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ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ
Satbayev University

# Х А Б А Р Л А Р Ы

# ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ
НАУК РЕСПУБЛИКИ
КАЗАХСТАН
Satbayev University

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## NEW VARIANTS FOR WIDE OREBODIES HIGH–CAPACITY MINING SYSTEMS WITH CONTROLLED AND CONTINUOUS IN–LINE STOPING

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**Abstract.** The work is devoted to achieving the goal of creating a cost-effective, technologically feasible and safe mining scheme for high-capacity ore bodies with controlled and in-line stoping. The directions of scientific research are methodologically grounded. Breaking-out out of ore by vertical fans (less often by parallel wells) at level excavation with tight-face blasting on a layer of the massif beaten off by the previous explosion or on a wall of the caving rock carries a danger of excessive dilution, discrepancy of particle size distribution of the beaten off mass to optimum fractional distribution and additional difficulties at release. The formation of the initial cut-off riser and the creation of a compensating space from it is also a difficult process to manage. Releasing ore under cover of the stump pillar or from undercut rock is inefficient primarily due to additional tunnelling, ore loss and dilution. In the case of sublevel caving, the amount of rock excavation for the design of transport gradients and their entry points to the sublevels is significant. The proposed technological scheme of ore blasting by means of explosive borehole fans drilled from a drill winze by a drilling unit located in the cabin of a mechanized tunneling monorail complex allows eliminating the mentioned disadvantages. In this case, the fans are drilled subparallel to the normal thickness of the ore body (perpendicular to the plane of the ore body dip).

**Keywords:** drilling rooms**,** fan wells, development system**,** wide ore bodies, controlled in-line mining technology

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# БАСҚАРЫЛАТЫН ЖӘНЕ ҮЗДІКСІЗ АҒЫНДЫ ТАЗАРТУ КЕҢІСТІГІ БАР ҚУАТТЫ КЕН ДЕНЕЛЕРІН ҚАЗУ ЖҮЙЕЛЕРІНІҢ ЖАҢА НҰСҚАЛАРЫ

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**Аннотация.** Жұмыс басқарылатын және ағынды тазарту қазбасы бар қуатты кен денелерін игерудің экономикалық тиімді, технологиялық мүмкін және қауіпсіз схемасын құру мақсатына қол жеткізуге арналған. Ғылыми зерттеулердің бағыттары әдістемелік негізделген. Кенді тік желдеткіштермен (сирек параллель) ұңғымаларды қабатпен ойып алу кезінде "қысқышта" алдыңғы жарылыспен ұрылған массив қабатына немесе құлаған жыныс қабырғасына жару артық сөл бөлу, ұрылған массаның гранулометриялық құрамының оңтайлы фракциялық бөлінуге сәйкес келмеуі және шығару кезіндегі қосымша қиындықтар қаупін тудырады.Бастапқы кесілген өрлемені жобалау және одан компенсациялық кеңістік құру да қиын басқарылатын процесс болып табылады.Штрек үсті кентірегінің жабынымен немесе опырылған жыныстардың астынан кен шығару бірінші кезекте жоғалым мен құнарсыздану, қосымша ұңғылау жұмыстарының салдарынан тиімсіз болады. Қабат астындағы құлау кезінде көлік еңістерін және олардан қабат аралық қабаттарға кіруді рәсімдеу үшін жыныстарды қазу жұмыстарының көлемі елеулі болады. Механикаландырылған ұңғылау

монорельсті кешенінің кабинасында орналасқан бұрғылау-көтермелі бұрғылау агрегатымен бұрғыланған ұңғымалардың желдеткіштерін жару арқылы кенді шайқаудың ұсынылған технологиялық схемасы көрсетілген кемшіліктерді жоюға мүмкіндік береді. Бұл жағдайда ұңғымалар кен денесінің қалыпты қуатына параллель бұрғыланады (кен денесінің құлау жазықтығына перпендикуляр).

**Түйін сөздер:** бұрғылау қазбалары, желпуішті ұңғымалар, қазу жүйесі, қуатты кен денесі, басқарылатын ағынды өндіру технологиясы

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## НОВЫЕ ВАРИАНТЫ СИСТЕМ РАЗРАБОТКИ МОЩНЫХ РУДНЫХ ТЕЛ С УПРАВЛЯЕМОЙ И НЕПРЕРЫВНОЙ ПОТОЧНОЙ ОЧИСТНОЙ ВЫЕМКОЙ

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**Аннотация.** Работа посвящена достижению цели создания экономически эффективной, технологически осуществимой и безопасной схемы разработки мощных рудных тел с управляемой и поточной очистной выемкой. Методически обоснованы направления научных исследований. Отбойка руды вертикальными веерами (реже параллельными) скважин при этажной выемке со взрыванием в «зажиме» на слой отбитого предыдущим взрывом массива или на стену обрушенной породы таит в себе опасности излишнего разубоживания, несоответствия гранулометрического состава отбитой массы оптимальному фракционному распределению и дополнительных трудностей при выпуске. Оформление первоначального отрезного восстающего и создание из него компенсационного пространства также представляет собой трудноуправляемый процесс. Выпуск руды под прикрытием надштрекового целика или из-под обрушенных пород неэффективен в первую очередь из-за дополнительных проходческих работ, потерь руды и разубоживания. При подэтажном обрушении значительны объемы проходческих породных работ для оформления транспортных уклонов и заездов из них к подэтажам. Предлагаемая технологическая схема отбойки руды взрывом вееров скважин, обуренных из бурового восстающего буровым агрегатом, находящимся в кабине механизированного проходческого монорельсового комплекса, позволяет устранить указанные недостатки. Веера при этом бурятся субпараллельно нормальной мощности рудного тела (перпендикулярно плоскости падения рудного тела).

**Ключевые слова:** буровые выработки**,** веерные скважины, система разработки**,** мощные рудные тела, управляемая поточная технология добычи

**Introduction**

One of the important directions of searching and creation of new variants of development systems is the area of effective stoping from powerful edge seam or flat and inclined deposits with extensive strike in perpendicular directions and considerable thickness in upwards.

This question stems from a review of the performance of existing and widely used mining systems of different classes: open face, caving and backfill, i.e. both stable and unstable host rocks, rich or poor ores.

