

ISSN 2518-170X (Online)

ISSN 2224-5278 (Print)

**NEWS OF THE NATIONAL ACADEMY
OF SCIENCES OF THE REPUBLIC
OF KAZAKHSTAN, SERIES OF
GEOLOGY AND TECHNICAL SCIENCES**

№5

2026

ISSN 2518-170X (Online)

ISSN 2224-5278 (Print)



N E W S
OF THE NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN,
SERIES OF GEOLOGY AND TECHNICAL
SCIENCES

5 (479)

September – Oktober 2026

THE JOURNAL WAS FOUNDED IN 1940

PUBLISHED 6 TIMES A YEAR

ALMATY, 2026

The scientific journal News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences has been indexed in the international abstract and citation database Scopus since 2016 and demonstrates stable bibliometric performance.

The journal is also included in the Emerging Sources Citation Index (ESCI) of the Web of Science platform (Clarivate Analytics, since 2018).

Indexing in ESCI confirms the journal's compliance with international standards of scientific peer review and editorial ethics and is considered by Clarivate Analytics as part of the evaluation process for potential inclusion in the Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI), and Arts & Humanities Citation Index (AHCI).

Indexing in Scopus and Web of Science ensures high international visibility of publications, promotes citation growth, and reflects the editorial board's commitment to publishing relevant, original, and scientifically significant research in the fields of geology and technical sciences.

«Қазақстан Республикасы Ұлттық ғылым академиясының Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналы 2016 жылдан бастап халықаралық реферативтік және ғылымиметриялық Scopus дерекқорында индекстеледі және тұрақты библиометриялық көрсеткіштерді көрсетіп келеді.

Сонымен қатар журнал Web of Science платформасының (Clarivate Analytics, 2018) халықаралық реферативтік және наукометриялық дерекқоры Emerging Sources Citation Index (ESCI) тізіміне енгізілген.

ESCI дерекқорында индекстелуі журналдың халықаралық ғылыми рецензиялау талаптары мен редакциялық этика стандарттарына сәйкестігін растайды, сондай-ақ Clarivate Analytics компаниясы тарапынан басылмды Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI) және Arts & Humanities Citation Index (AHCI) дерекқорларына енгізу қарастырылуда.

Scopus және Web of Science дерекқорларында индекстелуі жарияланымдардың халықаралық деңгейде жоғары сұранысқа ие болуын қамтамасыз етеді, олардың дәйексөз алу көрсеткіштерінің артуына ықпал етеді және редакциялық алқаның геология мен техникалық ғылымдар саласындағы өзекті, бірегей және ғылыми тұрғыдан маңызды зерттеулерді жариялауға ұмтылысын айқындайды.

Научный журнал «News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences» с 2016 года индексируется в международной реферативной и наукометрической базе данных Scopus и демонстрирует стабильные библиометрические показатели.

Журнал также включён в международную реферативную и наукометрическую базу данных Emerging Sources Citation Index (ESCI) платформы Web of Science (Clarivate Analytics, 2018).

Индексирование в ESCI подтверждает соответствие журнала международным стандартам научного рецензирования и редакционной этики, а также рассматривается компанией Clarivate Analytics в рамках дальнейшего включения издания в Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI) и Arts & Humanities Citation Index (AHCI).

Индексирование в Scopus и Web of Science обеспечивает высокую международную востребованность публикаций, способствует росту цитируемости и подтверждает стремление редакционной коллегии публиковать актуальные, оригинальные и научно значимые исследования в области геологии и технических наук.

EDITOR-IN-CHIEF

ZHURINOV Murat Zhurinovich, Doctor of Chemical Sciences, Professor, Academician of IAAS and NAS RK, General Director of the Research Institute of Petroleum Refining and Petrochemicals (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=6602177960>; <https://www.webofscience.com/wos/author/record/2017489>

DEPUTY EDITOR-IN-CHIEF

ABSADYKOV Bakhyt Narikbayevich, Doctor of Technical Sciences, Professor, Academician of NAS RK, Satbayev University (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=6504694468>; <https://www.webofscience.com/wos/author/record/2411827>

EDITORIAL BOARD:

ABSAMETOV Malis Kudysovich, Doctor of Geological and Mineralogical Sciences, Professor, Academician of NAS RK, Director of the U.M. Akhmedsafa Institute of Hydrogeology and Geoecology (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=56955769200>; <https://www.webofscience.com/wos/author/record/1937883>

ZHOLTAEV Geroy Zholtaevich, Doctor of Geological and Mineralogical Sciences, Professor, Honorary Academician of NAS RK (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=57112610200>; <https://www.webofscience.com/wos/author/record/1939201>

SNOW Daniel, PhD, Associate Professor, Director, Aquatic Sciences Laboratory, University of Nebraska (Nebraska, USA), <https://www.scopus.com/authid/detail.uri?authorId=7103259215>; <https://www.webofscience.com/wos/author/record/1429613>

SELTMAN Reimar, PhD, Head of Petrology and Mineral Deposits Research in the Earth Sciences Department, Natural History Museum (London, Great Britain), <https://www.scopus.com/authid/detail.uri?authorId=55883084800>; <https://www.webofscience.com/wos/author/record/1048681>

PANFILOV Mikhail Borisovich, Doctor of Technical Sciences, Professor at the University of Nancy (Nancy, France), <https://www.scopus.com/authid/detail.uri?authorId=7003436752>; <https://www.webofscience.com/wos/author/record/1230499>

SHEN Ping, PhD, Deputy Director of the Mining Geology Committee of the Chinese Geological Society, Member of the American Association of Economic Geologists (Beijing, China), <https://www.scopus.com/authid/detail.uri?authorId=57202873965>; <https://www.webofscience.com/wos/author/record/1753209>

FISCHER Axel, PhD, Associate Professor, Technical University of Dresden (Dresden, Germany), <https://www.scopus.com/authid/detail.uri?authorId=35738572100>; <https://www.webofscience.com/wos/author/record/2085986>

AGABEKOV Vladimir Enokovich, Doctor of Chemical Sciences, Academician of NAS of Belarus, Honorary Director of the Institute of Chemistry of New Materials (Minsk, Belarus), <https://www.scopus.com/authid/detail.uri?authorId=7004624845>

CATALIN Stefan, PhD, Associate Professor, Technical University of Dresden (Dresden, Germany), <https://www.scopus.com/authid/detail.uri?authorId=35203904500>; <https://www.webofscience.com/wos/author/record/1309251>

JAY Sagin, PhD, Associate Professor, Nazarbayev University (Astana, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=57204467637>; <https://www.webofscience.com/wos/author/record/907886>

FRATTINI Paolo, PhD, Associate Professor, University of Milano - Bicocca (Milan, Italy), <https://www.scopus.com/authid/detail.uri?authorId=56538922400>

NURPEISOVA Marzhan Baysanovna, Doctor of Technical Sciences, Professor of Satbayev University (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=57202218883>; <https://www.webofscience.com/wos/author/record/AAD-1173-2019>

RATOV Boranbay Tovbasarovich, Doctor of Technical Sciences, Professor, Head of the Department of Geophysics and Seismology, Satbayev University (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=55927684100>; <https://www.webofscience.com/wos/author/record/1993614>

RONNY Berndtsson, Professor, Director of the Centre for Advanced Middle Eastern Studies, Lund University (Lund, Sweden), <https://www.scopus.com/authid/detail.uri?authorId=7005388716>; <https://www.webofscience.com/wos/author/record/1324908>

MIRLAS Vladimir, PhD, Professor, Eastern R&D Center, Ariel University (Ariel, Israel), <https://www.scopus.com/authid/detail.uri?authorId=8610969300>; <https://www.webofscience.com/wos/author/record/53680261>

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: «Central Asian Academic Research Center» LLP (Almaty).

