Study on the impact of granite exploitation on the environment

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Abstract: The granite exploitation activity in Gorj county is done in four quarries: La Brazi-Novaci, Porceni Pleșa, Peștișani and Călugăreni Padeș. For each quarry, is presented the location in the environment, the geographical location, the quarry hydrography, the physical-mechanical characteristics of the deposit, the zone climate and the soil characteristics. To point out the impact produced by the granite exploitation on the environment, it is presented the activity done in the granite quarries, the operating flow of the granite and the physical, mechanical, chemical characterization of the deposit. The carrying on the activity, by two major aspects, the deforestation of the forest vegetation and the proper operation, produces an impact on water, air, soil and subsoil, on biological environment and on anthropogenic environmental. The global assessment of the produced impact, is based on a matrix that correlates the activity of the deforestation of the vegetation with the produced effects on the environment compounds and allows the assessment of the damages on the environment quality.

Key-Words: granite, quarries, impact, global assessment.

1. The granite exploitation activity at the Gorj county level

1.1. The location in the environment of the granite quarries

The granite exploitation activity in Gorj county is done in four quarries: at Brazi-Novaci, Porceni Pleșa, Peștișani and Călugăreni Padeș.

La Brazi-Novaci perimeter is part of the southern ramification of the Parang mountains, with altitudes of 600 – 1000m, being located in the Novaci unincorporated town, on the upper flow of Gilort river and of the Gîlortel affluent, starting at 3 km from the city limits (figure 1.).

The Porceni-Pleșa granite exploitation quarry fits in terms of geographically in the Meridional Carpathians system, in the southwestern part of the Vâlcun Mount [1].

The Peștișani granite exploitation quarry fits in the Meridional Carpathians system, and in terms of administrative in the perimeter of the Peștișani commune, from the Gorj county (figure 2.).

The „Călugăreni-Padeș” quarry for the exploitation of granite rocks is located in the Padeș commune, Gorj county, at the western limit of the incorporated of the Călugăreni locality (unincorporated), in the protected area of the archaeological site "La Morminți" located at a distance of 300 m.

Fig. 1. Location in the area granite quarry exploitation of Brazi-Nova
1.2. The description of the operating flow of the granite

The carrying on the activity have two major aspects:
- the deforestation of the forest vegetation
- the proper operation

The exploitation technology includes the deployment of the following processes:
- the timber harvesting (includes the operations of felling and trimming of trees, using the mechanical saws)
- the collection (the gathering-upcoming of the wood from the stumps, using U650 winch tractors)
- the cleaning works of the stumps out of the carriageway of the forest road (the felling, sorting, sectioning, chopping of the wood, using the mechanical saws)
- the loading of the timber in trucks for transport (using a frontal loader equipped with special installation of loading or manually)
- the cleaning of the felling place (by removing the exploitation scrap, their loading and transport)

The most common granite exploitation method is by drilling-blasting. The exploitation hearth will take the form of a step, and the step height ranging between 3 m to 15 m, with the slope inclination of 5:1. The step berms have the final configuration flat, to allow the execution of the return in the productive circuit works of the affected lands [2].

The main phases of the technological process deployed on the location are:
- the dislocation of the granite rocks
- the primary sorting
- the primary crushing
- the loading in the weighing machines

The organization works on site suppose the ensuring of the access by strengthening of the existing access roads and the making of the drainage ditches of the rainwaters along the access roads. For the works necessary for the site organization there is no question of some collect – filter – evacuate installations in the atmosphere of the contaminated air, because these are open and free sources.

2. The physical and mechanical characteristics of the deposit

The granite deposit is a faneritic rock with the following characteristics:
- hypidiomorphic granulation
- compact
- massive texture
- gray colour
- hard
- mottled aspect
- no magnetic properties
- bulk density 2,50 Kg/dm

The physical and chemical characteristics of the granitoids are presented in table 1.

