ON THE POSSIBILITY OF WASTE-FREE USE OF MINERAL RESOURCES OF THE ANGRENSKY BRAIN COAL DEPOSIT

Bekpulatov Javlon Mustafokulievich[1], Makhmarezhabov Dilmurod Bakhtiyarovich[2], Umirzokov Azamat Abdurashidovich[3*]
[1, 2,3]Associate Professor of the Mining Department, Ph.D. Tashkent State Technical University, Tashkent, Republic of Uzbekistan

Abstract. The Angren lignite basin is a complex coal-kaolin deposit. Here, in addition to brown coal, there are large reserves of kaolin clays of two types - primary and secondary, occurring respectively in the soil and the roof of the coal strata. Secondary clays, in turn, subdivided into gray and variegated, which during overburden and mining of coal seams in the bulk go to the dump. Gray kaolins currently partially processed at the "Angren Kaolin" LLC factory in order to obtain enriched kaolin used for the production of building ceramics, etc.

Key words: lignite, kaolin, enrichment, alumina, component, extraction, concentrate, motley and quartz.

1.INTRODUCTION.

Since a significant increase in the volume of processing of gray and variegated kaolins in the production of ceramics and for the production of alumina is planned, it seems appropriate to study the possibility of additional enrichment of waste obtained during the enrichment of kaolins and representing quartz sand, largely clogged with mineral impurities. The task of complex enrichment of sands - wastes of kaolin production included obtaining enriched quartz sand in the form of quartz concentrates of sufficiently high quality, as well as pyrite and siderite concentrates along the way, which can also be used in industry. Thus, the solution of this problem raised the question of the possibility of waste-free use of all the minerals of the Angren coal basin. The integrated use of secondary kaolins would increase the profitability of production and provide enterprises in Uzbekistan with high-quality quartz raw materials.

2.MATERIALS AND METHODS.

The study of the material composition of quartz sands - secondary kaolin enrichment waste showed that they contain mainly free silica, as well as (in a significant amount) alumina, iron oxides, sulfide sulfur and other impurities, which indicates the low quality of the investigated

* a_umirzoqov@mail.ru

 https://doi.org/10.1051/e3sconf/202449102018

quartz sand, highly impoverished with mineral impurities in Table 1. Granulometric analyzes, the construction of summary curves of the granulometric composition and distribution curves of the main components by size classes established a uniform granulometric composition of sand, as well as a uniform distribution by size classes of the main chemical components polluting it - iron oxide, pyrite sulfur, alumina, etc. (Fig.1, 2).

Table 1

The results of chemical analysis of the average sand sample from the tailings of gray and variegated kaolins

Component	The content of chemical components in the tailings of gray kaolin, %	The content of chemical components in wastes of enrichment of variegated kaolins, %
SiO_2	70,90	86,22
Al_2O_3	10,20	6,42
FeO	2,77	0,14
Fe_2O_3	3,98	0,77
TiO_2	0,35	0,33
$S_{sum.}$	2,80	0,00
$S_{val.}$	2,98	0,07
MnO	0,04	0,00
MgO	0,67	0,09
CaO	0,59	1,40
Na_2O	0,27	0,18
K_2O	0,20	0,78
CO_2	1,70	1,23
BaO	0,15	0,00
$-H_2O$	0,93	0,21
$+H_2O$	1,47	2,16

Variegated kaolin waste differs from sulfur kaolin waste in the absence or low content of pyrite and siderite. The difficulty of enriching quartz sand is aggravated not only by its complex mineralogical composition, but also by the presence of a large number of defective grains in it - fine-grained quartz aggregates with inclusions of dark-colored minerals. The possibilities of deep enrichment of quartz from waste sands are also limited by the technical requirements for the granulometric composition of enriched sand, which should not be too thin (at least 0.2 mm).

