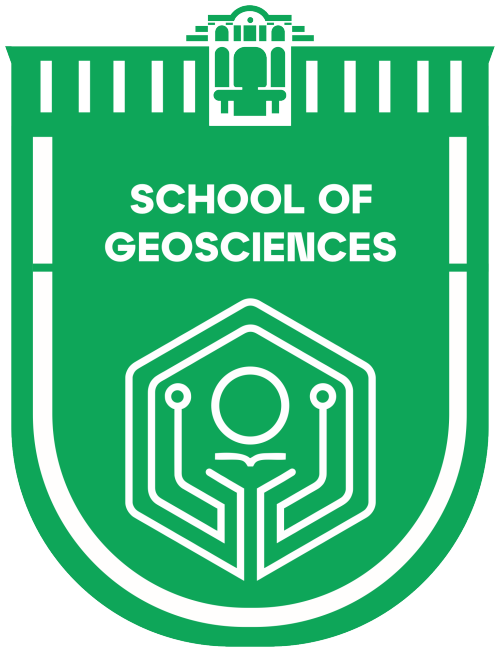
ШКОЛА НАУК О ЗЕМЛЕ



№	Наименование публикации	Выходные данные (doi статьи)	Аннотация статьи	Ссылка для цитирования (Ф.И.О., название статьи, название, номер и/или выпуск, том журнала, страницы, doi статьи)
1	Geology, Mineralogy, and Age of Li-Bearing Pegmatites: Case Study of Tochka Deposit (East Kazakhstan)	https://doi.org/10.3390/min12121478	New geological, mineralogical, geochemical, and geochronological data have been obtained for Li-bearing pegmatites from the Tochka deposit located within the Karagoin–Saryozek zone in East Kazakhstan. Earlier, the exploration works in this zone were carried out to detect only Ta and Sn mineralization, but other ores (including Li) were not considered. The estimation of lithium resources in pegmatites from the area was methodologically imperfect. Previously, it was believed that the formation of rare-metal pegmatite veins was associated with Late Carboniferous Na-granites. The obtained geological observation confirms that the ore-bearing rare-metal pegmatites at the Tochka deposits cut the Late Carboniferous Na-granites and do not cut the Early Permian Kalba granites. The associations of the accessory minerals in host hornfels, Na-granites, and rare-metal pegmatites are different and the accessory minerals in pegmatites are similar to the accessory minerals in the Kalba granites. Geochemical data show that the behavior of rare elements (Ba, Th, HFSE, and REE) and the levels of accumulation of rare metals prove that pegmatites are similar to the product of the differentiation of the granitic magmas of the Kalba complex. The 40Ar/39Ar muscovite age of the Tochka pegmatites (~292 Ma) fits the age range of the Kalba granite complex. Based on the main principles of the generation of rare-metal pegmatites, the Tochka pegmatites formed during the fluid–magmatic fractionation of magma in large granitic reservoirs of the Kalba complex. The Karagoin–Saryozek zone-located between several large granite massifs of the Kalba complex where host rocks play a role as a roof-may be very promising for rare-metal pegmatite mineralization.	Zimanovskaya N.A., Oitseva T.A., Khromykh S.V., Travin A.V., Bissatova A.Y., Annikova I.Y., Aitbayeva S.S. Geology, Mineralogy, and Age of Li-Bearing Pegmatites: Case Study of Tochka Deposit (East Kazakhstan), Minerals 2022, 12(12), 1478 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85144835481&doi=10.3390%2fmin12121478&partnerID=40&md5=3ebf5d7b7e25993a9065b86379894fd8

2	Utilization of Spent Sorbent in the Production of Ceramic Bricks	10.3390/ chemengineering6050082	The composition and technology for the production of semi-dry ceramic bricks using a nanostructured complex sorbent based on bentonite clay of the 11th horizon of the Tagan deposit of the Republic of Kazakhstan and basalt fiber (gabbro-diabase) of the Karauzek deposit of East Kazakhstan have been developed. The characteristics, chemical composition, and structure of the spent sorbent are given based on electron microscopic and X-ray phase analyses. A number of physical and mechanical parameters have been studied to evaluate the spent sorbent as a raw material for the production of ceramic products. The microstructures of fired ceramic samples with loam and spent sorbent have been studied, and the features of their structure have been revealed. The environmental safety of waste sorbents utilization by extraction in acidic, alkaline, and neutral media with the determination of the content of chromium, zinc, and iron ions has been studied. Experimentally obtained data indicate an insignificant concentration of chromium and zinc ions, not exceeding 3.5 µg/L. Relatively high concentrations of iron ions in ceramic bricks are associated with their high content in the feedstock and in the spent sorbent. It has been established that the introduction of the spent sorbent in the amount of 25% of the total mass increases the strength of the final product from 10.8 to 15.8 MPa, which corresponds to the M125 ceramic brick grade.	Daumova G., Seraya N., Azbanbayev E., Assanov D., Aubakirova R., Reutova G. Utilization of Spent Sorbent in the Production of Ceramic Bricks. ChemEngineering, 2022, 6, 82. https://doi.org/ 10.3390/ chemengineering6050082 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85140610563&doi=10.3390%2fchemengineering6050082&partnerID=40&md5=15762cc2d3c9d2485011caecce990898

3	Development of three-dimensional models of the spread of pollution on agricultural land in industrial cities	DOI 10.1063/5.0100029	Under conditions of excessive anthropogenic pressure on the environment special attention is paid to the ecological state of the soil in Kazakhstan. The quality of soil is the basis for production of environmentally friendly food products, which also provides a more complete transition to the organic use of land resources. The main sources of pollution are mining and metallurgical enterprises that pollute the environment with heavy metals and their compounds. In a light of the current requirements on sustainable development and transition to a circular economy, it's necessary to create new models of "intelligent" agriculture, based on the use of automated management technologies, ecosystem modeling. The paper substantiates a method to the environmental assessment of agricultural land in industrial cities based on geoinformation modeling processes of the distribution pollutants in the urban environment. The proposed approach will provide a detailed and objective assessment of the environmental situation and will be the basis for the development of various recommendations for protection and rational use of land, including the development of a number of measures to clean up soil and reduce content of pollutants in soil, plants through introduction of a phytoremeditation system, use of natural bentonite clays and other minerals.	Kulenova N., Toguzova M., Assylkhanova Z., Mamysheva A., Sadenova M., Rakhymberdina M. Development of three-dimensional models of the spread of pollution on agricultural land in industrial cities, 2022, AIP Conference Proceedings, 2570, 040014, 10.1063/5.0100029 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85137461514&doi=10.1063%2f5.0100029&partnerID=40&md5=015f6f86a3a0b99805b81803b8d7e2e7

4	Geological History of the Great Altai: Implications for Mineral Exploration	10.3390/min12060744	The Great Altai region, located at the boundary of Russia, Mongolia, China, and Kazakhstan, belongs to the system of the Central Asian Orogenic Belt. It has undergone a long complex geological and metallogenic history. Extremely rich resources of base, precious, and rare metals (Fe, Cu, Pb, Zn, Ag, Au, Li, Cs, Ta, Nb, REE, etc.) maintain developed mining and metallurgical industry, especially in East Kazakhstan, which is the key metallogenic province. The East Kazakhstan province comprises the Rudny Altai, Kalba-Narym, West-Kalba, and Zharma-Saur metallogenic belts, each having its typical mineralization profiles and deposits. The reconstructed geodynamic and metallogenic history of the Great Altai province, along with the revealed relationships between tectonic settings and mineralization patterns, allowed us to formulate a number of geodynamic, structural, lithostratigraphic, magmatic, mineralogical, and geochemical criteria for exploration and appraisal of mineral potential in Eastern Kazakhstan. Geodynamic criteria are based on the origin of different mineralization types in certain geodynamic settings during the Late Paleozoic–Early Mesozoic orogenic cycle. Structural criteria mean that the location of base-metal deposits in Rudny Altai, gold deposits in the West Kalba belt, rare and base metals in the Kalba-Narym and Zharma-Saur zones is controlled by faults of different sizes. Lithostratigraphic criteria consist of the relation of orebodies with certain types of sedimentary or volcanic-sedimentary rocks. Magmatic criteria are due to the relation between mineralization types and igneous lithologies. Mineralogical and geochemical criteria include typical minerals and elements that can serve as tracers of mineralization. The joint use of all these criteria will open new avenues in prospecting and exploration at a more advanced level.	D’yachkov B.A., Mizernaya M.A., Khromykh S.V., Bissatova A.Y., Oitseva T.A., Miroshnikova A.P., Frolova O.V., Kuzmina O.N., Zimanovskaya N.A., Pyatkova A.P., Zikirova K., Ageyeva O.V., Yeskaliyev Y.T. Geological History of the Great Altai: Implications for Mineral Exploration, Minerals, 2022, 12(6), 744, 10.3390/min12060744, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85131600250&doi=10.3390%2fmin12060744&partnerID=40&md5=4994cf908ca0507b2a3b611a6137087b

5	Using Space Survey Materials for Modeling Hydrodynamic Accidents at Mining Enterprises in Kazakhstan	10.5194/isprs-archives-XLVI-5-W1-2022-193-2022	The timeliness of using modern computer programs for modelling flood zones, the consequences of hydraulic accidents, dam breakthroughs, flood and flood forecasting in a complex system of rivers and channels for the prevention of hydro meteorological emergencies is beyond doubt. The use of BIM technologies will make it possible to move from point-based flood risk assessments to areal ones, which will significantly improve the reliability of planned measures to prevent natural and anthropogenic emergencies. The purpose - to perform works on modelling of hydrodynamic accident and forecast of its development by the example of tailings dumps in concentration plant in East Kazakhstan. As the initial data - digital model for the area of work, technical reports on engineering-hydrographical survey, topographic-geodetic works, engineering-geological survey, high-resolution satellite images in a panchromatic survey mode. On the basis of geoinformation modelling methods with use of initial and remote sensing data, final digital terrain model was built in Digital software. The method based on direct hydrodynamic modelling of area flooding was used to calculate hydrodynamic accidents, to model the dynamics of area flooding because of tailings dam break in several levels. The practical result is numerical hydrodynamic modelling of dynamics flooding area because of partial destruction, erosion of embankment dam of tailings concentrator, total area and extent of flooding, as well as the area and depth of partially flooded buildings of residential development was estimated, thematic maps of flooded area were created, as well as maps of water passage with flow velocities during the hydrodynamic accident. Thus, the application of advanced space imagery, GIS technologies in full measure allow for simulating the occurrence, development of hydrodynamic accidents in structures, to determine area, time of flooding.	Rakhymberdina M.Y., Grokhotov E.V., Assylkhanova Z.A., Toguzova M.M. Using Space Survey Materials for Modeling Hydrodynamic Accidents at Mining Enterprises in Kazakhstan, 2022, The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences; Gottingen, XLVI-5/W1-2022, 193-198 10.5194/isprs-archives-XLVI-5-W1-2022-193-2022, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125489624&doi=10.5194%2fisprs-archives-XLVI-5-W1-2022-193-2022&partnerID=40&md5=33ad3e23111e872b0fad8820fc6d6ddb

