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GEOLOGICAL PROBLEMS OF THE DEVELOPMENT OF THE DONETS COAL BASIN

Summary. The tasks of geological investigation and exploration connected with restructurisation and further development of   coal-mining industry of the Donets basin are: to modify the structure of explored coal reserves and fundamental investigation for new classification of hard coals which include their genetic characteristics;carrying out hydrodynamical, gas-dynamical and rock-dynamical investigations and with exploring works on gas-coal and coal-gas deposits.

GEOLOGICZNE PROBLEMY ROZWOJU WYDOBYCIA W DONIECKIM ZAGŁĘBIU WĘGLOWYM

Streszczenie. Przedstawiono następujące zadania badawcze i poszukiwawcze, związane z restrukturyzacją i rozwojem przemysłu wydobywczego węgla kamiennego w Zagłębiu Donieckim:
− zmiana struktury istniejących zasobów węgla,
− badania podstawowe dla nowych klasyfikacji węgli obejmujące ich klasyfikację genetyczną,
− poprowadzenie badań nad dynamiką skał i gazów wraz z   prowadzeniem poszukiwań złóż gazu.

The principal characteristics of the gas-coal reserves of the Donets coal basin are the following: relatively low coalbearingness, low technological efficiency of coal exploitation, sufficient amount of explored reserves.

Estimated total coal resources of Ukraine part of the Donets coal basin reveal 101,2 billion tonnes (Bt) (1991). Of these, explored reserves attain 53 Bt (52,4 % of total resources). Explored reserves of coking coals are 16,8 Bt (31,5 %) and explored reserves of anthracites are 8,33 Bt (15,7 %). Explored coal reserves can be subdivided on the basis of seam thickness. Ineffective coal seams with thickness less than 0,8 m contain 42,5 % of explored reserves; subeffective seams with thickness from 0,8 up to 1,0 m contain 23,3 % of explored reserves; effective seams with thickness from 1,0 up to 1,2 m contain 17,8 % of explored reserves and high-effective seams with thickness more than 1,2 m contain 16,4 % of explored reserves.

Ash content varies usually from 8 to 15 %, calorific value - from 30,1 to $36,0 \times 10^6$ J/kg. The factor which essentially reduce the economic viability of coals in the Donets basin is high sulfur content varies from 1,5-2,5 % up to 3,5 %.

In 1997 total coal yield in the basin reveals 70,9 million tonnes (Mt) (comp. 170 Mt in 1987).

The total amount of explored reserves divided into 49 districts for new mine establishment (category "A" of explored reserves) for 98,4 Mt total annum yield and 63 districts for reconstructing of existing mines (category "B" of explored reserves). The low limits of coal reserve assessment vary from 1200 down to 1500 m and attain depth of 1600-1800 m in some explored districts.

Geological coal resources of Russian part of the Donets basin (Rostov-Don region) reveal 22,66 Bt (1995). Of these, explored reserves amount 7,87 Bt (34,7 % of geological resources). Explored reserves of coking coals reveal 0,29 Bt, anthracites - 6,8 Bt. Only 15,5 % of explored reserves occur in high-effective seams with thickness over 1,2 m; they supplied more than 50 % of annum yield which attains about 20 Mt.

The main inconvenience of explored reserves of "A" category consists in strict connection with characteristics of standard mine type. They are following: strictly defined annum yields, very long mine life with demand of modernization, up to 80 % reserves contained in subeffective coal seams. Explored reserves of "B" category are strictly connected with existing mines without consideration of their economic viability.

Geological estimation of methane resources contained in coalbeds and surrounding rocks amount 645,3 billion m^3. Of these, 292,7 billion m^3 contained within the operating mining districts.

The essential problem of methane resources assessment consists in necessity of distinguishing of assessed reserves into categories divided on the basis of the following geological

factors: form of methane presence, type of methane carrier, conditions of methane migration and type of fluid, nonuniformity of reservoir pressure.

The present task of geological investigations ar

1) Determination of geological criteria for distinguish between the existing mines on their economic viability into: a) economic mines which have no necessity of financial support; b) subeconomic mines which should be supported from state budget; c) uneconomic mines which should be closed in the nearest future.

2) To concentrate exploitation from the seams with favorable thickness conditions and remove ineffective and sub effective coal seams from the mining process.

3) To reduce the hazardous environmental and economic (losses of reserves contained in ineffective and subeffective coal seams) consequences of uneconomic mines closing.

For the nearest 10-15 years the main problem is to compensate reduction of coal annum yield connected with uneconomic mines closing. Coal annum yield could be increased by establishing of non-standard shallow (with depth not more than 300 m) mines with effective coal seams.

