

## THE IMPACT OF THE MINING EXPLOITATIONS FROM BUDOI ON THE NATURAL ENVIRONMENT

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**Abstract:** The work is an attempt to respond to what extent the environment affected by serious anthropogenic interventions (the mining exploitation from the Budoï tunnel and the Budoï Village) is close to its original state or a similar one, as a result of cessation of anthropic impact and the conduct of a program of restoration and preservation of the environment.

**Key words:** soil, anthropic relief, waste dump, pollution, rehabilitation

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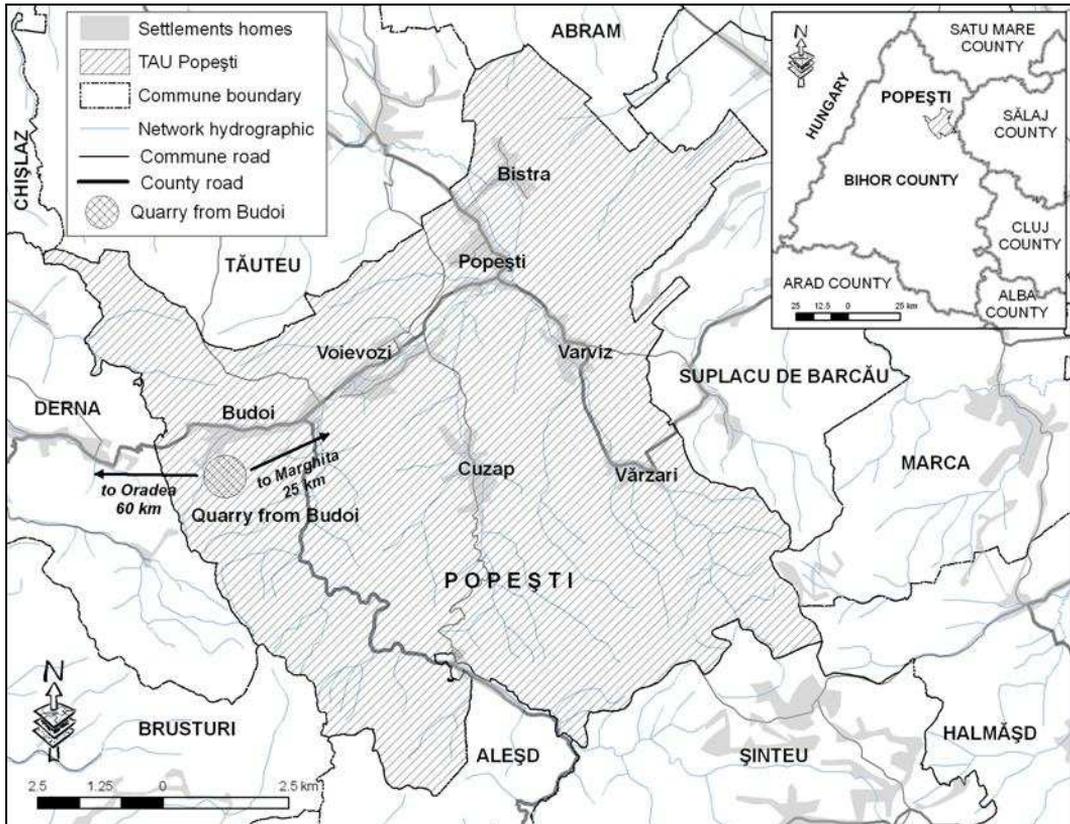
### INTRODUCTION

On the grounds of Romania's accession to the European Union and the harmonization of the environmental legislation with the community, an ever larger attention is paid to the activities and measures for the rehabilitation of the areas of land affected by mining holdings. Relocation on the basis of criteria relating to the cost-effectiveness of the mining activities has led to the closure of numerous mining sites and opening others. The result of these actions has been the emergence of new forms of relief with negative features (excavate hollows, deserted galleries etc. ) or positive features (sterile dumps, degree of abandoned exploitation etc.), as well as some important changes concerning the soil, vegetation and fauna, all representative for the area. Obviously all of these changes have affected further the other components of the natural frame (soil, hydrography, topoclimate etc.) and ultimately on the anthropic factor. It is for this reason an attempt is made as far as possible to limit the effects of negative developments in anthropic impact on the environment through a series of measures aimed at closing mining work from Budoï and rehabilitation of the affected fields. „Due to the presence in the soil of a large number of autotroph micro-organisms, that contribute to the breakdown of waste, residue and manure as well as to kill germs, soil has a power of self-purification much higher, in comparison with water and air” (Negulescu et al., 1995, p. 111).

