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THESIS

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RESEARCHES ON THE SELECTION OF OPTIMAL SOLUTIONS FOR THE REHABILITATION OF LANDS DETERIORATED BY THE OPEN PITS FROM THE TULCEA COUNTY

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Synthesis of the doctoral thesis

The mining industry in Romania and, implicitly, that of Tulcea County, in its long existence has considerably affected all the environmental components. For this reason, it is imperative today to control the impact it exerts on the environment, as well as to rehabilitate affected areas. The degradation of the degraded land is progressing both progressively with the extraction activities and after their termination.

More than half of the territory of Tulcea County, the northern area, overlaps the Danube River with no solid mineral resources economically recoverable, except for some sands. Besides, this area is included in the Danube Delta Biosphere Reserve. In the rest of the county, although there are also delimited areas with special protection regime (Măcinului Mountains National Park, ROSPA Măcin-Niculiţel etc.), there are 50 quarries spread in which special constructions are exploited.

Older lithological formations store copper reserves (Altan Tepe) and iron (Palazu Mare), and the construction rocks (granite, quartzite, limestone) abound in the Măcin Mountains (Macin, Greci, Iacobdeal) or the Babadag and Medgidia Babadag, Topalu, Mahmudia, Basarabi).

Because, in large part, the mining activities in Tulcea County have almost ceased, it is necessary to find solutions for the rehabilitation of the areas affected by these activities and the annihilation of the sources that continue to pollute the environment

In the thesis, after a detailed analysis of the mining activities in Tulcea County, it is chosen as a case study case the Turcoaia-Iacobdeal quarry, which is one of the oldest perimeter of exploitation in the county and at the same time where the activity takes place in the largest exploitation at surface of the rocks that are currently useful.

At the basis of the approach to solving the proposed theme were the documentation regarding the status of the surface exploitations in Tulcea county, especially the Turcoaia-Iacobdeal quarry, the own investigations regarding the environmental quality indicators, the laboratory analyzes, the processing and the systematization of all the information obtained puts decision-makers in the affected areas at hand with solutions that will objectively guide them in taking action to remedy the situation.

The thesis is structured in three parts, containing 11 chapters.

In the Introduction, after general considerations regarding the reconstruction of a degraded area of anthropogenic activities are described the research methods used for the ecological rehabilitation of the mining perimeter studied Turcoaia-Iacobdeal. The proposed interventions refer to the integration of the perimeter in a functional context, taking into account the high tourist potential of the studied area and of Tulcea County as a whole.

The first part of the thesis focuses on the general description of the exploitation perimeters of the construction rocks in Tulcea County (copper and iron exploitation being closed at the present time).

Chapter I. Description of the exploitation perimeters of the useful rocks in Tulcea County

presents, in a concise form, general data regarding the geographic location of the exploitation perimeters, the useful rock quarries inventory, the geomorphology of the exploitation perimeters, the geology of the deposits, the hydrology and the hydrogeology of the deposits in Tulcea County.
Chapter II. The general description of the activities in the exploitation perimeters of the useful rocks in Tulcea county details the methods of opening, preparation, exploitation and processing of useful rocks in this county and presents the prospects for the extraction of useful rocks in this area of the country.
The second part of the thesis aims at identifying and evaluating the impact on the environment of the useful life of the useful rocks. To do this, in a rigorous and detailed manner, the Turcoaia Mining Perimeter was chosen as a case study. This is the most extensive exploitation perimeter, with mining activities extending over 130 ha.
Chapter III. General characterization of the Turcoaia mining perimeter with a short history of the Turcoaia perimeter, physical and geographical features, geological characteristics, pedological aspects, climatic, hydrological and hydrogeological characteristics, flora and vegetation, fauna and human communities.
Chapter IV. The presentation of the operational context of the mining perimeter Turcoaia makes a mining engineering analysis of this perimeter, starting from the description of the premises and sites, description of the exploitation technology and the technological flow and ending with the geological, physico-mechanical and chemical characterization of the exploited rocks.
Chapter V. Impact on environmental components induced by anthropogenic activities in the mining perimeter Turcoaia highlights both on the basis of the results obtained from the competent institutes but also from its own research, the sources and pollutants of the environmental components and the quality indicators characteristic of these environmental components .
Chapter VI. The assessment of the degree of pollution and the environmental impact in the area pertaining to the Turcoaia mining perimeter is achieved through the Global Pollution Index (IPG) method, the rapid assessment matrix method (MERI) and the integrated environmental impact and risk method.
Following these evaluations, the following resulted:
- after the environmental component of the environment, the environment subject to the effects of human activities causing disturbances to medium-life life forms, preventive measures are necessary;
- after the environmental component water, environment subject to the effects of human activities within acceptable medium risk limits, preventive measures are necessary;
- after the environmental component of the soil, medium subject to the effects of human activities within acceptable medium risk limits, preventive measures are necessary;
- after the noise / vibration environment, the environment seriously affected by the human activities with major risks, preventive measures are necessary.
By calculating the mean value for the four analyzed environmental components, an average