6	ZONED RARE-METAL MINERALIZATION IN THE CENTRAL KALBA AREA (EAST KAZAKHSTAN)	10.5593/sgem2022/1.1/s01.008	Currently the resources of rare metals, especially Ta, Nb, Be, and Li used in high-tech industries, are of great demand in Kazakhstan and worldwide. Main Ta, Nb, Be, Li, Sn, and W deposits in the Great Altai territory are hosted by Permian granitic belts that formed during the Late Paleozoic-Early Mesozoic orogeny, in a postcollisional setting. The largest metallogenic structure of the Kalba-Narym granitoid belt accommodates many genetically different deposits and occurrences. Pegmatitic rare-metal deposits have vertically and laterally zoned distribution patterns, with mineralization mostly localized in the tectonically active Central Kalba ore district. The richest spodumene and pollucite pegmatites are located in the upper parts of the ore zone. The mineralization types make up the following sequence: barren oligoclase-microcline pegmatites followed by microcline-quartz-muscovite (Nb, Be), microcline-albite (Ta, Sn, Be), albite (Ta, Nb, Be, Sn), albite-spodumene greisen (Li, Ta, Be, Sn), and cleavelandite-lepidolite-pollucite-spodumene (Ta, Li, Cs, Sn) zones. The zoned patterns of rare-metal mineralization have to be taken into account in further studies.	Oitseva T., Mizernaya M., Kuzmina O., Bissatova A., Zimanovskaya N. ZONED RARE-METAL MINERALIZATION IN THE CENTRAL KALBA AREA (EAST KAZAKHSTAN), 2022, International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, 22, 1.1, 67-74, 10.5593/sgem2022/1.1/s01.008, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85151119692&doi=10.5593%2fsgem2022%2f1.1%2fs01.008&partnerID=40&md5=aa3af8410833ac924bb7999047d23460

7	Diesel Particulate Matter Exposure to an Operator of LHD Loader Working in an Active Ore Heading Area	10.11159/mmme22.132	Considerable scientific evidence shows that inhalation of diesel exhaust particles is associated with a wide range of adverse health effects. This study examined the concentrations of diesel particles in five stations of the operational phases of an underground mine in Kazakhstan. Real-time monitoring of particulate number concentration (PNC), lung deposited surface area (LDSA) concentrations, PM1, PM2.5, and PM10 concentrations in the mining operational area, and the breathing zone of the loader driver inside the loader cabin was conducted. The results showed that the highest average PNC and LDSA concentrations were 7 × 105 cm−3 and 4 × 103 μm2 cm−3, respectively, and most of the particles were in the sub-100 nm range. The concentrations level in the loader cabin area (LA), and operational area (OA) of mine was similar with respect to PM1 and PM2.5 as a result of the homogenous distribution of the PM inside the mine's operational phase. The major source of the PM1 and PM2.5 was the diesel engine, while the low LA/OA ratio for PM10 in this study suggested the source of the coarse particles was dust resuspension around the loader cabin.	Sabanov S., Magauiya N., Zenulla A., Abil A., Nurshaiykova G. Diesel Particulate Matter Exposure to an Operator of LHD Loader Working in an Active Ore Heading Area, 2022, Proceedings of the World Congress on Mechanical, Chemical, and Material Engineering, 2 10.11159/mmme22.132, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85145304748&doi=10.11159%2fmmme22.132&partnerID=40&md5=1001264de51f67dc165cbf1ea1a0c455

8	Using Remote Sensing Data to Support Intelligent Agricultural GIS to Monitor the Condition of Arable Land and Crops	10.3303/CET2294147	The article reviews the modern state of the multi-level agricultural land monitoring system in Kazakhstan, as an element of the precision farming system, carried out both at the state level and in the context of land users. The main constraints to the widespread use of remote sensing (RS) and unmanned aerial vehicles (UAV) data were identified. The large extent of the country's territory, different climatic conditions, large differences in the altitude of the terrain impose an impact on the choice of methods of data processing and interpretation. Data from Sentinel, Landsat, Modis satellites are used as input data, on which software applications of the most common in agriculture are based. On the basis of conducted monitoring of agricultural lands in KH "Mayak" farm in Pavlodar region with the use of available online applications, programs, native web services, UAV evaluated the potential of multi-level use of remote sensing in modern conditions of Kazakhstan. The results of the UAV survey with a mobile RTK station allow ensuring the accuracy of the map at a scale of 1: 1000.	Rakhymberdina M.Y., Kulenova N.A., Shaimardanov Z.K., Assylkhanova Z.A., Toguzova M.M., Kassymov D.K. Using Remote Sensing Data to Support Intelligent Agricultural GIS to Monitor the Condition of Arable Land and Crops, 2022, Chemical Engineering Transactions, 94, 883-888 10.3303/CET2294147, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139464388&doi=10.3303%2fCET2294147&partnerID=40&md5=606ab28f92cee8487d2e9c832a29863d

9	Analysis of Process Modeling in Modern Software Program to Support "Smart" Agriculture	10.3303/CET2294145	The modern level of development of computer technology and software has created the prerequisites for a new approach used in the precision farming system. One of the priority areas is the use of modern software products that are based on the use of computer simulation models that allow performing crop yield forecasting modeling, including approaches to differentiated fertilization and minimizing negative environmental impact. The purpose of this work is to analyze and substantiate the main effective software modules, which are based on the integration of meteorological indicators, satellite measurements of spectral parameters of agricultural crops, statistical data on crop yields for a certain period and satellite images, allowing you to create dynamic predictive models aimed at solving the problem of managing technological processes in the offline and online modes. Based on a comprehensive analysis of modern GIS software products, the main modules were identified and a technological scheme for integrating input data and their subsequent processing was proposed: creating a yield map, planning, according to weather conditions, sowing dates, the ability to prepare tasks for differentiated application of fertilizers and plant protection products, conducting statistical analysis of harvesting data, planning sampling points for agrochemical examination and subsequent accounting of the results. These processes will be implemented through the geoinformation application "Agronomist's Tablet".	Toguzova M.M., Rakhymberdina M.Ye., Kulenova N.A., Shaimardanov Z.K., Assylkhanova Z.A., Apshikur B., Beisekenov N.A. Analysis of Process Modeling in Modern Software Program to Support "Smart" Agriculture, 2022, Chemical Engineering Transactions, 94, 871-876, 10.3303/CET2294145, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139329438&doi=10.3303%2fCET2294145&partnerID=40&md5=4fd23cbda2bc9f573cd83afd0fbd4c50

10	Research on Potential Application of a New Fertilizer based on Natural Sorbents for Toxic Soils	10.3303/CET2294058	The article considers the study on potential application of fertilizer containing natural sorbents from Kazakhstan deposits in order to develop a new organomineral fertilizer from household waste water and sorption materials. There was the study on the possibility for the developed organomineral fertilizers to influence heavy metals input into plant products, including those ones on polluted soil. There was the research on heavy metals input into soil with meltwater on urban territory plots close to metallurgic enterprises in order to apply the proposed new fertilizer. The following factors were defined: the required area of the plots, their service life period, produced fertilizers application load, economically reasonable distance for transporting fertilizers. The work demonstrates test results related to studying influence of new fertilizer types on Amoria creeping clover (Trifolium repens) feeding crop capacity, accumulation of heavy metals in soil and plants. Content of heavy metals was defined in plant products grown with new fertilizers application and it was proved that the proposed fertilizers were safe. Heavy metals content in plants decreases on 2.3 - 10.2 % of heavy metals content in soil if there is fertilizer based on shungite. Shungite-based fertilizer provides better results in copper and zinc than bentonite-clay based fertilizer (from 0.6 to 6 % of heavy metals content in soil). But bentonite-clay based fertilizer provides better results in cadmium and lead (0.4 - 1.9 %).	Petrova O., Daumova G., Idrisheva Z., Mashekenova A., Kaissina M. Research on Potential Application of a New Fertilizer based on Natural Sorbents for Toxic Soils, 2022, Chemical Engineering Transactions, 94, 349-354, 10.3303/CET2294058, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139250738&doi=10.3303%2fCET2294058&partnerID=40&md5=a675a53003e957759bdd19a1f9f93621

11	Modelling of Alfalfa Yield Forecasting Based on Earth Remote Sensing (ERS) Data and Remote Sensing Methods	10.3303/CET2294116	This study aims to develop a method for modelling early forecasting of alfalfa yield on a farm scale located in East Kazakhstan. The authors evaluated the correlation coefficient between forage crop yield and different data sets, including weather data, climate indices, spectral indices from drones and satellite observations. An ensemble machine learning model was developed by combining three commonly used basic training modules: random forest (RF), support vector method (SVM), and multiple linear regression (MLR). It is found that the best yield prediction algorithm in this study is the Random Forest (RF) algorithm, which predicts yields with R2 = 0.94 and RMSE = 0.25 t/ha. The results of this study showed that combining remote sensing drought indices with climatic and weather variables from UAV and satellite imagery using machine learning is a promising approach for alfalfa yield prediction.	Sadenova M.A., Beisekenov N.A., Apshikur B., Khrapov S.S., Kapasov A.K., Mamysheva A.M., Klemes J.J. Modelling of Alfalfa Yield Forecasting Based on Earth Remote Sensing (ERS) Data and Remote Sensing Methods, 2022, Chemical Engineering Transactions, 94, 697-702, 10.3303/CET2294116, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139245353&doi=10.3303%2fCET2294116&partnerID=40&md5=c63de408290cdfd91763fd7a93a8b46e

12	TOP-DOWN CUT-AND-FILL MINING METHOD AT THE PERVOMAYSKIY DEPOSIT OF THE DONSKOY MINING AND BENEFICIATION PLANT	10.32014/2022.2518-170X.197	Purpose. Study on the chemical composition of lake waters, salt brines, brine and bottom sediments to identify the mineralization of rare metals and other types of minerals. Methodology. Mass spectrometric studies (mass spectrometer with inductively coupled plasma ICP-MS 7500cx from AgilentTechnologies) for the purpose of high-precision analytical studies on the chemical composition of salt lake water in order to assess the content of rare elements. The use of unmanned aerial vehicles for linking and geometrizing lakes. Findings. Field surveys on the geometrization and linking of lakes were carried out. From the materials obtained with the help of the drone, orthophotoplans were created (with a measurement accuracy of up to 1 centimeter), as well as a digital terrain model and a digital terrain model. A complex of analytical works was carried out using inductively coupled plasma spectrometry. When analyzing the distribution graphs of the absolute content of micro-components in the waters of the lakes of the Delbegeteysky massif, it was found that all samples were enriched with sodium, phosphorus, iron, magnesium and barium. The results of the analyses revealed the predominance of sulfates and chlorides in the composition of the surface waters of most of the water bodies of the Delbegeteysky massif. At the Burabai site, lake waters are characterized by an alkaline reaction of the environment (on average pH = 8.71). At the same time, the salinity of water bodies varies from 05 to 9 g/dm3 Originality. Large-scale outcrops of granites of the Kalba complex (P1), with which a rare-metal type of mineralization is genetically associated, are known to be on the selected study sites. Quartz-wire-greisen and quartz-wire tin, tin-tungsten and tungsten formations are also widely developed. Considering the large geochemical migration ability of rare alkaline elements in the thickness of loose sediments as a result of intensive geodynamic processes in the East Kazakhstan region, it is possible to assume the possibility of their migration to the upper horizons and accumulation in salt lakes localized within the area of development of granite intrusions of Permian age and associated deep tectonic faults. Practical value. The results of the research can serve as a revival of the rare metal industry in the region, which will allow developing new high-tech industries and creating new jobs in this area. The obtained results can be used for setting up further exploration and operational work on the selected promising areas.	Ananin A.I., Tungushbayeva Z.K., Nurshaiykova G.T., Kalelova G.Zh. TOP-DOWN CUT-AND-FILL MINING METHOD AT THE PERVOMAYSKIY DEPOSIT OF THE DONSKOY MINING AND BENEFICIATION PLANT, 2022, News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2022, 4, 16-27, 10.32014/2022.2518-170X.197, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135572254&doi=10.32014%2f2022.2518-170X.197&partnerID=40&md5=7847985dd9b3cb8895b5275267cb4b1a

