

SOILS' DEGRADATION IN THE MINING AREA ON THE WESTERN SLOPE OF THE APUSENI MOUNTAINS

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Abstract: According to the Law of Environmental Protection (Nr.137 din 1995) „*the polluter is represented by any solid, liquid, gaseous or steaming substance, as well as any energy form (electromagnetic radiation, ionized, thermic, sound or vibrations) which once introduced into the environment alters the natural balance of its constituencies entailing damage to the living organisms, material goods and the legitimate usage of the environment*”. In the case of soil we can refer to its degradation to the extent in which more features are damaged following a complex process which finally leads to its exclusion from the agricultural circuit namely the restriction of the productive potential. In the proximity of the mining perimeters, due to specific activities of rock blasting, exploitation and transportation there emerge elements which speed up the soil degradation process.

Key words: soil, pollution, mining activities, The Apuseni Mountains

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INTRODUCTION

Generally the causes of soil degradation can be natural or man-made. The soil is a complex of organic and inorganic matter with a varied structure, colour, thickness or texture, with a high or a low content of water but with a basic feature, namely it is indispensable to the life of numerous plants and terrestrial animals to whom it provides food, shelter or other necessary life-sustaining elements. In his paper on the Pedospheric Environmental Pollution Prof. Nicu Cornel Sabău rightfully compares the soil with a living plant/factory.

„This living factory aims to transform the organic matter, which represents the basic link of the food chain of nature-based elements. Any malfunction issued in the running of this factory has major impacts on its creatures, animals, human beings. In ecological terms these malfunctions are similar to the break of the ecological balance from the terrestrial ecosystems as a result of pollution” (Sabău, 2008, p.169).

METHODOLOGY

In this study we will analyze the situation of soil degradation at the proximity of mining areas located on the western slope of the Apuseni Mountains and the way in which the specific activity of these exploitations can enhance soil degradation in the neighbouring areas of these perimeters.

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RESULTS

„As a result of Romania's accession negotiations to the EU, after 1989 a greater importance has been attributed to environmentally-related issues. The need to align to EU's environmental legislation, has concretized, in terms of soil pollution and degradation, in the Order 765 of 03.11.1977 for the approval of the Regulation concerning the assessment of environmental pollution which features normal warning and intervention thresholds of the chemical polluters from the soil” (Sabău, 2008, p.170).

There is a soil ranking in terms of its degradation and pollution listed within the Romanian Soil Classification System. The nature and source of pollution are the main criteria used with a view to accomplish this ranking. According to the nature of pollution we can refer to:

- Physical pollution (PF);
- Chemical pollution (PC);
- Biological pollution (PB);
- Radioactive pollution (PR).

The ranking, according to the pollution degree, takes into account the decrease compared to the production of the same type of unpolluted soil, thus being 6 encoded groupings from 0 for unpolluted to 5 excessively polluted.

Table 1. The pollution degree representation
(Source: Sabău, 2008, p.173)

Symbol	Appreciation	Production Decrease
0	Unpolluted	Below 5%
1	Weakly polluted	6 – 10 %
2	Moderately polluted	11 – 25 %
3	Highly polluted	26 – 50 %
4	Very much polluted	51 – 75 %
5	Excessively polluted	Over 75 %

According to the pollution generating activities, 6 activity groups divided into more subgroups were settled nonetheless among which the first and the most significant is the mining activity of basic material and construction materials.

For the western area of the Apuseni Mountains harmed by mining activities the most important soil degradation processes relate to:

- unfavourable changes in the biochemical circuit of elements,
- soil erosion due to favouring factors such as water and wind;
- physical destruction of the soil by the destruction of its structure,
- consolidation in the area of ponds and crust formation at the surface;
- occurrence of extreme humidity or humidity excess;
- soil acidization;
- soil alkalization;
- decrease or even removal of life from the soil (biological degradation).

We can note that in the perimeter of the mining activities on the western slope of the Apuseni Mountains we can encounter a wide range of the degradation processes defined above such as:

- soil degradation by day-hole works;
- pollution by soil covering with deposits, dumps, tailing ponds, flotation tailing deposits, waste dumps and so on;
- soil pollution with inorganic tailing and refuse (mineral, inorganic matter including heavy metals, salts, acids, basis) from industrial activities (including mining);
- pollution with air-borne substances;

- pollution with radioactive matter;
- pollution with vegetal and forestry refuse.