All known methods of deposit development, both at level and sub-level mining, in practice apply vertical fans of wells, at which:

1) when using self-propelled equipment in a caving method, ore is stripped and extracted with its transport by sub-levels to ore passes from circular transport gradients; these gradients and approaches to them are passed completely through the rock, which considerably increases the cost; the cut-off slot in the block is formed by blasting of parallel vertical boreholes into the cut-off riser, which is preliminary formed by a single short-delayed blasting of boreholes drilled to the full height of the riser, using a special drilling and blasting passport;

2) in the case of variants of development system with stripping from sub-level drifts with open space freed ore is released at the bottom of the block, which is designed as a system of draw holes with funnel-like cavity from the delivery drift to the undercut drift or as a flat bottom with face loading of ore from the system of runs directly on the working horizon; cut-off slot is prepared in the same way as in paragraph 1;

3) In a block caving or induced block caving mining system, freed ore is delivered for haulage in the same manner as in paragraphs1and 2.

It should be noted, that in the literature about the applicability of borehole drilling are the following: as a rule, in one plane parallel to the surface of the working face with the arrangement in the knocked-out layer in parallel, parallel-close, fan and bundle, with the knocked-out layers arranged vertically or horizontally (fig. 1, 2 and 3) (Stupnik et al., 2019: 3; Ferreira et al., 2015: 1081; Orynbassarova et al., 2022: 146).

The general disadvantage of the used variants of underground development of steeply-sloping thick deposits is:

- Ore excavation both in sub-level and level systems of development with caving in "jammed environment", which cannot avoid dilution by waste rock from the caving massif, mixed with the excavated ore;

- In the case of a mining system where the open-pit mining system is used, there is also unavoidable dilution by rock which has spontaneously collapsed from the host rock on the hanging wall and the bottom wall;
- the use of selective consolidating stowing to create artificial pillars to reduce losses with the practical dilution rates in place is significantly more costly, compounded by the introduction of backfill material into the waste ore as a result of borehole charge explosions directed directly at the backfill rock and the resulting reduced recovery in the ore dressing process.

Variants of horizon - chamber mining system of inclined ore bodies (at dip angles from $30^0$ to $50^0$ depending on inclined chamber length and ore body thickness from 4 m to 15 m) with stowing or open face using the principle of ore delivery by explosion force are known. Giprotsvetmet Institute (Moscow) originally created this variant especially for mines of Mirgalimsay deposit in 1962 and its application at that time was estimated as a technological breakthrough (Kovalenko et al., 2022; Kicki et al., 2010: 245; Uteshov et al., 2021: 102). But this variant cannot be applied to such mining-geological conditions, for which the developed scheme is suggested, because, firstly, in uprising with dip angle more than $50^0$–$55^0$ it is impossible neither to drill a hole, nor to charge and blast while being in the chamber; Secondly, with dip angles up to $50^0$ it is not possible, as we suggest, to partially and temporarily shrinkage the freed ore, which will freeze during ore shrinkage and will not be delivered to the delivery horizon by gravity, i.e. the chamber will be lost. The chamber will be lost.

The purpose of the proposed versions is to eliminate drawbacks in the described versions of systems of development of ore bodies with a thickness from 3 m to 15–20 m and dip angles over 45–$50^0$, with increase of economic efficiency, simplification of practical feasibility of the technological scheme due to:

- exclusion of rock works during block preparation;
- eliminating unpredictable and unprojected as well as reducing traditional losses and dilution and enabling control of these indicators to optimize processability and costs in a comparative calculation of various cost items achieved by stripping ore with fans of holes, perpendicular to the plane of the ore body dip, where ore is delivered under pressure of explosion gases and its own weight down into the shop thus created, compacting the rock mass in it and not destructively affecting the backfill;
- Creating the most predictable mining pattern, enabling the implementation of a digital control algorithm for non-stop and accident-free operation, using the proposed innovation as a "twin pulley block", or a system of such blocks within one ore body;
- Increase of efficiency of underground development due to reduction of specific volume of preparatory and ripping works per 1 ton of reserves, including, first of all, rock works, decrease in cost price and increase of mining productivity of the block;
- Increasing recovery of mineral resources in ore beneficiation from richer commercial ore and reducing the cost of concentrate;
- Creation of an improved working environment and occupational safety as compared to the existing technological schemes with a reduced level of injuries;

- Achieving full mechanization of all production operations related to drifting, drilling, stripping and loading of ore at the working horizon, laying of interlocks, complete independence and controllability of these operations from each other and controllability of the entire production process;
- The same advantages and positive effect can be achieved by applying the developed technological schemes to the development of thick declining and inclined ore bodies of extensive strike in perpendicular directions, where the dip angle of the created chambers is adjusted by the design to obtain the most comfortable conditions.

Set aim is achieved by the fact that the project creates a "twin pulley block" with the following dimensions: natural or artificial dip angle $50^0$ or higher, ore body thickness along normal from 4 m to 15–20 m, block vertical height (distance between levels) 50 m, block length along strike of 100 m (the distance between the axes of risers, passed for ore extraction from the future interblock pillars, and their subsequent filling. The strike length may vary depending on FEM results (Pivnyak et al., 2015; Kamiński et al., 2021: 1; Bazaluk et al., 2022; Iordanov et al., 2020: 119).

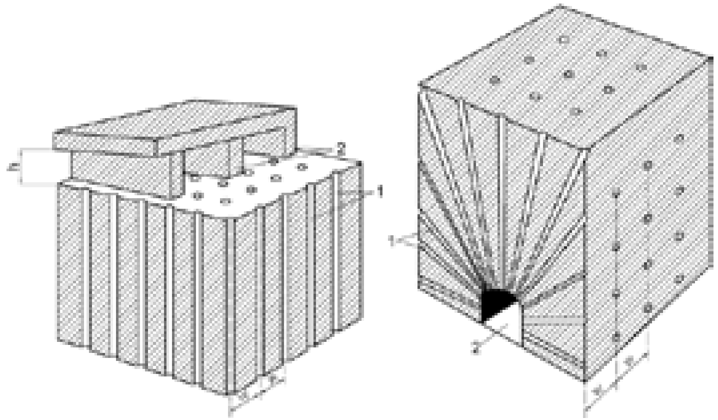


Fig. 1. Diagrams of blasting holes arrangement when stripping the ore:
a - parallel; b - fan; 1 - boreholes; 2 - drilling rooms; W - line of least resistance; h - drilling room height

