

A Method for Developing Low-Power Flat and Inclined Vein Bodies by Separate Excavation

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Abstract:

The method of ore extraction by drilling and blasting in low-power shallow and inclined deposits during underground mining of mineral deposits is presented.

Keywords: ore body, angle of incidence, power, rebound, crushing, delivery.

According to the classification of Prof. M.I. Agoshkov, low-power shallow and inclined veins include ore bodies with a thickness of up to 0.5 m and an angle of incidence from 0° to 40-45°. The basis for the separate excavation of ore and rock during the development of low-power shallow and inclined veins is the idea of technological separation of ore and rock flows at the stage of stripping due to the multidirectional rejection of the beaten rock mass during the advanced stripping of the layer of waste rock above (or under) the ore body [1].

It is quite natural that in both cases, a sufficient condition for the implementation of the stripping process is the separation of the drilled volume from the rock mass and its crushing into pieces suitable for delivery and transportation. But the technological efficiency of using the energy of an explosion is determined by various necessary conditions.

When breaking up waste rocks and forming a primary gap, such a condition is the complete release of all the chipped material and its placement in the rock pile outside the boundary of the chipped cutting. When the ore body is broken off, the maximum concentration of the broken material is required precisely within the boundaries of the cutting due to the rejection of the ore mass towards the hanging (or recumbent) side of the cleaning space. In any case, the choice of the parameters of the rebound includes ensuring the solution of two technological tasks:

- crushing and delivery of technologically necessary volume of waste rock horizontally by the force of an explosion (formation of a primary gap);
- crushing with discard in the direction of the roof (or soil) of the vein section within the worked-out cutting (formation of an ore shaft).

Both of these stages are performed within the same rebound cycle and are separated by the use of appropriate deceleration steps, but the methods of choosing rational drilling and blasting passports are different here and therefore will be considered separately from each other.

The values of the three main parameters of the cleaning space in case of multidirectional discarding of the chipped rock and vein mass are related by the following ratios:

$$M = M_{\Pi} + M_{\text{жн}} \text{ и } M_{\Pi} \geq k_p M_{\text{ж}}$$

where: M_{Π} is the thickness of the layer of waste rocks selected during the formation of the primary gap, m;

k_p - taking into account the increase in the perimeter of this ore body due to small-scale bends of its surface, i.e. due to the complexity of the shape of the external contours of the ore body.

Then the thickness of the layer of waste rocks beaten off during the formation of the primary gap will be:

$$M_{\Pi} \geq 1,121 k_p m_z.$$

where: m_z is the average geological thickness of the vein, m.

The implementation of the idea of multi-time stripping of ore and rock during vein excavation is possible in two versions [2,3]:

- 1) with the location of the vein in the hanging side of the cleaning space (Fig. 1a);
- 2) with the location of the vein in the recumbent side of the cleaning space (Fig. 1b).

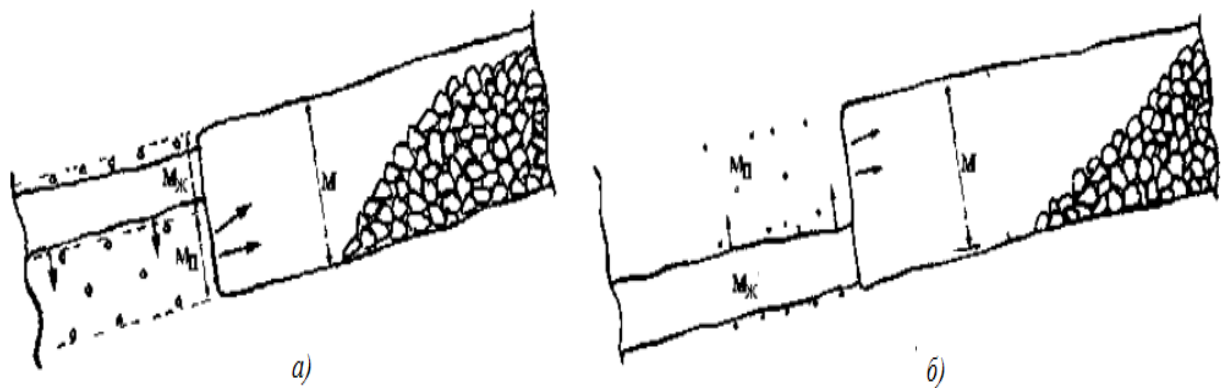


Fig.1. Various options for the location of veins in the face

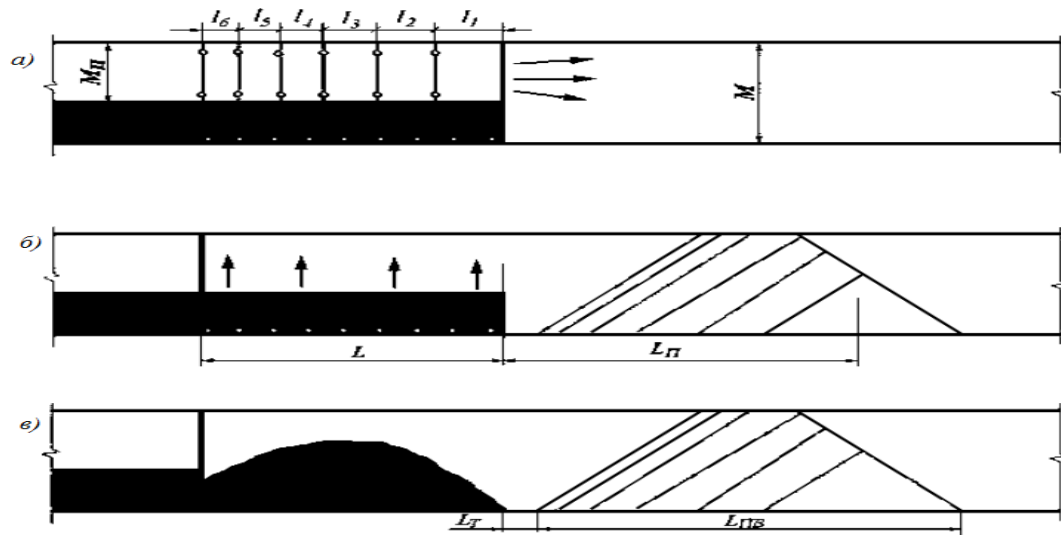


Fig.2. A diagram explaining the sequence of operations for separate excavation

a - before the start of the cull; b - after the cull of the rock; c - after the cull of the vein

Methodically, the task of forming a primary gap is similar to the option of gross ore extraction with explosive delivery elements. A distinctive feature of the variant with a separate excavation is that the discarded waste rock is discarded within the developed space of variable height. If the volume of rock recaptured by the first row of wells moves completely in the purification space with a height of M (Fig.2), then during the explosion of each subsequent row, an increasing part of the trajectory of explosive delivery of the recaptured ore is located within a narrower gap, with a height of $M_n = M - m$. This increases the resistance to movement and requires additional energy consumption.

List of literature:

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