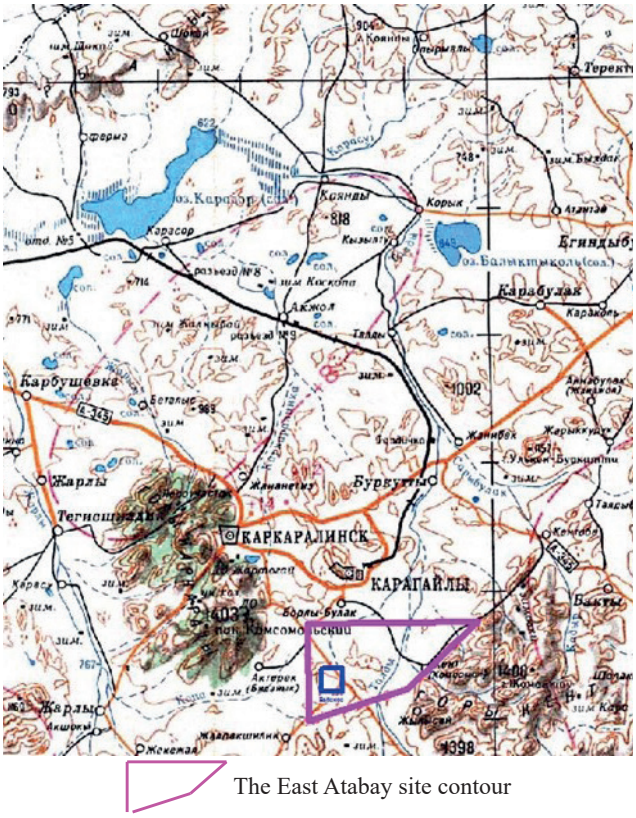

Figure 1 – The east Atabay layout

Within the limits of the Karagaily ore field, the tops of the Givetian-Fransian deposits are exposed, according to which they are overlain by coarse clastic deposits of the lower sequence of the Famennian stage.

The total thickness of the deposits of the Givetian-Fransian stages reaches 1000 meters.

The deposits of the Famennian stage are most widely developed in the central and southern parts of the area composing the Karagaily field and the Atabay-Dugulinsky region. Since these deposits are ore-bearing, they are the most studied part of the stratigraphic section.

As a result of geological surveys on a scale of 1:50,000, the Famennian deposits were subdivided into two sequences: lower (D_3fm a) and upper (D_3fm b) ones. The division of the deposits was based on the lithological difference between the constituent rocks.

The deposits are represented by conglomerates, tuffites, tuffs, inequigranular sandstones and siltstones with limestone lenses. The main accumulations of barite-polymetallic and iron ores of the Atabay-Dugulinsky structure are confined to these deposits (Mizernaya, 2020).

The deposits of the Famennian stage are sedimentary-volcanogenic in character and overlie unconformably the sedimentary rocks of the Givetian-Fransian stages. The conditional boundary between these complexes is drawn along the base of purple inequigranular sandstones attributed to the lower sequence of the Famennian stage (D_3fm a) (Baibatsha, 2008).

The section of the deposits of the lower stratum of the Famennian stage is not sustained: in the area of the Karagaily ore field, the lower stratum is composed of coarse-grained sandstones with a subordinate value of calcareous sandstones and conglomerates; east of the Karagaily deposit, calcareous sandstones and siltstones acquire an important role in the composition of the lower stratum.

The deposits of the upper Famennian stratum conformably overlie the deposits of the lower stratum, they sharply differ in lithological composition (Pearce, 1984).

The structure of the section of this stratum involves carbonate-siliceous deposits with a significant admixture of volcanic material. The rocks that make up the upper stratum are intensively dislocated and metamorphosed, which makes it difficult to make sections. In the section of the upper stratum, the presence of nodular-layered and lumpy calcareous-siliceous formations is everywhere established (Ponomareva, 2021).

In the area of the town of Duga, deposits of the upper part are represented by calcareous sandstones, nodular-layered and lumpy limestones, calcareous siltstones, and nodular-layered limestones with brachiopod fauna. These deposits overlie conformably coarse clastic sandstones of the lower sequence.

In the structure of the section of the Famennian deposits of the Atabay-Dugulinsky region, cherry fine-grained cross-bedded sandstones with hematite interlayers, ash tuffs, lithocrystal-clastic tuffs of intermediate composition, clay-sericite shales, tuffaceous sandstones and siltstones take part.