Table 1. Chemical and physical characteristics of granitoids

<table>
<thead>
<tr>
<th>Feature</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>quartz</td>
<td>20 - 22 %</td>
</tr>
<tr>
<td>plagioclase feldspar ortoclaz</td>
<td>30-35%</td>
</tr>
<tr>
<td>accessory minerals</td>
<td>6 - 12 %</td>
</tr>
<tr>
<td>structure</td>
<td>massive</td>
</tr>
<tr>
<td>texture</td>
<td>porphyry</td>
</tr>
<tr>
<td>specific gravity</td>
<td>2,8 - 3,1 daN/cm³</td>
</tr>
<tr>
<td>apparent gravity</td>
<td>2,5 - 2,7 daN/m³</td>
</tr>
<tr>
<td>apparent porosity</td>
<td>0,53 - 1,4 %</td>
</tr>
</tbody>
</table>

3. The impact produced by the granite exploitation on the environment

3.1. The impact produced by the granite exploitation on the water
- the pollutants sources for the surface waters are insignificant at the deforestation of the forest vegetation
- in the technological process of granite exploitation is not used the industrial water; to prevent the accidental falls of the rock which will block the normal flow of the water and will affect the water quality, the quarry (the hearth) will be surrounded by a row of suprasizes with a height of at least one meter
• it is not used the technological water in the production process from the microquarry
• the mining perimeter for the granite microquarries from Gorj county does not intercept with the neighboring river beds
• for the protection of the bed drain section, this will be protected with suprasizes which will stop the accidental falls of the rocks at the loading of the trucks or during the blasting operation
• the transport vehicles do not cross the rivers, in this respect are erected temporary bridges of concrete precasts
• the only potential pollution source is represented by the accidental drains of the fuels or lubricantes from the machinery of the transport and exploitation flow

To avoid the phenomenon of the gully erosion rainwater on dump slopes and of quarry during the exploitation period and during the closing activity operating period, there are provided the water management works which collect the rainwaters and the maintenance and development works of those existing in the operational phase [3].

3.2. The impact produced by the granite exploitation on the air

The air is the environmental factor affected by the granite exploitation during the operation of the saws and during the removal of the soil blanket. Effect on air falls into the category of the medium negative effects, the standards in force not being exceeded only for short periods of time. The specific sources for the deforestation period are sources at the soil level and intermitent sources.

• the emission of the pollutants is due to the exhaust of the gases generated by the operation of the internal combustion engines with which the saws and the transport vehicles are endowed
• the characteristic pollutants for the clearing works are in small quantity and do not affect the quality of the area air
• the pollutant emissions in the atmosphere are subject to dispersion phenomena, phenomena which develop concurrently with those of emission
• the air circulation in the earth surface layer is characterised by the turbulent transport of the air masses
• the location of the granite quarries in a mountain area, afforested, a large part of the pollutants from the exhaust gases being absorbed by the surround forest vegetation
• the engines from the saws and from the vehicles produce gases of CO and NO type and in small quantities, which fall into standards and which not affect of the air quality
• the pollutant solutions with dust and NOx can appear during the operation of deforestation works, but with reduced intensities, without persistent follows
• due to the location of the objective in an afforested area, the pollution level of the atmosphere for the afforested areas is below the limits which require the protection of the forest ecosystem
• the tree vegetation absorbs most of the hazards resulted from the deforestation period (CO, CO₂, NOx, SOx, heavy metals)
• the carbon oxides are used in the process of photosynthesis through which the vegetation captures and transforms CO in the presence of the sun energy into organic matter, phenomenon which produces a release of O₂
• estimating an average consumption of diesel for production of one tone of granite (0,330,4 l diesel), results a quantity of consumed fuel (diesel) of about 43,200 l, which lead to the emission in the atmosphere of the following hazards quantities: NO (1080 kg); SO (241.9 kg); CO (475.2 kg); COV (527 kg);

The granite exploitation with proper mining technologies is not a source of suspensions, hazards which affects the air quality. At the driling of the mine holes, derocking with explosives and the cutting-load operations due to the big hardness of the granite rocks, it is produced a small quantity of dust and powders. Driven by the air currents, these fall to earth because of the big density of the particles.

