PROCEEDINGS OT THE XI-TH NATIONAL CONFERENCE WITH INTERNATIONAL PARTICIPATION OF THE OPEN AND UNDERWATER MINING OF MINERALS

НАУЧНО-ТЕХНИЧЕСКИ СЪЮЗ ПО МИННО ДЕЛО, ГЕОЛОГИЯ И МЕТАЛУРГИЯ
SCIENTIFIC AND TECHNICAL UNION OF MINING, GEOLOGY AND METALLURGY
НАУЧНО-ТЕХНИЧЕСКИЙ СОЮЗ ПО ГОРНОМУ ДЕЛУ, ГЕОЛОГИИ И МЕТАЛЛУРГИИ

PROCEEDINGS

OF THE XI-TH NATIONAL CONFERENCE WITH INTERNATIONAL PARTICIPATION OF THE OPEN AND UNDERWATER MINING OF MINERALS

June 19-23, 2011
International House of Scientists “Fr. J. Curie”
Varna, Bulgaria

TECHNOLOGY OF EXPLOITATION FOR ONYX STONES WITH DIAMOND WIRE SAW AND PILOW SAW MACHINE IN THE OPEN PIT QUARRY "MANASTIR" , PRILEP

Prof. dr Risto Dambov[1]; MSc. Goran Stojkoski[2]; BSc. Zoran Kostoski[3]; Igor Stojkoski[4]
[1] University "Goce Delcev", FPTN, Insitute for Mining, Štip, R. Macedonia, E-majl:risto.dambov@ugd.edu.mk
[2], [4] Bela Pola Mine - Larin company, Prilep, R. Macedonia, E-majl: gstojkoski@larin.com
[3] BSci., Marmo bijanco Company, Prilep, R. Macedonia, E-maj: kostoskiz@yahoo.com

ABSTRACT

In this paper work are given some aspect of the exploitation of dimension stones - onyx in open pit quarry "Manastir" near Prilep town.
In short, we have set up the parallel of the existing equipment in some querries and will be describe the technology of exploitation of dimension stones, dumping of strips and the devices. The paper will also give an account of latest equipment used in quarries.
In excavation (exploitation) of stone blocks (onyx) is one of the most important operations. Various devices and techniques are used depending on the kind of the mine, the capacity, properties of stone blocks and the efficiency of the equipment used in the quarry.
At the moment the exploitation of dimension stone are in use more different methods and techniques for turning down of strip.
The manufactures of this equipment have a lot of different products but which of techniques will be use depends of character of the open pit quarry, capacity and physical - mechanical characteristics of dimension stone.

KEY WORDS: dimension stones, onyx, exploitation, production, cutting, lamelae

1.0 Introduction

Although relatively with small area Republic Macedonia is rich with a lot of different mineral resources dimension stone blocks for the architecture, that make some major part of Macedonian mining industry.

More significant research works to define the larger reserves with dimension stones , diferent origin and quality.

Today is made lot of numerous geological researches, mining research activities to a smaller extent and be established the new mineral fields with economic significance. All of this activities contribute to create conditions for development of mining industry as an important segment in the overall economy of the Republic of Macedonia.

The rapid expansion in exploatation and processing of architectural - dimension stone over the past years in the R. Macedonia, particulary in the region of Prilep, had as a result to open lot of small quarryes for white marbles, granites, onyxs etc. at the present time.

These raw materials are almost with various entities throughout the territory of Macedonia and a large number of different quantitative and qualitative characteristics.

They represents a potential raw materials and stones for the development of small quarries, small businesses for processing and shaping, which is have already been proven and in previous decades. With relatively small investments, limited resources and rapid turnover of the capital for several years, in these existing facilities are established stable low capacity, high quality raw materials and teams succeed for management and appearances on local and world market.

Especially here invoked the large number of low capacity for receiving and processing different types of marbles, igneous rocks of technical stone, and especially set as acquiring queries and processing of decorative white marble, with high quality with trade mark.