13	Analysis of the Composition of Municipal Wastewater Sludge from Small Settlements in East Kazakhstan	10.12911/22998993/149896	One of the biggest environmental problems of modern countries is the pollution of territories with waste. Of particular concern are wastes generated during the treatment of municipal wastewater - sewage sludge. They are the inevitable price of urbanization and improved quality of life. As a result of the research conducted, a comprehensive analysis of the composition of municipal sewage sludge was made using the example of four small settlements in East Kazakhstan. The results of laboratory studies established the composition of the organic part, biogenic elements, as well as microbiological and parasitological indicators. It was revealed that cadmium, copper, zinc and arsenic are main sources of problems in sewage treatment plant sludge. For copper and zinc, the standards set by the European Directive 86/278/EEC were exceeded by up to 3.2 and 1.5 times, respectively. At the same time, there is an increased content of nutrients. Organic matter in all studied samples exceeds the minimum established values by 3.5–3.7 times; the potassium content in all studied samples is 5.1–5.6 times higher than the minimum established value for organomineral fertilizers in the Republic of Kazakhstan. The concentration of hydrogen ions (pH) corresponds to neutral. Tests for the determination of microbiological and parasitological parameters indicates that the studied sludge does not contain various pathogenic bacteria and microorganisms.	Litvinov V., Daumova G., Shaikhov M., Sergeyeva N. Analysis of the Composition of Municipal Wastewater Sludge from Small Settlements in East Kazakhstan, 2022, Journal of Ecological Engineering, 23, 7, 105-112, 10.12911/22998993/149896, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85131299500&doi=10.12911%2f22998993%2f149896&partnerID=40&md5=8283e59e09517af113ba588a43fd3683

14	First Age and Geochemical Data on Zircon from Riebeckite Granites of the Verkhnee Espe Rare Earth-Rare Metal Deposit, East Kazakhstan	10.1134/S0016702922010086	This paper is dedicated to the isotope-geochemical study of zircon from riebeckite granites of the Verkhnee Espe rare earth-rare metal deposit and the specification of its U–Pb age. Zircon from the Verkhnee Espe massif is peculiar in the high content of non-formula elements (up to 43000 ppm REE, up to 22000 Y, and others) and demonstrates a clearly expressed heterogeneous structure. The central and rim zones of the zircon show a “magmatic” rare-earth element (REE) distribution. The intermediate zones are characterized by a flattening of the REE patterns and an anomalous enrichment in REE, Y, Nb, and Ca. This compositional feature of the zircon may be caused by impact of fluid-saturated granite melts enriched in incompatible trace elements. The $\delta^{18}O$ values in the zircon are 5.83–7.16‰, which generally corresponds to zircon formed from granitoid melts. The age of zircon from the Verkhnee Espe rare earth–rare metal deposit is 283 ± 3 Ma, which indicates that there is no significant age gap between granite crystallization, on the one hand, and metasomatic processes and ore generation, on the other.	Levashova E.V., Skublov S.G., Oitseva T.A., Dyachkov B.A., Li X.-H., Li Q.-L., Shatova N.V., Shatov V.V. First Age and Geochemical Data on Zircon from Riebeckite Granites of the Verkhnee Espe Rare Earth–Rare Metal Deposit, East Kazakhstan, 2022, Geochemistry International, 60, 1, 10.1134/S0016702922010086, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125234773&doi=10.1134%2fS0016702922010086&partnerID=40&md5=e2a3e287c7e115c108ecf3fdce8e2a1d

15	LI-BEARING PEGMATITES OF THE KALBA-NARYM METALLOGENIC ZONE (EAST KAZAKHSTAN): MINERAL POTENTIAL AND EXPLORATION CRITERIA	10.32014/2022.2518-170X.144	New geological, mineralogical, geochemical, and geochronological data have been obtained for Li-bearing pegmatites from the Tochka deposit located within the Karagoin–Saryozek zone in East Kazakhstan. Earlier, the exploration works in this zone were carried out to detect only Ta and Sn mineralization, but other ores (including Li) were not considered. The estimation of lithium resources in pegmatites from the area was methodologically imperfect. Previously, it was believed that the formation of rare-metal pegmatite veins was associated with Late Carboniferous Na-granites. The obtained geological observation confirms that the ore-bearing rare-metal pegmatites at the Tochka deposits cut the Late Carboniferous Na-granites and do not cut the Early Permian Kalba granites. The associations of the accessory minerals in host hornfels, Na-granites, and rare-metal pegmatites are different and the accessory minerals in pegmatites are similar to the accessory minerals in the Kalba granites. Geochemical data show that the behavior of rare elements (Ba, Th, HFSE, and REE) and the levels of accumulation of rare metals prove that pegmatites are similar to the product of the differentiation of the granitic magmas of the Kalba complex. The 40Ar/39Ar muscovite age of the Tochka pegmatites (~292 Ma) fits the age range of the Kalba granite complex. Based on the main principles of the generation of rare-metal pegmatites, the Tochka pegmatites formed during the fluid–magmatic fractionation of magma in large granitic reservoirs of the Kalba complex. The Karagoin–Saryozek zone—located between several large granite massifs of the Kalba complex where host rocks play a role as a roof—may be very promising for rare-metal pegmatite mineralization.	Oitseva T.A., Dyachkov B.A., Kuzmina O.N., Bissatova A.Y., Ageyeva O.V. LI-BEARING PEGMATITES OF THE KALBA-NARYM METALLOGENIC ZONE (EAST KAZAKHSTAN): MINERAL POTENTIAL AND EXPLORATION CRITERIA, 2022, News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2022, 1, 83-90 10.32014/2022.2518-170X.144, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125087219&doi=10.32014%2f2022.2518-170X.144&partnerID=40&md5=40d600be76785ba4cf65041d8b888960

16	Waste Water Purification from Metal Ions by Ultra-Dispersed Natural Sorbents	10.12911/22998993/143867	This work is devoted to mine waste water purification from metal ions, such as copper, zinc, lead, cadmium, iron, and manganese. The rationale was provided for the possibility to purify waste water from metal ions with nonactivated and ultra-dispersed natural sorbents. Adsorption capacity of bentonite clay from Tagan deposit and shungite from Koksui deposit of the Republic of Kazakhstan was studied on the basis of its fraction composition. It was found that the most effective method of sorbents modification was mechanical activation. The comparative studies of metal ions adsorption efficiency were carried out with mechanically activated and ultra-dispersed bentonite clay and shungite. The experiment enabled to find out that ultra-dispersed bentonite clay is prospective for use in order to purify deeply mine multicomponent waste water. The highest degree of metal ions extraction is achieved due to 30-minutes contact of waste water.	Yerbolov S., Daumova G. Waste Water Purification from Metal Ions by Ultra-Dispersed Natural Sorbents, 2022, Journal of Ecological Engineering, 23, 1, 43-50, 10.12911/22998993/143867, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122271283&doi=10.12911%2f22998993%2f143867&partnerID=40&md5=7b5487f7785963571273500b10d08956

17	Optimization of conditions for processing of lead–zinc ores enrichment tailings of East Kazakhstan	10.3390/met11111802	his article presents the results of studies of a low-waste technology for processing enrichment tailings using a combined enrichment–hydrometallurgical method. After washing the enrichment tailings from harmful products and reducing their size, multi-stage flotation of the crushed material of the enrichment tailings was carried out. The use of a new reagent in the flotation process was studied in order to ensure the maximum recovery of the main valuable components from the enrichment tailings. A new collector of Aero 7249 (Shenyang Florrea Chemicals Co., Ltd., Shenyang, China) type was used for the flotation. The recovery of valuable components was as follows: Cu, 6.78%; Zn, 91.69%; Pb, 80.81%; Au, 95.90%; Ag, 82.50%; Fe, 78.78%. Tailings of the flotation were re-enriched using a fatty acid collector (sodium oleate). Additional (reverse) flotation resulted in obtaining a product corresponding to the composition of building sand in terms of the content of valuable components of the waste rock. The studies of the conditions for processing the enrichment tailings of lead–zinc ore indicate the possibility of its optimization in order to maximize the involvement of waste in the production. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.	Seksenova N., Bykov R., Mamyachenkov S., Daumova G., Kozhakanova M. Optimization of conditions for processing of lead-zinc ores enrichment tailings of East Kazakhstan, 2021, Metals, 11 (11), 1802 10.3390/met11111802 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85118760041&doi=10.3390%2fmet11111802&partnerID=40&md5=71fbf1a7ef5a9a7d24c6cfaf5dac4b54

18	Integrated approach to solving the problems of land recovery and disposal of solid waste in the coal mining region	10.1051/e3sconf/202131502009	As a result of anthropogenic destruction of natural biogeocenoses, a decrease in biodiversity occurs, leading to instability and degradation of both individual elements and the biosphere as a whole. In coal-mining regions, there are two equivalent environmental problems: land degradation as a result of mining and an increase in production and consumption waste. The unfavorable ecological situation affects the state of the ecosystem of the regions as a whole, which negatively affects the health of the population. In this regard, the development of predictive models of the state of disturbed lands - their reclamation and return to the national economic turnover - are relevant. The purpose of this work is to develop principles of rational nature management during land reclamation in the Kemerovo region, disturbed as a result of opencast mining of mineral deposits. The principles of rational use have been developed, their implementation will contribute to the improvement of the ecological situation. The mechanisms of implementation include: an integrated approach to solving the problems of land reclamation and disposal of solid household waste in a coal-mining region; forecasting and regulation of the introduction of alien objects; introduction of environmentally friendly technologies to minimize emissions of xenobiotics into the biosphere and decontamination of MSW processing products. 	Zakonnova L., Babenko A., Nikishkin I., Idrisheva Z., Minasyan R. Integrated approach to solving the problems of land recovery and disposal of solid waste in the coal mining region, 2021, E3S Web of Conferences, 315, 02009 10.1051/e3sconf/202131502009, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85146886629&doi=10.1051%2fe3sconf%2f202131502009&partnerID=40&md5=2c235597670f1dcebf3867b2605964b3