 https://doi.org/10.1051/e3sconf/202449102018

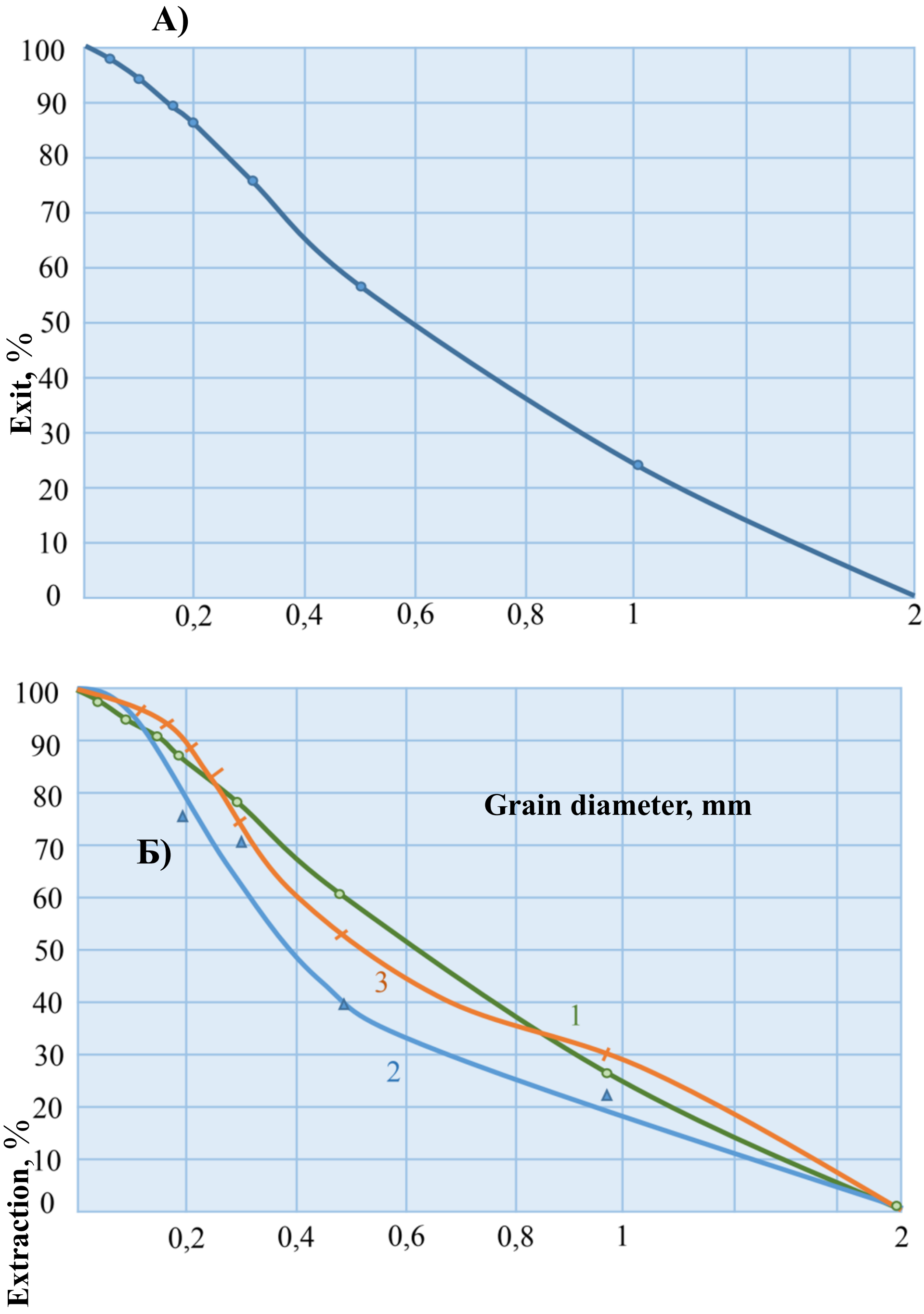

Fig. 1. **A) summary curves of the granulometric composition of the original sand; B) distribution curves: 1 - by silica size classes, 2 - iron oxide (2), 3 - pyrite sulfur**