The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Communications of the Republic of Kazakhstan № KZ50VPY00121155, issued on 05.06.2025
Thematic scope: *geology, hydrogeology, geography, mining and chemical technologies of oil, gas and metals*
Periodicity: 6 times a year.

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

© «Central Asian Academic Research Center» LLP, 2026.

БАС РЕДАКТОР

ЖҰРЫНОВ Мұрат Жұрыңұлы, химия ғылымдарының докторы, профессор, ХҒАҚ және ҚР ҰҒА академигі, Мұнай өңдеу және мұнай-химиясы ғылыми-зерттеу институтының бас директоры (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=6602177960>; <https://www.webofscience.com/wos/author/record/2017489>

БАС РЕДАКТОРДЫҢ ОРЫНБАСАРЫ:

АБСАДЫҚОВ Бақыт Нәрікбайұлы, техника ғылымдарының докторы, профессор, ҚР ҰҒА академигі, Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университеті (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=6504694468>; <https://www.webofscience.com/wos/author/record/2411827>

РЕДАКЦИЯ АЛҚАСЫ:

ӨБСӘМЕТОВ Мәліс Құдысұлы, геология-минералогия ғылымдарының докторы, профессор, ҚР ҰҒА академигі, У.М. Ахмедсафин атындағы Гидрогеология және геоэкология институтының директоры (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=56955769200>; <https://www.webofscience.com/wos/author/record/1937883>

ЖОЛТАЕВ Герой Жолтайұлы, геология-минералогия ғылымдарының докторы, профессор, ҚР ҰҒА құрметті академигі (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=57112610200>; <https://www.webofscience.com/wos/author/record/1939201>

СНОУ Дэниел, PhD, қауымдастырылған профессор, Небраска университетінің Су ғылымдары зертханасының директоры (Небраска, АҚШ), <https://www.scopus.com/authid/detail.uri?authorId=7103259215>; <https://www.webofscience.com/wos/author/record/1429613>

ЗЕЛБТМАНН Раймар, PhD, Жер туралы ғылымдар бөлімінің петрология және пайдалы қазбалар кен орындары саласындағы зерттеулерінің жетекшісі, Табиғи тарих мұражайы (Лондон, Ұлыбритания), <https://www.scopus.com/authid/detail.uri?authorId=55883084800>; <https://www.webofscience.com/wos/author/record/1048681>

ПАНФИЛОВ Михаил Борисович, техника ғылымдарының докторы, Нанси университетінің профессоры (Нанси, Франция), <https://www.scopus.com/authid/detail.uri?authorId=7003436752>; <https://www.webofscience.com/wos/author/record/1230499>

ШЕН Пин, PhD, Қытай геологиялық қоғамының Тау-кен геологиясы комитеті директорының орынбасары, Американдық экономикалық геологтар қауымдастығының мүшесі (Бейжің, Қытай), <https://www.scopus.com/authid/detail.uri?authorId=57202873965>; <https://www.webofscience.com/wos/author/record/1753209>

ФИШЕР Аксель, PhD, қауымдастырылған профессор, Дрезден техникалық университеті (Дрезден, Германия), <https://www.scopus.com/authid/detail.uri?authorId=35738572100>; <https://www.webofscience.com/wos/author/record/2085986>

АГАБЕКОВ Владимир Енокович, химия ғылымдарының докторы, Беларусь ҰҒА академигі, Жаңа материалдар химиясы институтының құрметті директоры (Минск, Беларусь), <https://www.scopus.com/authid/detail.uri?authorId=7004624845>

КАТАЛИН Стефан, PhD, қауымдастырылған профессор, Дрезден Техникалық университеті (Дрезден, Германия), <https://www.scopus.com/authid/detail.uri?authorId=35203904500>; <https://www.webofscience.com/wos/author/record/1309251>

САҒЫНТАЕВ Жанай, PhD, қауымдастырылған профессор, Назарбаев университеті (Астана, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=57204467637>; <https://www.webofscience.com/wos/author/record/907886>

ФРАТТИНИ Паоло, PhD, қауымдастырылған профессор, Бикокк Милан университеті (Милан, Италия), <https://www.scopus.com/authid/detail.uri?authorId=56538922400>

НҮРПЕЙІСОВА Маржан Байсанқызы, техника ғылымдарының докторы, Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университетінің профессоры (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=57202218883>; <https://www.webofscience.com/wos/author/record/AAD-1173-2019>

РАТОВ Боранбай Товбасарович, техника ғылымдарының докторы, профессор, «Геофизика және сейсмология» кафедрасының меңгерушісі, Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университеті (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=55927684100>; <https://www.webofscience.com/wos/author/record/1993614>

РОННИ Беридтссон, профессор, Таяу Шығысты заманауи зерттеу орталығының директоры, Лунд университеті (Лунд, Швеция), <https://www.scopus.com/authid/detail.uri?authorId=7005388716>; <https://www.webofscience.com/wos/author/record/1324908>

МИРІАС Владимир, PhD, профессор, Ариэль университетінің Шығыс ғылыми-зерттеу орталығы (Ариэль, Израиль), <https://www.scopus.com/authid/detail.uri?authorId=8610969300>; <https://www.webofscience.com/wos/author/record/53680261>

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)

Меншіктеуші: «Орталық Азия академиялық ғылыми орталығы» ЖШС (Алматы қ.).

Қазақстан Республикасының Ақпарат және коммуникациялар министрлігінің Ақпарат комитетінде 05.06.2025 ж. берілген № KZ50VPY00121155 мерзімдік басылым тіркеуіне қойылу туралы куәлік. Тақырыптық бағыты: *геология, гидрогеология, география, тау-кен ісі, мұнай, газ және металдардың химиялық технологиялары*

Мерзімділігі: жылына 6 рет.

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

ГЛАВНЫЙ РЕДАКТОР

ЖУРИНОВ Мурат Журинович, доктор химических наук, профессор, академик МАН и НАН РК, Генеральный директор НИИ нефтепереработки и нефтехимии (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=6602177960>; <https://www.webofscience.com/wos/author/record/2017489>

ЗАМЕСТИТЕЛЬ ГЛАВНОГО РЕДАКТОРА

АБСАДЫКОВ Бахыт Нарикбаевич, доктор технических наук, профессор, академик НАН РК, Казахский национальный исследовательский технический университет им. К.И. Сатпаева (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=6504694468>; <https://www.webofscience.com/wos/author/record/2411827>

РЕДАКЦИОННАЯ КОЛЛЕГИЯ:

АБСАМЕТОВ Малис Кудысович, доктор геолого-минералогических наук, профессор, академик НАН РК, директор Института гидрогеологии и геоэкологии им. У.М. Ахмедсафина (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=56955769200>; <https://www.webofscience.com/wos/author/record/1937883>

ЖОЛТАЕВ Герой Жолтаевич, доктор геолого-минералогических наук, профессор, почетный академик НАН РК (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=57112610200>; <https://www.webofscience.com/wos/author/record/1939201>

СНОУ Дэниел, PhD, ассоциированный профессор, директор Лаборатории водных наук Университета Небраски (Небраска, США), <https://www.scopus.com/authid/detail.uri?authorId=7103259215>; <https://www.webofscience.com/wos/author/record/1429613>

ЗЕЛЬТМАНН Раймар, PhD, руководитель исследований в области петрологии и месторождений полезных ископаемых в Отделе наук о Земле Музея естественной истории (Лондон, Великобритания), <https://www.scopus.com/authid/detail.uri?authorId=55883084800>; <https://www.webofscience.com/wos/author/record/1048681>