19	The indicators of agricultural crops based on the remote sensing of the earth (ERS)	10.23919/SpliTech52315.2021.9566469	The paper reflects the results of studies carried out on experimental plots of a peasant farm. The vegetation index is calculated for an adequate assessment and analysis of the growth and development of a plant. Conclusions are drawn about the need for a comprehensive assessment of crop growth conditions. For a detailed assessment of the cultural condition in individual fields, it is necessary to rely on aerial photography materials from UAV, providing high detail images with a spatial resolution of 5–10 cm/pixel.	Sadenova M.A., Rakhymberdina M.Y., Kulenova N.A., Mamysheva A.M., Assylkhanova Z.A., Klemes J.J. The indicators of agricultural crops based on the remote sensing of the earth (ERS), 2021, 2021, "6th International Conference on Smart and Sustainable Technologies, SpliTech 2021" 10.23919/SpliTech52315.2021.9566469 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85118464710&doi=10.23919%2fSpliTech52315.2021.9566469&partnerID=40&md5=3a0be383cd946f589eb9b451bb6138db

20	Smart green agriculture on industrially polluted agricultural landscapes	10.23919/SpliTech52315.2021.9566460	The article analyzes information on the degree and nature of soil pollution of agricultural land with heavy metals near the territory of metallurgical enterprises. It is proposed to use the soil buffering scale to characterize the soil quality in relation to heavy metals. Based on the calculations, a soil map was constructed with a gradation of the degree of soil pollution depending on the degree of remoteness from the epicenter of pollution. It was shown that the mass of carbon in the soil and the values of cation exchange correlate with the degree of retention of carbon and heavy metals in the soil. In the studied soils of East Kazakhstan, the mass of carbon varies from 1.4 to 2.7 g and the values of cation exchange range from 16.0 to 40.8%. Based on the considered soil factors - soil buffering capacity, carbon content and cation exchange capacity, it was revealed that the most susceptible to heavy metals were leached powerful low-humus chernozems. It was found that by spraying soybeans with fullerenol, an effective process of soil phytoremediation is ensured.	Rakhymberdina M.Y., Sadenova M.A., Kulenova N.A., Erkinovna U.M., Klemes J.J., "Smart green agriculture on industrially polluted agricultural landscapes, 2021, "2021 6th International Conference on Smart and Sustainable Technologies, SpliTech 2021, 10.23919/SpliTech52315.2021.9566460", https://www.scopus.com/inward/record.uri?eid=2-s2.0-85118446441&doi=10.23919%2fSpliTech52315.2021.9566460&partnerID=40&md5=a96520f5082eb753b4486f73ad9b6975

21	Specific Features of Geotectonic Development and Ore Potential in Southern Altai (Eastern Kazakhstan)	10.1134/S1075701521050020	The article considers the peculiarities in the geotectonic development and ore potential of geological structures in Southern Altai, Eastern Kazakhstan. The territory encompasses the southeastern flanks of the tectonic zones of Rudny Altai and Kalba of Greater Altai, which are part of the overall system of the Central Asian mobile belt. The spatial adjacency of geological and ore-bearing structures of different ages and composition is emphasized, which were subjected to intense metamorphic and hydrothermal–metasomatic alterations under the influence of the Dzungarian massif and Siberian Plate and subsequent thrust–strike-slip deformations. The iron ore, copper, polymetallic, gold, and rare metal deposits formed in various geodynamic settings are characterized. The ore-controlling factors and criteria for forecasting and prospecting for ore objects are noted.	Dyachkov B.A., Bissatova A.Y., Mizernaya M.A., Zimanovskaya N.A., Oitseva T.A., Amralinova B.B., Aitbayeva S.S., Kuzmina O.N., Orazbekova G.B. Specific Features of Geotectonic Development and Ore Potential in Southern Altai (Eastern Kazakhstan), 2021, Geology of Ore Deposits, 63, 5, 383-408 10.1134/S1075701521050020 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119093158&doi=10.1134%2fS1075701521050020&partnerID=40&md5=073828 2b4f1d50b234852b94d1d6e6f8

22	Research of kinetics of zinc leaching with sulfuric acid from smithsonite	Research of kinetics of zinc leaching with sulfuric acid from smithsonite, 2021, Metalurgija	The study investigates the kinetics of zinc leaching from smithsonite with sulfuric acid in order to expand the zinc production feedstocks. The recovery rate of zinc from smithsonite into water-soluble zinc sulfate was found at different leaching time and temperature. Sulfuric acid concentration, its consumption and smithsonite particles size selected in this work for leaching of zinc from this mineral using the indicated solution allowed to determine the magnitude of "apparent" activation energy of the smithsonite reaction with the indicated acid, equal to 2,633 kJ / mol. The calculated value of E, shows that the process investigated is accompanied by diffusion phenomena.	Ramazanova R.A., Mamyachenkov S.V., Seraya N.V., Daumova G.K., Aubakirova R.A., Bagasharova Z.T. Research of kinetics of zinc leaching with sulfuric acid from smithsonite, 2021, Metalurgija, 60, 3-4, 407-410 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105361427&partnerID=40&md5=2dade9880b202f2a5b6cdc8499b01486
23	Research of ultra-dispersed opal-quartz-carbonate bentonite clay for coating welding electrodes uoni-13/55	Research of ultra-dispersed opal-quartz-carbonate bentonite clay for coating welding electrodes uoni-13/55, 2021, Metalurgija	New single-layer and double-layer coatings of UONI-13/55 welding electrodes for welding low-carbon and low-alloy steels have been proposed. The coatings were applied with superfine ultradispersed opal-quartz-carbonate bentonite clay of the Taganskoye deposit of the East Kazakhstan region. Studies have confirmed that the use of new coatings can improve the welding and technological properties of electrodes and increase the strength and ductile characteristics, as well as the cold resistance of the deposited metal.	Daumova G.K., Lopukhov Y.I., Azbanbayev E.M., Seraya N.V., Russakova A.V. Research of ultra-dispersed opal-quartz-carbonate bentonite clay for coating welding electrodes uoni-13/55, 2021, Metalurgija, 60, 3-4, 377-380 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105243313&partnerID=40&md5=84bc51417e5bb6b2573c2e29bfacee0b

24	Mineralogical tracers of gold and rare-metal mineralization in Eastern Kazakhstan	10.3390/min11030253	Replenishment of mineral resources, especially gold and rare metals, is critical for progress in the mining and metallurgical industry of Eastern Kazakhstan. To substantiate the scientific background for mineral exploration, we study microinclusions in minerals from gold and rare-metal fields, as well as trace-element patterns in ores and their hosts that may mark gold and rare-metal mineralization. The revealed compositions of gold-bearing sulfide ores and a number of typical minerals (magnetite, goethite, arsenopyrite, antimonite, gold and silver) and elements (Fe, Mn, Cu, Pb, Zn, As, and Sb) can serve as exploration guides. The analyzed samples contain rare micrometer lead (alamosite, kentrolite, melanotekite, cotunnite) and nickel (bunsenite, trevorite, gersdorffite) phases and accessory cassiterite, wolframite, scheelite, and microlite. The ores bear native gold (with Ag and Pt impurities) amenable to concentration by gravity and flotation methods. Multistage rare-metal pegmatite mineralization can be predicted from the presence of mineral assemblages including cleavelandite, muscovite, lepidolite, spodumene, pollucite, tantalite, microlite, etc. and such elements as Ta, Nb, Be, Li, Cs, and Sn. Pegmatite veins bear diverse Ta minerals (columbite, tantalite-columbite, manganotantalite, ixiolite, and microlite) that accumulated rare metals late during the evolution of the pegmatite magmatic system. The discovered mineralogical and geochemical criteria are useful for exploration purposes.	Dyachkov B.A., Bissatova A.Y., Mizernaya M.A., Khromykh S.V., Oitseva T.A., Kuzmina O.N., Zimanovskaya N.A., Aitbayeva S.S., Mineralogical tracers of gold and rare-metal mineralization in Eastern Kazakhstan, 2021, Minerals, 11 (3), 253 10.3390/min11030253 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85101704524&doi=10.3390%2fmin11030253&partnerID=40&md5=2ed818f30c303e7805e4188dabaa277b

25	Improvement of Technology, Machines, and Recipes for the Production of Compound Feed and Feed Additives for Farm Animals	10.15866/ireme.v15i11.21291	The article investigates the optimization of feeding and has developed a formulation, machines, and technology for the preparation of feed additives for cattle with biologically active substances in order to increase productivity. The article investigates the processing in new crushers of grain product waste, in which feed carbohydrates and, first of all, starch undergoes significant changes, and also creates the technological possibility of introducing missing micro- and macroelements in the cattle ration into the feed composition, and increasing the productivity of animals by increasing the transformation of feed nutrients into products. The article presents the results of the efficiency analysis of use and a theoretical study of the geometric and kinematic parameters of a roll crusher with a convex-concave roll profile, as well as a new method for determining the energy intensity of the crushing process of grain products. The results of theoretical research are confirmed experimentally. This research is funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AR09562749 "Improvement of the formulation and technology of compound feeds and feed additives for farm animals"). 	Asangaliev Y., Kim V., Kim A., Doudkin M., Danilov M., Guriyanov G. Improvement of Technology, Machines, and Recipes for the Production of Compound Feed and Feed Additives for Farm Animals, 2021, International Review of Mechanical Engineering, 15, 11, 598-608 10.15866/ireme.v15i11.21291 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85126329980&doi=10.15866%2fireme.v15i11.21291&partnerID=40&md5=5a8ce8b80de316ead55e576939ff8d58

26	Thermodynamic Description of Oxidized Zinc Minerals and Comparative Analysis of Their Reactivity	10.3303/CET2188193	Due to depletion of sulfide zinc ores, the problem of involvement of economically significant oxidized zinc ores into the treatment is a vital task. In this article, the thermodynamic functions have been considered and determined for many oxidized zinc minerals, such as calamine, smithsonite, willemite, hydrozincite and others. The reactivity of minerals was determined by the groups of the same type, and the series were compiled according to the increase in their reactivity. The Gibbs energies ?? ?? ?? ?? ?? of the chemical reaction of sphalerite (ZnS), smithsonite (ZnCO3) and calamine Zn4(Si2O7)(OH)2·H2O with sulfuric acid were calculated and the following data were obtained per 1 mol of H2SO4: for sphalerite (13.27 kJ/mol), for smithsonite (75.46 kJ/mol) and for calamine (154.07 kJ/mol). Based on the calculated thermodynamic analysis of the dissolution of these minerals, the following series of changes in the standard values of Gibbs energies ?? ?? ?? ?? ?? was established: ZnS > ZnCO3 > Zn4(Si2O7)(OH)2·H2O. The results of thermodynamic calculations make it possible to distinguish the most reactive oxidized zinc minerals, so that in future, when treating oxidized zinc ores, to know about the properties and characteristics of these minerals.	Ramazanova R., Zhussupova A., Mamyachenkov S., Seraya N., Daumova G., Azbanbayev E. Thermodynamic Description of Oxidized Zinc Minerals and Comparative Analysis of Their Reactivity, 2021, Chemical Engineering Transactions, 88, 1159-1164 10.3303/CET2188193, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122506612&doi=10.3303%2fCET2188193&partnerID=40&md5=b74d7831a75a5037974cc16bf521a8a0