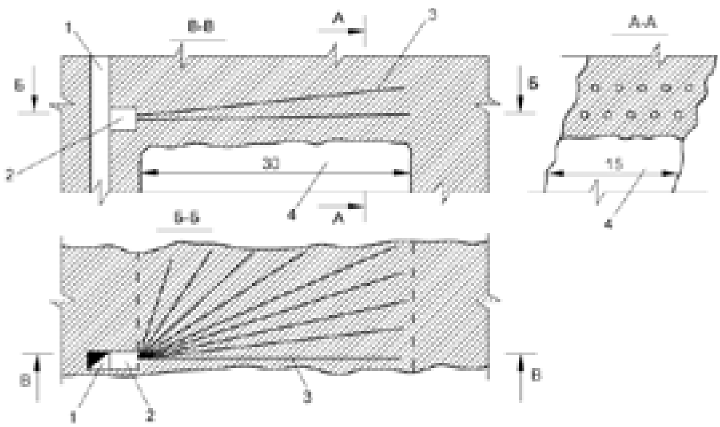


Fig. 2. Borehole bundle arrangement:
1 - drill winze; 2 - drilling chamber; 3 - boreholes; 4 - compensation space

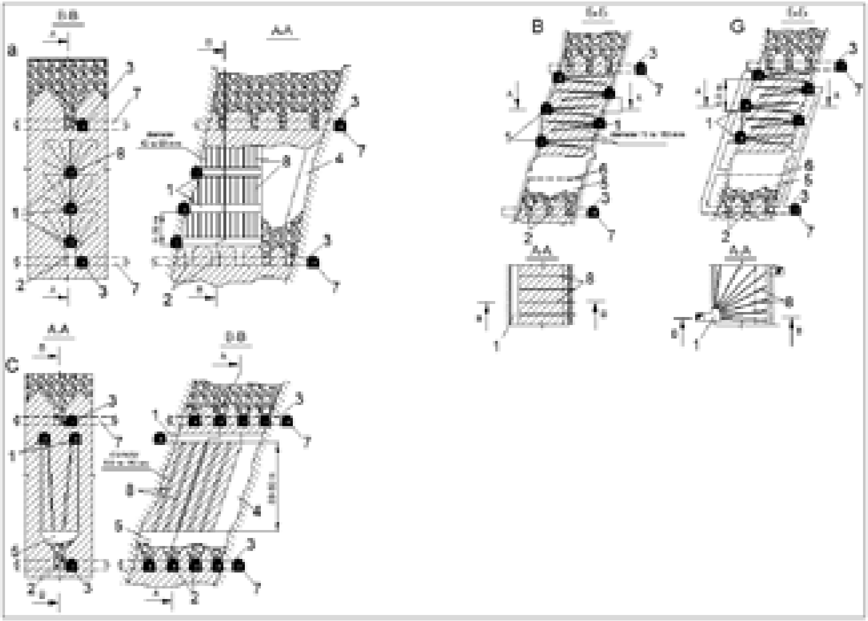


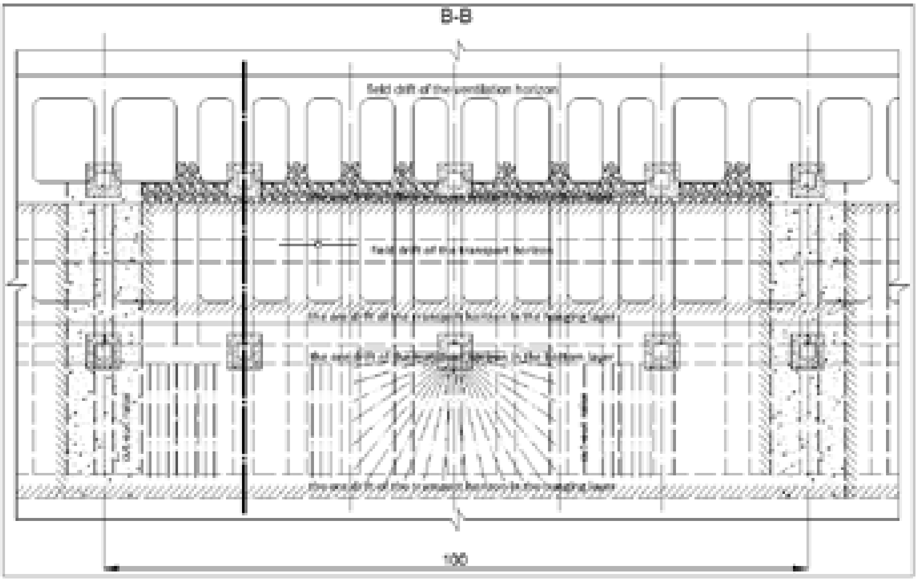
Fig.3. Well layout schemes:
a - sub-level vertical layers, fan arrangement of holes; b - level steeply inclined layers, parallel arrangement of holes; c - horizontal layers, parallel arrangement of holes in plan; d - horizontal layers, fan arrangement of holes in plan; 1 - drilling workings; 2 - workings for ore mass release; 3 - workings for ore mass delivery; 4 - cut-off slot; 5 - undercut; 6 - upper border of undercut; 7 - field drift; 8 - blast holes