Within the Karkaraly ore region, most of the deposits and ore occurrences of polymetals, barite, iron and manganese are spatially associated with the deposits of the lower strata, which determines their practical significance.

The production Atabay-Dugulinsky section is composed of clarified opalized rocks developed over carbonaceous-argillaceous shales, limestones and siliceous-hematite shales. The latter are fixed from the surface by a strip of loose kaolinized white rocks (oxidation zone). Below the oxidation zone, the rocks of the productive horizon are represented by dark carbonaceous shales and layers of pyrite rhythmites (Porotov, 2006).

Between the carbonaceous-argillaceous and clayey-sericite schists, a horizon of manganese-hematite ores is fixed in the form of a lens from 9 to 24 m (East Atabay site). The level is represented by the alternation of thin interlayers of manganese and hematite oxides with clay-sericite and siliceous wax-red schists.

The described productive horizon can be traced from the former Konstantinovsky mine to the Zataldinsky site for a distance of about 20-25 km. All polymetallic ore occurrences of the Atabay-Dugulinsky zone are spatially associated with it.

The described area is characterized by a wide development of Neogene deposits, which are mostly overlain by Quaternary deposits. Deposits of the Neogene system are represented by the Aral and Pavlodar suites.

The Aral suite (N_1 ar) is not mapped on the surface; it is noted only according to drilling data and is represented by green, greenish-gray dense and viscous clays with an insignificant admixture of sandy material. Rarely, accumulations of iron-manganese segregations of rounded shape (pisolites) and small druses of gypsum crystals are observed in the lower Aral clays. The thickness of the Aral suite reaches 45 m (Roser, 1988).

The Pavlodar suite (N_{1-2} pv) is represented by loose red-brown and yellowish-gray clays with a significant admixture of sand. The clays of the Pavlodar suite lie with erosion on the greenish-gray and green clays of the Aral suite or directly on the rocks of the Paleozoic basement. Interlayers and lenses of medium-coarse-grained sands are often noted in the section of Pavlodar clays. In the valley of the Talda River, the thickness of Pavlodar clay reaches 100 m.

Quaternary deposits in the area of work are ubiquitous with the thickness of several centimeters to 20-25 m. According to the formation conditions, they are divided into alluvial, alluvial-proluvial, deluvial-proluvial and lacustrine.

The age division of the Quaternary deposits was made according to the geomorphological feature and has the following form (Samygin, 2019):

1. The lower-middle sections are undivided. These are alluvial-proluvial and deluvial-proluvial deposits of the second floodplain terrace and foothill areas.

2. The upper-modern sections are undivided. These are alluvial-proluvial deposits of troughs and temporary runoff planes.

According to the lithological composition, Quaternary deposits are subdivided into sandy, gravelly loams, sandy loam, crushed stone, sandy pebble and sandy formations.

Intrusive rocks in the area are widely developed and are represented by complexes of different composition and age (Tretyakov, 2015):

1. Gabbro-peridotites, gabbro-diorites, diorites, and gabbro-diabases of the Upper Devonian age $акD_3$ exposed within the Zataldinsky deposit.

2. Granodiorites of the Middle Carboniferous (Topar) $укC_2$ complex are widely developed in the southern part, where they are represented by coarse-grained hornblende varieties. Fine-grained veined granites are noted, localized along the fractures of fragments in granodiorites.

3. Kaldyrminsky (Upper Carboniferous) yC_3kd complex is represented by coarse-medium-grained biotite granites of the second intrusion phase and additional intrusions composed of fine-medium-grained biotite-bearing granites. The vein series of the Kaldyrma complex, represented by rocks of the first and second stages, is noted in the form of steeply dipping and gently dipping bodies confined to a system of fractures in the intrusion.

4. The vein rocks of the second stage are represented by dikes of granite-porphyries, microdiorites, and gabbro-diabases. The dikes of the second stage are predominantly submeridional and northeasterly, very consistent along strike, up to 10 m thick.

5. Permian (Akchatau) γPaк intrusive complex is represented by coarse-grained alaskite granites, which are exposed in the Kent and Karkaraly mountains.

It should be noted that due to the significant development of intrusive rocks, the area is characterized by a wide manifestation of metamorphism processes. The formations enclosing the intrusions were subjected to contact metamorphism, as a result of which, depending on the initial composition of the rocks, metasomatites of both magmatic and postmagmatic stages, different in composition, were formed.