27	Mathematical Modelling in Crop Production to Predict Crop Yields	10.3303/CET2188204	In this study, for remote recognition of crops of agroecosystems in Kazakhstan by methods of comparative and historical analogy with the active use of mathematical modelling, the yield indicator of agricultural crops was determined, their dynamic characteristics were studied to predict productivity. The parameters of the dynamicstatistical biomass model were determined separately for each region of the Republic of Kazakhstan based on training data for 21 y (2000 – 2021). The correlation coefficient between the calculated yield values and the official statistics is 0.84. According to the results of cross-validation, the correlation coefficient between the actual and predicted yield of spring wheat was ~ 0.70, which indicates a sufficient resistance of the model to the variability of meteorological conditions for the formation of the crop	Sadenova M.A., Beisekenov N.A., Rakhymberdina M., Varbanov P.S., Klemesh J.J., Mathematical Modelling in Crop Production to Predict Crop Yields, 2021, Chemical Engineering Transactions, 88, 1225-1230 10.3303/CET2188204 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122486264&doi=10.3303%2fCET2188204&partnerID=40&md5=7ef2ca444dc1daa0c7a4bde0ebdbf992

28	Nanopreparations Impact on Soybeans Growth and Development under Conditions of Piedmont Zone of East Kazakhstan	10.3303/CET2188216	The article provides the outcomes of field experiments related to studying influence of plant growth stimulant “Fullerenol” (foliar application) when soybeans are cultivated under conditions of piedmont zone of East Kazakhstan on agricultural lands. The obtained results of soybeans foliar application by fullerene derivatives ?60 enabled to identify the range of its concentration that have positive effect on biometric characteristics of soybeans herbage growth and indicate the need for further researches for improvement of concentrates compositions in order to strengthen growth stimulating functions. It has been observed that leaves, stems, and roots herbage are increased on 27-30 %, and when Fullerenol concentration 0.002 g/ dm3 was used (from the entire range of concentrations), soybeans crop yield is increased by 8.51 %.	Rakhymberdina M.Y., Sadenova M.A., Kulenova N.A., Asangaliyev Y.A., Shaimardanova B.K., Toguzova M.M., Varbanov P.S., Shaimardanov Z.K. Nanopreparations Impact on Soybeans Growth and Development under Conditions of Piedmont Zone of East Kazakhstan, 2021, Chemical Engineering Transactions, 88, 1297-1302 10.3303/CET2188216 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122483744&doi=10.3303%2fCET2188216&partnerID=40&md5=913209909a7a7c66a7207d43fa4ddfd1

29	Mineralization of rare metals in the lakes of East Kazakhstan	10.33271/nvngu/2021-5/016	Purpose. Study on the chemical composition of lake waters, salt brines, brine and bottom sediments to identify the mineralization of rare metals and other types of minerals. Methodology. Mass spectrometric studies (mass spectrometer with inductively coupled plasma ICP-MS 7500cx from AgilentTechnologies) for the purpose of high-precision analytical studies on the chemical composition of salt lake water in order to assess the content of rare elements. The use of unmanned aerial vehicles for linking and geometrizing lakes. Findings. Field surveys on the geometrization and linking of lakes were carried out. From the materials obtained with the help of the drone, orthophotoplans were created (with a measurement accuracy of up to 1 centimeter), as well as a digital terrain model and a digital terrain model. A complex of analytical works was carried out using inductively coupled plasma spectrometry. When analyzing the distribution graphs of the absolute content of micro-components in the waters of the lakes of the Delbegeteysky massif, it was found that all samples were enriched with sodium, phosphorus, iron, magnesium and barium. The results of the analyses revealed the predominance of sulfates and chlorides in the composition of the surface waters of most of the water bodies of the Delbegeteysky massif. At the Burabai site, lake waters are characterized by an alkaline reaction of the environment (on average pH = 8.71). At the same time, the salinity of water bodies varies from 05 to 9 g/dm3. Originality. Large-scale outcrops of granites of the Kalba complex (P1), with which a rare-metal type of mineralization is genetically associated, are known to be on the selected study sites. Quartz-wire-greisen and quartz-wire tin, tin-tungsten and tungsten formations are also widely developed. Considering the large geochemical migration ability of rare alkaline elements in the thickness of loose sediments as a result of intensive geodynamic processes in the East Kazakhstan region, it is possible to assume the possibility of their migration to the upper horizons and accumulation in salt lakes localized within the area of development of granite intrusions of Permian age and associated deep tectonic faults. Practical value. The results of the research can serve as a revival of the rare metal industry in the region, which will allow developing new high-tech industries and creating new jobs in this area. The obtained results can be used for setting up further exploration and operational work on the selected promising areas.	Amralinova B.B., Frolova O.V., Mataibaeva I.E., Agaliyeva B.B., Khromykh S.V. Mineralization of rare metals in the lakes of East Kazakhstan, 2021, Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2021, 5, 16-21 10.33271/nvngu/2021-5/016 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85118299038&doi=10.33271%2fnvngu%2f2021-5%2f016&partnerID=40&md5=65b67f6ddd91357bc96e78ebba4ad933

30	Leading genetic types of base metal deposits of Rudny Altai	10.33271/nvngu/2021-2/011	Purpose. Study on the processes contributing to the formation of pyrite-polymetallic mineralization in the Rudny Altai, development of recommendations for directions for further research. Methodology. Analysis of literature and fund materials, field studies within known ore fields and deposits, sampling and laboratory studies: spectral analysis, studies on the chemical composition of host rocks (ISP-MS Agilent 7500cx), study on the mineral composition of the main types of mineralization (JSM 6390LV)). Findings. A model of pyrite-polymetallic mineralization genetically related to the Devonian basalt-andesite-rhyolite Early Hercynian riftogenic volcanism (D1e-D3fr) was developed. Originality. The spatial confinement of a number of industrial deposits, areas of sulfide mineralization and near-ore-hydrothermally altered rocks to the areas of pinching out of inter- and sub-stratal subvolcanic porphyries of the Middle Upper Devonian and overlying porphyrites, creating a kind of ore-magmatic systems (OMS), has been established. Practical value. A new stage of deep geological study on the territory of the Rudny Altai and promising ore-bearing structures with the introduction of modern methods of deep geological and mineragenic mapping is recommended.	Mizernaya M.A., Dyachkov B.A., Pyatkova A.P., Miroshnikova A.P., Chernenko Z.I. Leading genetic types of base metal deposits of Rudny Altai, Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2021, № 2, 11-16, 10.33271/nvngu/2021-2/011, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105671519&doi=10.33271%2fnvngu%2f2021-2%2f011&partnerID=40&md5=6b6f75ca6a8ed82e7e558e3bb5cc5709

31	Investigation of the kinetics of sulphuric acid leaching of zinc from calamine	Investigation of the kinetics of sulphuric acid leaching of zinc from calamine, 2021, Metalurgija, 60, 1-2, 113-116	This article aims at the research of kinetics of the sulphuric acid leaching of zinc from calamine (hemimorphite) of Shaimerden deposits. The ratio of zinc extraction from calamine to water-soluble zinc sulphate was determined at various leaching durations and its temperatures. The concentration of the sulfuric acid solution, the flow rate of this solution and the size of the calamine particles, selected in the course of this work for leaching zinc from this mineral with the specified solution, made it possible to establish the value of the “apparent” activation energy of the reaction of calamine with sulfuric acid, amounting to 3,075 kJ / mol.	Ramazanova R.A., Samoilov V.I., Seraya N.V., Daumova G.K., Azbanbayev E.M., Aubakirova R.A. Investigation of the kinetics of sulphuric acid leaching of zinc from calamine, 2021, Metalurgija, 60, 1-2, 113-116 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096193670&partnerID=40&md5=33d33fd9b42a775fc296989727180baa

32	Rare-metal pegmatite deposits of the kalba region, eastern kazakhstan: Age, composition and petrogenetic implications	10.3390/min10111017	The paper presents new geological, mineralogical, and isotope geochronological data for rare-metal pegmatites in the Kalba granitic batholith (Eastern Kazakhstan). Mineralization is especially abundant in the Central-Kalba ore district, where pegmatite bodies occur at the top of large granite plutons and at intersections of deep faults. The pegmatites contain several successive mineral assemblages from barren quartz-microcline and quartz-microcline-albite to Li-Cs-Ta-Nb-Be-Sn-bearing cleavelandite-lepidolite-spodumene. Ar-Ar muscovite and lepidolite ages bracket the metallogenic event between 291 and 286 Ma. The pegmatite mineral deposits formed synchronously with the emplacement of the phase 1 Kalba granites during the evolution of hydrous silicate rare-metal magmas that are produced by the differentiation of granite magma at large sources with possible inputs of F and rare metals with fluids.	Khromykh S.V., Oitseva T.A., Kotler P.D., Dyachkov 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, 2020, Minerals, 10(11), 1017. 10.3390/min10111017 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096390321&doi=10.3390%2fmin10111017&partnerID=40&md5=07e4e2ab83a50945c1920d0b23baf8ce

33	Research of cutting temperature reducing of titanium alloy grade 5 below polymorphic transformation depending on calculation of cutting modes	10.33271/nvngu/2020-4/011	Titanium alloys not only have high physical and mechanical properties, in addition, they are the most suitable materials for medical use among metal biomaterials. The machinability of titanium alloys depends on the phase and chemical composition, microstructure parameters and selected cutting conditions. Titanium alloy Grade 5 is used for research, its properties are as close as possible to the analogue of medical titanium alloy. Therefore, it is experimentally determined the surface roughness dependence of the implant on the angular velocity of cutting and feeding tool. The results obtained on the optimal processing conditions for the main and auxiliary movements from Grade 5 titanium alloy are similar for a medical alloy and the basis for choosing the exact processing modes in order to ensure the required surface roughness. The upgraded implant with a double thread provides an increase in translational linear displacement for a full revolution. Rational modes for finishing and double-threading of titanium alloys are defined, and preliminary recommendations on accuracy control for processing difficult titanium implants are proposed. Experimental studies were carried out on a numerically controlled lathe and a vertically milling machine. A technological process has been developed for the manufacture of an implant for the hip tibia using a modified design of double-thread.	Doudkin M., Kim A., Kombayev K., Azamatov B., Azamatova Z. Research of cutting temperature reducing of titanium alloy grade 5 below polymorphic transformation depending on calculation of cutting modes, 2020, International Journal of Mechanical and Production Engineering Research and Development, 10(2), 747-758, 10.24247/ijmperdapr202074 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85083321998&doi=10.24247%2fijmperdapr202074&partnerID=40&md5=1a436cf71b57d247446601201b36b0c6