Grain diameter, mm

 https://doi.org/10.1051/e3sconf/202449102018

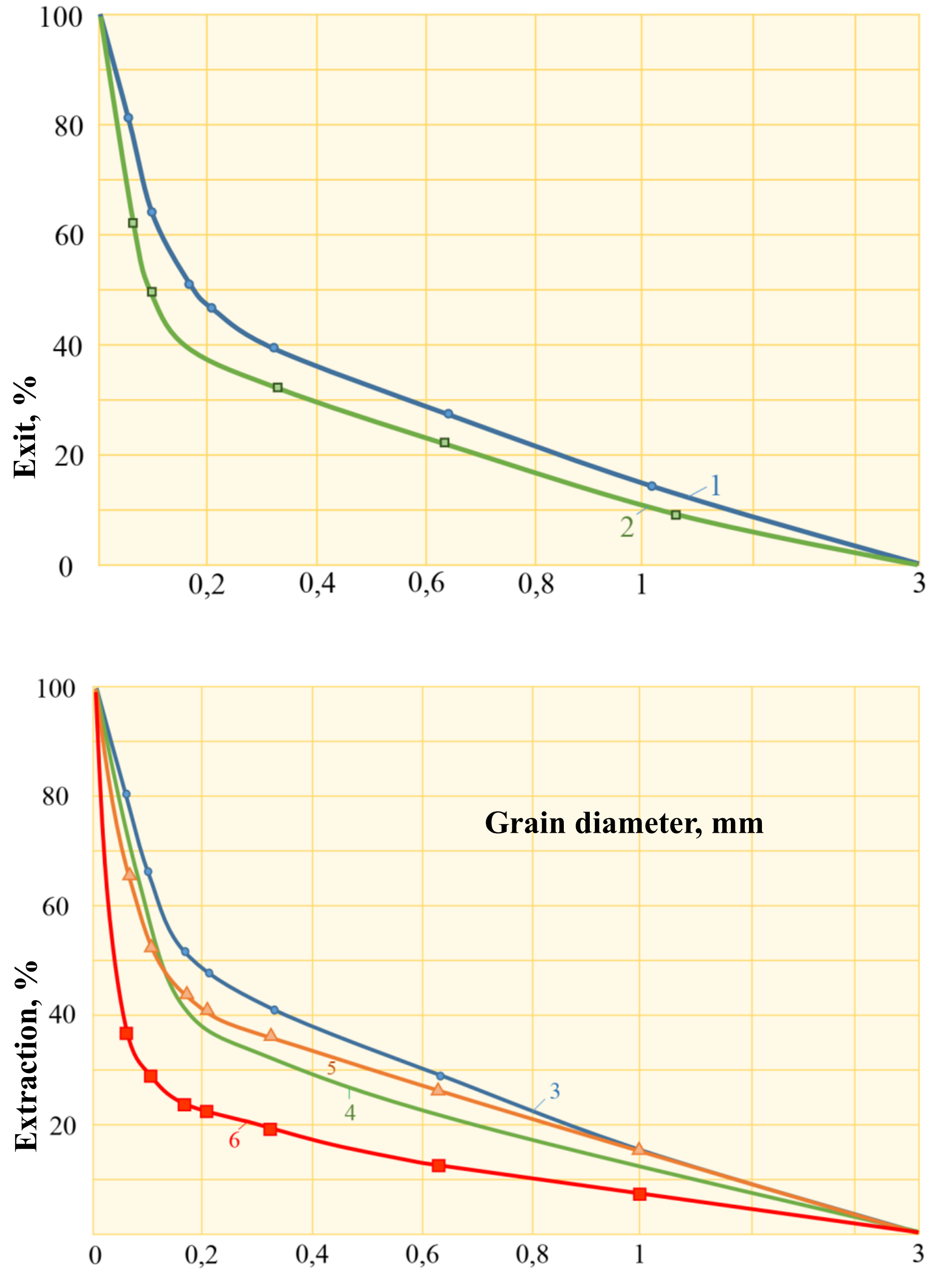

Fig. 2. **1 - total curves of the granulometric composition of the original sand; 2 - sand after scrubbing; 3.5 - silica distribution curves; 4,6 - iron oxides.**

Grain diameter, mm

The presence in quartz sand of a large number of various impurities with various physical and chemical properties necessitates the implementation of various enrichment processes. Flotation, magnetic separation, and gravity methods used to extract iron sulfides from sand. First, sand grains had to clean of clay films and impurities, as well as to destroy independent aggregate grains and particles of kaolinite - halloysite. This achieved by the methods of disintegration and grinding of sands in a ball mill with a small load of small balls, followed by the separation of fine sludge from the sandy fraction by washing. Film oxides of the surface of quartz grains partially rubbed off, partially dissolved by hydrochloric acid. However, due to the complex mineral composition of sand, each of the tested enrichment operations was not effective enough and did not provide the desired results when enriching its quartz fraction, although for some minerals extracted from sand (for example, pyrite and siderite), quite high-quality concentrates were obtained that meet technical requirements.