impact IM = 590,18 and an average RM = 218,77 are obtained. These values qualify the area of Turcoaia - Iacobdeal quarry as an environment subject to the effects of human activities within acceptable medium risk limits and preventive measures are necessary.
The third part of the thesis contains the ecological remediation solutions of the areas affected by mining in Tulcea County, the perimeter taken into account being the same, respectively the concession perimeter of the Turcoaia quarry.
Ecological reconstruction is an extremely complex objective. It can be integrated as a concept in policies and strategies for prevention, assessment of sensitive ecosystems and remediation. The main purpose of ecological reconstruction is to completely rebuild the elements and processes of a site or ecosystem destroyed / degraded to its state at a given time, to a current standard or to a preconditioned condition.
Starting from these general considerations, the thesis describes the interventions necessary for the ecological reconstruction of the mining perimeter studied at the end of productive activities. These interventions are not intended for ecological reconstruction in the traditional sense, that is, to restore as much as possible the environmental conditions before the start of operation (this is virtually impossible if we consider only the morphological changes). They refer to the integration of the perimeter in a functional context, taking into account the high tourist potential of the studied area and of Tulcea County as a whole.
Chapter VII. Ecological reconstruction is a theoretical chapter in which a series of considerations on the concept of ecological reconstruction are made, and the relationship between reconstruction and other activities, the purpose and objectives of ecological reconstruction and ends with a few possibilities to recover degraded land.
Chapter VIII. The current situation regarding the degradation of the terrain in the Turcoaia mining perimeter is a concrete analysis of the actual state of the analyzed perimeter presenting the causes of the degradation, the forms and types of degradation, the physico-mechanical characteristics of the sterile and useful rocks in the exploitation perimeter based on their own researches and observations land. The chapter ends with a check of the stability of the waste dumps, a sine qua non condition for the next step.
Chapter IX. Modeling and landscaping of degraded land also has a theoretical character, laying the basis for choosing optimal land remediation solutions in the analyzed area as a case study.
Chapter X. The design of the ecological rehabilitation works of the mining perimeter Turcoaia is an important chapter of the thesis. Here, more or less detailed, the ecological rehabilitation solutions of the Turcoaia mining perimeter, namely: the arrangement of the access ways and the parking spaces, the layout of the Iacobdeal pit lake, the vegetation of the waste dumps, the construction and the arrangement of the minipar, the arrangement of the accommodation spaces and camping, arranging escalade and tyrolean routes, etc. All these arrangements are presented in a floor plan.
Chapter XI. General conclusions, own contributions and proposals is a synthesis of the whole approach to finalizing the study taken as a doctoral thesis.
The bibliography used for the doctoral thesis elaboration consists of 76 bibliographic notes, of

which 7 belong to the author of this work as sole author or co-author.
The main contributions to the thesis are:
- Identification of the 50 active quarries in Tulcea County, their owners, their location and their classification from the point of view of the operating permits;
- general characterization of the geomorphologic, geological, hydrological, hydrogeological exploitation perimeters and the exploitation methods applied with the Turcoaia-Iacobdeal perimeter detail;
- laboratory analyzes of samples taken from the quarry and tailings dumps in order to determine the geological, physical, mechanical and chemical characteristics;
- air, soil, water, and noise level measurements in the perimeter of the quarry in order to characterize these environmental components and to determine the degree of pollution;
- analyzing the quality of the environment through three methods: the Global Pollution Index, the Rapid Impact Assessment Matrix and the Integrated Environmental Impact Assessment and Risk Assessment;
- field trips in order to identify and evaluate the causes that led to the degradation of the land and the degradation forms present in the perimeter studied;
- checking the stability of tailings dumps, using Hoek's graf-analytical procedure;
- establishing the need for ecological reconstruction, intervention level and identification of the main objectives;
- designing the ecological reconstruction works leading to the transformation of the Turcoaia - Iacobdeal mining perimeter into the Turcoaia - Iacobdeal recreation complex:
- access roads;
- arrangement of cycling routes;
- arrangement of the accommodation capacities, of the camping area and connection to the utilities networks;
- arrangement of parking areas and household waste collection platform;
- arrangement of the minipar;
- creating the conditions for the formation of Lake Iacobdeal 2;
vegetation of heaps 6, 7 and 8;
- arrangement of escalade and tyrolean routes;
- construction of the cable transport line.
Finally, some suggestions are made for future activities of both the author of the thesis and the interested authorities.
The most important thing the author proposes is to transform this conceptual project into one that is put into practice. To this end, starting from the solutions presented in the PhD thesis, it aims to elaborate a feasibility study and then the technical execution projects, including design details for all stages of development and accompanied by technical- economic development with specialists on each level.
Of course, the implementation of these projects must also involve local authorities and why not the county ones, which bring local communities to good fortune and provide the basis for their

sustainable development.
Last but not least, it aims at identifying the most suitable sources of financing, so that the recreation complex Turcoaia - Iacobdeal will become a reality in the shortest time after the end of the productive activities.