34	The Experience of modeling magmatogenic ore systems on the example of Zhumba Quartz-Vein Deposit, East Kazakhstan	• DOI: 10.3997/2214-4609.2020geo008	The definite ore metasomatic system was reconstructed in trans-intrusive zone of hidden granitoid solid mass on the example of studying Zhumba ore zone by the methods of system analysis.	Zatserkovnyi V.I., Mizernaya M.A., Orazbekova G.B., Miroshnikova A.P., The Experience of modeling magmatogenic ore systems on the example of Zhumba Quartz-Vein Deposit, East Kazakhstan, 2020, Geoinformatics 2020 - XIXth International Conference "Geoinformatics: Theoretical and Applied Aspects" 17600, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85094205793&partnerID=40&md5=03be2d4535b58e2c860326c31713a516

35	Assessment of changes a number of surface water bodies within the sub-basin of the Desna River using remote sensing materials	Assessment of changes a number of surface water bodies within the sub-basin of the Desna River using remote sensing materials, 2020, Geoinformatics 2020 - XIXth International Conference ""Geoinformatics: Theoretical and Applied Aspects, 17521	Assessment of changes a number of surface water bodies within the sub-basin of the Desna River using Remote Sensing (RS) materials. To assess changes in the number of surface water bodies, the Normalized Difference Pond Index (NDPI) was used. As a result, we obtained a series of images of the study area from all Landsat-8 scenes from April-October 2018, illuminating changes in the parameters of surface water bodies over this period. It is established that the use of the NDPI index makes it possible to estimate the amount and seasonal change in the area of surface water bodies (ponds and reservoirs) in the study area.	Plichko L.V., Zatserkovnyi V.I., Khilchevskyi V.K., Mizernaya M., Bakytzhan A. Assessment of changes a number of surface water bodies within the sub-basin of the Desna River using remote sensing materials, 2020, Geoinformatics 2020 - XIXth International Conference ""Geoinformatics: Theoretical and Applied Aspects, 17521 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85094190322&partnerID=40&md5=f42bccd978e0a899d7dd880d032b42a7

36	Sorption extraction of heavy metal ions from wastewater by natural and synthetic sorbents	10.3303/CET2081058	East Kazakhstan region is the center of non-ferrous metallurgy of the Republic of Kazakhstan. There are large metallurgical enterprises in the region that pollute ground and surface waters with heavy metals. Wastewater treatment of large enterprises, which include Ust-Kamenogorsk metallurgical complex "Kazzinc", is an urgent problem. Among the chemical and physical-chemical methods of purification, sorption is very advantageous due to the opportunity to seal and neutralize the waste. Sorbent of different nature for purification of the given metallurgical complex wastewater is used in the work: natural material – shungite, activated by chlorhydric acid and water; polymer-protected hydrogel with embedded particles of activated shungite. Polymer-protected hydrogel is a cross-linked polymer based on acrylamide and N,N?- methylene-polyacrylamide, bis-acrylamide. Preliminary tests were carried out on model solutions in order to determine the optimal contact time of the sorbent with the solution. Static conditions were chosen to obtain higher values of extraction coefficients. Studies conducted on real wastewater have shown that the most effective sorbent is a polymer-protected hydrogel with activated shungite particles. Shungite is easily introduced into the polymer in the mixing process and requires less energy consumption for distributing in the polymer. Mineral and carbon parts of shungite can be introduced nearly into all polar and nonpolar polymers that is due to the components contained in shungite (noncrystalline carbon and silicon dioxide with hydrophilous and hydrophobic properties), due to metastability of shungite carbon structure, as well as possibility to change surface characteristics during chemical modification.	Aubakirova R., Daumova G., Seraya N., Afanasenkova I. Sorption extraction of heavy metal ions from wastewater by natural and synthetic sorbents, 2020, Chemical Engineering Transactions, 2020, 81 343-348 10.3303/CET2081058 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85092098030&doi=10.3303%2fCET2081058&partnerID=40&md5=161df072875edca1cf6201b12d93bd62

37	New data on non-traditional types of East Kazakhstan rare metal ore	10.33271/nvngu/2020-4/011	Purpose. Studying the patterns of formation and assessing the prospects of non-traditional types of rare-metal mineralization in East Kazakhstan. Methodology. Analysis of literary and funds materials; conducting field research on typical objects; sample selection; conducting of isotope research on typical objects; ICP-MS – Agilent 7500cx mass spectrometric analysis, microprobe analysis using a JSM 6390LV scanning electron microscope with an energy dispersive attachment, X-ray diffraction analysis — CPB-1M, silicate chemical analysis. Findings. A new non-traditional “non-pegmatite” type of rare-metal mineralization of predominantly lithium specialization associated with small intrusions and dikes of the kunush complex and albitized and greisenized granites (apogranites) is substantiated. Originality. A geological and genetic model of rare metal ore formation has been developed, reflecting the superimposition of rare metals (Sn, W, Li, etc.) on earlier small intrusions of plagiogranites of the kunush complex (C3), susceptible to contactmetasomatic transformations under the influence of rare-metal granites of the Kalba complex (P1). The prospects of an independent “non-pegmatite” type of tin-tantalum-lithium mineralization are substantiated. Practical value. The results of the research are aimed at strengthening the mineral resource base as an additional source of rare metals for existing enterprises in East Kazakhstan. Keywords: East Kazakhstan, granitoid belts, adakites, deposits, rare metals, Kalba-Narymskaya zone	Dyachkov B.A., Aitbayeva S.S., Mizernaya M.A., Amralinova B.B., Bissatova A.E. New data on non-traditional types of East Kazakhstan rare metal ore, 2020, Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2020, 4, 11-16 10.33271/nvngu/2020-4/011 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091013392&doi=10.33271%2fnvngu%2f2020-4%2f011&partnerID=40&md5=08ca169425ae0877c59f65db29def059

38	Silver halides in the hypergene zone of the Arkharly gold deposit as indicators of their formation in dry and hot climate (Dzungar Alatau, Kazakhstan)	• 10.37624/IJERT/13.1.2020.181-190	Oxidation of the ores from the Arkharly deposit was favored under the conditions of the dry and hot climate in the Paleozoic, leading to dissolution of gold and silver, their migration in acid solutions and further deposition on appropriate geochemical barriers, when opportunity arose for sedimention of hardly soluble salts of chlorides, bromides and iodides. Described are interesting findings of silver halide minerals in the oxidation zone of the Arkharly deposit, in a state of accretions with native silver and gold. Native silver, gold and silver-containing sulphides are sources of silver for halide minerals, as witnessed by their zonal accretions. Among silver halide minerals, identified in thin rims were chlorargyrite, brome iodide, embolite, and iodyrite. The hypergene nature of gold is indicated by its close paragenesis with silver and silver halides. Keywords: Arkharly, gold, native silver, hypergene, deposit, halide, weathering rust.	Umarbekova Z.T., Zholtayev G.Zh., Amralinova B.B., Mataibaeva I.E. Silver halides in the hypergene zone of the Arkharly gold deposit as indicators of their formation in dry and hot climate (Dzungar Alatau, Kazakhstan), 2020, International Journal of Engineering Research and Technology, 13(1), 181-190 • 10.37624/IJERT/13.1.2020.181-190 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85081996022&partnerID=40&md5=a3cf083f9a43b1852571921e4029193e

39	Geochemical characteristics and metalogeny of Herzin granitoid complexes (Eastern Kazakhstan)	10.33271/nvngu/2020-1/005	Purpose.To find out regularities of formation and spatial distribution of new non-conventional types of rare metal mineralization, to develop forecasting and search criteria and to evaluate perspectives as an additional reserve for strengthening and developing East Kazakhstan region mineral resources base. Methodology. Using ICP MS methods at D. Serikbayev EKSTU Advanced Development Center, there are studied conventional and unconventional plays and occurrences of rare-metal mineralization within the Western Kalba and Rudny Altai, magmatites of Kalba-Narymsky rare-metal granitoid belt. Study on chemical composition of magmatites of a number of intrusive complexes was carried out, the relation of the granitoids with rare metals deposits and manifestations was stablished. A comparative characteristics of ore mineralization in studied deposits was carried out by scanning electron microscopy (JSM 6390LV). Findings. Magmatic complexes of potential various rare-metal mineralization within the Kalba–Narym granitoid belt (East Kazakhstan) were identified; conclusions about the relation of potential ore content with granites of certain formation types were made. Originality. It is established that along with the conventional rare-metal type within the Kalba–Narym metallogenic belt there are found non-pegmatitic unconventional manifestations of rare-metal mineralization of Nb, Li, Sn. Rare-metal pegmatitic ores with the increased content of Li, Ta, Nb, as well as greisen-silica-veined manifestations of Sn, W and gold ore sites with with the increased content of rare elements are to be prospective. The high content of rare metals and rare earth in ores of gold ore deposits of the Western Kalba and Rudny Altai was established. Practical value. The obtained data can be used for rare metal deposits and complex gold-rare metal deposits prognosis and prospecting.	Mizernaya M.A., Aitbayeva S.S., Mizerny A.I., Dyachkov B.A., Miroshnikova A.P. Geochemical characteristics and metalogeny of Herzin granitoid complexes (Eastern Kazakhstan), 2020, Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2020, 1, 5-10 10.33271/nvngu/2020-1/005 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85081913587&doi=10.33271%2fnvngu%2f2020-1%2f005&partnerID=40&md5=c9e7ef059e84049419c3c2be190072da

40	Discrimination of lithological types of the runovshchyna area for alpha and beta activity	10.1007/978-3-030-25741-5_3	The specific alpha and beta activity of the sedimentary rocks of the Runovshchyna area are characterized by statistically significant correlation with the content of uranium and K2O, which are very similar to those of Volyn-Podillya and Mauritania. The use of alpha-beta radiometry data for direct lithological discrimination is impossible because there is a overlapping of the ranges of parameters in different lithological groups of rocks. For this purpose, it is proposed that linear discriminatory functions for distinguishing clay and sandstone groups. The conducted statistical simulation showed the effectiveness of the allocation of sandstone groups (96%), while for clay only 20%. The low percentage of clay classification is clearly related to the multicomponent of their radionuclide composition. In clay, besides uranium and K-40, there are other alpha and beta emitters (for example from the family of thorium-232). However, a group of incorrectly classified lithological objects is of interest to oil and gas geology as a source of information for the reconstruction of formation and migration of hydrocarbons. An increase in the number of discriminating features of a classification model (if data on the chemical composition of rocks are included) improves the efficiency of distinguishing rules up to 100%.	Vyzhva S., Shabatura O., Mizernaya M., Onyshchuk V., Onyshchuk I. Discrimination of lithological types of the runovshchyna area for alpha and beta activity, 2020, Advances in Intelligent Systems and Computing, 1019, 21-28, 10.1007/978-3-030-25741-5_3 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85073913599&doi=10.1007%2f978-3-030-25741-5_3&partnerID=40&md5=9e5a3c457ae74505c6995bb26ef03100

