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THE IMPACT OF EXTRACTION ACTIVITY ON THE ENVIRONMENT QUALITY

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ABSTRACT. For the valorization of the mineral deposits are necesary different operations. The result of the extractive process is the useful and useless rock. Each action who compose the extractive activity produce the inorganic mineral pollutants: sedimental powders, gas dispersoids and reactive or inert pollutants. In this work are presented the important aspects of the impact over the environment generated by the extractive and handle process of the granite deposit.

ВЪЗДЕЙСТВИЕ ВЪРХУ ОКОЛНАТА СРЕДА ПРИ МИННО-ДОБИВНАТА ДЕЙНОСТ

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РЕЗЮМЕ. За поддържането на цените (валоризация) на минералните находища са необходими различни регулаторни дейности от страна на държавата. Като резултат от минно-добивната дейност е получаването на полезен продукт и отпадък. Всяка дейност, която е свързана с добива на минерални суровини води до замърсяване на околната среда с различни вещества от рода на прахообразни утайки, вредни газови емисии, реактиви или инертни замърсители. В доклада са представени важните аспекти на въздействието върху околната среда при дейности, предизвикани от минно-добивни работи и при експлоатацията на гранит-съдържащи залежи.

Introduction

The environment represents a unitary and complex system, composed of a great number of elements and connections, bearing a significant capacity for inherent regulation and where the active factor is symbolized by human communities performing their activities and displaying their concerns. The basic elements of the environment are rendered by soil, water and air, as they constitute the material support for the entire integrated system. The activity of useful rocks extraction is executed within the open-pit mining (surface working), respectively in quarries and pits. For drawing of some mineral substances or useful rocks which are less encountered and thus greatly valued it is resorted to further open-pit mining together with deep workings. No matter the method applied, deposit refinement would need various and numerous operations which result, on the one hand in useful mineral substances and on the other hand, the sterile mass extracted from earth. The greater the quantity of extracted and processed rock, the bigger the amounts of pollutants released into the atmosphere, different noxious substances resulted from explosive mines bursting, rock particles in suspension or which shall remain in the soil as a deposit. At the same time, the amounts of residues resulted from the refinement shall also increase so that the quarry's activity would exercise various influences on the environment which cover all stages of technological exploitation and refinement processes (Fodor and Baican, 2001).

Identification of potential sources causing pollution and the estimation of their impact on the environment

The mining lease Bratcu-Meri covers a surface of 0,217 sq km identified by the National Agency for Mineral Resource, located in Gorj district, along the banks of Bratcu watercourse, on the right slope of Jiu Valley, at approximately 5 km in the Northern area of Bumbesti-Jiu locality and about 22 km in the Southern area of Petrosani town. The granite deposit from Bratcu-Meri represents a massive deposit which displays throughout its extension a constant measurement of its petrographic, mineralogical and spatial parameters.

Pollutants released into the atmosphere and measurement for emissions reduction

The air pollution sources within Meri Quarry are considered as fixed (stationary) artificial pollution sources, admitted in the category of pollution sources resulted from the industry of construction materials. The operations connected to technological flow which constitute air pollution sources are: bursting extraction, crushing, loading of rocks in motor trucks, the transport of rocks by means of vehicles to selecting-washing station, discharging of rocks at the sorting hopper, the operating of machineries in the quarry, the operating of machinery within the granite refinement stations (crushers, feeders, graders, discharging points for conveying belts, charging openings in bascules from the storage pits), the operating of equipments from the delivery deposit (conveying belts, auto-chargers). Besides these operations, another air

pollution source is constituted by the gas-oil distribution point existing on the emplacement.

Bursting extraction determines the evacuation into the atmosphere of noxious substances resulted from the explosives detonation and rock particles with a wide dimensional spectrum. The particles bigger than 20 mm are rapidly deposited into the soil, and the particles having smaller sizes are dispersed into the atmosphere on big distances and they are retrieved as suspension particles.

Table no 1 indicates the weight rates of main pollutants released into the atmosphere as a result of the activities performed at Meri Quarry.

In order to assess the impact on atmosphere quality due to radiated pollutants during detonation, the maximum concentrations and the moments for reaching them have been calculated in two points located at 100 m and 500 m from the source, for the scenario which involves the usage of the bigger dynamite amount. Tables 2 and 3 show the minimum and maximum values of maximum concentrations and of the moments these concentrations are reached. The minimum values of the biggest concentrations of pollutants shall appear within a very unstable atmosphere with a wind velocity of 1m/s.

Table 1
Emissions of pollutants disposed into the atmosphere

Source	Mass unit	Weight rates						
		Particles			CO	NO_x	CH_4	H_2S
		≤ 30 μm	≤ 20μm	≤ 10 μm				
Detonation 25 kg dynamite	Kg/det	55.66	41.75	28.94	0.800	0.250	0.018	0.400
Detonation kg dynamite	Kg/det	55.66	41.75	28.94	1.600	0.500	0.036	0.800
Detonation 100 kg dynamite	Kg/det	55.66	41.75	28.94	3.200	1.000	0.072	1.600
Loading	Kg/tranche	10.53	0.066	0.049	-	-	-	-
Crushing	Kg/day	4.38	4.29	4.2	-	-	-	-

Maximum values appear into the less stable atmosphere for the point located at 100 m distance compared to the source and within the very stable atmosphere for the point located at 500m from the source and a wind velocity of 2m/s and respectively 1 m/s. The duration for achieving maximum concentration values resulted above is expressed in minutes.