3.RESULTS.

The study of the dressability of waste sands carried out by various methods using simple and combined enrichment schemes.

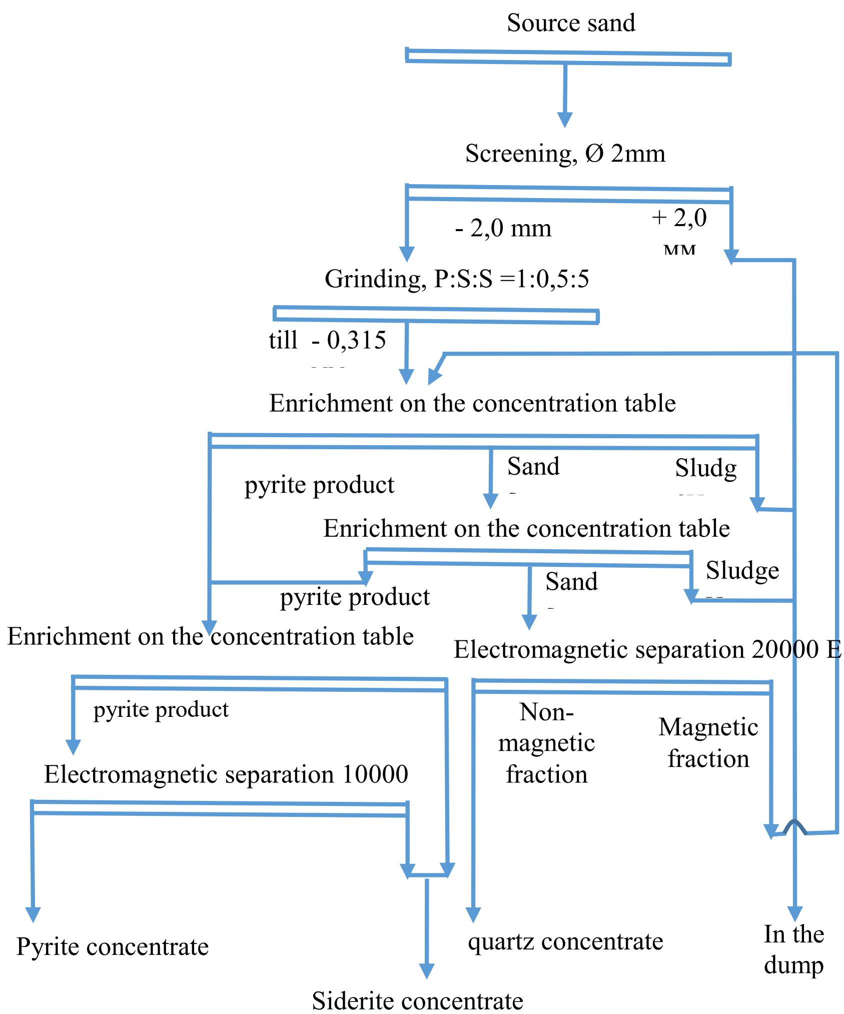

Fig.3. Schematic diagram of the enrichment of sands-wastes of enrichment of secondary kaolins