The Westren Macedonian zone is present as several formations. The geological coposition made possible the occurrence of number of rocks that can be used as architectonical - dimension and dekorative stones such as: marbles, granite, gabbro, basalt, travertines, onyxes etc.

One of lot of querryes for extraction architectural and decorative dimensiot n stones is open pit querry Manastir wich is which is developed into a modern open pit mine to obtain a quality blocks of onyx.

This stone from Prilep is an important row material - a base for the development of numerous open pit mine, small quarryes and procesing plants and lot of modern factory.

2.0 Methods of Technological process

In this paper is describe the methods for obtaining onyx blocks in the Manastir open pit quarry.

The first method which describe is use of diamond wire and cuting machines (Jet Belt). The paper shows figures of way to make cuts which are obtained after the methods.

Extraction of onyx blocks from the hard rock mass is done with cominations: with cutting machine and diamond wire.

Benches in the open pit are 6m high. The height is conditioned by the structural-tectonic characteristics of the massif, and the technical characteristics of the machinery used during excavation. The height (1/2H) is also in favour of the dimensions of the final product - commercial blocks in size.

2.1 Block excavation by the use of Diamond wire saw

The cutting of lamellae with a diamond wire saw is done with two cuts. The first, the dimensions 6.0x1.7m is done from the rear side and the second, the dimensions 10.4x1.7m, is done horizontally along the bottom (fig. 1).

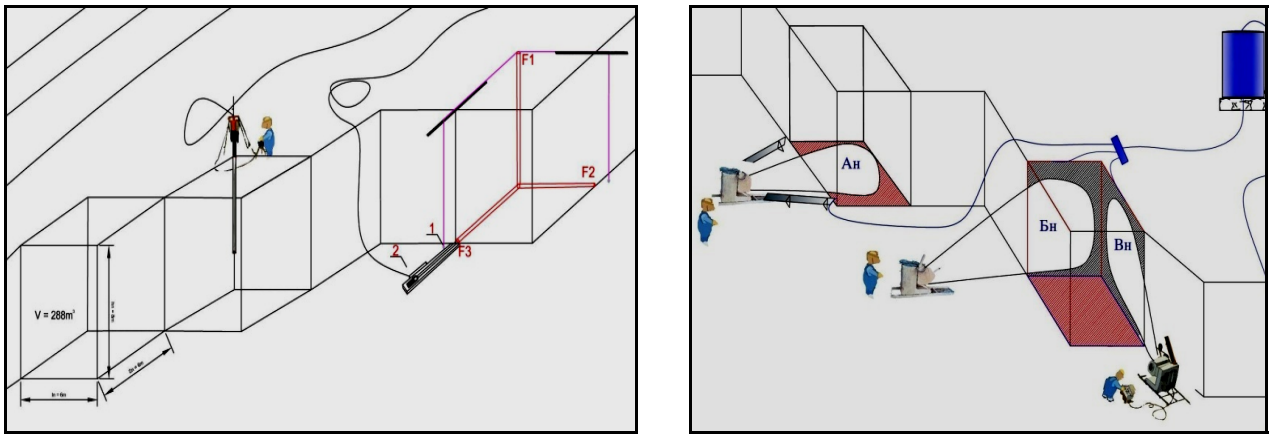


Figure 1 Preparing of drillholes for cutting,(a) Cuting of horizontal (An) and vertical (Bn) cuts with diamond wire (b)

The Benetti PP 630 type perforator drilling machine is used for prepare the vertical and horizontal drill holes the diameter of 76 mm.

The vertical and horizontal drill holes should have the same direction to allow easy connection of the diamond wire saw.For the horizontal cut it is necessary to perform two horizontal drill holes - the first 1.7 m long and the second (normal to it) 10,4 m. long.

The diamonds wires saws machines which in use are: "Marini mini fil", and "Diamond board " type.

The machine “MARINI MINI FIL“ is with power of 15 KW and with this installed power this diamond wire saws machine can make cut in length from 10 to 15m and the effect of cutting is 6 - 10 m^2/h.