The studied area is located at the junction of the northeastern end of the Uspenskaya tectonic zone with the Tokrau synclinorium. The rocks of the region are united in the Variscian structural stage.

According to the degree of dislocation of the constituent rocks, a two-membered division of the Variscan stage is clearly established for the region.

Devonian rocks compose linearly elongated sublatitudinal structures complicated by higher-order folds, faults, and cut through by intrusions of the Topar and Kaldyra complexes. This complex of rocks is combined into the Early Varisian substage.

Volcanic rocks of the Karkaraly suite rest unconformably on Devonian deposits. They compose brachyform structures predominantly of northwest strike. These structures are combined into the Late Varisian substage (Vdovkin, 2018).

Loose deposits of the Cenozoic form the upper structural stage of the platform type.

The Atabay-Dugulinsky syncline stands out from the structural elements of the Early Varistian substage in the studied area. The northern part of the Atabay-Dugulinsky syncline is divided into small blocks by tectonic faults. Devonian rocks that make up the syncline are crumpled into isoclinal folds with a wingspan of 1 to 3 km, the dip angles of the layers are steep and range from 50 to 80°.

Among the largest faults, disturbances of two main directions are distinguished: northwestern and northeastern, the latter being more recent. Significant displacements (up to 1.5-2.0 m) are noted along them. These faults are fixed on magnetometric maps by sharp changes in magnetic fields.

The faults of the northeast direction should be considered as a continuation of the Uspensky deep zone.

The morphology of the ore bodies in the studied areas is rather uniform. The main ore bodies are stratal deposits consistent with the enclosing rocks having the thickness of 10-15 m, stretching along the strike for 30 km and participating together with the enclosing rocks in all the folded and discontinuous deformations.

At the East Atabay site, ferromanganese ore bodies have a lenticular shape, and copper-barite ores have the same shape. The vein bodies are very rare and are represented by small barite veins of no practical importance.

The complexity of the development of the Atabay-Dugulinsky ore zone has led to the development of various types of ores, both in terms of textural and structural features, and in terms of material composition and genesis.

Within the studied areas, the following types of ores are distinguished and manifested in the following forms:

1. Packages of layers (0.1-10 mm) of finely dispersed pyrite, interbedded with layers of clayey-carbonate rocks with finely disseminated sphalerite (pyrite rhythmites).

2. Fluorite-baritized sedimentary breccias of pyrite rhythmites (brecciated pyrite rhythmites) with disseminated sphalerite and galena.

3. Packages of interlayers (0.1-8 mm) of carbonate material with dense dissemination of galena interbedded with interlayers (10-100 mm) of carbonate-argillaceous rocks with rare dissemination of galena. The package capacity is up to 3 m.

4. Alternating layers of hematite, ferruginous jaspers, siliceous limestones.

5. Horizons of weakly mineralized limestones.

6. Zones of brecciation and hornfelsing with disseminated galena.

7. Zones of brecciation of silicified rocks with copper mineralization.

8. Quartz-barite veins with disseminated galena.

Mineralization of the first five varieties is syngenetic with the enclosing rocks. This is indicated by the strict stratification of ores, the absence of near-ore changes, participation of ores together with enclosing rocks in all the folded and fault formations, characteristic sheet-like shape of ore bodies with large lateral dimensions compared to thickness, and the layered textures of ores. The rest belong to the later epigenetic stage and are metasomatic and vein formations. All the ores of this type are also concentrated within the productive unit. Syngenetic ore bodies have a sheet-like shape, their thickness ranges from 5-30 m, the horizontal extent of ore bodies reaches several kilometers. According to the material composition, iron, iron-manganese, zinc, lead, lead-zinc, barite-polymetallic and copper are distinguished among them. The main mass of barite-polymetallic (syngenetic and hydrothermal) and iron-manganese ores is localized in the lower part of the upper sequence of the Famennian stage, forming an extended (more than 30 km) productive member 100-400 m thick.

The results of the work performed by the predecessors were recognized as not economically viable for further work (Volkov, 2006).

The most significant factors in recognizing the East Atabay area as economically inexpedient for further work were as follows:

– local and rather disparate location of promising areas. At the Old Atabay site, the main mineralization was detected in the near-surface part but was not traced to deep horizons. At the East Atabay site, three promising deposits were identified: pyrite rhythmites containing lead-zinc ores, an iron-manganese ore body with the preliminary calculated average iron content of about 25%, and quartz-barite metasomatites with copper mineralization represented by chalcopyrite.