Such districts for non-standard mine can keep mining supplied with coal reserves for the 10-years period with 100 000 - 150 000 tonnes coal annum yield at each mine. The most distinctive features of such type of mine consist in the following: one or two (not more) exploited seams; the lowest financial expenditures for surface infrastructure, shaft building and underground working; not very long (up to 15 years) life.

For the time until 2012-2015 the most important geological task is to select the most favorable districts among explored areas for establishment of coal mines with deep shafts which attain the depth of 1000-1200 m.

The very important point consists in the real possibility to use opencast mining within the northern, north-eastern and western areas of the Donets coal basin.

New deep mine designed should be based on the following technological and economical ideas which can return mining in the conditions of the Donets basin to the effective way:

- there are several mining districts established within the mine and connected with the main shaft; each of mining districts has economical independence;

- the part of total financial investments which is required for shaft building (about 2/3 of total capital investments) should be supplied from state budget; the part of investments required for development of each mining district within the mine should be supplied by mining companies;

- in the each mining district coal should be extracted from one shortwall face with daily output 2000-3000 tonnes; existing economics require to deny the idea of longwall faces and presence of spare faces;
- service life of mining district should be not more than 10-15 years without necessity of modernization.

To increase effectiveness of underground mining and reduce the hazard of methane presence in workings it's necessary to carry out a procedure of methane removal prior to coal exploitation. The methane of different form of presence is drained from coalbeds and surrounding rocks through boreholes drilled from the surface. This procedure should be carried out (i) 2-5 years before mining; (ii) directly before mining; (iii) during the whole time of mine existence; (iv) after mine closing to reduce the methane content in abandoned mining zones.

Economic consideration of coal deposit first of all depends on its geological characteristics. The quality of the coal(s) is an essential parameter for potential economics of a coal deposits. The quality of the coal is determined by the makeup of original organic and inorganic material of the coal and its rank. Characteristics of coal seam(s) define its specific coal-yield. The main of these are coal seam(s) thickness; splitting; deterioration of seam due to clastic intercalations, ash, sulphur, etc.; dip of coal seam; roof and floor conditions.

In the previous system of exploration the seam thickness strictly determined in advance for which seam should be considered as prospective and which one should not. This determination was spread onto the whole coal deposit for the coals of the same rank. It's necessary to attach the different meaning to seam thickness criterion and use it for checking the regularity of mine district exploitation and for mining taxation distinguished on the basis of thickness conditions.

Conclusions

1) The tasks of geological investigation and exploration connected with restructurisation and further development of coal-mining industry of the Donets basin are:
- To modify the structure of explored coal reserves at the acting mines for selection the most effective coal seams for urgent exploitation. It's necessary to increase the level of exploring information for prediction the underground mining conditions at high yield faces. The prediction of metane-bearingness, active methane removal and its usage as accompanying mineral is very important.
- Carrying out hydrodynamical, gas-dynamical and rock-dynamical investigations for reducing

environmental harm on the abandoned mining districts.

- Carrying out exploring works to supply shallow mines with the reserves.

2) The tasks for gas-coal and coal-gas deposits development are:

- Carrying out the additional exploring works for the micro-reservoirs of coalbed methane on the explored districts, within the mining districts and on the abandoned mining areas.

- To improve the technology of coalbed methane removal and its utilization as an energy material.

- To improve the procedure of sudden gas-coal outbursts on the base of the model of outburst seat which has zoning structure.

3) The scientific tasks for making the mining industry of the Donets basin more effective consist in hydrogeological and environmental investigations and fundamental investigation for new classification of hard coals which include their genetic characteristics. It's necessary to consider a possibility to classify coals on the idea of structural changes during metamorphism. System researches of coalbearing formation of the Donets coal basin provided data for coalbed methane reservoirs and high-effective coal seams with thickness more than 1,2 m.

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Abstract

The principal characteristics of the gas-coal reserves of the Donets coal basin are the following: relatively low coalbearingness, low technological efficiency of coal exploitation, sufficient amount of explored reserves.

The present task of geological investigations in the Donets coal basin are:

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• To concentrate exploitation from the seams with favorable thickness conditions and remove ineffective and sub effective coal seams from the mining process.

• To reduce the hazardous environmental and economic (losses of reserves contained in ineffective and subeffective coal seams) consequences of uneconomic mines closing.

For the nearest 10-15 years the main problem is to compensate reduction of coal annum yield connected with uneconomic mines closing. Coal annum yield could be increased by establishing of non-standard shallow (with depth not more than 300 m) mines with effective coal seams. For the time until 2012-2015 the most important geological task is to select the most favorable districts among explored areas for establishment of coal mines with deep shafts which attain the depth of 1000-1200 m.

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