ПАНФИЛОВ Михаил Борисович, доктор технических наук, профессор Университета Нанси (Нанси, Франция), <https://www.scopus.com/authid/detail.uri?authorId=7003436752>; <https://www.webofscience.com/wos/author/record/1230499>

ШЕН Пин, PhD, заместитель директора Комитета по горной геологии Китайского геологического общества, член Американской ассоциации экономических геологов (Пекин, Китай), <https://www.scopus.com/authid/detail.uri?authorId=57202873965>; <https://www.webofscience.com/wos/author/record/1753209>

ФИШЕР Аксель, PhD, ассоциированный профессор, Технический университет Дрезден (Дрезден, Берлин), <https://www.scopus.com/authid/detail.uri?authorId=35738572100>; <https://www.webofscience.com/wos/author/record/2085986>

АГАБЕКОВ Владимир Енокович, доктор химических наук, академик НАН Беларуси, почетный директор Института химии новых материалов (Минск, Беларусь), <https://www.scopus.com/authid/detail.uri?authorId=7004624845>

КАТАЛИН Стефан, PhD, ассоциированный профессор, Технический университет Дрезден (Дрезден, Германия), <https://www.scopus.com/authid/detail.uri?authorId=35203904500>; <https://www.webofscience.com/wos/author/record/1309251>

САГИНТАЕВ Жанай, PhD, ассоциированный профессор, Назарбаев университет (Астана, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=57204467637>; <https://www.webofscience.com/wos/author/record/907886>

ФРАТТИНИ Паоло, PhD, ассоциированный профессор, Миланский университет Бикокк (Милан, Италия), <https://www.scopus.com/authid/detail.uri?authorId=56538922400>

НУРПЕИСОВА Маржан Байсановна, доктор технических наук, профессор Казахского национального исследовательского технического университета им. К.И. Сатпаева (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=57202218883>; <https://www.webofscience.com/wos/author/record/AAD-1173-2019>

РАТОВ Боранбай Товбасарович, доктор технических наук, профессор, заведующий кафедрой «Геофизика и сейсмология», Казахский национальный исследовательский технический университет им. К.И. Сатпаева (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=55927684100>; <https://www.webofscience.com/wos/author/record/1993614>

РОННИ Берндтссон, профессор, Директор Центра современных ближневосточных исследований, Лундский университет (Лунд, Швеция), <https://www.scopus.com/authid/detail.uri?authorId=7005388716>; <https://www.webofscience.com/wos/author/record/1324908>

МИРЛАС Владимир, PhD, профессор, Восточный научно-исследовательский центр, Университет Ариэля (Ариэль, Израиль), <https://www.scopus.com/authid/detail.uri?authorId=8610969300>; <https://www.webofscience.com/wos/author/record/53680261>

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)

Собственник: ТОО «Центрально-Азиатский академический научный центр» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и коммуникаций и Республики Казахстан № KZ50VPY00121155, выданное 05.06.2025 г.

Тематическая направленность: *геология, гидрогеология, география, горное дело и химические технологии нефти, газа и металлов*

Периодичность: 6 раз в год.

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

© ТОО «Центрально-Азиатский академический научный центр», 2026.

CONTENTS

Akbayeva L.KH., Akhmetova Zh.A., Doskenova B.B., Aktayev M.R., Baubek N.A. Assessment of the Radiocapacity of Atomic Lake at the Semipalatinsk Nuclear Test Site.....	8
Aliyev I.N., Kazimov Sh.P., Mammadova G.G., Manafov R.G., Gurbanov G.A. Measures for Removing Carbonate Scale Deposits Formed in the Wellbore and Downhole Equipment.....	26
Azizov B.M., Mammadov H.N. Some Aspects of Predicting Underground Hydrocarbon Reserves Based on Multispectral Satellite Imagery.....	45
Baibatsha A.B., Duczmal-Czernikiewicz A., Bulegenov K., Muratkhanov D. Geology of the Formation of Mineral Associations in the Arganat Ore Occurrence (Eastern Balkhash), Kazakhstan.....	62
Bashirov R., Zakenov S., Rzaev E., Bashirova G., Nurshakhanova L. Scientific Principles for Selecting Powder Materials for Laser Cladding in the Restoration of Components in the Oil and Gas Industry.....	74
Beisseyev S.A., Dossaliyev K.S., Tulekbayeva A.K., Alsheriye E.T., Ivakhnyuk G.K. Recommendations for Hazard Identification and Occupational Safety Risk Analysis Considering Geological and Technical Factors.....	89
Dossymbekova Zh.B., Issayeva L.Z., Assubayeva S.K., Zhumabay N.Zh., Baudagulova G.T. Petrophysical Characteristics of Bayan Deposit Rocks and Scheelite Deposition with Rare Earth Impurities.....	109
Galiyev S.Zh., Annakulov T.J., Sabirova L.B., Axanaliyev N.E. Mathematical Modeling of the Dependence of Open-Pit Excavator Productivity on Particle Size Distribution and the Loosening Coefficient of Blasted Rock Mass.....	125
Guvalov A.A., Aghazade M.E., Ibraimbayeva G.B., Stanevich V.T., Vyshar O.V. Study of Ash Obtained from Household Waste Incineration as a Mineral Additive.....	142
Iovbak A.S., Sennikov M.N. Modelling of Hydraulic Flow Redistribution in Parallel Pump Systems.....	160
KosolapYu.G., KropisYu.N., Nikitina V.A., Kononenko R.V., Komar E.V. Prediction of the Thermal Conductivity of Aqueous Electrolyte Solutions for Calculations of Mining and Geological Systems.....	177
Krasikov V.A., Losev A.N., Nikanorov M.S., Kukartseva S.V., Tsyganko E.N. Prediction of Crushing Equipment Productivity at Mining Enterprises Using the Random Forest Algorithm.....	192

Kurashkin S.O., Korableva G.V., Vakhrusheva I.A., Cherniaeva P.D., Lepekhina Y.A. Prediction of Energy Consumption of a Mining Enterprise Crushing and Screening Complex Using Machine Learning Methods.....	208
Kurmanbayev O., Baidautetova G., Jangulova G., Sarsembekova Z., Bayanbek R. Concept of Processing Static GNSS Measurements in Geodynamic Monitoring of Almaty.....	224
Makhmarejabov D., Kuttybayev A., Umirzokov A., Daminov T., Sharopov Kh. Evaluation of the Compositional Differences of Fuel Types Obtained from the Angren Coal Mine.....	243
Mukaliyev Zh.K., Zhumatayeva Zh.M., Turganaliyev S.R. GIS-Based Geomorphometric Assessment of Topographic Erosion Potential at the Semipalatinsk Test Site.....	256
Mukhambetov B., Nasiyev B., Kanat T., Zhumin B. Geocological Assessment and Phytomeliorative Restoration of Degraded Arid Lands in the Atyrau Region of Western Kazakhstan.....	273
Murtazin Ye.Zh., Toktar A.T., Rakhimova V.S., Sapargaliyev D.S. Assessment of Groundwater Recharge and Resources in Mangystau Sand Massifs, Western Kazakhstan.....	290
Oralbekova L.M., Baibotayeva A.D., Kenzhalieva G.D., Naukenova A.S., Kocherov E.N. Intelligent Digital Platform for Solid Waste Management: Shymkent Smart Waste.....	309
Oralova A.T., Tsheshkovskaya Ye.A., Tsoy N.K., Matonin V.V., Timoshenko P.S. Research on the Fractional Composition of Oil by Spectroscopic Methods.....	325
Panfilov I.A., Gorbachev S.I., Puchkova O.S., Oleynikova O.O., Modina M.A. Prediction of the Technical Condition of Bearing Units of Mining Equipment Using Vibration Parameters and Machine Learning.....	340
Ratov B.T., Khomenko V.L., Kuttybayev A.E., Kamyshatskyi O.F., Zhailiyev A.O. Hydraulic Characteristics of an Improved System for Real-Time Drilling Fluid Density Measurement.....	356
Ryszhana A., Amangossova A.G., Kadasheva Zh.K., Yessenamanova Zh.S., Abdinov R.Sh. Geocological-Chemical Assessment of Technogenic Contamination of the “Tukhlaya Balka” Filtration Fields Area.....	376
Shutkina E.V., Babkina A.V., Zhuravlev M.V., Kleshko I.I., Kozenkova G.L. Automatic Assessment of Crushed Rock Particle Size Distribution Based on Computer Vision Methods.....	398
Zholtayev G.Zh., Umarbekova Z.T., Mashrapova M.A., Amanbaev R.A., Karatayeva G.M. Model of Gold Mineralization Formation at the Bestobe Deposit (Northern Kazakhstan).....	414

NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC
OF KAZAKHSTAN, SERIES OF GEOLOGY AND TECHNICAL SCIENCES
ISSN 2224-5278
Volume 5.
Number 479 (2026), 62–73

<https://doi.org/10.32014/2026.2518-170X.690>

UDC: 553.43:549

IRSTI: 38.35.91

©Baibatsha A.B.¹, Duczmal-Czernikiewicz A.², Bulegenov K.^{1*},
Muratkhanov D.¹, 2026.

¹Satbayev University, Almaty, Kazakhstan;

²Institute of Geology, Adam Mickiewicz University in Poznan,
Poland, Kazakhstan.

*E-mail: bulegenov85@mail.ru

GEOLOGY OF THE FORMATION OF MINERAL ASSOCIATIONS IN THE ARGANATY ORE OCCURRENCE (EASTERN BALKHASH), KAZAKHSTAN

Baibatsha Adilkhan — Doctor of Geological and Mineralogical sciences, Professor, Satbayev University, Almaty, Kazakhstan,

E-mail: baibatsha48@mail.ru, <https://orcid.org/0000-0002-9521-7872>;

Duczmal-Czernikiewicz Agata — PhD, Professor, Institute of Geology, Adam Mickiewicz University in Poznan, Poland,

E-mail: duczer@amu.edu.pl, <https://orcid.org/0000-0002-8682-7513>;

Bulegenov Kanat — PhD student, Satbayev University, Almaty, Kazakhstan,

E-mail: bulegenov85@mail.ru, <https://orcid.org/0000-0001-9513-1668>;

Muratkhanov Daulet — PhD student, Satbayev University, Almaty, Kazakhstan,

E-mail: daulet.muratkhanov@satbayev.university, <https://orcid.org/0000-0001-8322-3311>.

Abstract. Relevance. The Arganat copper-porphyry ore occurrence is located in the East Balkhash region of Kazakhstan. Major industrial deposits such as Aktogai, Aidarly, Saiak, and Konyrat are known in this region, and there is high potential for the discovery of additional industrial-scale deposits. For many years, this area remained insufficiently studied geologically. Our targeted geological investigations indicated the potential presence of copper-molybdenum deposits associated with the buried Arganat granite massif deposits that do not outcrop at the surface. Geological processes here led to the formation of copper-molybdenum porphyry deposits; consequently, there is significant potential for discovering new porphyry-type deposits. **Objective.** To this end, recent work at the Arganat field has focused on studying its geology, geophysics, and structure, as well as the geochemistry and petrogenesis of the Arganat granite massif. However, the origin and mineralogy of the identified deposit remain insufficiently understood.

Methods. Collected samples were analyzed using optical microscopy and SEM-EDS to examine ore minerals, their composition, and their formation sequence. **Results.** Results obtained using high-precision optical instruments show that sulfides such as pyrite and chalcopyrite are localized along the edges and within fracture zones of titanite, indicating that the sulfides formed later than the oxides. Albitization of potassium feldspar and alteration of biotite were observed. Titanite undergoes decomposition, transforming into rutile and ilmenite. The association of molybdenite with high-temperature quartz veins provides insight into the conditions of its formation. **Conclusions.** No other mineral compounds were detected in the molybdenite, which may indicate that it formed independently. Based on laboratory studies of the Arganaty ore occurrence, it can be hypothesized that, in addition to the primary copper-molybdenum ore components, minerals containing precious and rare metals of industrial significance may also be present.

Keywords: porphyry copper deposit, mineralogy, scanning electron microscopy, Arganaty, Eastern Balkhash

Financing. *This research has been funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan AP27511149, titled “Geological and mineralogical studies of granitoids of Kazakhstan as sources of rare metals to replenish their resources”.*

For citations: Baibatsha A.B., Duczmal-Czernikiewicz A., Bulegenov K., Muratkhanov D. *Geology of the Formation of Mineral Associations in the Arganaty Ore Occurrence (Eastern Balkhash), Kazakhstan. News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences.* 2026. No.5. Pp. 62–73. DOI: <https://doi.org/10.32014/2026.2518-170X.690>

©Байбатша Ә.Б.¹, Duczmal-Czernikiewicz A.², Бөлегенов Қ.^{1*},
Муратханов Д.¹, 2026.

¹ Сәтбаев университеті, Алматы, Қазақстан;

²Геология институты, Адам Мицкевич университеті, Познань, Польша.

*E-mail: bulegenov85@mail.ru

АРҒАНАТЫ КЕНБІЛІНІМІ МИНЕРАЛДАРЫ БІРЛЕСТІГІ ҚАЛЫПТАСУЫНЫҢ ГЕОЛОГИЯСЫ (ШЫҒЫС БАЛҚАШ), ҚАЗАҚСТАН

Байбатша Әділхан — геология-минералогия ғылымдарының докторы, профессор, Сәтбаев университеті, Алматы, Қазақстан,

E-mail: baibatsha48@mail.ru, <https://orcid.org/0000-0002-9521-7872>;

Duczmal-Czernikiewicz Agata — PhD, профессор, Геология институты, Адам Мицкевич университеті, Познань, Польша,

E-mail: duczer@amu.edu.pl, <https://orcid.org/0000-0002-8682-7513>;

Бөлегенов Қанат — PhD докторант, Сәтбаев университеті, Алматы, Қазақстан,

E-mail: bulegenov85@mail.ru, <https://orcid.org/0000-0001-9513-1668>;

Муратханов Даулет — PhD докторант, Сәтбаев университеті, Алматы, Қазақстан,
E-mail: daulet.muratkhanov@satbayev.university, <https://orcid.org/0000-0001-8322-3311>.