– the quality of drilling operations was at a rather low level (core recovery from promising ore intervals in some cases was about 60%). This fact indicates that both the percentages and the reserves themselves, with a high degree of probability, were underestimated.

Taking into account this fact and how much the approach has changed in the economic justification of the prospects of the territories in the Soviet period and today, it is considered necessary to re-evaluate and recalculate reserves and predicted resources within the East Atabay area.

Since the first two stages of exploration work in this area have already been completed by the predecessors (regional geological study of the subsoil and prospecting), it is necessary to complete the next stage: prospecting and evaluation works.

The main criteria for prospecting and evaluation works at the East Atabay site are as follows (Pak, 2021):

– formulating the detailed geophysical works to refine the structural-tectonic model of the area. The result of this type of work will be a structural-tectonic model built in the Micromine program, which will in the future give understanding of the possible block structure of promising areas;

– implementing a complex of mining operations (ditching by mechanical means and drilling of inclined core exploratory and structural wells with modern drilling rigs). This type of work is primarily aimed at verifying the work of previous years, as well as at clarifying the percentages of useful components and the power characteristics of production levels;

– the result of the entire complex of works is a wireframe and later a block model of ore bodies and lenses built in the Micromine program, Figure 2. Inferred resources will also be built up. The final stage of the work will be preparing a feasibility study of industrial conditions with the further calculation of reserves and predicted resources in categories P_1-C_2. Given the current economic situation and the need to increase the mineral resource base of the republic, it is highly likely that the East Atabay site will be involved in industrial development.

Results. The geographic and economic position, climatic conditions and infrastructure of the East Atabay area have been studied.

The data of the geological and geophysical knowledge of the studied area have been systematized in order to establish the boundaries of promising areas with ore mineralization.

As a result of studying the geological structure of the East Atabay area, it has been found that iron-manganese mineralization is localized within the East Atabay area. Iron-manganese mineralization comes to the surface, which is confirmed by the data on the sinking mine workings, their geological documentation, as well as the results of analytical studies.

Iron-manganese ore bodies have a lenticular shape, and copper-barite ores have the same shape. The vein bodies are very rare and are represented by small barite veins of no practical importance.

Polymetallic mineralization is inextricably linked with pyrite rhythmites and can be traced in the sublatitudinal direction through the entire East Atabay area. Pyrite rhythmites, like iron-manganese mineralization, have ubiquitous outcrops on the day surface.

Copper mineralization is represented almost everywhere in the entire East Atabay area. Mineralization has accesses to the daylight surface, which is confirmed by mine workings, and in the East Atabay area it is in a blind occurrence and was discovered exclusively based on the results of core drilling.

Discussion. A low level state of knowledge of copper ore at the East Atabay site is associated with an insufficiently complete set of geological exploration work performed earlier. Copper mineralization is not contoured to the depth to the dip and has very uneven thicknesses of ore cuts along the profiles. The above factors were the main reasons for a detailed study of the East Atabay site.