**Materials and methods**

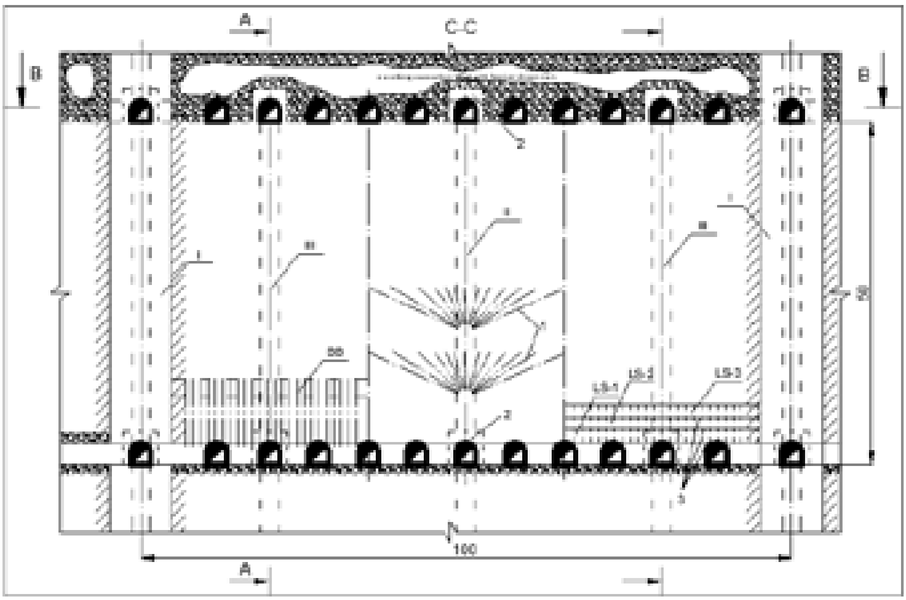
Block preparation begins with the sinking of three drifts at the working horizon level — two ore drifts and one rock drift. The ore drifts are driven in contact with the hanging wall and the bottom wall of the ore body. The ore drift, which is passed in the bottom wall at a distance safe from the effects of mass explosions, is designed for the transport of extracted ore, which can be shipped in different variants: by dump trucks into which ore is loaded by front-end loaders (loading and delivery machines, or LDM), directly by the LDM themselves, if the transport distance permits, using a rolling rail, or by conveyors in which ore is also loaded into wagons or onto a conveyor by an LDM or vibro-conveyor.

" Twin pulley block " between internal borders of interblock pillars is divided into chambers, prepared by tunneling of risers with application of tunneling mechanized monorail complexes (MMC) up to joining with ore drifts of bottom wall on top horizon. The same MMC cabins, left for the time of excavation of ore in the risers, passed in the future pillars along the block boundaries and inside the block in the chambers, are used for shaping the fans of holes, which subsequently after creating the cut-off slot (compensation space) are charged from the cabins and blasted after MMC lifting into the drive from the field to the ore drift of upper horizon (Fig. 4a and 4b).

The width of chambers, created as interblock pillars, is calculated according to the geological and mining conditions in each individual case according to the laws of geomechanics (Petlovanyi et al., 2021: 122; Sundar et al., 1995: 927; Kononenko et al., 2021: 111).

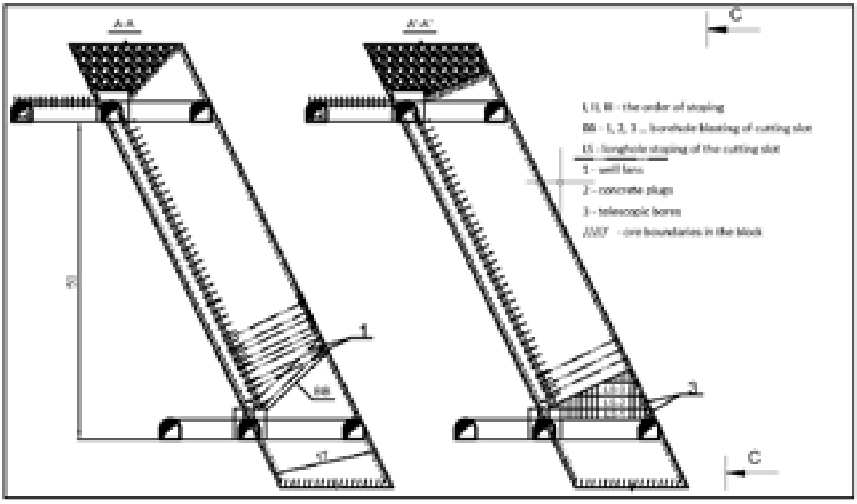



a)




b)

Fig. 4. Floor excavation system with slant-hole fanning from the cab of the mechanised monorail complexes
(half of «twin pulley block»)




c) Fig. 4. Formation of the cut-off slot by the cut-off slotwith parallel boreholes (WS)

d) Fig. 4. Formation of the cut-off slot with vertical and horizontal boreholes (HS-1, 2, 3).

The distance between chambers within a block along strike is limited by the optimum length of the borehole drilled along the diagonal of the rectangle that makes up the plane of the fan. In a rectangle, with the maximum thickness of the ore body at which the development system is applied, 15–20 m, a 3x3 m riser section, a 0.5 m of bottom wall rock catch and a side perpendicular to the thickness, 13.5 m, the diagonal (longest hole) would be 18.4–25 m. This 56mm diameter borehole length ensures both drilling accuracy and minimal seismic and dynamic loads on the backfill or natural massif when blasting with the line of least resistance (LLR) and a maximum distance between the borehole ends of at least 1.8m. The borehole diameter, LLR and wellhead spacing will vary depending on the optimum parameters to be determined.

In doing so, the thickness of the ore body affects the application with the proposed design parameters of the development system as a limitation of the permissible in order to:

1) Drill holes of a length no longer than effective for optimum extraction rates;

2) to optimize dimensions of interblock pillars of consolidating stowing by their stability in the period of stoping and specific consumption of stockpile per 1 ton of excavated reserves (Kalybekov et al., 2019: 34);

3) maximum reduction of ore reserves ratio in triangular pillar at the bottom of block, temporarily left and hammered by the block below upwards, which is created for unhindered delivery of hammered ore along its upper plane under the action of its own weight.

The cut-off slot (compensation space) is formed in two ways, the application of which depends on the angle of incidence of the ore body. The formation of the cut-off slot by parallel boreholes drilled from the passed risers at an angle, which ensures that the ore, cut off in the chamber by the borehole fans under its own weight, can be continuous along the whole extent of the ore body in the application area of the development system proposed in the created variants.

The second method is to hammer with hand and/or telescope perforators also continuously, but horizontally, starting from the drive connecting the ore drifts of the hanging wall and the bottom wall. In this variant the triangular target for ore rolling under its own weight is not left, and a part of the beaten off ore will artificially create a ramp, which will pass for extraction to the underlying block (fig. 4c and fig. 4d).

Each method is chosen graphically to provide an accurate picture of the clearing space, but both methods allow for loss-free mining of ore.

All risers are covered to a height of 6 m with a reinforced concrete cap (stopper) after sinking and chipping of the cut-off slot at the working horizon to use the riser later for safe and guaranteed departure of people after drilling to the upper horizon in the MMK stand and prevent the chipped ore and collapsed rock to get into the riser, since in such an outcome the mining workflow would be stopped

At the level of the working horizon, midway between the access crosscutsfor raise work in the interblock pillars and in the chambers, access crosscuts are passed between the rock drift and the ore drift, which has been passed in contact with the bottom wall of the ore body.