With this machine are preparing cuttings the flat surfaces of a rectangular shape, vertical and horizontal regarding of the work floor. (Fig. 1) The regulation of tightening diamond wire saw is automatic.

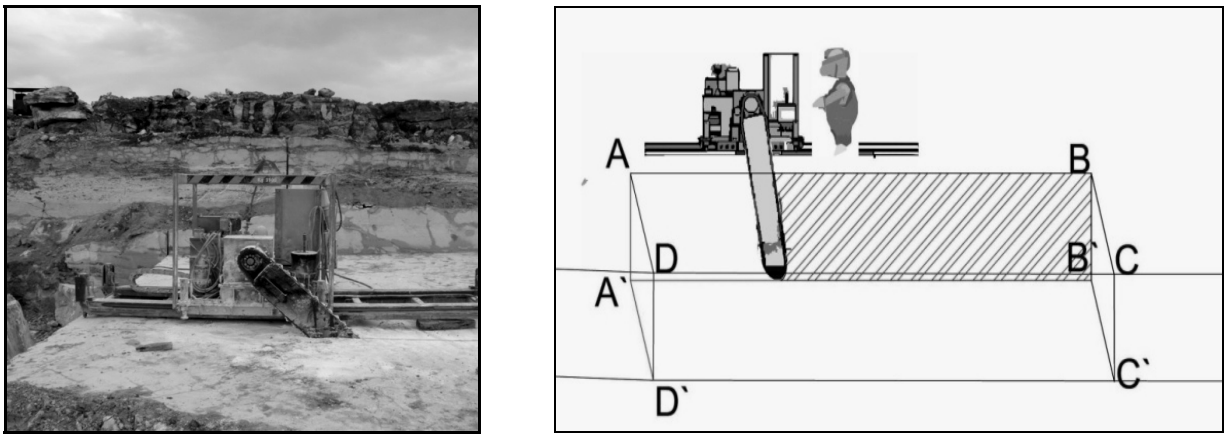
2.2 Use of cutting machine type "FANTINI 50.90"

Block excavation by the use of chain saws (cutting machines) is very effective technical and methods of obtaining blocks is applied to doing vertical (face and frontal) and horizontal cuts.

The cutting of lamellae with cutting machine is done with one or two cuts and combine with diamond wire saw. In Figure 2 is done some ways to prepare cutings with this techniques.

This machine is used for making vertikal and horizontal cuts in a massiv, the construction of channels for opening and development of floor plans - working benches. The power is electric, and with own rails with lenght more than 10m.

Cutting width is 38 mm and the working effect is 4m^2/h. The work of this machines can take place independent of one each another.



a. b.

Figure 2 Cutting machine "FANTINI 50.90" (a), cutting one frontal cut AA'- BB' (b)

3.0 Preparation of cutts for new floor and benches

This technology is for preparation of vertical and horizontal cuts with two diferent machines in combination: diamond wire saw machine and chain saws (cutting machine) - Fantini.

In this way can prepare two trenches with "V" and "U" profile.

For preparation of "V' profile is necessary only one vertical drillhole with Φ90mm and two horizontal drillholes with Φ 36mm. (Fig. 3)

