

АННОТАЦИЯ

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РАЗРАБОТКА ПРОТИВОВЫБРОСНЫХ МЕРОПРИЯТИЙ ПРИ ПРОВЕДЕНИИ ГОРНЫХ РАБОТ В ЗОНЕ ГЕОЛОГИЧЕСКИХ НАРУШЕНИЙ

The relevance of the problem. Coal mining in the Karaganda basin is currently associated with the intensification of mining operations, an increase in the depth of development, the complication of mining geological conditions, the development and implementation of new technological solutions.

The development of high-gas-bearing coal seams in the Karaganda basin is complicated by gas-dynamic phenomena. The greatest danger for miners at present is sudden emissions of coal and gas due to insufficient knowledge of their nature and forecasting capabilities. The danger of damage to people working in the mine by emissions products is exacerbated by the possibility of overturning a fresh jet of air and gas contamination of the mine workings of the site, the wing and the entire mine.

All sudden emissions in the Karaganda basin occurred in areas of geological disturbances and in areas of disturbed coal. This is explained primarily by the fact that coal seams, prone to sudden emissions of coal and gas, are characterized by a complex structure, the presence of low-strength bundles with difficult to predict tectonic disturbance and crumpling, which reduces their stability. Practice shows that only about 10% of geological violations carried out by mining operations are explosive, but at the same time it is possible to predict the violation in advance, at the stage of geological exploration, only in no more than 15% of cases. And therefore, the problem of forecasting tectonically disturbed zones is certainly relevant for mines developing explosive formations.

Despite the successes achieved in the prevention of accidents, which resulted from the work of scientists, researchers and production workers in this direction, the state of the emission hazard in coal mines, as analysis and practice show, requires further theoretical study and practical improvement of methods for forecasting and prevention of dangerous gas dynamic phenomena.

In this regard, the development of scientifically based measures for the prediction and prevention of gas-dynamic phenomena during mining operations in areas with geological disturbances is an urgent scientific and technical problem, the solution of which is aimed at improving the level of safety during mining operations on explosive formations.

The purpose of the work is to establish the regularities of the formation of the stress-strain state of the carboniferous massif between the geological disturbance and the development carried out on the outburst formation to determine the zones of violation of the continuity of the massif and aimed at improving anti-blowout measures on this basis, improving the safety of mining operations at coal mines.

The idea of the work is to numerically simulate the stress state of the rock mass around the workings in the area of disjunctive geological disturbance and the occurrence of a gas-dynamic phenomenon as a consequence of the destruction of the continuity of the massif, taking into account the strength and deformation properties of coal formation and host rocks, the characteristics of the workings and geological disturbance.

The main objectives of the study:

1. Research and study of tectonic disturbance of coal seams and rocks in the conditions of the mines of the Karaganda basin, to quantitatively characterize discontinuous tectonic disturbances within the mine fields.

2. Development of research methods for the regularities of changes in the stress-strain state of a contiguous mountain range in the presence of geological disturbances.

3. Development of a methodology for determining zones of discontinuity of the massif for the development of measures to prevent gas-dynamic phenomena during mining operations in areas of geological violations of numerical simulation.

The research methods used in the work include:

- analysis and generalization of scientific and technical, patent-licensed and literary sources of information in the field of research;
- mathematical modeling of the stressed state of the mountain massif around the mine in the area of geological disturbance;
- methods for solving geomechanics problems using strength theories for a mountain range;
- numerical and statistical methods of data analysis and interpretation;
- construction of the optimal order of drilling wells in order to increase degassing;
- implementation of practical research generalization and analysis of the results obtained.

Scientific provisions to be defended:

1. The regularities of the formation of zones of discontinuity of the contiguous massif, as potential foci of gas-dynamic phenomena, are determined by the interaction of stress fields created by a discontinuous geological disturbance and mining;

2. The size and distribution of the zones of occurrence of sudden emissions depend on the relative location of the conducted mining and disjunctive geological disturbance;

3. The greatest danger of sudden outbursts occurs when the fields of tensile stresses from geological disturbance and ongoing mining are combined (connected).

The reliability of the research results and conclusions is confirmed:

- the correct formulation of research tasks and the use of the fundamental provisions of aerogasodynamics and geomechanics when creating models, the validity of the accepted initial assumptions, research methods and the correspondence of the conclusions obtained when analyzing the results of field mine observations;
- satisfactory convergence of the results of calculations and experimental studies on numerical models for the conditions of the Karaganda basin;
- approbation of work at international, republican and regional conferences, meetings and publications of the main scientific provisions in the open press.

The scientific novelty of the work consists in the following:

- for the first time, the features of the formation of stress fields as a consequence of the mutual influence of natural geological disturbance and technological intervention in the massif by mining are established;
- the possibility of using theoretical propositions of rock mechanics and strength theories for numerical modeling in order to determine potential zones of manifestation of gas-dynamic phenomena, taking into account the presence and location of disjunctive disturbance, is proved.

The author's personal contribution consists in the formulation of scientific and applied problems and research tasks, the development of methods for their solution, personal participation in the implementation of analytical and experimental studies, the development of algorithms for modeling the stressed state of the mountain range around the mine in the area of tectonic disturbance.

The scientific significance of the results obtained in the dissertation work lies in the theoretical substantiation of the formation of conditions for the occurrence of sudden emissions of coal and gas, the development of methods for mathematical modeling of the processes of the stressed state of the mountain massif around the workings carried out in the area of tectonic disturbance, the development of scientifically based methods for preventing gas dynamic phenomena during mining operations in areas of geological disturbances.

The practical significance of the work is as follows:

- in the development of methodological recommendations, application programs that allow us to effectively solve specific production tasks aimed at preventing sudden emissions during mining operations on hazardous formations in tectonically disturbed zones;

- in substantiating the ways of safely conducting preparatory workings in areas of geological disturbances and proposals for correcting the points of regulatory documents in terms of conducting preparatory workings on hazardous formations;

Implementation of the work. The scientific results and practical recommendations developed by the author were used in the development of an "Improved numerical engineering methodology for localization of sites of destruction of the production contour during mining operations on explosive formations in zones of geological disturbances."

Approbation of the work. The main provisions of the dissertation work were reported and approved: at the International Scientific and Practical Conference "Geology in the Developing World" (PSNIU, Russia, Perm, April 18-21, 2017); the International Symposium named after Academician M.A. Usov, students and young scientists dedicated to the 155th anniversary of the birth of Academician V.A. Obruchev, 135- the anniversary of the birth of Academician M.A. Usov, the founders of the Siberian Mining and Geological School and the 110th anniversary of the first graduation of mining engineers in Siberia, Russia, Tomsk, 2018; International Scientific and Practical Conference "Integration of science, education and production - the basis for the implementation of the National Plan" (Saginovsky Readings No. 10), June 14-15, 2018

The dissertation was presented and approved at an expanded meeting of the Department "Development of Mineral deposits" of the Karaganda Technical University (Karaganda, 2022).

Publications. The main content of the dissertation has been published in 14 scientific papers.

Structure and scope of work. The dissertation consists of an introduction, four chapters and a conclusion, 91 pages of printed text and a list of used sources from 98 titles.

The dissertation work was performed at the Department of "Development of mineral deposits" of the Abylkas Saginov Karaganda Technical University.