All tunneling operations are carried out simultaneously and independently of each other. The cut-off slot is first formed in the interblock pillars, then it is formed in the "twin pulley block", starting from the centre of the block to both sides, and the connection (bridging) of this cut-off slot with the interblock pillars is not made until the interblock pillars have been excavated and the solid stowing above the top edge of the cutting slot at the hanging wall of the ore body has been carried out.

Stopingfrom all chambers of the "twin pulley block" is carried out starting from the central riser on both sides with a 2–4 fan behind the adjacent riser.

Ore is released with the provision of the volume of open purification space in the chambers, which freely accommodates the volume of blasted 2–4 fan wells taking into account the loosening factor.

After all ore reserves in the block are mined, full release of shrinked ore material is made from all risers. The clearing space will, following the release of broken ore, be filled by both the collapsed host rocks of the block itself and by gravity-flowing rocks from the upper block, which filled the previously worked-out block.

More powerful ore bodies can be mined using the developed variants when blocks consisting of first stage chambers and second stage chambers (full height temporary pillars) are arranged along both the strike and cross-strike. Block cutting for thickedge seams, for heavy flat and inclined ore bodies of extensive strike in perpendicular directions, when the thickness cut off in a cycle exceeds 15–20 m, is a special task, which is solved taking into account calculation of geomechanical parameters to ensure stability and sequence of mining, providing system operability and continuity of production.

When creating variants of development systems, first, it is necessary to define the reasons for such prospecting. In this case, we think that the variant of borehole recovery from drilling risers instead of retrieval from sub-level drifts should have advantages under the following main attainable parameters, other things being equal:

1) Increased loading-delivery labour productivity, which depends on:

— continuity of the flow of broken ore;

— its lumpiness with fractional composition not less than 95–98 % in the intervals 20–300mm;

2) Reduction of mining costs, which we determined for the conditional metal, rather than for 1 ton of rock mass, as usual, because depending on the technology of mining dilution may cause a significant reduction or increase the number of mined metals in the rock mass.

This formulation of the mining efficiency is a new approach to their optimal solution. Based on this methodology, we present the dependency graphs in Fig. 5 and Fig. 6.

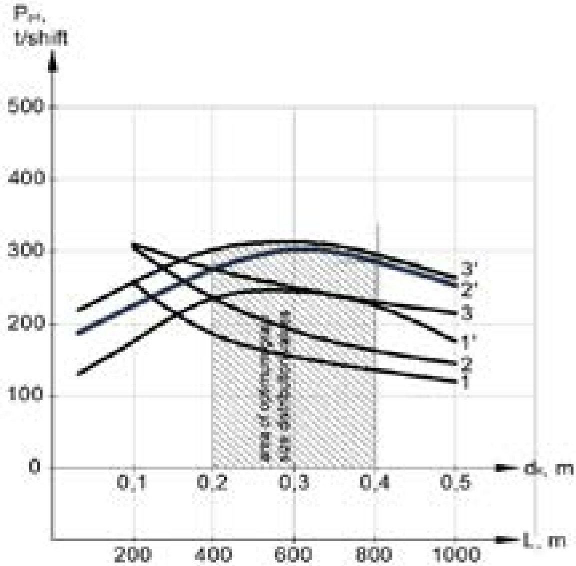



Fig. 5. Dependence of labour productivity (Rpd) at loading-delivery on delivery distance (L), complex composition and fractional composition.

1– loading-delivery by a loading-delivery vehicle (PDM) from a single block with drill winzes;

1' – loading-delivery by a PDM from the "double block" with cutting off from drill winzes;

2' – loading-delivery by PM + dumper truck complex from a single block with drill winzes;

2' – loading-delivery by PMD + dumper truck from a "double block" with auger drills; 2 – loading-delivery by PMD + dumper truck from a "double block" with auger drills;

3' – loading-delivery by PDM from the block with cutting from underfloor drifts;

3' – loading-delivery of PDM + dumper truck from the block with cutting back from understorey drifts.

Notes:

1– Calculated using one PDM and complex of one PDM and one dump truck;

2– Speed of transport (loaded and unloaded) taking into account unforeseen downtime was taken 6 km / h (100 m / min);

3– The duration of loading and unloading PDM, respectively, 8 min and 3 min, dump truck loading PDM 24 min, unloading 9 min;

4– Average duration of loading and unloading operations during 7- hour shift 300 min from the single block and 360 min from the "double block";

5– Working capacity of the bucket of a PDM 12,6 tons, body of dump truck 37,8 tons (bucket and body filling factor 0,9);

6– For calculation we took PMs Sandvik LH514 and Epiroc ST14, dump trucks Sandvik TH545i and Epiroc MT42;

7– Loading capacity of single blocks with drill winzes are determined without time costs for wireline lining of host rock from shrinked ore material, from "twin pulley blocks" with these costs taken into account

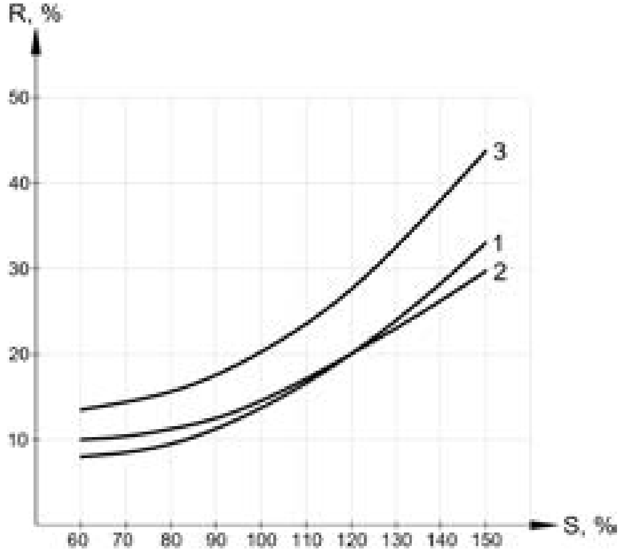



Fig.6 Cost of metal equivalent in concentrate versus dilution.

1– Breakage from the drill winzes without anchoring of host rock;

2– Breakage from the drill winzes with cable lining of host rocks;

3– Breakage from the sublevel drift.

