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Determination of rational location of working of the pulled together layers

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Abstract. The distances rationale for the conditions given in the article are determined, at which there is no noticeable effect of K_2 formation lava on K_3 formation lava, and the bottom hole state is characterized by minimal values of formation deformations and rock convergence. The obtained results are confirmed by practical observations in production conditions. Thus, the decrease in the distance between the lavas K_3 and K_2 admitted at the mine. I. A. Kostenko very significantly complicated the work of lava K_3 , which led to an increase in the extraction of coal in the face, the violation of the bottom-hole part of the roof, the formation of domes. All the main technical and economic indicators of lava K_3 sharply decreased and increased the risk of work. As the calculations show, a significant factor determining the mutual influence of treatment faces in the conditions of simultaneous mining of close-knit layers is also the normal distance between the layers. The joint influence of the power of the inter-zone and the distance between the lavas are taken into account. The calculations allow to objectively assess the influence of various factors on the formation of the stress-strain state of the massif around the mines during the mining of contiguous seams, to explain arising in practice, complications in the love, and to provide for the possibility of such complications. Based on the analysis of Kostenko mine issued recommendations to establish a rational distance between lavas K_2 and K_3 in specific conditions 70 m.

Keywords: rocks, finite element method, stress-strain state, creep, fracture, deformation, stress, development.

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Introduction

Choice of the rational location of treatment and preparatory workings during mining of pulled together layers is a very urgent task. If these workings are not located well, significant rock pressure causes them to be inoperative.

Repeated working' redevelopment requires significant labor and material costs, and the accident rate of working faces is associated with a significant loss of production.

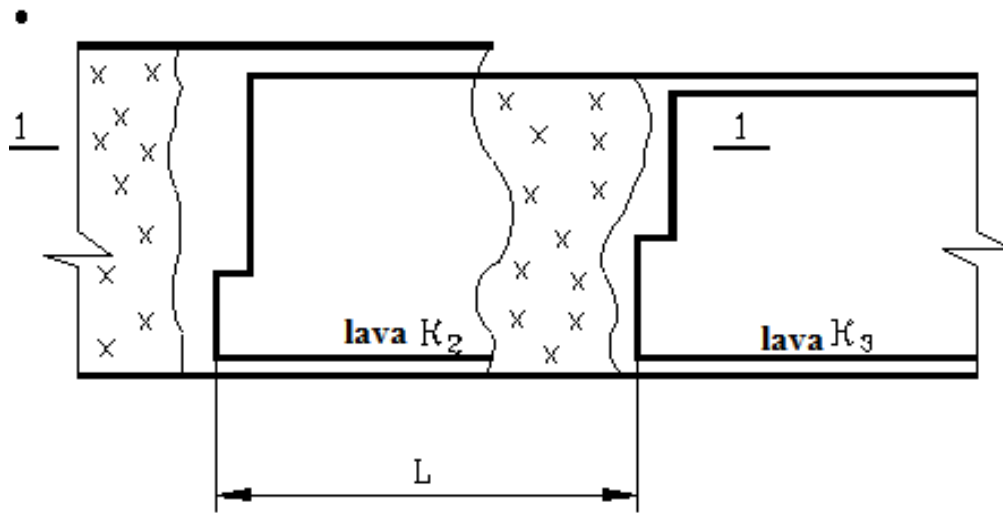
Let us consider as an example specific case of mining the pulled together layers K_2 and K_3 at Kostenko mine.