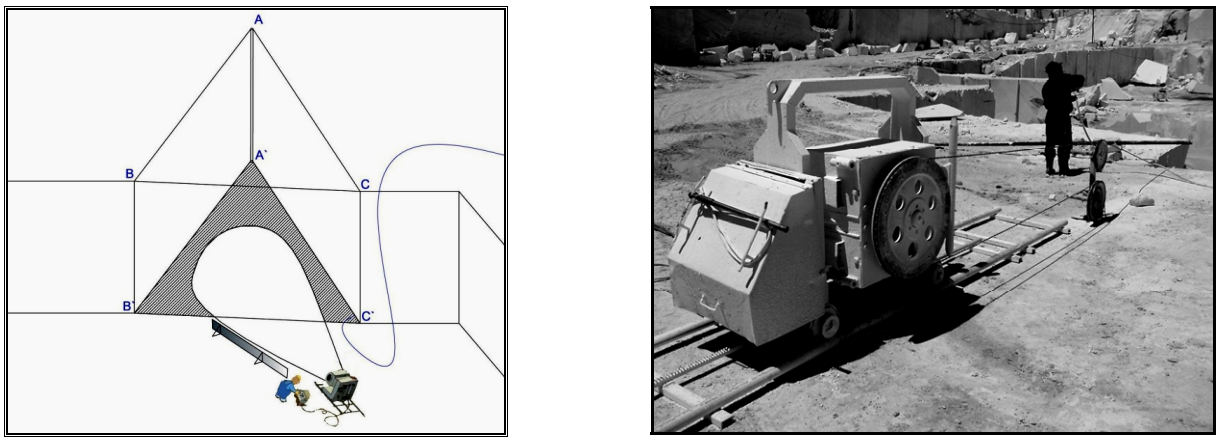


Figure 3 Praparation of cuts for "V" profile with diamond wire saw

Once you develop a channel is accessed towards the work on the working bench. The way of develop in the bench are given in figure 4.

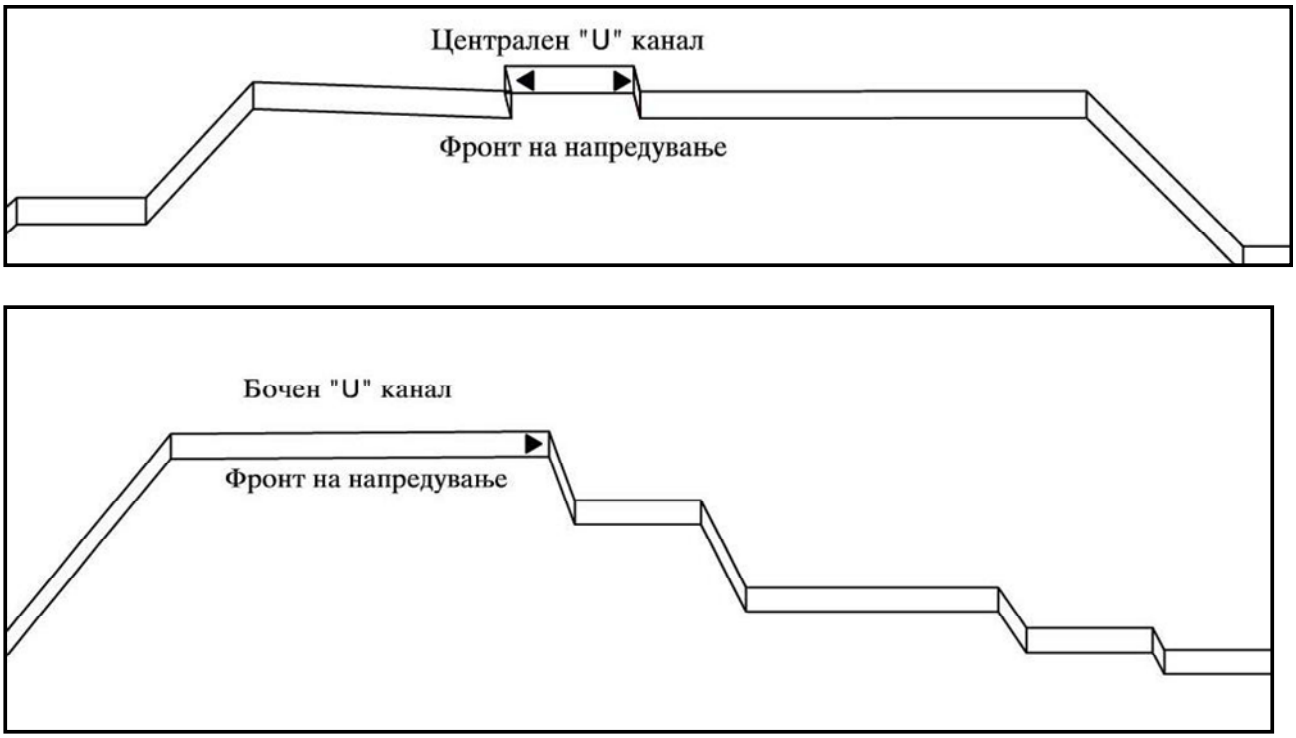


Figure 4 Development of working benches

3.1 Getting lamellas from working bench productive

On start are prepare dimensioning and measurement of lamellas, than making the drillholes (vertical and horizontal) and prepare cuts with diamond wire saw (Fig. 5).