Note:

1– 100 % is taken as cost of obtaining 1 tonne of metal equivalent in concentrate, equal to zero margin of sales for metallurgical processing;

2– The cost of metal equivalent is made up of mining and extraction costs to process all minerals, reduced to a single price in the market.

The graphs in Fig. 5 and 6 enable selection of the composition of the loading and unloading complex and the development system option for mining steeply dipping massive ore bodies, which ensures maximum labour productivity and minimum cost of production

**Results and discussion**

The execution of the mining system option with slant-hole fanning, partial storage and subsequent solidification of pillars between "twin pulley blocks" and self-destruction of host rocks after the release of knocked-out ore is a geotechnical and organizational challenge that must be carried out according to a pre-prepared schedule.

While the future pillars are being cleaned, the interblock chambers can be raised and hammers drilled, during the break-in period the hammers drill hammers and the cut-off slot, and finally, after the break-in is completed, the ore is stripped in the interblock chambers (Bitimbayev et al., 2022; Bitimbayev et al., 2022; Takhanov et al., 2021: 50; Rysbekov et al., 2022: 64).

Designs of floor caving development systems with fan-hole drilling, the plane of which is parallel (sub-parallel) to the normal thickness of the ore body, provide in practice the obvious advantages, which are described above. They require to solve a number of technical problems related to drilling of inclined fans of wells from drill winzes, passed with the use of MMK:

- – The first of them is the availability of drilling unit for drilling of wells fans from the cabin of monorail system, possibility of rearrangement of drilling unit from fan to fan (raising it on the value of line of least resistance) with its breakout and fixing in the body of drilling rig, change of drilling rods (uncoupling, raising and screwing, storage of necessary number of drill winzes in the cabin).
- – Second — separation of the drilling unit from the cabin of the tunneling complex in order to eliminate the impact of vibration on the people in the cabin and on the cabin itself and the monorail head.
- – The third one is creation of digital control systems (e.g., integrated into the existing Auto-Mine software by Sandvik) for full range of operations for drilling, fanning, bracing, raising and uncoupling of the drill string from a distance, while being on the upper horizon or in the extended and raised part of the cabin.

Solutions to these problems, representing a rather complex set of interrelated technical problems, nevertheless, firstly, can be implemented, taking into account the level of development of mining machinery and availability of working variants of electrohydraulic control system EDS (Electronic Direct System) and computer control system RCS (Rig Control System) (Rysbekov et al., 2022: 41; Popescu et al., 2020: 40).

Secondly, the advantages of using stage ore excavation according to the developed development system allow to achieve total technological and economic efficiency, taking into account additional expenses for solution of high-performance borehole drilling from the cabin of the tunneling complex. After completion of tunneling works, it may be necessary to change the cabin to a more spacious in height, length and width in a modular design, expandable in height into two separate cabins to separate workers with a control system console and to create the possibility of fan drilling.

The design should also allow for wire or fiberglass anchoring of the host rock if necessary by drilling and lining with a Sandvik AS 422i from the ventilating and working levels.

The above tasks are solved using standard control and anchoring systems made by Epiroc and Sandvik.

The scientific results are derived from three levels of work. The first level is the production of standard drawings representing the development of mining operations within a single "twin pulley block" created from the classic steep-falling massive ore body, in which the stages and types of mining operations show the workability, design feasibility and reliability of the technological scheme. The second level is the extension of the developed designs of the proposed variants of development systems to the full development of not only the "ideal" steeply dipping powerful ore body, but also to the development of the ore deposit, the thickness of which between the host rocks is directed subvertically in the flat and inclined ore bodies with a significant area in the perpendicular subhorizontal directions. The third level - practical implementation of technological schemes with control of geomechanical manifestations at different stages of mining works, safety in terms of ventilation and carrying out of a complex of drilling and blasting works, loading, delivery and transport of rock mass, operability and reliability of the adopted scheme of management of clearing space, calculation of actual technical and economic indicators by processes and in general by development system for analysis and determination of optimal interdependencies of individual technological processes from each other.

**Conclusions**

The most important results of the scientific work performed are:

- Creation of designs of "twin pulley block"; reinforced concrete cap in MHV; drilling unit with special cabin as a part of monorail complex; development of digital remote control of drilling process; layout of compensation space and technology of its formation; block cutting allowing non-stop preparation and extraction; system of filling mixture feeding — all these works are new, not applied before for such purposes and in such design;
- Creation of a real-time controlled overall design of the cleanout space, operating on the principle of relying solely on the activity of the loading-delivery-transportation system;
- Standardization of the design advantages and mass application of the created technological solutions allows transforming the stoping process into an effective regulator of practical geoengineering as a major strategic component of the complex of gentle intervention into the natural equilibrium of the subsoil mass. The implementation of the proposed technologies will be a creative development of the 4th Industrial Revolution, the objectives of which were defined by the founder of the Davos Economic Forum, Klaus Schwab.

The dependences of the productivity of loading and delivery operations and the cost of production of 1 ton of conventional metal in concentrate on the applied complexes of self-propelled equipment and the variant of development system with borehole extraction are experimentally determined.

According to the diagrams, it is possible to determine the conditions for achieving maximum productivity and minimum production cost.

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**REFERENCES**

Bazaluk O., Rysbekov K., Nurpeisova M., Lozynskyi V., Kyrgizbayeva G., Turumbetov T., 2022 — *Bazaluk O., Rysbekov K., Nurpeisova M., Lozynskyi V., Kyrgizbayeva G., Turumbeto, T.* Integrated monitoring for the rock mass state during large-scale subsoil development. Frontiers in Environmental Science, (10), 852591. https://doi.org/10.3389/fenvs.2022.852591.

Bitimbayev M.Z., Rysbekov K.B., Krupnik L.A., Stolpovskikh I.N., 2022 — *Bitimbayev M.Z., Rysbekov K.B., Krupnik L.A., Stolpovskikh I.N.* Method of underground development of ore deposits using "bottom-up" approach. Patent № 6903, Kazakhstan.

Bitimbayev M.Z., Rysbekov K.B., Krupnik L.A., Stolpovskikh I.N., 2022 — *Bitimbayev M.Z., Rysbekov K.B., Krupnik L.A., Stolpovskikh I.N.* Method for development of steeply dipping ore bodies. Patent № 35375, Kazakhstan.