Аннотация. *Өзектілігі.* Арғанаты мысты-порфир кенбілінімі Қазақстанның Шығыс Балқаш аймағында орналасқан. Бұл аймақта Ақтоғай, Айдарлы, Саяқ, Қоңырат және басқа да ірі өндірістік кенорындар белгілі. Мұнда басқа өнеркәсіптік кендер болуының әлеуеті жоғары. Көптеген жылдар бойы бұл аймақ геологиялық тұрғыдан аз зерттелген. Біздің арнайы жүргізген геологиялық зерттеу жұмыстары жер бетіне шықпаған, көмулі Арғанаты гранит массивімен байланысты кендер бар екенін көрсетті. Геологиялық процестер мұнда мысты-молибденді порфир кеннің пайда болуына әкелген. Сондықтан жаңа кенорындар ашудың мүмкіндігі жоғары. *Мақсаты.* Осы мақсатта Арғанаты алаңында соңғы жылдары жүргізілген жұмыстарда оның геологиясы, геофизикасы мен құрылысы, сондай-ақ Арғанаты гранитінің геохимиясы және петрогенезі зерттелді. Дегенмен, анықталған кенбілінімнің пайда болуы және оның минералогиясы жеткілікті түрде зерделенген жоқ. *Әдістері.* Алынған сынамалар микроскоптың көмегімен және SEM-EDS арқылы алынған нәтижелерді пайдалана отырып, кенбілінімнің минералдары, олардың құрамы және түзілу реттілігі зерттелді. *Нәтижелері.* Алынған нәтижелер пирит пен халькопирит сияқты сульфидтер титаниттің шеттері мен жарықшақты аймақтарымен шектелгенін көрсетеді, бұл жағдай сульфидтер оксидтерден кейінірек жаралғанын көрсетеді. Калий дала шпатының альбиттенуінен және биотиттің өзгеруі байқалды. Титанит ыдырап, рутил мен ильменитке айналады. Молибдениттің жоғары температуралы кварц желішіктерімен байланысы, оның пайда болу жағдайларын білдіреді. *Қорытынды.* Молибденитте басқа минералдар қосылыстары байқалмайды, бұл оның дербес пайда болуын көрсетуі мүмкін. Арғанаты кенбілінімін лабораториялық зерттеу нәтижелеріне сүйене отырып, мұнда кендердің негізгі мыс және молибден компоненттерінен басқа, басым құндылыққа ие металдар минералдары болуы мүмкін екенін болжауға болады.

Түйін сөздер: мысты-порфир кенорны, минералогия, электрондық микроскоп, Арғанаты, Шығыс Балқаш

©Байбатша А.Б.¹, Душмал-Черникиевич А.², Булегенов К.^{1*},
Муратханов Д.¹, 2026.

¹Университет Сатпаева, Алматы, Қазақстан;

²Институт геологии, Адам Мицкевич Университет, Познань, Польша.

*E-mail: bulegenov85@mail.ru

ГЕОЛОГИЯ ФОРМИРОВАНИЯ МИНЕРАЛЬНЫХ АССОЦИАЦИЙ РУДОПРОЯВЛЕНИЯ АРГАНАТЫ (ВОСТОЧНОЕ ПРИБАЛХАШЬЕ), КАЗАХСТАН

Байбатша Адильхан — доктор геолого-минералогических наук, профессор, Университет Сатпаева, Алматы, Казахстан,

E-mail: baiibatsha48@mail.ru, <https://orcid.org/0000-0002-9521-7872>;

Ducmal-Czernikiewicz Agata — PhD, профессор, Адам Мицкевич Университет, Познань, Польша,

E-mail: duczer@amu.edu.pl, <https://orcid.org/0000-0002-8682-7513>;

Булегенов Канат — PhD докторант, Университет Сатпаева, Алматы, Казахстан,

E-mail: bulegenov85@mail.ru, <https://orcid.org/0000-0001-9513-1668>;

Муратханов Даулет — PhD докторант, Университет Сатпаева, Алматы, Казахстан,

E-mail: daulet.muratkhanov@satbayev.university, <https://orcid.org/0000-0001-8322-3311>.

Аннотация. *Актуальность.* Медно-порфировое рудопоявление Арганаты расположено в Восточно-Балхашской части Казахстана. В этом регионе известны Актогайское, Айдарлы, Саякское, Коныратское и другие крупные промышленные месторождения. Потенциал наличия других промышленных месторождений высок. В течение многих лет эта территория была геологически не достаточно изучена. Наши специально проведенные геологические исследования показали возможность наличие медно-молибденовых месторождений, связанных с погребенным гранитным массивом Арганаты, которые не вышли на поверхность. Геологические процессы привели к формированию здесь медно-молибденовых порфировых месторождений. Поэтому существует высокий потенциал для открытия новых месторождений порфирового типа. *Цель.* С этой целью в последние годы на поле Арганаты проводились работы по изучению его геологии, геофизики и структуры, а также геохимии и петрогенеза массива гранитов Арганаты. Однако происхождение выявленного месторождения и его минералогия изучены еще недостаточно. *Методы.* Отобранные образцы были исследованы с помощью микроскопа и СЭМ-ЭДС для изучения минералов руды, их состава и последовательности образования. *Результаты.* Полученные с помощью высокоточных оптических приборов результаты показывают, что сульфиды, такие как пирит и халькопирит, локализованы на краях и в зонах трещин титанита, что указывает на более позднее образование сульфидов по сравнению с оксидами. Наблюдалась альбитизация калиевого полевого шпата и изменение биотита. Титанит разлагается и превращается в рутил и ильменит. Ассоциация молибденита с высокотемпературными кварцевыми жилами указывает на условия его образования. *Выводы.* В молибдените не обнаружено других минеральных соединений, что может указывать на его самостоятельное образование. На основании результатов лабораторных исследований рудопоявление Арганаты можно предположить, что помимо основных медно-молибденовых компонентов руды, могут присутствовать минералы благородных и редкие металлических металлов, имеющие промышленное значение.

Ключевые слова: медно-порфировое месторождение, минералогия, электронный микроскоп, Арганаты, Восточный Балхаш

Introduction. The Arganaty porphyry copper–molybdenum ore occurrence is associated with the buried granites of the Arganaty massif, which is located in the Eastern Balkhash region. Geologically, the Arganaty granite massif is situated within the North Balkhash–West Jongar tectonic belt of the Balkhash metallogenic belt (Chen et al., 2010; Li et al., 2012), which hosts major porphyry copper deposits such as Aktogai, Saiak, Konyrat, and others (Sillitoe, 2010; Pirajno, 2000; Daukeev et al., 2002; Orynbasarova et al., 2024; Seirov et al., 2025; Ermolov et al., 2015; Gao et al., 2018). In recent years, numerous studies have investigated deposits of the Balkhash metallogenic belt, as well as other ore districts of Kazakhstan (Baibatsha et al., 2025; Ermolov et al., 2018; Antonenko et al., 2016; Mataibayeva, 2026), whereas the Arganaty district has remained less extensively studied. Nevertheless, recent studies in this area have resulted in the discovery of the Arganaty copper–molybdenum ore occurrence (Baibatsha and Muszynski, 2020; Baibatsha, 2024).

The stratigraphic succession of the Balkhash region consists of three main units: a Precambrian metamorphic basement, Paleozoic folded sedimentary and metamorphic rocks, and Mesozoic and Cenozoic deposits (Bekzhanov et al., 2000; Daukeev et al., 2002; Koshkin et al., 2007). Most of the Arganaty area is covered by Quaternary deposits. Paleozoic complexes are well exposed and consist mainly of Devonian and Carboniferous volcanic and sedimentary sequences (Figure 1). The granite pluton is located in the central part of the depression and probably has an oval shape, covering an area of 100–120 km². The apical part of the Arganaty granite massif occurs at depths of 10–70 m. Surface exposures of intrusive rocks are rare, except for mafic dykes. Weak regional hydrothermal alterations (quartz, muscovite, and albite) and quartz veins have been identified within the ore district (Baibatsha et al., 2024; Baibatsha and Muratkhanov, 2025).

The buried Arganaty massif consists of fine- and medium-grained, porphyritic biotite granites of pinkish-grey and, less commonly, greenish-grey colour. The granites exhibit hypidiomorphic-granular and glomeroporphyritic textures and consist of K-feldspar (40–50%), quartz (up to 30–40%), plagioclase (up to 20–30%), biotite (up to 5%), and accessory minerals (titanite, zircon, and ore minerals, amounting to up to 5%). The accessory minerals also include titanite, apatite, and zircon.