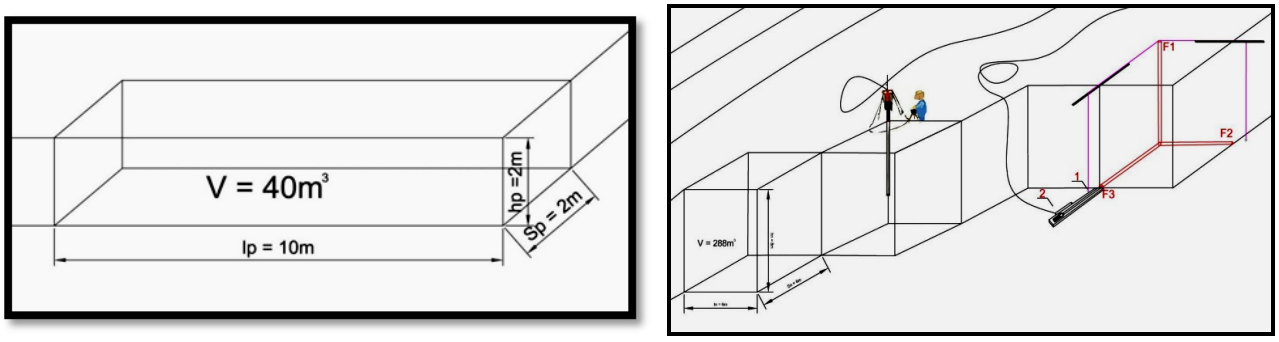
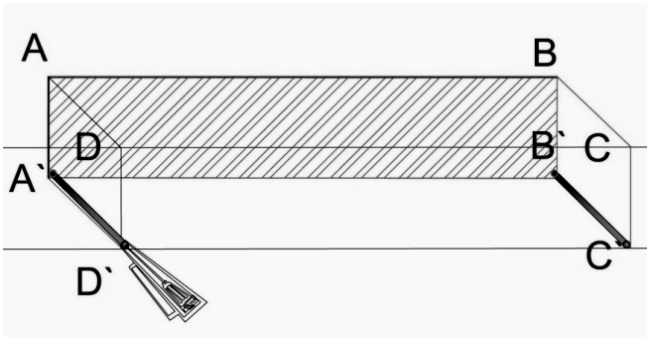
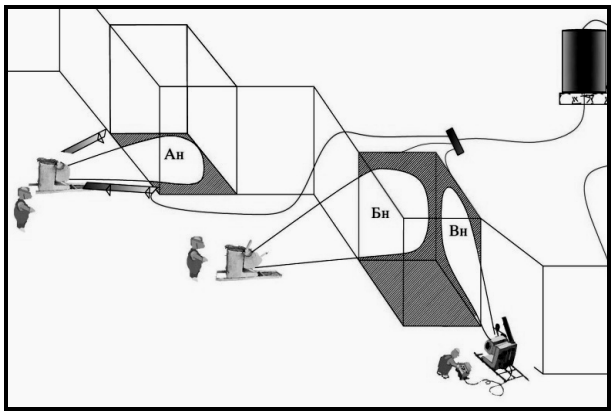