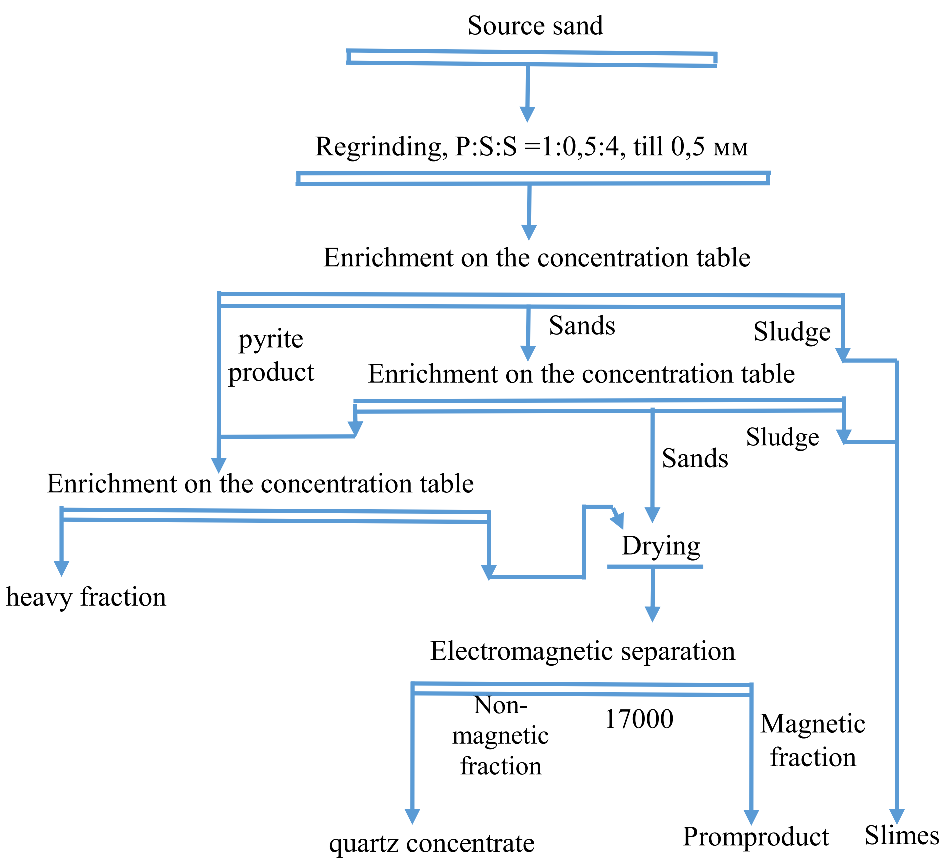

Fig.4. Gravity-magnetic scheme of sand enrichment

According to all the tested schemes, a quartz concentrate obtained, suitable for use in a particular industry. The highest enrichment rates were obtained with a magnetic-gravity scheme (Fig. 3), which includes the screening of a coarse fraction (+2 mm class), grinding and partial grinding of sand in a metal mill to 0.315 mm, enrichment on a concentration table, subsequent refining of the obtained sands and gravity concentrate also on the concentration table. Subsequently, the sands were subjected to magnetic separation in a separator for weakly magnetic ores (magnetic field strength up to 20,000), and pyrite concentrate in a magnetic separator (magnetic field strength up to 10,000). Since the enrichment wastes of variegated kaolins contain a small amount of pyrite and siderite, the enrichment scheme for them is simplified - magnetic separation is excluded (Fig. 4).

4.DISCUSSION.

According to the recommended scheme, quartz concentrates obtained that conditioned for fine ceramics, molding sands and other types of industrial products. From the tailings of gray kaolins, a quartz concentrate obtained with a content of SiO_2 - 95.06% and Fe_2O_3 - 0.18% with a yield of 43.2% pyrite concentrate suitable for sulfuric acid production, with a sulfur content of 47.02% and iron (siderite) concentrate with iron content - 35.76% with a yield of 5.9%.

From sands - wastes of enrichment of variegated kaolins, a quartz concentrate obtained containing SiO2 - 94.7% and Fe2O3 - 0.23% with a yield of 48.5%. Technological results of enrichment according to the developed scheme given in Table 2.

The use of more expensive operations, for example, hydrochloric acid leaching of a quartz product in order to obtain high-quality quartz concentrates, did not give positive results.