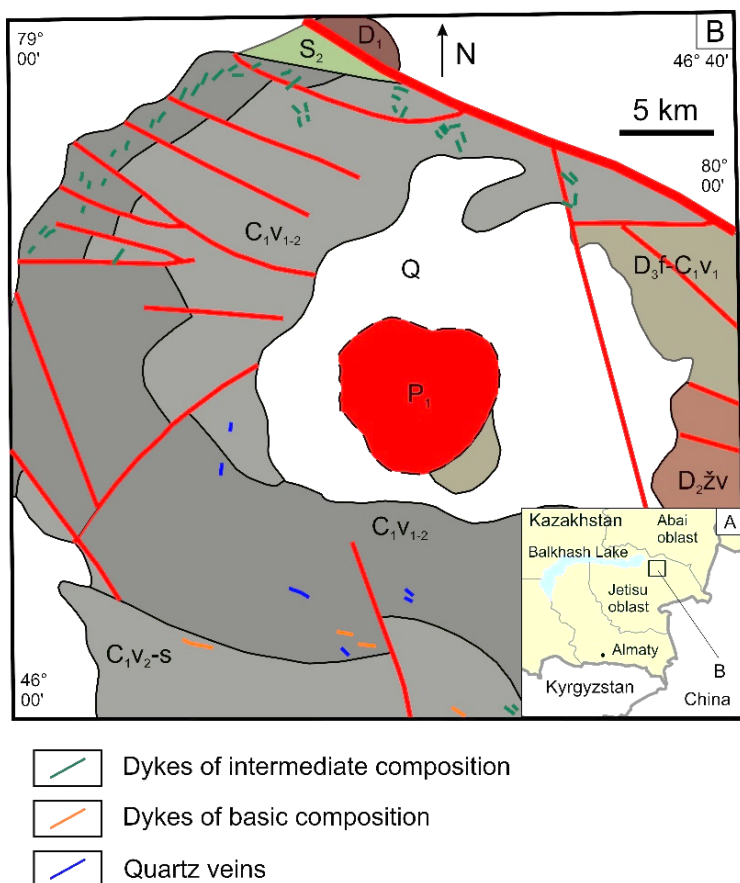


Figure 1. A – Location of the Arganaty area within Kazakhstan; B – Schematic geological map of the Arganaty area.

Previous studies focused on the geology of the district and the ore occurrence, as well as the geochemistry and petrogenesis of the granites (Baibatsha et al., 2026; Muratkhanov et al., 2023; Muratkhanov et al., 2024), but the ore mineralogy has not been sufficiently characterized. In this study, ore mineral associations and their formation sequence were established based on SEM–EDS data.

Materials and Methods. Mineralogical studies were carried out using a Hitachi S-3700N variable-pressure scanning electron microscope equipped with an energy-dispersive X-ray spectrometer (EDS) at the laboratory of Adam Mickiewicz University (Poznań, Poland). The samples were examined in backscattered-electron (BSE) mode, which allowed mineral phases to be differentiated based on variations in their mean atomic number and the corresponding image contrast. Measurements were conducted at an accelerating voltage of 15–25 kV. The chemical compositions of individual mineral grains were determined by EDS in semiquantitative mode. The obtained results were recalculated and normalized to 100 wt.%.

Results. Laboratory data revealed minerals in the studied ores that allow the geochemical sequence of mineral formation and the characteristics of their associations to be determined. A brief description of the ore minerals of the occurrence is provided below.

Pyrite is one of the most common ore minerals. It forms irregular grains ranging from 15 to 350 μm in size within a biotite–K-feldspar–quartz matrix. In backscattered-electron images, pyrite is characterized by a relatively homogeneous grey contrast (Figure 2). Pyrite may contain Si, Al, Mg, Ca, and Ti impurities. It may occur in fractures, in intergrowths with titanite, and along the margins of thorite grains. Pyrite also occurs in biotite affected by chloritization. Pyrite grains may contain inclusions of chalcopyrite and coffinite. Oxidized pyrite grains also occur along the margins of titanite, where titanite has been transformed into rutile.

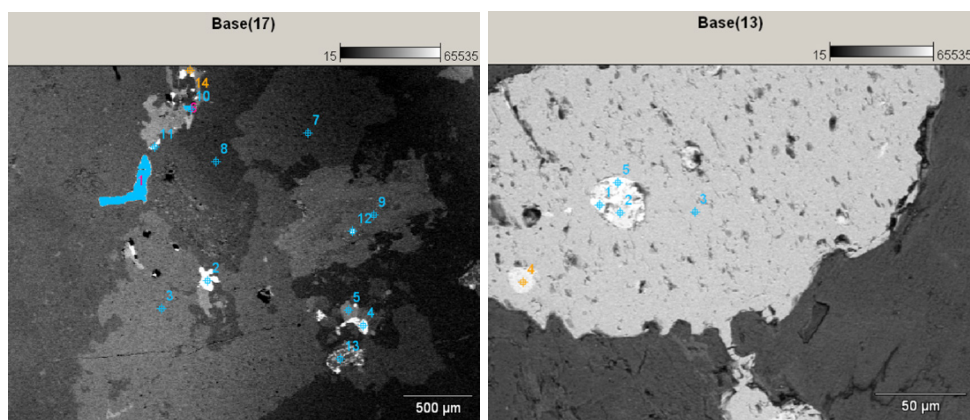


Figure 2. Left: Pyrite (points 1, 2), K-feldspar (3, 7), zircon (4), fluorapatite (5), chalcopyrite (6), quartz (8), biotite (9, 14), plagioclase (10, 11), Fe-bearing sphalerite (12), and calcite (13). Right: U–Si-bearing phase (points 1, 5), chalcopyrite (2, 4), and pyrite (3). Backscattered electron (BSE) image.

Chalcopyrite is the principal copper mineral in the studied samples from the Arganaty ore occurrence. It occurs predominantly as irregular and rounded grains ranging in size from several to tens of micrometres (up to 60 μm). It forms discrete grains in the altered silicate matrix, occurs along pyrite boundaries, and is also present as small inclusions within large pyrite grains. In backscattered-electron images, chalcopyrite is characterized by a grey contrast (Figure 3).

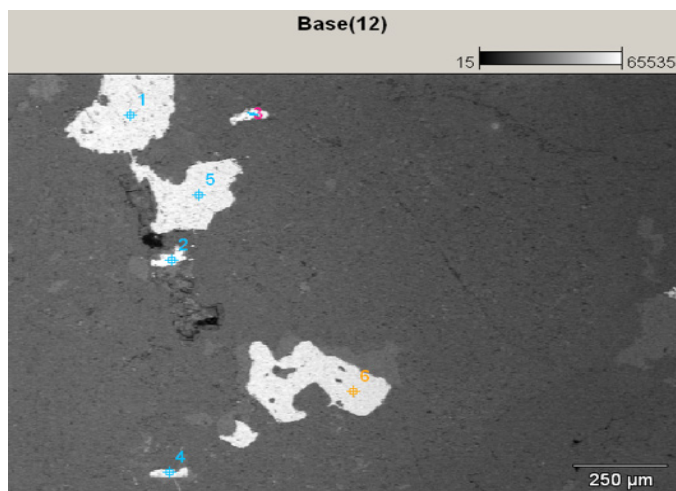


Figure 3. Pyrite (points 1, 4–6) and chalcopyrite (points 2, 3) in an altered silicate matrix. Backscattered electron (BSE) image.

The elemental contents of chalcopyrite are, in wt. %: Cu 29.20–33.38, Fe 29.41–31.24, and S 30.50–36.35. The Cu ratio in the purest analyses approaches 1:2, corresponding to the CuFeS_2 formula. The analyses also revealed impurities, in wt. %: Si 3.09–4.24, Al up to 2.29, and Ca up to 0.96.

Sphalerite forms irregular and locally subhedral grains ranging from several to 60–70 μm in size, enclosed within the altered silicate matrix. Both relatively large discrete grains and smaller grains located near pyrite, chalcopyrite, and rutile–titanite aggregates are observed. In backscattered-electron images, sphalerite is characterized by a bright contrast and is clearly distinguishable from the surrounding silicate minerals.