Figure 5 Dimensioning of lamellas and prepare of drillholes

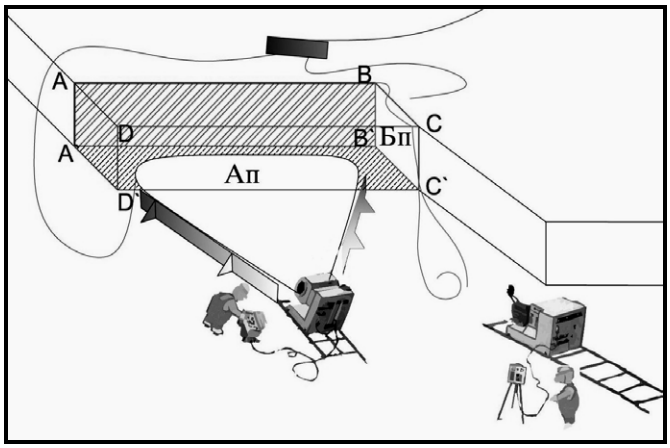
Getting the lamellas from bench takes place in several stages or phases. (Fig 6) . All phases are given in the figure 6.

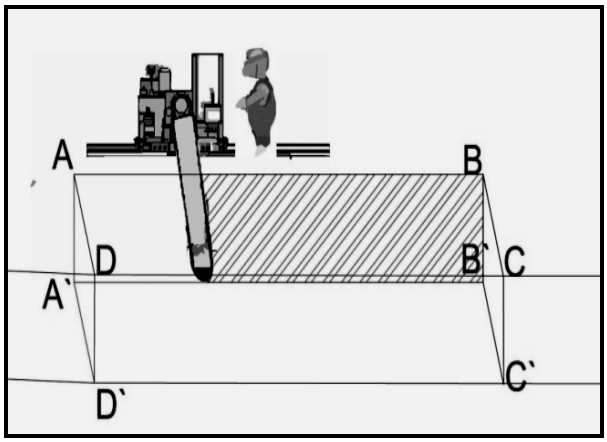


I phase



II phase





III phase

Figure 6 Phases for getting lamellas from productive beches,

I phase - frontal vertical cut and horizontal (vertical) drillholes, II phase - vertical and horizontal cuts with diamond wire saw, III phase - cuts with chain saw machine or diamond wire saw

3.2 Dimensioning of Lamellae Obtained

The dimensioning of lamellae according to dimensions needed for further processing or commercial use is done with hand drilling machine by drilling vertical drill holes with small diameter (28 - 32mm) and hydro blasting detonating fuse and water. Holes are drilled at 20 cm distance. Extraction of a block the dimension 3,0x1,7m from the lamellae knocked down is necessary to perform horizontal and vertical holes.
Anmother way to obtain the small cometcial block from turnnig lamelae is to prepare vertical drillholes with drill machine directly to the blocks.

3.3 Turned over down of lamellas (large strips)

The strips is turned over (laid) on the base made of small and soft material. For this operation are in use more technics and equipment.
After cutting all surfaces the block or large strips is separated and turning down with special equipment.
Separation of the blocks are with hydraulic cylinders, special pneumatic cushions or hydraulic metal cushions. (Fig 7).

After separation og the block from massive the final turning down of the lamellaes is with hydraulic loader or hydraulic excavator. (Fig .8)