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Inside the quarries of Budoï tunnel and the village of Budoï there have been operated deposits of lignite, which form part of the boundary mining Derna-Budoï located in the north-west Romania, to the south of Plopiș mountains, not far away from the town Marghita, approximately 25 km and 60 km of its place of residence by the capital city Oradea, in the perimeter of the Popești Commune (figure 1).



**Figure 1.** Geographical location of mining exploitations from Budoï

Due to the presence of lignite, in this area geological research have begun in the year 1818 and were intensified around the year 1900. By performing numerous forje of geological prospecting it was highlighted the existence of gasses lignite layers (from 3 to 8 m thick) and accumulation of bituminous sands cantonate in pontian deposits which have on extended surfaces thicknesses ranging between 300 - 400 m. First activities in the direction of the lignite mining started in the year 1874 in the same time with the granting of a ground surface of 1.443.513 mp to the company Antonia-Frantz, as it is attested documentary since the 26th of June 1891 in the register of mining concessions as an exclusive exploitation for lignite.<sup>1</sup>

From then until now exploitations have continued with an intensity greater or less depending on the interest of the moment and the administration that managed the process of extraction. From the year 1958 once they passed to the lignite mining in quarries shall an intensification of the work of operation takes place, from the point of view of the increasing quantities of overbudrden sterile material and extracted coal. The exploitation in this quarry by everything it means it provoked changes to the natural system, changes that often prove to be

<sup>1</sup> [http://ump.minind.ro/planuri\\_mm/descriere\\_budoï.pdf](http://ump.minind.ro/planuri_mm/descriere_budoï.pdf)

irrecoverable. It is also one of the reasons for which the production units from Budoï had no alternative but to cease work, one by one, being non-profitable against the imposing of the obligation of the exploiter to perform rehabilitation works for the environment. Therefore, their quarries Budoï tunnel and the Budoï village were the last quarries belonging to E. M. Voivozi which have ceased to operate. Once they have been closed a stage of anthropic intervention has ended and the process of rehabilitation of the areas affected by exploitation started. The last consultation with local communities on the total complex of work necessary closing and ecologizing the two quarries took place on the 24th of September 2006 after it passed to the carrying out the work.<sup>2</sup>

It must be noted that in addition to the efforts made by the state authorities in order to remedy and bring to the initial status of the environment a particularly important contribution in this respect it is owned by the environment through its mechanisms of battle in a tendency to return to a steady state.

### METHODOLOGY

The research is based on the study of specialized literature in Romania and abroad, the study of official documents issued by the authorities responsible for carrying out the mining undertakings from the area of Budoï's place, the observations made in the field, on-the-spot. Through the observation and the phenomena which occurred and appear, in time, after the carrying out of the works of rehabilitation we can draw conclusions aimed to improve this activity absolutely necessary in various boundaries after closing different perimeters of mining. We are trying through this work to suggest a mathematical model for quantification of the extent to which a rehabilitation of the natural frame subject to anthropogenic operation (mining undertakings) may bring it back or not in a state as close as possible to the original, before the performing the operation.

### RESULTS

*„Through the extraction activities and processing of mineral substances useful, spaces which are in arelative balance, it changes its dynamics through an acceleration linear regression, generating other landscapes that wors in an advanced degree of into entropy" (Duma, 1998, p. 25).*

Closing exploratory workings of crude lignite from Budoï were necessary launching of extensive work for the rehabilitation of the environment. The rehabilitation or attempting to rehabilitate the environment is perceived by deep changes that occurred at the level of each subsystem of natural frame (geomorphological, pedological, hydrological, biogeographical) as a result of intervention previous anthropogenic.