41	Development of mathematical models describing the processes occurring in the railway track construction as a whole, or in the work of its individual elements	10.32014/2019.2518-170X.120	The article presents the development of mathematical models describing the processes occurring in the construction of a railway track as a whole, or in the work of its individual elements, an example of calculating the stress-strain state of the soil of two-layer embankments filled from the soils of the South Kazakhstan.	Doudkin M.V., Apshikur B., Kim A.I., Ipalakov T.T., Asangaliyev E.A., Mlynczak M., Tungushbayeva Z.K. Development of mathematical models describing the processes occurring in the railway track construction as a whole, or in the work of its individual elements, 2019, News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 5, 437, 6-15, 10.32014/2019.2518-170X.120 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85074222316&doi=10.32014%2f2019.2518-170X.120&partnerID=40&md5=e1a809312cba05671971e70af165ca11

42	Development of an installation for shear ground testing in the railway track construction	10.32014/2019.2518-170X.152	The article presents an apparatus for testing ground shear to determine reliable baseline data taking into account the influence of vibrodynamic and pulsating loads on the strength and deformation parameters of clay grounds of various types with the possibility of modeling train load and train traffic.	Doudkin M.V., Apshikur B., Kim A.I., Ipalakov T.T., Asangaliyev E.A., Mlynczak M. Development of an installation for shear ground testing in the railway track construction, 2019, News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, Volume 6, Number 438 (2019), 22 – 35, 10.32014/2019.2518-170X.152 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85077451217&doi=10.32014%2f2019.2518-170X.152&partnerID=40&md5=b0b9d27f2bbe22a7dcd4659a7326f780

43	The main geological-industrial types of gold deposits in East Kazakhstan	10.29202/nvngu/2019-5/2	Purpose. To characterize leading geological-industrial types of gold deposits within Kazakhstani part of the Great Altai. Methodology. Field studies are within proper gold ore and ore-bearing deposits. Sampling is carried out for defining chemical composition and regularities of basic ore minerals and impurities distribution. Microprobe analysis by using a scanning election microscope JSM 6390LV, comparative analysis of ore mineralization were applied at the studied deposits. Findings. Gold ore deposits of the Great Altai were formed within the period from the end of Riphean to the end of Phanerozoe time in different geodynamic conditions. The most productive ones are O3, D1-2, C and K2 age boundaries. Island arc, ensimatic, ensialic, volcanogenic-sedimentary and collision environments are of great interest for gold mineralization. The most important sources of gold mineralization within the Great Altai are gold-base metals, gold-quartz, gold-sulphide-quartz deposits. Part of medium and small deposits can be transferred to the higher rank after additional evaluation. Moreover, prerequisites for discovering new deposits are far from being exhausted in traditional ore mining regions. Complex gold-base metals (polymetallic and copper-lead-zinc) deposits of Rudny Altai belt also have high content of associated gold and silver. Originality. The research novelty is in using of highly precise methods for studying ores and host rocks that can be used for the development of low-cost technologies for qualitative evaluation of gold ore deposits that were formed in different geodynamic conditions and time intervals on the basis of mineralogical sampling method, topo-mineralogy method, which enables one to solve the task of replenishing mineral-raw materials of precious metals in Kazakhstan. Practical value. For the last 15 years there has been a clear tendency towards increase in the world demand and gold production. Although the world gold reserve base features abundant types of deposits, development of gold mining has slowed down in Kazakhstan since 1990-s due to depletion of the richest and favorable deposits, decrease in gold raw material quality, and increase in negative impact on the environment. Extra study on the known gold ore objects, search for gold deposits from the aspect of integrated development imply the aim of overall accounting of basic and secondary components when all the stages of operation are carried out – ranging from geological-estimating and to operational exploration. Nowadays, up-to-date technologies of concentration, and development methods enable to refer these deposits to the objects of primary commercial exploitation. Their studying has scientific value in the issues of endogenetic mineralization and creates prerequisites of discovering new perspective areas and deposits in Kazakhstan. Keywords: metallogenic specialization, Ore Belt, gold deposits, Central Asia, Great Altai, Kazakhstan.	Mizernaya M.A., Miroshnikova A.P., Pyatkova A.P., Akilbaeva A.T. The main geological-industrial types of gold deposits in East Kazakhstan, 2019, Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2019, №5, 5-10 10.29202/nvngu/2019-5/2", https://www.scopus.com/inward/record.uri?eid=2-s2.0-85076250455&doi=10.29202%2fnvngu%2f2019-5%2f2&partnerID=40&md5=2da021eac05dffb61126a91b98e6f5d5

44	Backfilling Mixture Preparation Using Milled Granulated Blast-Furnace Slag	10.1134/S1062739119015300	Backfilling mixture preparation technology using a cement-slag binder is developed for the Artem'evsky mine. It is shown that backfill with granulated blast-furnace slag reaches project strength at its fineness 80% of content milled down to -80 urn size. The authors analyze influence of milling fineness of granulated blast-furnace slag from different manufacturers on strength and rheological properties of backfill. The economic analysis of cost of binder in formation of load-bearing layer of backfill prepared using fly ash and milled granulated blast-furnace slag is performed.	Krupnik L.A., Shaposhnik Y.N., Shaposhnik S.N., Nurshaiykova G.T., Backfilling Mixture Preparation Using Milled Granulated Blast-Furnace Slag, 2019, Journal of Mining Science, 55(1), 66-76, 10.1134/S1062739119015300 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85074146643&doi=10.1134%2fS1062739119015300&partnerID=40&md5=501330571c57a6e77ee0dfa8567c8d30

45	Selecting a variant to allocate a plant producing shotcrete while implementing method of pneumatic concrete placing in Orlovskaia mine	10.33271/mining13.03.087	Purpose. Mining and geological conditions are complicated due to the decreased level of mining within deposits of West Kazakhstan. It results in significant increase in the amount of metal framed support which cannot always provide safety of mine workings. The problem may be solved by transition from heavy and labour-intensive in mounting metal special shape framed supports to the cheaper and more easily erected reinforced shotcrete with reinforced frames. “Dry” method of shotcrete application, used currently in Orlovskaia mine, can provide neither high quality nor the required amounts of pneumatic concrete placing; in this context, “wet” method makes it possible to support rock mass at a high mechanization level, and development of premium durable pavement. Thus, in the context of Orlovskaia mine it is required to solve the problems concerning selection of efficient schemes to deliver shotcrete mixtures or their components and to determine optimum location for a plant, producing shotcrete from the viewpoint of minimization of expenditures connected with shotcrete support. Methods. Calculations, determining the required shotcrete amounts to support mine workings, technological capacity of a plant to produce shotcrete as well as self-propelled mixers, have been performed. Basic production facilities for shotcrete operations have been selected. Three variants to allocate a plant for shotcrete manufacturing within Orlovskaia mine have been considered. The discounted net cash flows have been compared ignoring sales of the finished product of Orlovskaia mine in terms of the available and the proposed methods to support mine workings for the period of 2016 – 2025. Findings. Relying upon laboratory tests, carried out in Kazzink LLP as well as BASF and Normet Companies, efficient compositions of shotcrete mixtures, providing preparation of shotcrete mixture of the required quality in terms of minimal binder consumption have been identified. It has been recommended to use 3.5 m3 mining machine UnimecMF500 Transmixer by Normet Company as a mixture to deliver shotcrete; self-propelled equipment MeycoME-3 (theoretical output is up to 20 m3/h) by AtlasCopco Company has been proposed to apply “wet” shotcrete. Use of underground 15 m3/h mobile plant on stands or on trailer of Normet Company has been substantiated to be mounted in a small-cross chamber with cement bulk storage or in big bags. Schemes to allocate concrete mixing plant have been developed for specific conditions of Orlovskaia mine. Originality. Specific features of potential variants to allocate a plant, producing shotcrete to support mine workings in terms of Orlovskaia mine, have been identified from technological and economic viewpoints. Practical implications. Economic expediency of a process line intended to support mine workings in Orlovskaia mine using a “wet” shotcrete has been developed and substantiated.	Krupnik L., Shaposhnik Y., Shaposhnik S., Konurin A., Shokarev D. Selecting a variant to allocate a plant producing shotcrete while implementing method of pneumatic concrete placing in Orlovskaia mine, 2019, Mining of Mineral Deposits, 13, 3, 87-95 10.33271/mining13.03.087 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85073467956&doi=10.33271%2fmining13.03.087&partnerID=40&md5=68390bcb93fbcd4e0a6454d39e50518b

46	Features of polylingual education development in the Republic of Kazakhstan	Features of polylingual education development in the Republic of Kazakhstan, 2019, Opcion, 35, 88, 304-320	The aim of the study is to investigate features of polylingual education development in the Republic of Kazakhstan via comparative qualitative research methods. As a result, the preparation of English-speaking teachers for secondary, technical and vocational education, higher education has become possible within the framework of the international scholarship of the President of the Republic of Kazakhstan Bolashak. In conclusion, along with the content of university training it is necessary to review the organization of the 305 Saniya Nurgaliyeva et al. Opción, Año 35, No. 88 (2019): 304-320 development of professional and pedagogical competencies of students. Características del desarrollo de la educación polilingüe en la República de Kazajstán Resumen El objetivo del estudio es investigar las características del desarrollo de la educación polilingüe en la República de Kazajstán a través de métodos de investigación cualitativa comparativa. Como resultado, gracias a la preparación de profesores de habla inglesa para la educación secundaria, técnica y profesional, la educación superior ha sido posible en el marco de la beca internacional del presidente de la República de Kazajstán, Bolashak. En conclusión, junto con el contenido de la formación universitaria, es necesario revisar la organización del desarrollo de las competencias profesionales y pedagógicas de los estudiantes. Palabras clave: espacio polilingüe, situación lingüística, medio ambiente.	Nurgaliyeva S., Mashekenova A., Idrisheva Z., Yussubaliyeva M., Muslimanova G. Features of polylingual education development in the Republic of Kazakhstan, 2019, Opcion, 35, 88, 304-320 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85068875356&partnerID=40&md5=be2a44c177fa838c0194119245a9eaca

47	Method of Shaping Loading-and-Transportation System in Deep Open Pit Complex Ore Mines	10.1134/S1062739117042702	The article presents a procedure to select loading and transportation machines for an open pit complex ore mine. The choice of a shovel–dump truck production system is validated using a statistical testing method (Monte Carlo technique). Stop-watch readings allowed relating the productivity of the production system, degree of ore fragmentation and content of oversizes; the soundness of the choice of the production system based on the revealed criterion was proved. Using the law of the Palm flows, the authors determine the number and sequence of dump trucks for loading in a one-server system.	Kumykova T.M., Kumykov V.K. Method of Shaping Loading-and-Transportation System in Deep Open Pit Complex Ore Mines, 2018, Journal of Mining Science, 53(4), 708-717 10.1134/S1062739117042702 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045513932&doi=10.1134%2fS1062739117042702&partnerID=40&md5=7f878b9da47d06ffb68c5444cccc0ca8