„Soil are agressed by pickling, covering, infestation with rock powder and processing detritus, modifyind the structure, texture, Ph and chemical composition” (Duma, 1998, p.27).

The tailings resulted from the mining activity from the mines of the western area of the Apuseni Mountains have a varied composition according to the genesis of the encountered rocks (igneous, sedimentary, metamorphic) and are stored within tailings ponds.

„In some cases the negative influence is to be seen a very long time even after the entire productive activies stop in the area” (Fodor, 2006).

The most common compositions of the tailings are made of vegetal soil blended with different substances whose useful concentration is below the exploitable value and it can refer to limestone, quartz, feldspar, cat silver as we can see in figure 1, for example at day-hole mining in Pădurea Neagră.



Figure 1. Day-hole mining in Pădurea Neagră

A very significant side effect of the mining activities in the western area of the Apuseni Mountains is soil degradation and pollution by erosion and landslides. Doe to deforestation „the latent energy potentialof the slopes is expressed much better and is materialized in landslides” (Șumălan, 2007).

In figure 2 is such an exemple of embankment landslide in the quarry of Cărpinet. Due to the removal of the soil cover in the mining area, the neighbouring areas are also harmed as soil degradation occurs by erosion and landslides, degradation by humidity excess in the areas lying at the basis of the day-hole mining activity and soil degradation by consolidation, including crust formation in the areas of the tailings ponds ancillary to each mining activity as well as soil degradation by erosion-produced sediment coverings. In the survey area, erosion, this mechanic abrasion process of the crust is mainly caused by water and wind by a hydro and wind process. The intensity of the two factors is very variable in space and time as emphasized on the map featured in figure 3. These effects can be enhanced by the occurrence of mining works also highlighted on the map (figure 3). The limits of studied perimeter were determined in accordance

with „*The Geography of Romania*” (Geografia Romaniei, 1983) and „*Geographical units and subunits of the hills Banat and Crisana*” (Mahara, 2003).



Figure 2. Embankment landslide in the quarry of Cărpinet

As we can note within table 2 the land erosion degree can be ranked as follows:

Table 2. Numbers significance in the legend of the figure 3

1	Stable grounds, mostly unaffected by erosion and landslides and without risk of degradation by other natural processes
2	Relatively stable grounds with a varied risk of flooding and clogging unless protected by embankment works or water courses' and meadow torrents' regulation
3	Stable grounds liable to over humidity due to water stagnation as a result of the soil low permeability
4	Relatively stable lands but prone to over humidity by the groundwater level raising or by irrigation
5	Wet lands with low bearing and/or increased flooding risk
6	Relatively instable lands, affected or endangered by wind erosion, land declivity 8-30% of the hilly and plateau areas differently harmed or with a varied erosion risk by water or landslides
7	Relatively stable lands prone to low-moderate or insignificant erosion with a low landslide-producing risk and an increasing erosion risk
8	Moderately stable lands, prone to a moderate-high erosion and relatively more or less stabilized olden landslides, prone to occur during rainy years or by the change of land usage or slope destabilization works
9	Very low stable lands, harmed by an increased - excessive erosion associated to active ravines and landslides; common torrential organisms or over humidity situations occur determined by underground water or hillside springs, slopes >15%
10	Relatively instable lands prone to increased landslides, cave in, downfalls (mountain flysch area), highly fragmented piedmonts and plateaus
11	Relatively stable lands prone to frequent downfalls, falling rocks and stone (crystalline areas, volcanic mountains, sedimentary consolidation rocks, limestones, sandstone, conglomerates)