Research analysis

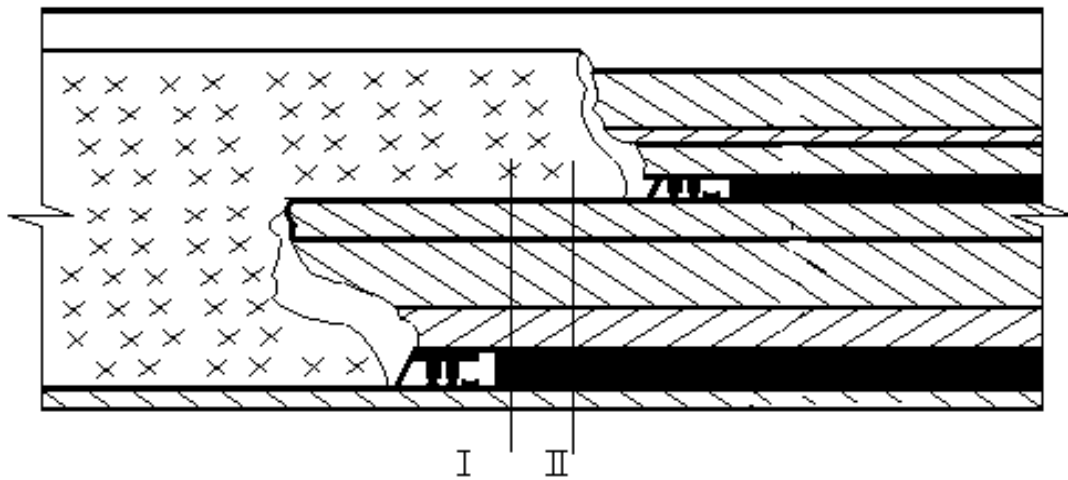
Location scheme of the workings in the layers K_2 and K_3 is shown on Picture 1. Distance between the lavas in plan during work varied over a wide range (from 40 to 120 m), and it was noted that a change in this distance had a significant effect on conveyor drifts condition.

Objective of the research is to determine the stressed-strained state parameters (SSS) of the array around working faces. Vertical section of a rock array with a working face is considered. Deformation along working face can be neglected

and the objective is reduced to a flat one. In order to estimate the SSS of the rock array (Picture 2), algorithm developed by authors and calculation program by the finite element numerical method are used [1-4]. The rock array is considered viscoelastic.



Picture 1 Location scheme of treatment and preparatory working during development of pulled together layers K_2 and K_3



Picture 2 Scheme of pulled together K_2 and K_3 layers' working

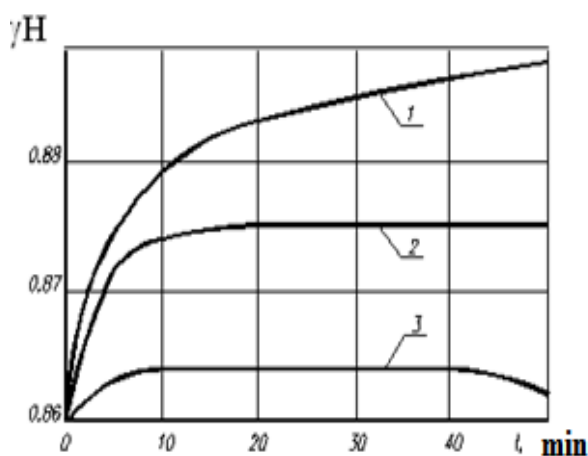
Elastic and rheological properties of rocks and layer powers, set in accordance with the stratigraphic section of the mine field, workings' depth and their dimensions, were used as initial data for calculating SSS around the workings.

Distance between the lavas varied within the range 10-70 m. Distribution of the values of vertical stresses (reference pressure) along the drifts' longitudinal axis was obtained at different distances between the lavas. As expected, maximum stresses occur at the lavas faces. Stresses in front of K_3 lava are more than 2 times higher than stresses in front of

K_2 lava. In order to establish the effect of coal mining in lower layer's working face on the upper layer's working face, as well as to choose rational distance between simultaneously working faces of pulled together layers, the SSS of array was calculated for the total cycle of production operations (about 3.5 hours) with taking into account the creep of roof and formation rocks.