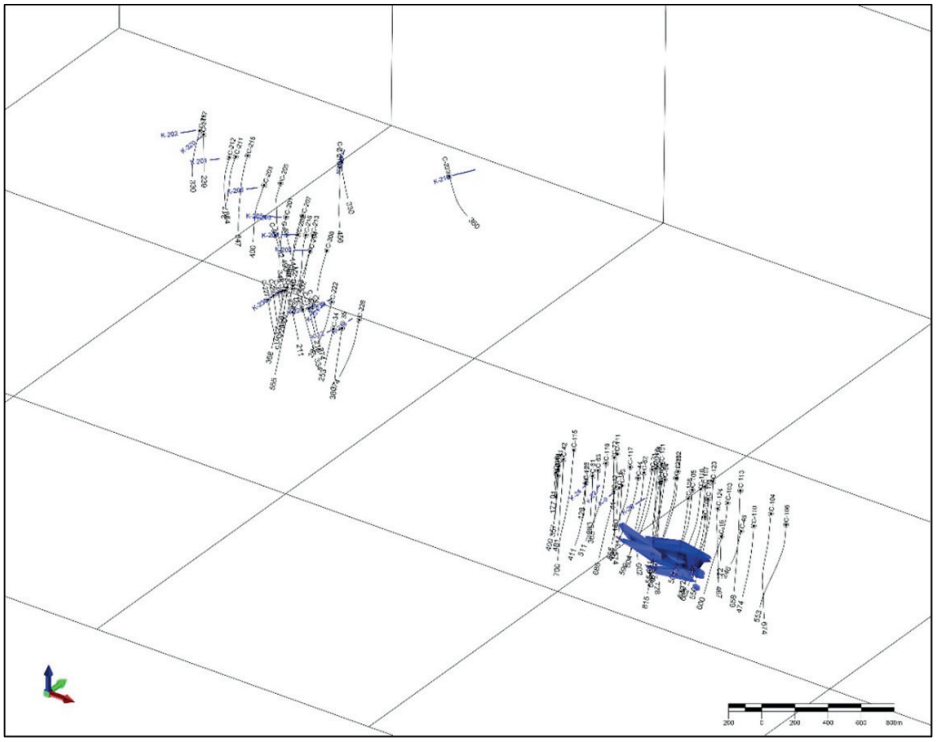

Figure 2 – Databases of ditches and boreholes built in the Micromine program, as well as wireframes of ore bodies for the Old and East Atabay sites

Conclusion. A database of ditches and wells has been developed, and a wireframe model has been built for ore zones, bodies, and lenses. The main criteria for prospecting and evaluation works have been identified and substantiated.

The entire complex of studies in the East Atabay area is aimed at a detailed additional study of reserves and predicted resources of copper and polymetallic ores.

Information about authors:

Ponomareva Yekaterina Vadimovna – Doctor of Philosophy PhD, Associate Professor of the Department of Geology and Exploration of Mineral Deposits, NPJSC «Abylkas Saginov Karaganda Technical University», Karaganda, Republic of Kazakhstan, tel.: +7 705 650 63 34, e-mail: *sea_kitten_1@mail.ru*, *https://orcid.org/0000-0003-1322-6773*;

Ponomareva Marina Victorovna – Candidate of Technical Sciences, Associate Professor of the Department of Geology and Exploration of Mineral Deposits, NPJSC «Abylkas Saginov Karaganda Technical University», Karaganda, Republic of Kazakhstan, tel.: +7 701 471 08 36, e-mail: *mv_ponomareva18@mail.ru*, *https://orcid.org/0000-0001-8652-9607*;

Issatayeva Farida Muratovna – Doctor of Philosophy PhD, Head of the Department of Geology and Exploration of Mineral Deposits, NPJSC «Abylkas Saginov Karaganda

Technical University», Karaganda, Republic of Kazakhstan, tel.: +7 701 606 46 53, e-mail: *adambekova_farid@mail.ru*, *https://orcid.org/0000-0001-6208-3292*;

Sukhanov Igor Vladislavovich – Master's degree, Leading geologist of the LLP «GEO.KZ», Karaganda, Republic of Kazakhstan, tel.: +7 777 850 52 90, e-mail: *igor121192@mail.ru*, *https://orcid.org/0000-0001-5223-0463.*

REFERENCES

Avdonin V.V., Ruchkin G.V., Shatagin N.N., Lygina T.I., Melnikov M.E. (2007). Search and exploration of mineral deposits. Fund "Mir". 540 p.

Baibatsha A.B. (2008). Geology of mineral deposits, Almaty

Baykenzhin M., Asanova Z., Rashid Z., Kasimov A., Ivadilinova D. & Zhunis G. (2022). Modeling the influence of rolled profile strengtheners on the arch support load-bearing capacity. Mining of Mineral Deposits, 16(1), 84-91. *https://doi.org/10.33271/mining16.01.084*

Bekzhanov G.R., Koshkin V.Ya. et al. (2000). Geological structure of Kazakhstan. Almaty

Herron M.M. Geochemical classification of terrigenous sands and shales from core or log data // Journ. Sed. Petrol. – 1998. № 58. Pp. 820-829

Khromykh S.V., Oitseva T.A., Kotler P.D., D'yachkov B.A., Smirnov S.Z., Travin A.V., Vladimirov A.G., Sokolova E.N., Kuzmina O.N., Mizernaya M.A., Agaliyeva B.B. Rare-Metal Pegmatite Deposits of the Kalba Region, Eastern Kazakhstan: Age, Composition and Petrogenetic Implications // Minerals 2020, 10(11), 1017; *https://doi.org/10.3390/min10111017*