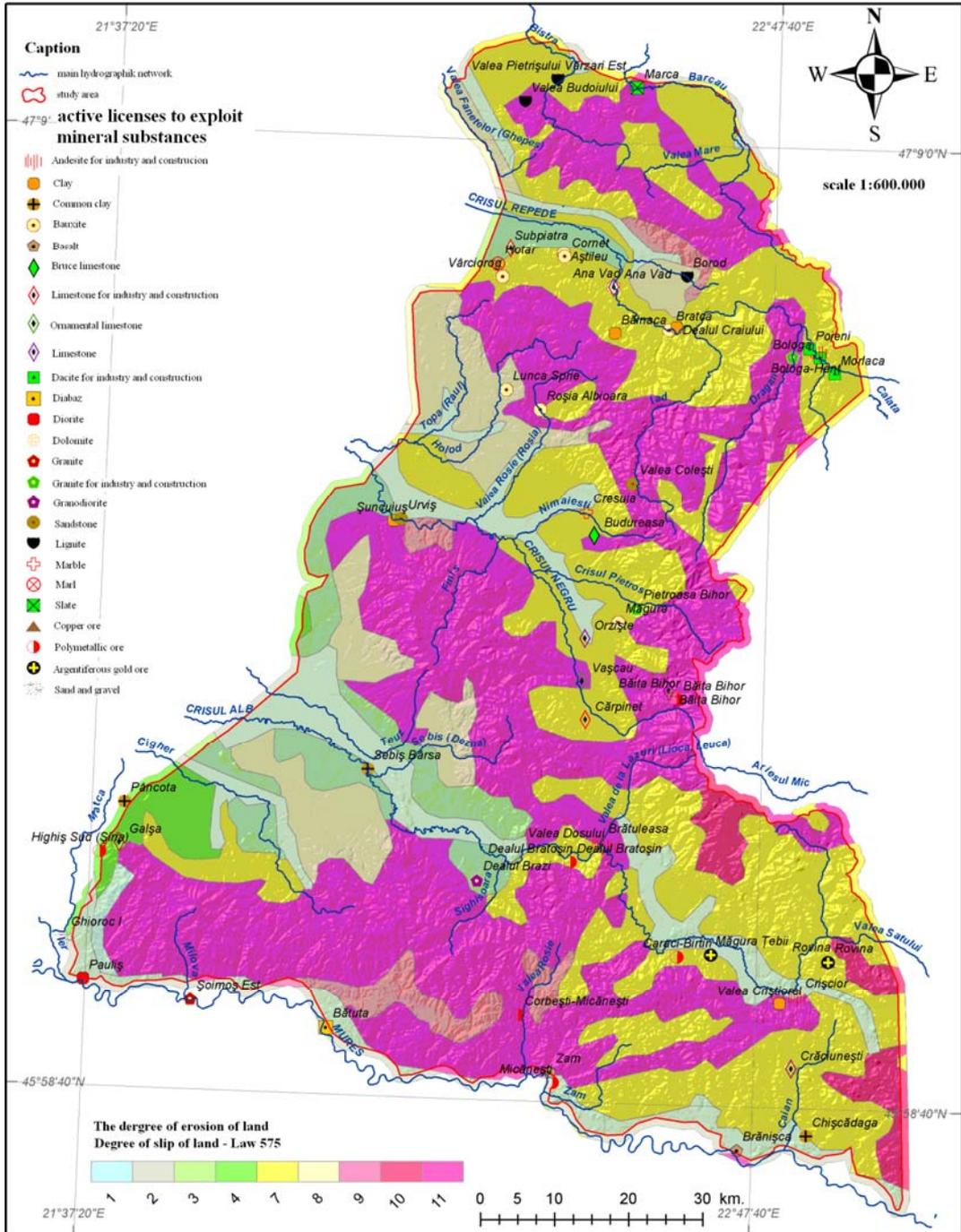


Figure 3. The land erosion degree
 (Source: Law 575/23.10.2002 and NAMR)

Another relatively frequent phenomenon relates to landslides. The latter occurs when gravitation overpasses cohesion and stability forces, thus resulting the land movement from a movement plan usually under the natural bank angle of the moved material.

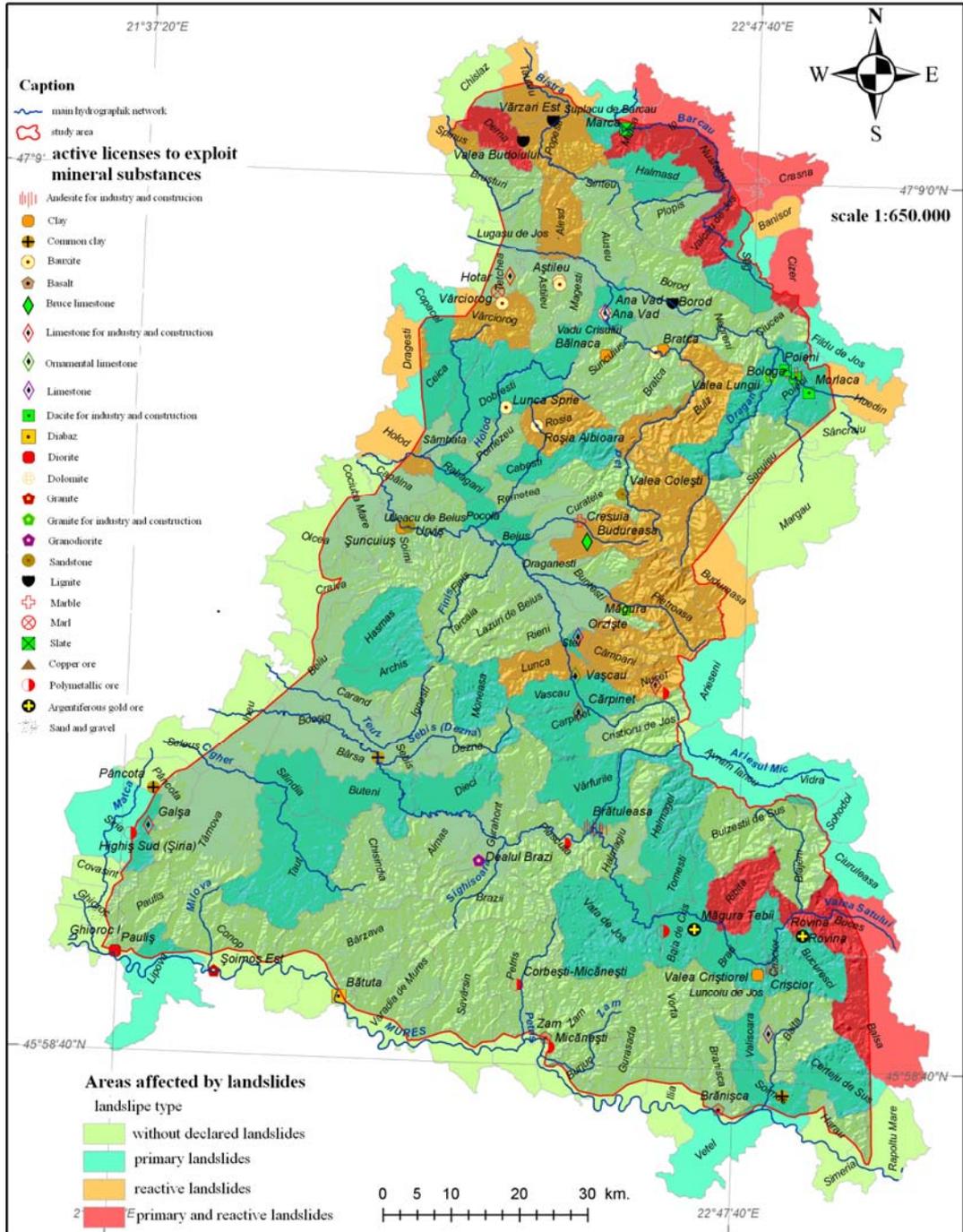


Figure 4. Surfaces harmed by landslides
(Source: Law 575/28.10.2002 and NAMR)

The landslide phenomena can be enhanced in the case of earthquakes when the cohesion and gravitation forces are in balance. The rock blasting by massive explosions can produce micro earthquakes which enhance the risk of a landslide occurrence.

CONCLUSIONS

Mining activities on the western slope of the Apuseni Mountains occur on relatively confined territories, nonetheless by their large number (over 70 active mining activities according to the data of the National Agency for Mineral Resources) and by the fact that these activities spread from upstream to downstream, their impact on the environment is very aggressive. As we know at present there is a stiff competition between the economic interests, strategically connected to the ore capitalization of useful mineral substances and the public interest concerning elements related to landscape, territory and soil degradation in the proximity of mining perimeters. Consequently it is obvious that the emphasized issues require, both in the case of the mines' and quarries' designers as well as those who will lead the productive activities on the field and the central public authorities responsible for natural assets' protection to foresee the negative effects and to adjust to preventive, protective and recovery measures

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