Table 2
Maximum concentration for particles disposed into the atmosphere

Pollutant	100 m				500 m			
	Maximum concentration (mg/ m^3)		The moment of reaching maximum concentration (min)		Maximum concentration (mg/ m^3)		The moment of reaching maximum concentration (min)	
	Min Value	Max Value	Min Value	Max Value	Min Value	Max Value	Min Value	Max Value
Particles ≤ 20μm	1.960	69.597	7	15	0.053	15.535	9	16
Particles≤ 10 μm	1.359	48.243	7	15	0.036	10.769	9	16

Table 3
Maximum concentration of gases disposed into the atmosphere

Pollutant	100 m				500 m			
	Maximum concentration (mg/ m^3)		The moment of reaching maximum concentration (min)		Maximum concentration (mg/ m^3)		The moment of reaching maximum concentration (min)	
	Min Value	Max Value	Min Value	Max Value	Min Value	Max Value	Min Value	Max Value
CO	0.150	5.334	7	15	0.004	1.191	9	16
NO_x	0.047	1.667	7	15	0.001	0.372	9	16
H_2S	0.075	2.667	7	15	0.002	0.595	9	16

The average concentrations for a 30-minute period of particles released into the atmosphere due to emissions resulted from the crushing and loading of rocks in vehicles display the following maximum values estimated at different distances from the quarry location (table 4).

The maximum concentrations of particles in suspension emerge into the atmosphere characterized by various degrees of thermal stability (from a little stable concentration to a very stable one) with feeble wind (v = 1m/s). From data obtained it is ascertained that it might be possible that the values of suspension particles' concentrations would exceed the maximum concentration admissible for distances up to 350 m from the quarry working points.

Table 4
Average concentrations of particles into the atmosphere

Pollutant ($\mu g / m^3$)	Distance (m)						
	50	100	150	200	250	300	350
Particles ≤ 20 μm	1934.8	1502.2	1453.2	1129.8	950.6	847	1642.2
Particles ≤ 10 μm	1731.8	1354.4	1300.6	1010.8	972.8	758.8	618.8

The measures for emissions' reduction are taken with a view to decrease the powder formation by means of special devices and optimization corrections within different productive stages, preparation and exploitation stages (Rojanschi *et al.*, 1997):

- devices for powder control through suction;
- humid working cycles ; maximum efficiency of drilling installations;
- proper dimensioning of explosive charges and detonation schedule;
- use of transport by means of isolated and covered bands;
- avoidance of powerful breakage of material;
- reduction of natural erosion in ash pits;
- surfaces drainage.

The limitation of emissions supposes a high degree of information with regard to variables influencing the dispersion of pollutant agents, especially local meteorological conditions and could be achieved by means of creation natural vegetable barriers acting as a filter against powders and by means of localization of pollutant agents within self-protection areas (Tumarov, 1989).

Soil Pollution. Measures for reducing the impact of extraction activity on soil

The soil, through its fundamental quality of basic environment for plants' life and a source of vegetative productivity, remains one of the most valuable natural goods of human society. Soil degradation is closely related to man productive activities. Under natural conditions, unaltered by human actions, the soil does not undertake any form of degradation because the substances which emerged following the interaction of environmental factors are cyclically used, thus imposing a limit to conservation possibilities of various residues and slime, under the form of deposits (Tomescu *et al.*, 2003).

By performing the granite extraction activities at Meri Quarry, the soil is being affected through:

- uncovering and excavation works for ground works (rocks layers) which are to be found above the granite layer resulted from the landfall of big land surfaces;
- modification of geomorphology of lands situated in the vicinity;
- the influence upon the quality of productive potential for the occupied surfaces and, to a less significant extent, for the surrounding ones.

Subsequent to operations involving rock disruption and ballast exploitation the soil is affected through digging and the transport of extracted material in the area. These activities do not have a chemical action on soil, but they affect it physically, that is, they involve shape modification.

In order to establish the interventions for reduction of extractive activity impact on soil and subsoil, geo-mechanical and geo-technical research are needed to stand at the foundation of exploitation project and environmental recovery of the quarry and adjacent works. Such studies should conduct, in the first place, to thorough knowledge of the morphological and hydro-geological situation and of the endurance characteristics of rocks to be further used. Within the execution operating phase, the need might appear, depending on the assessed risk level attributed to potential phenomena of instability, to schedule and execute a control plan for the evolution of these phenomena, for the checking of effectiveness during the engineering works in order to avoid landfalls (Laslu, 2003).

Conclusions

Mining industry imposes the execution of some complex activities, each of them constituting modification elements which interrupt the continuity status of the environment.

Extraction produces obvious effects when it is executed by means of explosive, resulting either in sonic pollution, either in the emission of big powder amounts which cause significant damages on the vegetation existing in the neighboring areas. The extraction by means of mechanical equipments produces a sonic pollution due to machinery being operated (permanent noise).

Deposit uncovering constitutes an activity which bears a destructive character with correspondence in the excavation of vegetal soil and vegetation and having possible repercussive effects on the habitat and local fauna. This effect falls into the extremely serious range in the case of natural environments classified on the valuable natural scale.

The quantitative assessment of the effects of extraction activity on the natural environment components (vegetation, floral vegetation, fauna, and ecosystem) is very complex and is due to spatial and temporal interdependence of different factors.

Generally, it is important that exploitation and recovery should be executed subsequent to a well established project, based on a real study of environmental issues within the territory on which the extraction activity is being performed.

Recommended for publication by the Editorial board

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