Ferreira H., Leite M.G.P., 2015 — *Ferreira H., Leite M.G.P.* A Life Cycle Assessment study of iron ore mining. Journal of cleaner production, 108. Pp.1081–1091. https://doi.org/10.1016/j.jclepro.2015.05.140.

Iordanov I., Novikova Yu., Simonova Yu., Yefremov O., Podkopayev Ye. & Korol A., 2020 — *Iordanov I., Novikova Yu., Simonova Yu., Yefremov O., Podkopayev Ye., Korol A.* Experimental characteristics for deformation properties of backfill mass. Mining of Mineral Deposits, 14(3). Pp.119–127. https://doi.org/10.33271/mining14.03.119.

Kalybekov T., Rysbekov K.B., Toktarov A.A., Otarbaev O.M., 2019 — *Kalybekov T., Rysbekov K.B., Toktarov A.A., Otarbaev O.M.* Underground mine planning with regard to preparedness of mineral reserves. Mining Informational and Analytical Bulletin, (5). Pp.34–43. https://doi.org/10.25018/0236-1493-2019-05-0-34-43.

Kamiński P., Dyczko A., Prostański D., 2021 — *Kamiński P., Dyczko A., Prostański D.* Virtual simulations of a new construction of the artificial shaft bottom (shaft safety platform) for use in mine shafts. Energies, 14(8), 2110. https://doi.org/10.3390/en14082110.

Kicki J., Dyczko A., 2010 — *Kicki J., Dyczko A.* The concept of automation and monitoring of the production process in an underground mine. New Techniques and Technologies in Mining. Pp.245–253. https://doi.org/10.1201/b11329-41.

Kononenko M., Khomenko O., 2021 — *Kononenko M., Khomenko O.* New theory for the rock mass destruction by blasting. Mining of Mineral Deposits, 15(2). Pp.111–123. https://doi.org/10.33271/mining15.02.111.

Kovalenko A.A., Petrova O.V., Mambetova Y.D., 2022 — *Kovalenko A.A., Petrova O.V., Mambetova Y.D.* Substantiation of Geotechnical Risk Assessment Criterion for Mining Systems with Uncontrolled Caving of Ore and Surrounding Formations. IOP Conference Series: Earth and Environmental Science, 988(3), 032046. https://doi.org/10.1088/1755-1315/988/3/032046.

Orynbassarova E, Yerzhankyzy A, Shults R, Roberts K, Togaibekov A., 2022 — *Orynbassarova E, Yerzhankyzy A, Shults R, Roberts K, Togaibekov A.* Strategies of GNSS processing and measuring under various operational conditions. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, (3). Pp.146–150. DOI: 10.33271/nvngu/2022-3/146.

Petlovanyi M., Malashkevych D., Sai K., Bulat I., Popovych V., 2021 — *Petlovanyi M., Malashkevych D., Sai K., Bulat I., Popovych V.* Granulometric composition research of mine rocks as a material for backfilling the mined-out area in coal mines. Mining of Mineral Deposits, 15(4). Pp.122–129. https://doi.org/10.33271/mining15.04.122.

Pivnyak G., Bondarenko V., Kovalevska I., 2015 — *Pivnyak G., Bondarenko V., Kovalevska I.* New developments in mining engineering. London, United Kingdom: CRC Press, Taylor & Francis Group, 607 p. https://doi.org/10.1201/b19901.

Popescu F.G., Pasculescu D., Marcu M.D., Pasculescu V.M., 2020 — *Popescu F.G., Pasculescu D., Marcu M.D., Pasculescu V.M.* Analysis of current and voltage harmonics introduced by the drive systems of a bucket wheel excavator. MiningofMineralDeposits, 14(4). Pp.40–46. https://doi.org/10.33271/mining14.04.040.

Rysbekov K., Bitimbayev M., Akhmetkanov D., Yelemessov K., Barmenshinova M., Toktarov A., Baskanbayeva D. 2022 — *Rysbekov K., Bitimbayev M., Akhmetkanov D., Yelemessov K., Barmenshinova M., Toktarov A., Baskanbayeva D.* Substantiation of mining systems for steeply dipping low-thickness ore bodies with controlled continuous stope extraction. // Mining of Mineral Deposits Volume 16, Issue 2. Pp.64–72. https://doi.org/10.33271/mining16.02.064.

Rysbekov K.B., Bitimbayev M.Zh., Akhmetkanov D.K., Miletenko N.A., 2022 — *Rysbekov K.B., Bitimbayev M.Zh., Akhmetkanov D.K., Miletenko N.A.* Improvement and systematization of principles and process flows in mineral mining in the republic of Kazakhstan. // *Eurasian Mining* (1). Pp.41–45. DOI: 10.17580/em.2022.01.08.

Stupnik M., Kolosov V., Pysmennyi S., Kostiantyn K., 2019 — *Stupnik M., Kolosov V., Pysmennyi S., Kostiantyn K.* Selective mining of complex stuctured ore deposits by open stope systems. E3S Web of Conferences, (123), 01007. https://doi.org/10.1051/e3sconf/201912301007.

Sundar D.K., Acharya D., 1995 — *Sundar D.K., Acharya D.* Blast schedule planning and shiftwise production scheduling of an opencast iron ore mine. Computers & industrial engineering, 28(4). Pp.927–935. https://doi.org/10.1016/0360-8352(94)00221-8.

Takhanov D., Muratuly B., Rashid Z., Kydrashov A., 2021 — *Takhanov D., Muratuly B., Rashid Z., Kydrashov A.* Geomechanics substantiation of pillars development parameters in case of combined mining the contiguous steep ore bodies. Mining of Mineral Deposits, 15(1). Pp.50–58. https://doi.org/10.33271/mining15.01.050.

Uteshov Y., Galiyev D., Galiyev S., Rysbekov K., Nauryzbayeva D., 2021 — *Uteshov Y., Galiyev D., Galiyev S., Rysbekov K., Nauryzbayeva D.* Potential for increasing the efficiency of design processes for mining the solid mineral deposits based on digitalization and advanced analytics. Mining of Mineral Deposits, 15(2). Pp. 102–110. https://doi.org/10.33271/mining15.02.102.