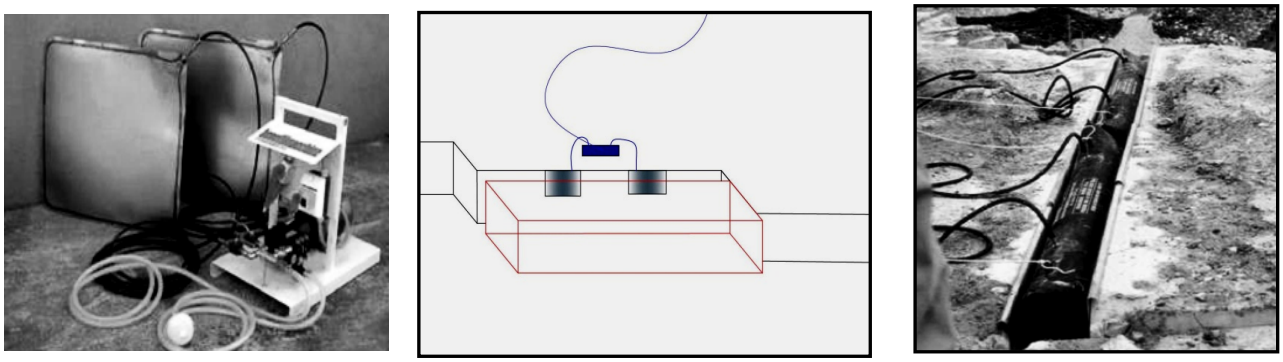


Figure 7 Air and hydraulic cushions and way of use

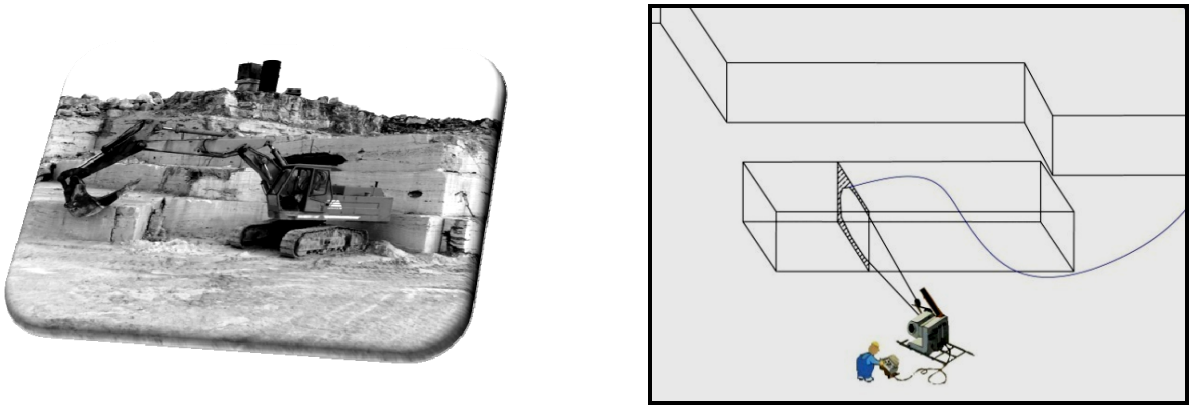


Figure 8 Hydraulic excavator in work and cutting of lamelas to small comercial blocks

In the open pit query "Manastir" most common way of support for the first and finally topple used hydraulic excavator. (Fig 8).

In order to apply this technology to finally topple if the lamella is necessary to dis clean place where to will be working set excavator (of hose, fuse, cable, etc.) and working planum be sufficiently {wide (extended) for the movement of hydraulic excavator.

Conclusion

The use of diamond wire saw, cutting machines in extraction, exploitation of blocks (dimension stone) are very specific and effective operations.This technology is non -invensive, quiet, with no noise, vibrations and dust.

This technology with use diamond wire saw and chain saw machines to getting onixis comercial block is flowering due to the good results and effects of its use nad the attention paid to traditional methods of exploitation of this decorative stone. The technology is widely used in all kinds of surface open pit querries. This methods for obtainnig blocks of onix with relatively small benches ((6m) are in use only in this querrie and if we see the level of recovery and the percent of getting comercial blocks, we can concluse that this technology is very effectivnes with more than 80 % level of recovery.Large blocks can be excavated easily, that makes possible maximum recovery of this stone for final products in terms of dimensions, design, kinds of primary and final processing.

References:

[1]. Major Mining Projects for the exploitation of the dimension stone onyx from "Manastir"- querry, 2001, Vitoliste, Prilep, R. Macedonia

[2]. Dunda, S., (1995), Technological process of open pit excavation of dimension stone of carbonate origin CLEANTECH, Zagreb, Croatia.

[3] Montani Carlo, (2009), STONE 2009, World marketiong handbook, Faence Editrice, Milano, Italy

[4] KAMEN & STONE, (2005, 2006), Journal of macedonian stone industry, No 1,2 and 5, Prilep, R. Macedonia