48	New data on the substantial composition of Kalba rare metal deposits	10.1088/1755-1315/110/1/012018	Geotectonic position, features of the geological structure and rare metal specialization of the Kalba-Narym granitoid belt formed in the Hercynian cycle in the postcollision (orogenic) geodynamic situation are considered. A geological-genetic model for the formation of the leading type of rare-metal pegmatite deposits (Ta, Nb, Be, Li, etc.) is presented. They are spatially and genetically related mainly to the granitoids of the 1st phase of the Kalba complex, P1 (Bakennoye, Jubilee, Belaya Gora, etc.). The rhythmically pulsating orientation of the process of pegmatite formation with the introduction of ore-bearing fluids (H2O, F, B, Cl, Ta, Nb, Be, etc.) is emphasized from the intracamera focus of a semi-closed magmatic system. The preferred location of ore pegmatite veins in granitoids of moderate basicity occupying an intermediate position in the petrochemical composition between normal granites and granodiorites geochemically specialized in Li, Rb, Cs, Sn, Nb, Ta. The leading ore-controlling role of the latitudinal deep faults of the ancient site in the distribution of rare-metal ore fields and deposits (Ognevsk-Bakennoye, Asubulak, Belogorsk, etc.) is determined. There is a zonal structure of pegmatite veins, a gradual development of mineral complexes from the graphic and oligoclase-microcline (non-ore) to microcline-albite and color albite-spodumene (ore). The mineralization of pegmatite veins is determined by the degree of intensity of the manifestation in them of metasomatic processes (microclinization, alibitization, greisenization, spodumenization, tourmalinization, etc.) and the identification of the main ore minerals (tantalite-columbite, cassiterite, spodumene and beryl). The diversity of the material composition of rare-metal pegmatites containing many unique minerals (cleavelandite, lepidolite, ambligonite, color tourmaline, spodumene, pollucite, etc.) is reflected, which brings them closer to the pegmatite deposits of foreign countries (Koktogai, Bernik Lake, etc.). New results of the investigation of the material composition of ore-bearing granites, pegmatites and typomorphic minerals using electron microscopy reflecting the distribution of rare-earth, rare-metal, chalcophile and other elements in them are presented. Indicators of rare metal ore formation are rock-forming minerals of granites (quartz, microcline, biotite, muscovite), ore and associated minerals (cleavelandite, lepidolite, cassiterite, etc.). The most informative minerals include mica (muscovite, giltbertite, lepidolite), colored tourmalines and beryls of different composition and color. Identified typomorphic minerals and geochemical elements-indicators of rare metal pegmatite formation are considered as a leading search criterion in assessing the prospects of the territory of East Kazakhstan.	Oitseva T.A., Dyachkov B.A., Vladimirov A.G., Kuzmina O.N., Ageeva O.V. New data on the substantial composition of Kalba rare metal deposits, 2018, IOP Conference Series: Earth and Environmental Science, 110, 1, 012018 10.1088/1755-315/110/1/012018 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85040713983&doi=10.1088%2f1755-1315%2f110%2f1%2f012018&partnerID=40&md5=9a72c36e89c4eafbba03dd1711ce9d69

49	Experimental studies on the sorption purification of groundwater with treatment of spent zeolites utilization	Experimental studies on the sorption purification of groundwater with treatment of spent zeolites utilization, 2018, "23rd International Congress of Chemical and Process Engineering, CHISA 2018 and 21st Conference on Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction, PRES 2018, 2, 1182-1183	Natural zeolites are abundant and low cost resources, which are crystalline hydrated aluminosilicates with a framework structure containing pores occupied by water, alkali and alkaline earth cations. Due to their high cation-exchange ability as well as to the molecular sieve properties, natural zeolites have been widely used as adsorbents in separation and purification processes in the past decades. In this paper, we review the recent development of natural zeolites as adsorbents in water and wastewater treatment. The properties and modification of natural zeolite are discussed. Various natural zeolites around the world have shown varying ion-exchange capacity for cations such as ammonium and heavy metal ions. Some zeolites also show adsorption of anions and organics from aqueous solution. Modification of natural zeolites can be done in several methods such as acid treatment, ion exchange, and surfactant functionalisation, making the modified zeolites achieving higher adsorption capacity for organics and anions.	Daumova G.K., Abdulina S.A., Karibayeva M.K., Kokayeva G.A., Adilkanova M.A., Serikbayev L.D. Experimental studies on the sorption purification of groundwater with treatment of spent zeolites utilization, 2018, "23rd International Congress of Chemical and Process Engineering, CHISA 2018 and 21st Conference on Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction, PRES 2018, 2, 1182-1183 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85084992090&partnerID=40&md5=b69a7e93ccb4879452a2de4edf674b89

50	Entropy factor of grain formation when solution evaporation in fluidized bed	Entropy factor of grain formation when solution evaporation in fluidized bed, 2018, 23rd International Congress of Chemical and Process Engineering, CHISA 2018 and 21st Conference on Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction, PRES 2018, 2, 1184	At charge preparation for metallurgical process stage raw materials and byproducts granulation is essential operation that reduces materials dusting, precious components loss with the dust when transportation, and improves charge gas-permeability.	Kokayeva G.A., Abdulina S.A., Adilkanova M.A., Userbaev M.T., Daumova G.K. Entropy factor of grain formation when solution evaporation in fluidized bed, 2018, 23rd International Congress of Chemical and Process Engineering, CHISA 2018 and 21st Conference on Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction, PRES 2018, 2, 1184 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85084968938&partnerID=40&md5=cb2452dc46ca8c7a381900145b125e2f

51	Selection of accessing and development schemes for extracting reserves of ore body 2 in irtysh deposit	10.15407/ mining12.04.108	Purpose. Justification and selection of a rational scheme for accessing the second ore body of the Irtysh deposit based on a technical and economic comparison of its adopted competitive options. Methods. The main mining, geological and engineering requirements for selecting the scheme for accessing the Irtysh field are considered to achieve the goal. Three competitive accessing options are proposed on the basis of project regulatory documents and geotechnological features of the ore body. The optimal scheme of accessing was suggested taking into account the volumes of mining and preparatory works and averaging of the metal content in the ore by the method of technical and economic comparison. Findings. Analysis of the accessing schemes was performed for deposits similar in the geological conditions and represented by fragmented ore bodies. The advantages and disadvantages of 3 competitive access options are reviewed in detail. The technological and economic feasibility of excavation of ore body 2 reserves has been substantiated, i.e. of accessing them by fringedrifts between the Irtysh and Vspomogatel'naya mines on the upper horizons of the deposit. It is established that the difference in the volume of capital works (CW) and preparatory works (PW) is 45640 m3 in favor of accessing ore body 2 by fringedrifts between the Irtysh and Vspomogatel'naya mines. At the same time, the volumes of CW and PW at the initial and final stages of development are much lower than in the case of accessing by a transport ramp from the surface. The change in the average content of copper, lead and zinc with the simultaneous development of the Osnovnaya Deposit and the South-Eastern Deposit in the lower horizons of the field has been calculated. Originality. For the conditions of ore body 2 of the Irtysh deposit, planned for development in accordance with the proposed access, it was found that despite the decrease in the copper content in the saleable ore, the lead content in the saleable ore will increase to 0.49% and zinc content, respectively, to 3.83%. Practical implications. Mining of ore body 2 according to the recommended accessing scheme with a minimum amount of mining will allow to raise the productivity of the Irtysh mine to 600 thousand tons per year during the period 2018 – 2026, as well as to increase the extraction of lead and zinc.	Krupnik L., Shaposhnik Y., Shaposhnik S., Konurin A., Shokarev D. Selection of accessing and development schemes for extracting reserves of ore body 2 in irtysh deposit, 2018, Mining of Mineral Deposits, 12, 4, 108-114 10.15407/mining12.04.108 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85079066180&doi=10.15407%2fmining12.04.108&partnerID=40&md5=0f2325bb8c6ebd46c85f00028308ca41

52	Studying the benefits of green workplace environment on health promotion in sympathoadrenal and Kallikrein-Kinin systems	Studying the benefits of green workplace environment on health promotion in sympathoadrenal and Kallikrein-Kinin systems", 2018, Ekoloji, 27, 106, 1087-1097	This study is performed to study the positive effects and benefits of going green and creating green physical environments of work on health promotion and stressors reduction on workers in Sympathoadrenal and Kallikrein-Kinin Systems. It also evaluates environmental conditions of work-place, as well as sympathoadrenal and kallikrein-kinin systems for early (prenosological) sings of de-adaptation to workrelated stressors in workers engaged in non-ferrous metallurgy. Workplace health promotion (WHP) has been proposed as a preventive intervention for stress, possibly operating by promoting positive organizational culture or via programs promoting healthy lifestyles. In order to do this a trial experiment was done on animals (white rats). Adrenaline and noradrenaline (AD and NAD) levels in the liver, adrenal glands and hearts of rats were measured throughout 2, 4 and 12 trial weeks. Changes in sympathoadrenal system, detected in workers, who were working at the main workshops for a long time, reflect all the stages of nonspecific adaptation process to work-place environment, defined as a standard activation of stress-realizing system. At the last stages of stress, the KKS, which represents a cascade, promotes body resistance to workrelated stressors and negative environmental conditions. Signs of early de-adaptation were found in healthy workers to identify who of them are at risk of adaptive breakdown. Our tests were used at five times as part of health examination, and some related guidelines were published.	Dakieva K.Z., Tusupova Z.B., Zhautikova S.B., Loseva I.V., Dzhangozina D.N., Beysembaeva R.S., Idrisheva Z.K., Zhamanbaeva M.K. Studying the benefits of green workplace environment on health promotion in sympathoadrenal and Kallikrein-Kinin systems", 2018, Ekoloji, 27, 106, 1087-1097 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85058173328&partnerID=40&md5=413f6e05ff9ef152db691277488e44c6

53	Experimental studies on wastewater sorption treatment with subsequent disposal of used sorbents	10.3303/CET1870355	The research proposes the method for cleaning of the chromium-containing wastewater by the modified sorbents based on the natural aluminosilicates of East Kazakhstan deposits, local wood waste and fibrous materials that differ by cheap, good sorption properties, availability and security in the environmental terms. The research of the waste complex sorbents for utilization in one of the most resource-intensive industries - the construction industry - is highly relevant and promising to create the necessary preconditions for the industrial development of the construction binders for various technology areas. The application of the research results will make sound recommendations how to expand the resource base, to use industrial raw materials in the production process, and to reduce the cost of widely used materials and products in the construction practice. The important factor in the technical and economic term is that the residue from the treated waste water is environmentally friendly since the chromium ions and other heavy metals have the form of the complex compounds. The complex compounds are environmentally safe and can be recycled in various building materials. The optimal construction materials for the utilization of the waste sorbents are mortar and concrete.	Daumova G.K., Abdulina S.A., Kokayeva G.A., Adilkanova M.A. Experimental studies on wastewater sorption treatment with subsequent disposal of used sorbents, 2018, Chemical Engineering Transactions, 70, 2125-2130 10.3303/CET1870355 https://www.scopus.com/inward/record.uri?eid=2-s2.0-85051431951&doi=10.3303%2fCET1870355&partnerID=40&md5=d161d797739767f73c8e148674e33e79