According to energy-dispersive spectrometry data, the elemental contents of sphalerite are, in wt. %: Zn 52.82–54.16, S 31.31–33.29, and Fe 6.13–7.34. The consistent presence of iron allows the studied grains to be classified as Fe-bearing sphalerite. The analyses also recorded the following contents, in wt. %: Mg 1.02–1.09, Al 1.79–2.51, Si 3.34–3.87, and Ca up to 0.93.

Molybdenite is a characteristic ore mineral of the studied sample from the Arganaty ore occurrence. It forms large platy and elongated grains ranging in size from several tens of micrometres to several centimetres. In some areas, molybdenite forms nearly monomineralic aggregates. It is characterized by numerous thin parallel bands and fractures oriented along the mineral cleavage. In backscattered-electron images, molybdenite exhibits a predominantly homogeneous light-grey contrast (Figure 4).

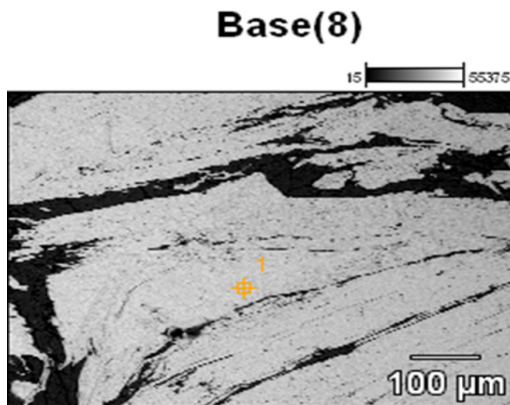


Figure 4. Molybdenite. Backscattered electron (BSE) image.

According to the analytical results, molybdenite compositions closest to the stoichiometric composition contain, in wt.%: Mo 56.97–57.58 and S 40.90–42.34. The atomic S/Mo ratio ranges from 2.13 to 2.22, which is close to the theoretical formula MoS_2 .

Titanite is an accessory mineral in the studied samples from the Arganaty ore occurrence. It forms irregular and subhedral structures, with locally observed wedge-shaped grains ranging in size from several tens of micrometres to 1 mm. Large titanite grains contain microfractures and areas of heterogeneous structure. Titanite is fractured, and pyrite and zircon occur along the fractures, indicating their later origin. The breakdown of titanite resulted in the formation of rutile and ilmenite. Manganese-bearing ilmenite develops after titanite. Titanite is spatially associated with sulfide minerals. Small amounts of sodium, aluminium, fluorine, iron, and magnesium were recorded in the titanite composition (Figure 5).

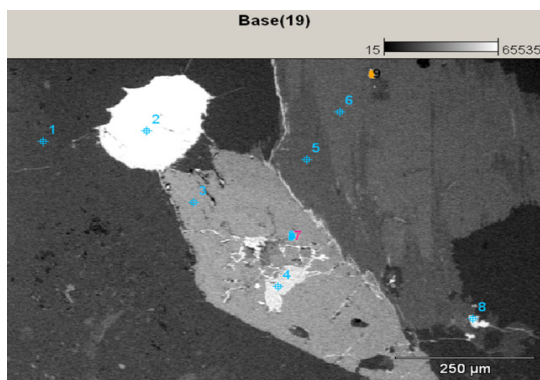


Figure 5. Plagioclase (1), Th–Zr–Ti silicate phase of thorite type (2), titanite (3), Mn-bearing ilmenite (4), chlorite (5), altered biotite (6), Th–Ca–Ti–Si phase (7), pyrite (8), and Fe-bearing sphalerite (9). Backscattered electron (BSE) image.

Discussion. The laboratory studies make it possible to draw conclusions regarding the sequence of mineral formation, their associations, and the relationships between them. It is clearly evident that minerals such as titanium silicates, characterized by well-defined crystal forms, crystallized from ore-forming fluids under relatively high-temperature conditions. The occurrence of pyrite along the margins and fractured areas of titanite most likely indicates later superimposed pyritization. Albitization of K-feldspar and the formation of amphibole after biotite (chloritization) were observed. Chloritization is also manifested by the development of Fe oxides (Figure 6). Titanite breaks down and is transformed into rutile and ilmenite. The association of molybdenite with high-temperature quartz veinlets also indicates the conditions of its formation. No inclusions of other minerals were observed in molybdenite, which may indicate its independent formation.

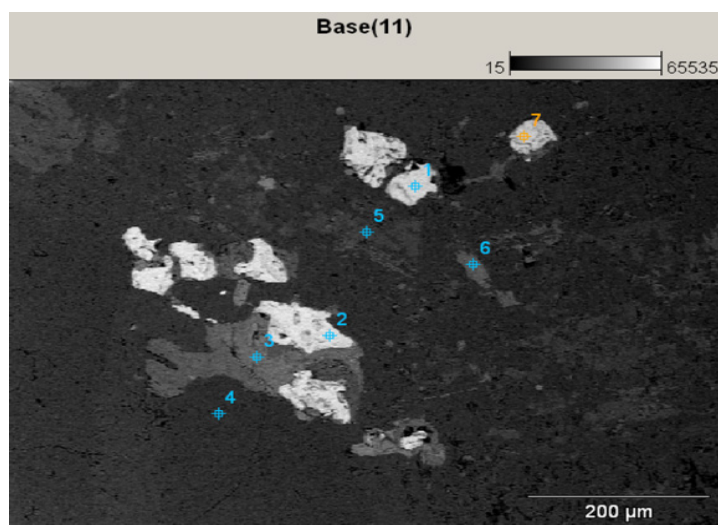


Figure 6. Iron oxides (points 1, 2, 7), Fe–Al–Si phase (3), quartz (4), K-bearing aluminosilicate (5), and Fe–Mg chlorite (6). Backscattered electron (BSE) image.

Conclusion. The geological conditions of the formation of porphyry copper mineralization associated with buried Upper Paleozoic granitoids were studied. For the first time, the mineral associations and relationships between sulfide and Th–U–Zr-bearing phases in samples from the Arganaty porphyry copper–molybdenum ore occurrence were characterized using SEM–EDS data. The sequence of ore mineral formation was established, including minerals that may also be associated with precious and rare metals. It can be predicted that, in addition to the principal ore components – copper and molybdenum – the Arganaty ore occurrence may contain other priority mineral commodities.

References

- Antonenko A.A., Zhukov N.M., Gerzen L.Y., Goikolova T.V. (2016). Features of mineral and element composition of poor ores of deposits Aktogay and Bozshakol. *News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences.* – Vol. 4(418). – P. 18-27 (in Eng.).
- Baibatsha A., Muratkhonov D. (2025). Mineralogical studies of porphyry copper deposits to replenish the mineral resource base. In *Recent Research on Sedimentology, Stratigraphy, Paleontology, Tectonics, Geochemistry, Volcanology and Petroleum Geology. Advances in Science, Technology & Innovation.* Cham: Springer. – P. 45-48. https://doi.org/10.1007/978-3-031-87558-8_9 (in Eng.).
- Baibatsha A., Vikentyev I., Muratkhonov D., Bulegenov K. (2024). New porphyry copper–molybdenum ore occurrence in Arganaty granites of the Eastern Balkhash (Kazakhstan): Geology, geochemistry, and mineralogy. *Geosciences.* – Vol. 14. – P. 237. <https://doi.org/10.3390/geosciences14090237> (in Eng.).
- Baibatsha A., Vikentyev I., Muratkhonov D., Bulegenov K. (2026). Petrogenesis and magma sources of Arganaty granites, Eastern Balkhash, Central Asia: Insights from geochemistry, first U-Pb age and comparison with Northern Balkhash and Alatau Mountains granitoid massifs. *Minerals.* – Vol. 16(4). – P. 364. <https://doi.org/10.3390/min16040364> (in Eng.).
- Baibatsha A.B., Nukhuly A., Agmanova A.Ye., Bashilova E.S., Amralinova B.B. (2025). The legacy of academician K.I. Satpayev in the study of uranium deposits of Kazakhstan. *News of the national academy of sciences of the Republic of Kazakhstan, Series of geology and technical sciences.* – Vol. 6. – P. 47-62. <https://doi.org/10.32014/2025.2518-170X.570> (in Eng.).
- Bekzhanov G.R., Koshkin V.Ya., Nikitchenko I.I., Skrinnik L.I., Azizov T.M., Timush A.V. (2000). *Geologicheskoe stroenie Kazakhstana [Geological structure of Kazakhstan]* Almaty: Academy of Mineral Resources of the Republic of Kazakhstan. – 396 p. (in Rus.).
- Chen X., Qu W., Han S., Seitmuratova E., Yang N., Chen Z., Zeng F., Du A., Wang Z. (2010). Re-Os geochronology of Cu and W–Mo deposits in the Balkhash metallogenic belt, Kazakhstan and its geological significance. *Geoscience Frontiers.* – Vol. 1(1). – P. 115-124. <https://doi.org/10.1016/j.gsf.2010.08.006> (in Eng.).
- Daukeev S.Zh., Uzhkenov B.S., Abdulin A.A., Bespayev Kh.A., Votsalevsky E.S., Lyubetsky V.N., Miroshnichenko L.A., 2002. *Glubinnoe stroenie i mineral'nye resursy Kazakhstana. T. 2. Metallogeniya [Deep structure and mineral resources of Kazakhstan. Vol. 2. Metallogeny].* Almaty: National Academy of Sciences of the Republic of Kazakhstan. – 272 p. (in Rus.).
- Daukeev S.Zh., Uzhkenov B.S., Abdulin A.A., Bespayev Kh.A., Votsalevsky E.S., Lyubetsky V.N., Miroshnichenko L.A., (2002). *Glubinnoe stroenie i mineral'nye resursy Kazakhstana. T. 1. Glubinnoe stroenie i geodinamika. [Deep structure and mineral resources of Kazakhstan. Vol. 1. Deep structure and geodynamics].* Almaty: National Academy of Sciences of the Republic of Kazakhstan. – 224 p. (in Rus.).
- Ermolov P.V., Degtyarev K.E., Kotov A.B., Salnikova E.B., Yakovleva S.Z., Plotkina Yu.V., Tolmacheva E.V. (2015). Age determination of ore-bearing granitoids of the Konyrat (Kounrad) porphyry copper deposit in the North Balkhash region, Central Kazakhstan. *Doklady Earth Sciences.* – Vol. 461. – P. 345-350. <https://doi.org/10.1134/S1028334X15040182> (in Eng.).
- Ermolov P.V., Degtyarev K.E., Salnikova E.B., Tretyakov A.A., Kotov A.B., Anisimova I. V., Plotkina Yu. V. (2018). Late Carboniferous monzonite–granosyenite magmatism in the Northern Balkhash region (Central Kazakhstan). *Doklady Earth Sciences.* – Vol. 478. – P. 156-160. <https://doi.org/10.1134/S1028334X18020125> (in Eng.).
- Gao J., Klemd R., Zhu M., Wang X., Li J., Wan B., Xiao W., Zeng Q., Shen P., Sun J., Qin K., Campos E. (2018). Large-scale porphyry-type mineralization in the Central Asian metallogenic domain: A review. *Journal of Asian Earth Sciences.* – Vol. 165. – P. 7-36. <https://doi.org/10.1016/j.jseas.2017.10.002> (in Eng.).
- Koshkin V.Ya., Rakishev B.M., Uzhkenov B.S., Tsirelson B.S. (2007). *Tektonicheskaya karta Kazakhstana. Ob'yasnitel'naya zapiska. [Tectonic map of Kazakhstan. Explanatory note]* Scale 1:1,000,000. Almaty. – 130 p. (in Rus.).

Li Y., Chen X., Dong S., Wang Z., Chen Z., Han S., Seitmuratova E., et al. (2012). Geochronology studies on metallogenesis and exhumation of super-large Aktogai porphyry copper deposit, Kazakhstan. *Acta Geologica Sinica*. – Vol. 86(2). – P. 295-306. (in Chin., abstract in Eng.).

Mataibayeva I., Aitbayeva S.S., Agaliyeva B., Shayahmetova Z.A., Alzhaparova S.N., Sypainova G., Kassenova N., Kapzhaparova Z., Akilbaeva A., Tailym K. (2026). Mineralogical and geochemical criteria of porphyry copper mineralisation at the Bala-Urpek deposit, Sarykol intrusive complex, Eastern Kazakhstan. *Minerals*. – Vol. 16(6). – P. 578. <https://doi.org/10.3390/min16060578> (in Eng.).

Muratkhanov D., Kembayev M., Sayat R. (2023). A new approach to the forecast of porphyry copper deposits on the buried territories of Kazakhstan. *Proceedings of the International Multidisciplinary Scientific GeoConference, SGEM 2023*. – Vol. 23. – P. 3-9. <https://doi.org/10.5593/sgem2023/1.1/S01.01> (in Eng.).

Orynbassarova E., Bekbotayeva A., Abdullayeva T., Urmanova D., Nurtas M. (2024). Metasomatic zoning and features of mineralization of porphyry copper deposits of the North-Eastern Balkhash region. *Engineering Journal of Satbayev University*. – Vol. 146(4). – P. 34-40. <https://doi.org/10.51301/ejsu.2024.i4.05> (in Eng.).

Pirajno F. (2000). *Ore Deposits and Mantle Plumes*. Dordrecht: Kluwer Academic Publishers. – 556 p. <https://doi.org/10.1007/978-94-017-2502-6> (in Eng.).

Seirov F.E., Ananyev Yu.S., 2025. Strukturno-metasomaticheskaya model' medno-porfirovogo rudnogo polya Aktogay po materialam distantsionnykh s"emok (severo-vostochnoe Pribalkhash'e). [Structural-metasomatic model of the Aktogay porphyry copper ore field based on remote sensing data (North-Eastern Balkhash region)]. *Bulletin of the Tomsk Polytechnic University. Geo Assets Engineering*. – Vol. 336(7). – P. 197-209. <https://doi.org/10.18799/24131830/2025/7/5088> (in Rus.).

Sillitoe R.H. (2010). Porphyry copper systems. *Economic Geology*. – Vol. 105(1). – P. 3-41. <https://doi.org/10.2113/gsecongeo.105.1.3> (in Eng.).

Publication Ethics and Publication Malpractice in the journals of the Central Asian Academic Research Center LLP

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 journals of the Central Asian Academic Research Center LLP 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 Central Asian Academic Research Center LLP 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 Central Asian Academic Research Center LLP.

The Editorial Board of the Central Asian Academic Research Center LLP will monitor and safeguard publishing ethics.

Requirements for articles design for publication in the journal are available on the websites:

**[www:nauka-nanrk.kz](http://www.nauka-nanrk.kz)
<http://www.geolog-technical.kz/index.php/en/>
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)**

Managing Editor: *T. Apendiyev*
Editors: *D.S. Alenov, A.Shormakova*
Computer layout: *G.D. Zhadyranova*

Signed for print: Oktober 14, 2026
Format: 70×90 1/16. 26.5 printed sheets. Order No. 5.

*«Central Asian Academic Research Center» LLP
Almaty, Shevchenko Street, 28*