Working faces are equipped with modern mechanized complexes KM 130, removable power on both layers is 35 w, distance between the layers along the normal is 6.5 m. Inter-layer is composed

of mudstones and siltstones, siltstones lie in the soil of the K_2 layer, mudstones and siltstones lie in the roof of the K_3 layer to a height of 13 m, above previously collapsed and caked rocks from mining of the overlying layer.

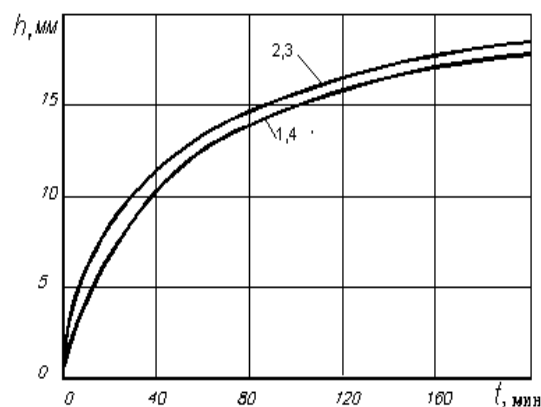


Picture 3 Stress variation in the roof at the face's line at distances between lavas: 1-20 m.; 2-30 m.; 3-50 m.

Physical-mechanical properties of rocks and coal are accepted according to geological exploration. The elastic solution of the problem performed earlier for similar conditions showed that a noticeable effect of chip extraction in the lower layer lava on the distance of the upper layer lava was found at distances shorter than 20 m.

However, the analysis of the SSS array with taking into account creep and fracture [1-3] shows that over time, the mutual influence of mining is more significant. Chip extraction in the lower layer lava at a distance between lavas of 50 m or less within the first three hours leads to an increase in horizontal movements of the face and convergence of rocks in the overlying layer lava. This under certain conditions can lead to a violation of the formation of stability and the bottom hole part of the roof in the lava of the K_3 formation.

Picture 3 shows graphs of the change in vertical stresses over time in fractions γH . From the graphs, it can be seen that with increasing time, stresses continuously increase at a distance between lavas at 20 m, stabilizing at 30 m and decreasing at 50 m. With an increase in the distance between lavas, stresses decrease with time. Horizontal movements of the face, the convergence of rocks in the K_3 layer's face (Picture 4) also increase in time. At the same time, with an increase in distance between lavas, movement of the face decreases noticeably, and the convergence of rocks and vertical displacements of the roof change slightly. The most unfavorable for these conditions is the distance between the lavas at 30 ... 60 m.



Picture 4 Graph of convergence of rocks in the layer's face at distances between lavas: 1-20 m; 2-30 m; 3-50 m; 4-70 m.

Given dependences confirm that movement of the face and vertical displacements of the roof decrease with increasing distance. Analysis of the calculation results, as well as obtained dependences, shows that the optimum distance for these conditions at which there is no noticeable influence of the K_2 lava on the K_3 lava, and the face's state is characterized by the minimum values of the layer deformation and rock convergence can be considered as 70 m.

Obtained results are confirmed by practical observations in a production environment. So, a decrease in the distance between the K_3 and K_2 lavas to 30 m allowed at Kostenko mine greatly complicated the work of K_3 lava, led to an increase in coal extraction in the face, a violation of the bottom hole part of the roof, and the domes' formation. All the main technical and economic performance indicators of K_3 lava sharply decreased, the danger of work increased.

As the calculations show, an essential factor determining mutual influence of the working faces in conditions of simultaneous mining of pulled together layers is also the normal distance between the layers.

Horizontal movement of the face along the K_3 layer increases with increasing distance between the layers to 15 m, and the convergence of the rocks decreases.

Joint effect of inter-layer power and the distance between lavas are taken into account.

Conclusion

Performed calculations make it possible to objectively evaluate the influence of various factors on the formation of the SSS array around the face during mining of pulled together layers, explain the practical difficulties encountered in the lavas' operation, and also provide possibility of such

complications. Based on the completed analysis, to establishing a rational distance between K_2 and K_3 Kostenko mine issued recommendations on lavas under specific conditions of 70 m.