**CONTENTS**

**D.K. Akhmetkanov, M.Zh. Bitimbayev, V. Lozynskyi, K.B. Rysbekov, B.B. Amralinova**
NEW VARIANTS FOR WIDE OREBODIES HIGH–CAPACITY MINING SYSTEMS
WITH CONTROLLED AND CONTINUOUS IN–LINE STOPING....................6

**F.A. Akhundov, M. Sarbopeeva, R. Bayamirova, A. Togasheva, A. Zholbasarova**
ON THE ISSUE OF PREPARING THE WELLBORE FOR ITS FASTENING....................22

**A.M. Baikadamova, Y.I. Kuldeyev**
GEOLOGICAL STRUCTURE OF THE ZHARKENT THERMAL GROUNDWATER DEPOSIT
BY THE EXAMPLE OF WELL 3-T....................35

**A.A. Yerzhan, P.V. Boikachev, B.R. Nakisbekova, Z.D. Manbetova, P.A. Dunayev**
METHOD OF SYNTHESIS OF MATCHING TELECOMMUNICATION DEVICES BASED
ON THE METHOD OF REAL FREQUENCIES FOR 5G ANTENNAS IN A DISTRIBUTED
ELEMENT BASIS....................47

**K.S. Zaurbekov, S.A. Zaurebkov, A.V. Sladkovsky, D.Y. Balgayev**
HYDRODYNAMIC SIMULATION OF THE STEAM-ASSISTED GRAVITY DRAINAGE
METHOD FOR DIFFERENT RESERVOIR THICKNESSES USING ECLIPSE....................60

**A.T. Ibrayev, D.A. Aitimova**
A METHOD FOR ACCOUNTING THE IMPACT OF ERRORS ON THE QUALITY
OF ANALYTICAL INSTRUMENTS AND OPTIMAL CONTROL SYSTEMS....................70

**I.G. Ikramov, G.I. Issayev, N.A. Akhmetov, SH.K. Shapalov, K.T. Abdraimova**
RECYCLING OF PRODUCTION WASTE AND ENVIRONMENTAL IMPACT ASSESSMENT....................80

**J.A. Ismailova, A.R. Khussainova, Luis E. Zerpa, D.N. Delikesheva, A.A. Ismailov**
A NEW PREDICTIVE THERMODYNAMIC MODEL OF PARAFFIN FORMATION WITH THE
CALCULATION OF THE MATHEMATICAL ORIGIN OF THE POYNTING CORRECTION FACTOR......96

**Zh.S. Kenzhetaev, K.S. Togizov, A.K. Omirgali, E.Kh. Aben, R.Zhalikyzy**
INTENSIFICATION OF INHIBITOR-ASSISTED URANIUM ISL PROCESS....................108

**M.A. Li, T.T. Ibrayev, N.N. Balgabayev, B.S. Kali, D.A. Toleubek**
SIMULATION AND OPTIMIZATION MODELING OF WATER USE MANAGEMENT
IN IRRIGATION SYSTEMS....................119

**A.S. Madibekov, L.T. Ismukhanova, A.O. Zhadi, A. Mussakulkyzy, K.M. Bolatov**
RANKING THE TERRITORY OF THE ALMATY AGGLOMERATION ACCORDING
TO THE DEGREE OF POLLUTION....................130

**E.K. Merekeyeva, K.A. Kozhakhmet, A.A. Seidaliyev**
CHARACTERISTICS OF THE STRUCTURAL UPLIFTS OF KURGANBAI AND
BAYRAM-KYZYLADYR LOCATED WITHIN THE ZHAZGURLI DEPRESSION....................149

**R.N. Moldasheva**, **N.K. Shazhdekeyeva, G. Myrzagereikyzy, V.E. Makhatova, A.M. Zadagali**
MATHEMATICAL FOUNDATIONS OF ALGORITHMIZATION OF WATER POLLUTION
MODELING PROCESSES....................164

**Y.G. Neshina, A.D. Mekhtiyev, A.D. Alkina, P.A. Dunayev, Z.D. Manbetova**
HARDWARE-SOFTWARE COMPLEX FOR IDENTIFICATION OF ROCK
DISPLACEMENT IN PITS....................180

**M.B. Nurpeisova, Z.A. Yestemesov, V.G. Lozinsky, A.A. Ashimova, S.S. Urazova**
INDUSTRIAL WASTE RECYCLING – ONE OF THE KEY DIRECTIONS
OF BUSINESS DEVELOPMENT....................................................193

**B. Orazbayev, M. Urazgaliyeva, A. Gabdulova, Zh. Moldasheva, Zh. Amanbayeva**
METHODS OF MULTI-CRITERIA SELECTION IN PETROLEUM GEOLOGY UNDER
CONDITIONS OF FUZZY INITIAL DATA....................................................206

**B.R. Rakishev, A.A. Orynbay, A.B. Mussakhan**
AUTOMATED FORECASTING OF THE PARTICLE SIZE COMPOSITION OF BLASTED
ROCKS DURING BLASTHOLE DRILLING IN HORIZONTAL UNDERGROUND
WORKINGS....................................................222

**Y.Sh. Seithaziyev**
GEOCHEMICAL STUDIES OF CONDENSATE, GAS AND CORE SAMPLES DERIVED
FROM GAS-CONDENSATE FIELDS IN THE MOYNKUM SAG (KAZAKHSTAN)....................................................242

**E.Yu. Seitmuratova, R.T. Baratov, F.F. Saidasheva, V.S. Goryaeva, M.A. Mashrapova, Ya.K. Arshamov**
TO STUDY THE RING STRUCTURES OF CENTRAL AND SOUTHERN KAZAKHSTAN
AND THEIR ORE CONTENT....................................................262

**J.B. Toshov, Sh.R. Malikov, O.S. Ergashev, A.K. Sherov, A. Esirkepov**
IMPROVING THE EFFICIENCY OF THE PROCESS OF DRILLING WELLS IN COMPLEX
CONDITIONS AT GEOLOGICAL PROSPECTING SITES....................................................282

**V.A. Tumlert, Zh.K. Kasymbekov, R.A. Dzhaisambekova, E.V. Tumlert, B Sh. Amanbayeva**
INFLUENCE OF THE HYDROGEOLOGICAL MODE OF OPERATION ON THE CHARACTER
OF COLLATING OF THE FILTER AND THE FILTER ZONE OF SEASONAL WELLS....................................................295

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