3.3. The impact produced by the granite exploitation on soil and subsoil

The pollution of the soil and subsoil takes place because of the deposit of various materials which affect his quality, because of the waste and the powders remained after using and draining the oil products. The possible sources of the soil pollution, resulting from the operation of the exploitation activity of the industrial limestone and of granite are the followings:

• the excavations made for the operational exploitation works of the industrial limestone resources
• the accidental drains of the fuels and lubricants at the fuel of the equipments or at the execution of the repairs works
the solid waste (household waste, used pieces).
- the waste rocks resulted from the stripping works are reused at the execution of the ecological reconstruction works of the lands affected by the industrial limestone resources exploitation
- to avoid the producing of some landslides it will be respected the exploitation technology and the waste storing technology

3.4. The impact produced by the granite exploitation on biological environment

The biological environment includes flora and fauna existing in the location area of the objective. The impact on the biological environment includes:
- the deforestation of the vegetation results in a temporary decrease of the forest land
- the process of the occupancy of the natural environment leads to an aggression against biomass in the analysed area
- the removal of the vegetation from the temporary occupied area generates a series of qualitative and quantitative resizings of the grassy and forest system
- by separating the habitats of the natural species as a result of the works from the area, it will occur the following secondary effects in the local biocenosis: the shortening of the food chain in the remained fragmentated habitat – this affecting the small species with fast growing, short life and very dependent of the habitat; the changement of the relationships between the competing species – the increasing of the number of the fragmented habitats could favour the competing species with big possibilities of adaptation to the environment changements and with a good dispersal capacity.

4. The global assessment of the produced impact

For the global assessment of the produced impact was created a matrix which correlates de deforestation activity with the effects on the environment compounds and allows the assessment of the damages on environment quality. To emphasize the complexity of the problems, the impact matrix for the environmental factors based upon the cause-effect relation, using a global assessment system for the negative effects and for the positive ones. The matrix allows the emphasizing of the negative effect and of the benefit effects [4]. The grading system is used only for the deforestation activity and for the granite exploitation activity of the granite quarry perimeter, depending on the kind and the number of the impact generating sources counted. Starting from the impact assessment matrix on environmental factors, the granite exploitation activity has different effects on environmental factors (table 2).

Table2. Impact assessment matrix environmental factors

<table>
<thead>
<tr>
<th>Environmental factor</th>
<th>The produces effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>The surface waters</td>
<td>- in the quarry perimeter do not repair the technical malfunctions of the equipment, do not fuel and do not locate constructions and fixed instalations of which operation affects the surface waters - they are affected by the deforestation of the vegetation in the normal limits, the effect on these being low - at the granite quarry levels does not result waste domestic waters, and on the location are mounted ecological toilets which are periodically emptied by the specialised companies</td>
</tr>
<tr>
<td>The groundwaters</td>
<td>- the effect on these is insignificant</td>
</tr>
<tr>
<td>The air</td>
<td>- at the granite quarry levels is produced dust, powders, exhaust gases at the derocking, precrushing, loading and transport; the produced quantities could be limitated by the judicious design of the mine holes and of the explosive loading, the sprinkling of the crushing stone heaps, of the working platforms and of the access road in the drought periods</td>
</tr>
<tr>
<td>The soil and subsoil</td>
<td>- the excavations made for the execution of the industrial limestone resource works - the accidental drains of the fuel and lubricants at the fuel of the equipments or at the execution of the maintenance and repair</td>
</tr>
</tbody>
</table>
## The vegetation
- Affected by the exploitation, the negative effect on this being low, the replacement of the vegetation is temporary.
- It should be considered the high regeneration capacity of the grasses forest or meadow vegetation.
- After the finish of the exploitation, the land will regain the status of forest land.

## The fauna
- It is affected in insignificant limits.
- The most prominent effect is on the soil fauna which is removed together with the soil blanket.
- Capacitatea mare de refacere a acestui tip de faună.

## The population
- It is affected insignificant limits.
- The human settlements are at big distances of the objective (the only exception is the granite exploitation quarry of "Porceni-Pleșa").
- The workers which work at the objective are affected in admissible limits on the condition of abiding the technology work and the work safety rules specific to the deforestation process.

## The scenery
- It is insignificant modified, the granite quarries being an old and useful presence in the activity of the area people.

### 5. Conclusions
1. Granite mining activity level Gorj is done in four career: the Brazi-Novaci, Porceni Pleșa, Peștișani and Călugarăeni Padeș.
2. To highlight the impact of exploitation on the environment granite air, surface water, groundwater, soil, subsoil, vegetation, fauna, landscape, people, work is presented in granite quarries, granite mining flow and physical characterization, mechanical and chemical deposit.

3. Activity through two major aspects, forest vegetation and proper exploitation produce environmental impact of all factors and overall assessment of the impact is based on a matrix that correlates with the activity of clearing vegetației effects on components damage to the environment and to assess environmental quality.

### References: