

## EUROPEAN EXPERIENCE OF RAW MATERIAL COMPLEX USAGE WHILE MINING NATURAL FACING STONE

**Introduction.** In Zhytomyr region natural facing stone is mined by open-pit techniques and it is used as raw material for construction and ritual items. Deposits of construction and ornamental facing stone are distributed unequally within region. Nine sites for mining and processing stone are established in Korostyshiv, Volodarsk-Volynsky, Zhytomyr, Cherniakhiv, Korosten, Malyn, Ovruch, as well as Olevsk and Radomyshl districts. Isometric stone is extracted from 100 deposits of Zhytomyr region. It is mined in horizontal layers with systematic deepening of mining works. According to the projects, the quarry depth is to be about several tens of meters deep. Such mining waste as overburden or substandard rock is kept into external dumps. Waste dumps are usually placed at a distance from several tens of meters to several hundreds of meters from the quarry. Fertile lands disturbed after mining exceed by 2 times the area of quarry fields, thus they are considered as non-agricultural lands. Considering the total area of lands disturbed by open-pit mining, facing stone quarries take the second place after iron-ore quarries. Along with economic losses after deposits mining, the environmental situation is also worsening.

**Aim and methods.** Uncontrolled usage of recourses when low-waste and non-waste technologies are weakly implemented can cause large amount of wastes on different stages of raw material mining and during marketable production. In major cases the amount of waste exceeds the product yield. Just 25% off the total mining mass can be classified as an end product; the rest is waste which is put into dumps.

Waste dumping is a technological process of placing overburden rock and waste for storage after open-pit mining. A heap on the surface of mine territory where barren and substandard rock is placed (is extracted in the process of mining) is called dump.

All dumps at open-pit quarries should be classified according N.V.Melnikov (Table 1).

Table 1

*Dumps classification for open-pit mining*

Classification feature	The type of dumps
according to the placement	external (outside the quarry contour) internal (in worked out part of the quarry)
according to the number of working dump horizons	single-layer multi-layer
according to the dumping works mechanization	plough excavator bulldozer conveyer vehicle (unloading on a slope)
according to the number of quarry horizons which are exploited	entire (group) separate
according to the relief of the area under the dump	flat upland upland-plain
according to the dump deformation	stable movable unstable
according to the type of rock transportation to the dump	railway vehicle conveyer

This classification can be applied to define the type of the dump while working out quarries of natural facing stone. Types of waste dumping are chosen according to the conditions of subsoil deposits, the relief, as well as rock characteristics and the type of transportation.

Dumps should have enough capacity and be at the minimum distance from the place of loading. They cannot be situated on the mining area and should not hinder mining works in the quarry. Dumps are formed taking into account safety requirements and environmental protection. It is also important to consider further recycling of dump materials.

Research study shows that almost 100% of igneous non-metallic rocks are worked out with further storage of overburden rock and waste after processing in external dumps and storages. 22 – 50% of the total area of mining enterprise are usually planned for dumps and transport communication. Lands disturbed by external dumps and waste storages are reclaimed by forestation.

As a rule, technological processes of block facing stone production are not directed on a complex use of raw material but on a selective use of its components. Stone mining and its use is not performed rationally. Quarry dumps contain substandard rock the processing of which by technological schemes known at the moment of the deposit development was economically inefficient, or the consumers of the dump raw material were absent at the moment. Modern level of technologies allows efficient use of raw material with lower parameters. Thus, it is an important problem that dumps contain substandard rock which is not the object of production. Of course, such process of stone mining causes accumulation of a considerable amount of industrial waste.

Statistic data show that the volumes of planned mining waste by business entities in regions of Ukraine have the tendency to increase and accumulate. Exploration and classification of anthropogenic deposits do not take into account the fact that storage of waste is performed today but the waste usage can be performed in the far future and it will consider the demand for mineral raw material, as well as the improvement of technology for processing natural resources, and calling for new standards.

The most widespread type of waste dumping while mining block stone is terrace dumping. But from the point of view of waste stone usage and processing, terrace dumping is not rational, as far as chaotic blocks placement makes the dumps working-off inefficient, thus, it complicates the work of equipment for further processing of dumps. From the point of view of a complex use of raw material, purposeful storage is the best type of waste dumping, notwithstanding its self-cost. In future, substandard blocks from anthropogenic deposits can be used as a secondary raw material.

Thus, purposeful storage of rocks can help to use minerals efficiently, to reduce environment disturbance and to solve the problem of raw material recycling while developing facing stone deposits.

In general, the technology of mining natural stone with separate storage of secondary raw material and industrial waste from the beginning of mining area working-off and without disturbance of other land areas by dumps is not developed and substantiated enough.

**Conclusions.** Taking into account mentioned above, the technology of separating dump areas into zones is offered. According to the technology, following usage of substandard raw material for production of paving blocks and crushed stone material can be performed.

Production of paving blocks and crushed stone material raises the percentage of subsoil usage and broadens the product nomenclature for stone mining enterprises; in its turn, it can raise techno-economic indices of such enterprises.

But offered technologies of raw material and industrial waste complex use are not implemented because of existing enterprise management and economic inefficiency of these technologies. That is why, technological solution of the problem of waste management implies implementation of European technological and technical methods which can raise economic efficiency of waste management and utilization.