TABLE 2

Results of enrichment of waste and variegated kaolins

Enrichment products	Exit %	**Content, %**												
		SiO_2	Fe_2O_3	Fe	$S_{sum.}$	Zn	Pb	CaO	MgO	K_2O	Na_2O	TiO_2	Al_2O_3	l.p.p.
Wastes of gray kaolin enrichment														
quartz concentrate	43,2	95,06	0,18	-	-	-	-	0,17	0,12	0,28	0,10	0,08	3,96	0,92
Pyrite concentrate	3,4	4,9	59,78	-	47,02	0,05	0,03	-	-	-	-	-	-	-
Siderite concentrate	5,9	20,1	51,14	35,76	-	-	-	-	-	-	-	-	-	-
Promprodukt	25,8	70,52	3,5	-	-	-	-	-	-	-	-	-	-	-
Class +2 mm	0,3	52,07	14,0	-	-	-	-	-	-	-	-	-	-	-
Slimes	21,9	64,25	4,5	-	-	-	-	-	-	-	-	-	20,88	-
Source sand	100	73,83	7,07	5,04	2,83	-	-	0,49	0,51	0,68	0,27	0,3	10,79	-
Wastes from enrichment of variegated kaolins														
quartz concentrate	48,5	94,7	0,23	-	-	-	-	-	-	-	0,37	0,11	2,94	-
Promprodukt	14,7	84,7	0,5	-	-	-	-	-	-	-	1,1	0,24	4,86	-
Heavy fraction	9,6	90,4	0,88	-	-	-	-	-	-	-	0,24	0,11	2,18	-
Slimes	27,2	77,22	0,84	-	-	-	-	-	-	-	0,69	0,08	8,88	-
Source sand	100,0	88,7	0,48	-	-	-	-	-	-	-	0,54	0,16	5,05	-

Note. Granulometric composition of quartz concentrates: 67.0% class -0.315 +0.1; -0.1 +0.044; 3.2% grade -0.44mm

5.CONCLUSION.

The conducted studies have shown the complete possibility of obtaining secondary sulfuric and variegated kaolins of quartz, as well as pyrite and siderite concentrates suitable for industrial use from the tailings. With a large scale of mining planned in the Angren coal basin, it is economically feasible and possible to organize waste-free production with the production and sale of pyrite and siderite concentrates in addition to currently produced coal and kaolin.

6.REFERENCES

[1]. Baradulin I. et al. Remote sensing in the ecology of the fuel and energy complex of Russia and Asian countries. - Liters (2022).

[2]. Lazchenko K., Terentyev B. Geotechnological methods of mining mineral deposits. – Litres (2022).
[3]. Nimchik A. G., Usmanov H. L., Kadyrova Z. R. Physico-chemical processes of obtaining agglomerite from industrial waste in Uzbekistan //Universum: chemistry and biology. (2019). – №. 11-2 (65). – Pp. 39-46.
[4]. Melentyev G. B. Innovative techno-ecology and new tasks of technological mineralogy (Graduation) For the beginning of the article, see No. 2 for 2009 //Ecology of industrial production. (2009). No. 3. – pp. 13-29.
[5]. Khoyutanov E. A., Gavrilov V. L. Coal quality control in mining complex-structure deposits //Journal of Mining Science. (2019) T. 55. – №. 3. – C. 399-406.
[6]. Jones P., Clifford J. Sub-bituminous Coals. (2016).
[7]. Nesmeyanov A. N. The Tasks and Possibilities of Modern Science in Overcoming the Economic Backwardness of Certain Countries-USSR. – JOINT PUBLICATIONS RESEARCH SERVICE ARLINGTON VA (1960).
[8]. Umarova I.K., Makhmarezhabov D.B., Yuldashev S.Kh. Material composition analysis and process flow development for the porphyry copper ores of the yoshlik-1 deposit // Obogashchenie Rud, (2021) p. 10-14. DOI:10.17580/or.2021.05.02
[9]. Bogdetsky V., Novikov V. Mining, development and environment in Central Asia: Toolkit companion with case studies. (2012).
[10]. COMMfRCF U. S. D. O. West Europe Report. (1982).
[12]. Umarova I.K., Matkarimov S.T., Makhmarezhabov D.B. Development of a flotation technology for gold-bearing ores of the amantaytau deposit // Obogashchenie Rud (2020) p. 29-33. DOI:10.17580/or.2020.02.05.
[13]. Peterson M. K. Pipe Dreams: Water and Empire in Central Asia's Aral Sea Basin. – Cambridge University Press (2019).
[14]. Nurkhodjaev S.N., Niyazova Z.A. INTER-CONNECTION WITH MEDICAL REHABILITATION AND PSYCHOLOGICAL CORRECTION OF PSYCHOLOGICAL STATUS OF PATIENTS WITH EYE INJURIES //4 TH INTERNATIONAL EDUINDEX MULTIDISCIPLINARY CONFERENCE. (2019). – C. 56.
[15] Nasirov, U. F., Ochilov, S. A., Umirzoqov, A. A., Xudayberganov, S. K., Narzillaev, A. N., & Sobirov, I. S. (2022). Development of algorithm for managing mineral resources of deposits. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0091542
[16] Hayitov, O. G., Akramov, B. S., Umirzokov, A. A., Gafurov, S. O., Juraev, S. Z., & Gafurova, M. O. (2022). On the geotectonic features of the southeastern part of the bukhara-khiva region. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0091265
[17] Bekpolatov, J., Mishareva, M., Salizhanova, G., Aminzhanova, S., Umirzoqov, A., & Xatamov, G. (2022). Technological research of gold-containing ore of the interfluve section. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0090782
[18] Akramov, B. S., Khayitov, O. G., Umirzokov, A. A., Nuritdinov, J. F., & Kushshaev, U. K. (2022). Forced fluid withdrawal as a method of enhanced oil recovery in hydrocarbon fields. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0091268
[19] Ochilov, S., Kadirov, V., Umirzoqov, A., Karamanov, A., Xudayberganov, S., & Sobirov, I. (2022). Ore stream management on the development of deposits of natural and technogenic origin. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0093311
[20] Khaitov, O. G., Umirzokov, A. A., Yusupkhojaeva, E. N., Abdurakhmonova, S. P.,

& Kholmatova, N. G. (2022). ASSESSMENT OF THE DENSITY OF THE WELL GRID IN THE SOUTHEASTERN PART OF THE BUKHARA-KHIVA REGION. News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 3(453), 253-264. doi:10.32014/2022.2518-170X.194

[21] Xayitov, O. G., Zokirov, R. T., Agzamov, O. A., Gafurov, S. O., & Umirzoqov, A. A. (2022). CLASSIFICATION OF HYDROCARBON DEPOSITS IN THE SOUTH-EASTERN PART OF THE BUKHARA-KHIVA REGION, JUSTIFICATION OF ITS METHODOLOGY AND ANALYSIS OF THE RESULTS. News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2022(1), 46-52. doi:10.32014/2022.2518-170X.139

[22] Nasirov, U. F., Ochilov, S. A., & Umirzoqov, A. A. (2020). Theoretical calculation of the optimal distance between parallel-close charges in the explosion of high ledges. Journal of Advanced Research in Dynamical and Control Systems, 12(7 Special Issue), 2251-2257. doi:10.5373/JARDCS/V12SP7/20202351

[23] Menglikulov, B., Umarov, S., Safarov, A., Zhyemuratov, T., Alieva, N., & Durmanov, A. (2023). Ways to increase the efficiency of transport logistics-communication services in Uzbekistan. In E3S Web of Conferences (Vol. 389, p. 05036). EDP Sciences. https://doi.org/10.1051/e3sconf/202338905036

[24] Narinbaeva, G., Menglikulov, B., Siddikov, Z., Bustonov, K., & Davlatov, S. (2021). Application of innovative technologies in agriculture of Uzbekistan. In E3S Web of Conferences (Vol. 284, p. 02009). EDP Sciences. https://doi.org/10.1051/e3sconf/202128402009

[25] Umarova, I., Matkarimov, S., Bekpulatov, J., Makhmaredjabov, D., & Yuldashev, S. (2021). Study of the Form of Minerals in Copper Porphyry Ores of "Yoshlik-I" Deposit. In *E3S Web of Conferences* (Vol. 304, p. 02003). EDP Sciences.

[26] Akramov, B. S., Khayitov, O. G., Usmonov, K. M., Gafurov, S. O., Bekmanov, N. O., & Amonov, T. S. (2022). Some aspects of the results of opening, testing and development of exploration wells. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0091266

[27] Kholismatov, I. K., Tursunova, T. M., Zokirov, R. T., & Hayitov, O. G. (2022). Prospects of oil and gas bearing capacity of middle lower jurassic terrigenous sediments of the baysun trough. Paper presented at the AIP Conference Proceedings, , 2432 doi:10.1063/5.0090927

[28] Hayitov, O. G., Yusupkhodzhaeva, E. N., Abdurakhmanova, S. P., & Holmatova, N. G. (2020). On the state of hydrocarbon resource base in the beshkent trough. Journal of Advanced Research in Dynamical and Control Systems, 12(7 Special Issue), 2327-2332. doi:10.5373/JARDCS/V12SP7/20202360