Levin V., Stepanets V., Li E.S. et al. Finding of Re Sulfides in Copper-Sulfide Ores. Geology of Ore Deposits, of the Maike Occurrence, Ulytau, Central Kazakhstan // Geology of Ore Deposits. – 2021. – Vol. 63. Issue 8. Pp. 830-841. DOI: 10.1134/S1075701521080067

Mizernaya M.A, Aitbayeva S.S., Mizerny A.I., Dyachkov B.A. & Miroshnikova A P. (2020) Geochemical characteristics and metalogeny of Herzin granitoid complexes (Eastern Kazakhstan) Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, Ukraine, vol. 1, 5-10. *https://doi.org/10.33271/nvngu/2020-1/005*

Pak Yu.N., Kolesova S.B., Pak D.Yu., Nuguzhinov Zh.S., Tebaeva A.Yu., Podgornaya D.A. Instrumental Solid Fuel Quality Control by a Neutron Method. Solid Fuel Chemistry, Vol. 55, No 6. Pp. 414-419. 2021. DOI: 10.3103/S0361521921060112.

Pearce J.A., Harris N.B.W. and Tindle A.G., Trace element discrimination diagrams for the tectonic interpretation of granitic rocks // J. Petrol. – 1984. № 25. Pp. 956-983

Porotov G.S. (2006). Mathematical methods of modeling in geology. St. Petersburg State Mining Institute (Technical University). St. Petersburg. 223 p.

Roser B.P., Korsch R.J. Provenance signatures of sandstone-mudstone suites determined using discriminant function analysis of major-element data // Chem. Geol. – 1988. № 47. Pp. 119-139

Samygin S.G., Kheraskova T.N. (2019). Geological structure and stages of tectonic evolution of the paleozoids of Kazakhstan. Lithosphere. 347-371

Tretyakov A.A., Degtyarev K.E., Shatagin K.N., Pilitsyna A.V., Kotov A.B., Salnikova E.B., Yakovleva S.Z., Anisimova I.V., Plotkina Yu.V. (2015). Neoproterozoic rhyolites of the Ulutau Precambrian massif (Central Kazakhstan): structural position and age justification. Report AN, 462(3), 325-329

Volkov V.M. (2006). Methodological Guidelines for Estimating Predicted Resources of Solid Minerals. Issue I. Principles and methods of evaluation. VIEMS. 44 p.

CONTENTS

A.M. Abdibay, K.K. Anuarbekov, J. Chormanski, Y.T. Kaipbayev, A.E. Aldiyarova
REGULATION OF WATER-SALT REGIME OF IRRIGATED LANDS IN THE LOWER REACHES OF THE SYRDARYA RIVER.....6

Zh.K. Akasheva, D.A. Bolysbek, B.K. Assilbekov
STUDY OF CARBONATE ROCK DISSOLUTION USING X-RAY MICROCOMPUTED TOMOGRAPHY: IMPACT OF ACID FLOW RATE.....20

K.M. Akishev, D.S. Zhamangarin, S. Zhardemkyzy, T.T. Murzabekov, A.Yu. Nurgaliyev, M.Yu. Zhiganbayev
APPLICATION OF THE PRINCIPLE OF SPECIAL STATES IN DEVELOPING SIMULATION MODEL.....33

I.N. Aliyev
HYDRODYNAMIC CHARACTERISTICS OF ONE DIMENSIONAL DISPLACEMENT OF OIL BY LIQUID.....45

S. Joldassov, S. Tattibaev, Z. Bimurzayeva, M. Bayzhigitova, G. Loginov
ANALYSIS OF EXISTING METHODS FOR CALCULATING THE ROUGHNESS COEFFICIENT OF CHANNELS ALONG THE PERIMETER OF THE CHANNEL.....56

F. Issatayeva, G. Aubakirova, G. Rudko, A. Mausymbaeva, R. Madysheva
TRANSFORMATION OF INDUSTRIAL ENTERPRISES IN THE COUNTRIES WITH TRANSITIONAL ECONOMIES: THE DIGITAL ASPECT.....72

M.K. Karazhanova, L.B. Zhetekova, S.V. Abbasova, K.K. Aghayeva, G.S. Sabyrbaeva
STUDY OF INTERRELATIONS BETWEEN COMPOSITION AND PROPERTIES OF HIGH-VISCOUS OIL.....92