Amendments to the geomorphological and pedological subsystem have appeared either as a result of work excavation that have overburden large surfaces ground and storage due various strata of soil originating in the process of decopertare near quarries, where the humus layer was mixed with sand or sand clayey, marne cãrbunoase, other types of soil, and industrial waste. In the case of Budoï tunnel and the Budoï village during the period of exploitation of that from 1991 until 1992 in the summer of 2003, according to the public data there were dizrupted 6.248.485 mc of material in the form of stripping and have been extracted, transported and leveraged its 1.089.960 t of lignite, on a total area of 420,176 square meter for land. In figure 1 shows the sizes of the Budoï mining perimeter. The geographical disorganization generated by quarrying, as well as the work of haldare influențat have dramatic hydrological subsystem. The first effect has been driving the particles from the surface of the overburden slopes to Budoï's stream bed located in the northern mining boundary, another effect has occurred on the date of expiry of productive activities and switching electro-pumps located at bottom dimensions of the quarry in the pools

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<sup>2</sup> *idem*

built specifically for this purpose, water uproot pluviale. Pumps have been turned off and reallocated to other points productive, in this way water is no longer carried out, transforming abandoned quarries in true lakes of accumulation.

In figure 3 it can be seen lake produced by water collection pluviale what have not been discharged. If you shut down the operating work taluzele remained under water influence pluviale and temperature differences of natural cycles are subject to diurnal rheological phenomena, manifestations of „*status of voltage - deformation, a massive neatacat, rock around mining work, properties that may occur in the form fluajului, relaxing and resistance long; causing secondary voltage status in rock around mining work reologic behavior on the basis of rock; laying down pressure regimes, interaction rock-support rheological phenomena in the context of the fact that affects the bulky of rock*” (Teodorescu, 1986, p. 16).

These lead finally to slipping on the ground and cannot access on the steps of the upper quarry. The phenomena referred to may be observed very well in figure number 4.

Because on the surface in which they are situated at present the two quarries, were forests and meadows we can say that another element affected by dangerous anthropogenic activity in this case is the system bio-geographical area. In figure 5 we can notice even younger trees at the top edge of taluzului career and young trees caught by landslides that take place from time to time. The main objective of land affected by rehabilitării mines also is returning intervention areas affected by dangerous anthropogenic, to a state of balance initial similar to that before the start of work, to secure your entire complexity and variety of the environment.



**Figure 2.** Budoi Mining Exploitation  
Source: Duran's Oradea



**Figure 3.** Accumulation of water on the mining exploitation's place in Budoi



**Figure 4.** Steep embankment affected by erosion in the Budoi quarry



**Figure 5.** Forest affected by mining sites work Budoi

An attempt to quantify what has been the extent to which a natural system has been returned or returned to its original condition, implies the use of quantitative and qualitative parameters with regard to this aspect, in close correlation with time required evolutionary process. Time is one of the factors determining evolution in environment it cannot be ignored. „Time is considered factor and necessary condition of pedogenezei, it requiring a certain length of time the abovementioned factors to interact, leading to the formation and gradual dezvoltarea soil" (Petrea, 2001, p. 64).

On this background, we propose an synthetic index of reversibility of the anthropologization (Ira) calculated as a weighted average of front fence of reversibility of the initial condition under the action anthropic impact, taking into account the time factor. It should be noted that, when we speak of the impact of anthropic mining exploitations, we are talking about a form of impact straight away, local (on the perimeter of the operation and in his immediate vicinity), high-intensity, with negative effects on the environment and on positive social economic system. So, as a result of mining undertakings in the place Budoï a large volume of mineral substance has been yearly excavated and removed. One side of these substances has been recovered as useful mineral substance, with the rest being relocation dumps material and that the rambleu mine galleries already operated, for umplerea blindspots. Another element of dangerous anthropogenic intervention are buildings built on the area of land in the boundary mining operations with a view to carrying various specific activities such as the administrative, accumulation and transport, loading and unloading, granular-sorting, preparation etc. in figure 6a, it can be noted that the initial administrative buildings with utilitate technological and mining operations in the perimeter Budoï, and in figure 6b, the situation in the area rehabilitation.



**Figure 6.** The administrative-technological building from the quarry of Budoï a) BEFORE and b) AFTER the rehabilitation <sup>3</sup>

Referring to the factor of time and taking into account that the mathematical series more often encountered in the world to the animal and plant is that of Fibonacci, suggest a hierarchy of reversibility or corrosion of components affected by dangerous anthropogenic intervention in order to take account of this formulă mathematics, namely:

The coefficient of the time factor "  $\tau$  " will take the following values

That period of time necessary to take place reversibility	Pooling
Elements that may be bad went close to their original condition within a period less than 3 years old	1
Elements that may be brought closer to their original condition in 3 - 21 years	2
Elements that may be brought closer to their original condition in 21 - 144 years	3
Elements that may be brought about their condition after more than 144 years	5

<sup>3</sup> [www.http://ump.minind.ro/graphics/08\\_04\\_2009/Galerie\\_foto\\_BUDOI.pdf](http://ump.minind.ro/graphics/08_04_2009/Galerie_foto_BUDOI.pdf), accesat în data de 10.04.2013

$$Ira = [\tau_1(Vre \times 100)/Vie + \tau_2(Vrh \times 100)/Vih + \tau_3(Vrc \times 100)/Vic] / (\tau_1 + \tau_2 + \tau_3)$$

Where:

Ira = percentage of reversibility or corrosion Index anthropogenic;

$\tau_1, \tau_2, \tau_3$  = the coefficients of time of various factors of impact anthropic;

Vie = the volume of material yearly excavated initially ( $m^3$ )

Vre = the volume of material relocated to their original location in the area cutteray burners ( $m^3$ )

Vih = the volume of material haldat initially ( $m^3$ )

Vrh = the volume of material relocated from dump back in initial area ( $m^3$ )

Vic = the volume of material contained in initial construction ( $m^3$ )

Vrc = the volume of material from construction avacuat retrieved from the surface ( $m^3$ )

The volume of the lignite extracted has been calculated at a specific weight of coal consumed with 1t/cubic meters.

The volume is the sum total yearly excavated volumes descopertei and lignite exploited.

$$Vei = 6248485 + 1089960 = 7338445 \text{ (mc)}$$

Inserting the values of volumes in the formula and taking into account the fact that the boundary of exploitation of have been dismantled and discharged in full 22 buildings and structures, with a total volume of 5,600 cubic meters in less than 3 years old<sup>4</sup>, but return the Chalde'ans be summoned and surface from quarries will take around 30 years will result:

$$Ira = (3 \cdot 1683800 \times 100) / 7338445 + 3 \cdot (91000 \times 100) / 6248485 + 1 \cdot (5600 \times 100) / 5600 / (3 + 3 + 1) \%$$

$$Ira = (3 \cdot 22,949 + 3 \cdot 1,4563 + 100) / 7 = (68,847 + 4,3689 + 100) / 7 = 173,2159 / 7 \%$$

$$Ira = 24,745 \%$$

## CONCLUSIONS

The problem of the anthropic impact and its consequences on the frame natural has been dealt with in numerous specialized studies of the romanian literature (Delia & Dan, 2010; Herman, 2009a; 2009b; 2010a; 2010b; Matei, 2012; Oana et al., 2011) and alien (Adewole et al., 2011; Bampton, 1999; Ehrlich, 1989; Faber et al., 2012; Goudie, 2006; Hawksworth & Bull, 2008). However the work of major importance front, it constituting an attempt at quantification (measurement) on the impact of mining activities in a given area (Locality Budoi, Bihor County) and to what extent the areas affected anthropic may may be restored and brought as close as possible to the original state. In this case, it appears that, as compared with the initial situation from the point of view of the volumes dizlocate environment has been returned to their original state at the rate of 24,745 %.

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<sup>4</sup> [http://ump.minind.ro/planuri\\_mm/descriere\\_budoi.pdf](http://ump.minind.ro/planuri_mm/descriere_budoi.pdf) accesat în data de 12.04.2013.

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