[29] Hayitov, O. G., Qarshiyev, A. X., & Xamroyev, B. S. (2018). Analyzing efficiency of drilling horizontal borehole in south kemachi deposit. Mining Informational and Analytical Bulletin, 2018(8), 71-76. doi:10.25018/0236-1493-2018-8-0-71-76

[30] Rybak, J., Gorbatyuk, S. M., Bujanovna-Syuryun, K. C., Khairutdinov, A. M., Tyulyaeva, Y. S., & Makarov, P. S. (2021). Utilization of mineral waste: a method for expanding the mineral resource base of a mining and smelting company. Metallurgist, 64(9), 851-861.

[31] Rybak, J., Kongar-Syuryun, C., Tyulyaeva, Y., & Khayrutdinov, A. M. (2021). Creation of backfill materials based on industrial waste. Minerals, 11(7), 739.

[32] Litvinenko, V. S., Tsvetkov, P. S., & Molodtsov, K. V. (2020). The social and market mechanism of sustainable development of public companies in the mineral resource sector. Eurasian Min, 2020, 36-41.

[33] Menglikulov, B., Dusmuratov, R., & Mamadiyorov, D. (2021). Improvement of methodological aspects to calculate the cost of dairy products: a review. In E3S Web of Conferences (Vol. 258, p. 04036). EDP Sciences. https://doi.org/10.1051/e3sconf/202125804036

[34] Abdullah, D., Gartsiyanova, K., Mansur qizi, K. (. M., Javlievich, E. A., Bulturbayevich, M. B., Zokirova, G., & Nordin, M. N. (2023). An artificial neural networks approach and hybrid method with wavelet transform to investigate the quality of Tallo River, Indonesia. Caspian Journal of Environmental Sciences, 21(3), 647-656. doi: 10.22124/cjes.2023.6942

[35] Uralovich, K. S., Toshmamatovich, T. U., Kubayevich, K. F., Sapaev, I., Saylaubaevna, S. S., Beknazarova, Z., Khurramov, A. (2023). 'A primary factor in sustainable development and environmental sustainability is environmental education', Caspian Journal of Environmental Sciences, 21(4), pp. 965-975. doi: 10.22124/cjes.2023.7155

[36] Usmanovich Burkhanov, A & Mansur qizi Eshmamatova, M 2021, The ways for improvement of investment strategy in the period of digital economy. In The 5th International Conference on Future Networks & Distributed Systems, pp. 655-662

[37] Xidirberdiyevich, AE, Ilkhomovich, SE, Azizbek, K & Dostonbek, R 2020, Investment activities of insurance companies: The role of insurance companies in the financial market. Journal of Advanced Research in Dynamical and Control Systems, 12: 719-725.

[38] Vivar-Arrieta, M. A., Haro-Altamirano, J. P., Carrillo Barahona, W. E., López Sampedro, S. E., Usmanovich, B. A., Usmonov, B., & Ulugbek kizi, M. S. (2023). Multicriteria evaluation of ancestral family agricultural systems, Chimborazo Province, Ecuador. Caspian Journal of Environmental Sciences, 21(5), 1123-1134. doi: 10.22124/cjes.2023.7400

[39] Khayitov, O. G., Umirzokov, A. A., Turdiev, S. S., Kadirov, V. R., & Iskandarov, J. R. (2022). ON SOME RESULTS OF STUDYING THE CAUSES OF ANOMALOUSLY HIGH FORMATION PRESSURE ON THE HYDROCARBONS DEPOSITS OF THE BASHKENT DEEP. *News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences*, *6*(456), 247-260.

[40] Umarova, I. K., Amindjanova, S. I., Salidjanova, G. K., Bekpulatov, J. B., & Djumaeva, K. Y. (2023). Hydrometallurgical processing of pyrite concentrates from Yoshlik deposits. In *E3S Web of Conferences* (Vol. 389, p. 01079). EDP Sciences.

[41] Almatov, I.V., Usenov, R.B., Makhmarezhabov, D.B. Comprehensive processing methods for oil shale from the Aktau deposit (Uzbekistan). 2023 Obogashchenie Rud 2023(6), c. 28-32 DOI: 10.17580/or.2023.06.05