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Жақындатылған қаттар қазбаларының ұтымды орналасуын анықтау

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Түйіндеме. Мақалада келтірілген K_3 қабатының лавасына K_2 қыртысының елеулі әсері жоқ, ал кенжардың жай-күйі қабаттың деформациясы мен жыныстардың конвергенциясының ең аз мәндерімен сипатталады. Алынған нәтижелер өндірістік жағдайлардағы практикалық бақылаулармен расталады. Мәселен, И. А. Костенко атындағы шахтада рұқсат етілген K_3 және K_2 лавалары арасындағы қашықтықтың азаюы K_3 лава жұмысын айтарлықтай қиындатып, кенжарда көмірді сығудың ұлғаюына, шатырдың забойлық бөлігінің бұзылуына, күмбездердің пайда болуына әкеп соқты. K_3 лава жұмысының барлық негізгі техникалық-экономикалық көрсеткіштері күрт төмендеп, жұмыстағы қауіп артты. Есептеулер көрсеткендей, жақындатылған қабаттарды бір мезгілде өңдеу жағдайында тазарту кенжарларының өзара әсерін анықтайтын маңызды фактор қабаттар арасындағы нормаль бойынша қашықтық болып табылады. Қабатаралық қуаттың және лавалар арасындағы қашықтықтың бірлескен әсері ескерілді. Орындалған есептеулер жақындатылған қабаттарды өңдеу кезінде тазалау кенжарлары айналасындағы массивтің кернеулі-деформацияланған жай-күйінің қалыптасуына түрлі факторлардың әсерін объективті бағалауға, лаваның жұмысында туындайтын асқынуларды түсіндіруге, сондай-ақ осындай асқынулардың мүмкіндігін қарастыруға мүмкіндік береді. Жүргізілген талдау негізінде И. А. Костенко атындағы шахтаға нақты жағдайларда K_2 және K_3 лавалары арасындағы 70 м ұтымды қашықтықты орнату бойынша ұсыныстар берілді.

Түйінді сөздер: тау жыныстары, соңғы элементтер әдісі, кернеулі-деформацияланған күй, сусымалылық, бұзылу, деформация, кернеу, қазба.

Определение рационального расположения выработок сближенных пластов

Тутанова С.К., Тутанова М. С.

Аннотация. Определены рациональные для приведенных в статье условий расстояния, при котором заметное влияние лавы пласта K_2 на лаву пласта K_3 отсутствует, а состояние забоя характеризуется минимальными значениями деформаций пласта и конвергенции пород. Полученные результаты подтверждаются практическими наблюдениями в производственных условиях. Так, уменьшение расстояния между лавами K_3 и K_2 , допущенное на шахте им. И. А. Костенко весьма существенно усложнило работу лавы K_3 , приводило к увеличению отжима угля в забое, нарушению призабойной части кровли, образованию куполов. Все основные технико - экономические показатели работы лавы K_3 резко снизились, повысилась опасность работ. Как показывают расчеты, существенным фактором, определяющим взаимное влияние очистных забоев в условиях одновременной отработки сближенных пластов является также расстояние по нормали между пластами. Учтены совместное влияние мощности междупластья и расстояния между лавами. Выполненные расчеты позволяют объективно оценить влияние различных факторов на формирование напряженно-деформированного состояния массива вокруг очистных забоев при отработке сближенных пластов, объяснить возникающие на практике осложнения в работе лав, а также предусмотреть возможность таких осложнений. На основе проведенного анализа шахте имени И. А. Костенко выданы рекомендации по установлению рационального расстояния между лавами K_2 и K_3 в конкретных условиях 70 м.

Ключевые слова: горные породы, метод конечных элементов, напряженно-деформированное состояние, ползучесть, разрушение, деформация, напряжение, выработка.

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