S.M. Koybakov, M.N. Sennikov, T.A. Tolkinbaev, G.E. Omarova, Zh.M. Mukhtarov
METHOD OF CALCULATION AND FORECAST OF THE DEGREE OF SNOW CAPACITY OF CHANNELS.....102

M. Kabibullin, K. Orazbayeva, V. Makhatova, B. Utenova, Sh. Kodanova
REFORMING UNIT OPERATION CONTROL IN OIL AND GAS REFINING TECHNOLOGY..... 113

S. Lutsenko, Y. Hryhoriev, A. Kuttybayev, A. Imashev, A. Kuttybayeva
DETERMINATION OF MINING SYSTEM PARAMETERS AT
A CONCENTRATION OF MINING OPERATIONS.....130

A.S. Madibekov, A.M. Karimov, L.T. Ismukhanova, A.O. Zhadi, A.B. Yegorov
COPPER POLLUTION OF THE SNOW COVER IN ALMATY.....141

A.T. Mazakova, Sh.A. Jomartova, T.Zh. Mazakov, G.Z. Ziyatbekova, A.A. Sametova
MATHEMATICAL MODELING AND DEVELOPMENT OF AN AUTOMATED SYSTEM FOR SEARCHING RING STRUCTURES IN GEOLOGY.....154

A.D. Mekhtiyev, Y.N. Abdikashev[2*], Y.G. Neshina[2], P.A. Dunayev[1], Z.D. Manbetova[1]
MONITORING THE GEOTECHNICAL CONDITION OF UNDERGROUND MININGS USING DIGITAL TECHNOLOGIES.....166

Ye.V. Ponomareva, M.V. Ponomareva, F.M. Issatayeva, I.V. Sukhanov
CRITERIA OF PROSPECTING AND EVALUATION WORKS FOR COPPER AND POLYMETALLIC ORES AT THE EAST ATABAY SITE.....177

K. Seitkazieva, K. Shilibek, A. Seitkaziev, R. Turekeldieva, N. Karpenko
ECOLOGICAL AND MELIORATIVE SUBSTANTIATION OF
GRAY-EARTH-MEADOW SALINE SOILS OF ZHAMBYL REGION.....189

I.K. Umarova, D.B. ***Makhmarezhabov, A.A. Umirzokov***
INVESTIGATION OF THE USE OF ION FLOTATION FOR THE
EXTRACTION OF COPPER FROM SULFURIC ACID SOLUTIONS.....202

M.K. Urazgaliyeva, R.Y. Bayamirova, K.T. Bissembayeva[*], G.S. Sabyrbayeva, A.A. Bekbauliyeva
METHODS FOR ASSESSING THE CHARACTERISTICS OF OIL RESERVES WITH FUZZY GEOLOGICAL INFORMATION AND DEVELOPMENT
OF OIL FIELDS.....211

O.G. Khayitov, L.Sh. Saidova, S.Zh. Galiev, A.A. Umirzokov, M. Mahkamov
INTERRELATION OF PERFORMANCE INDICATORS OF TECHNOLOGICAL TRANSPORT WITH MINING CONDITIONS OF A QUARRY.....226

D.M. Chnybayeva, Yu.A. Tsyba, N.K. Almuratova
LINEAR MONITORING OF THE MAIN PIPELINE BY MEANS OF WIRELESS DIGITAL TECHNOLOGY.....240

K.T. Sherov, B.N. Absadykov, M.R. Sikhimbayev, B.B. *Togizbayeva,* **A. Esirkepov**
INVESTIGATION OF THE STRESS-STRAIN STATE OF COMPONENTS
OF A HYDRAULIC IMPACT DEVICE.....260

Publication Ethics and Publication Malpractice
in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайтах:
www:nauka-nanrk.kz
http://www.geolog-technical.kz/index.php/en/
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Заместитель директор отдела издания научных журналов НАН РК *Р. Жәлиқызы*
Редакторы: *М.С. Ахметова, Д.С. Аленов*
Верстка на компьютере *Г.Д.Жадыранова*

Подписано в печать 18.02.2023.
Формат 70x90$^{1}/_{16}$. Бумага офсетная. Печать – ризограф.
20,0 п.л. Тираж 300. Заказ 1.

Национальная академия наук РК
050010, Алматы, ул. Шевченко, 28, т. 272-13-19