MONITORING STABILITY OF THE NOVAT DAM AND THE RELATED AREA

P. GHERGELAȘ ANDROO, A. C. LĂSCONI*

**University of Petroșani, Faculty of Mining*
email:androopaul@gmail.com

Abstract. *The exploitation of underground deposits, depending on some factors like depth exploration, method of operation, features rock and the rock cover after being exploited causes a change in the area and on the environment. Rebalancing these forces can bring movement of rocks that have a negative influence on the surface. Studying these influences and changes is necessary because through studies like these we can see how the phenomenon of displacement, deformation and subsidence of the surface is changing. Observing a longer period of time the phenomenon of sinking we can take the appropriate measures to protect the objectives from the surface. The main steps for monitoring and measuring the studied area will be: Surveying the field (systematic measurements and charts). Monitoring the pond stability and soil quality. Inspections/monitoring of construction (dams, canals). Current methods require a large volume of field activities related to diving for processing information and often the information is not very accurate. The quality of the information it depends not only on the equipment I used to obtain data, but also measurement methods and processing the data correctly. An important role has also the location of the benchmarks and the geometry of the tracing network used for a good observation in time of the location. Our monitoring program consists in an annual observation and measurements on the area that is more prone tor changes. It's very important to know how a dam structure is behaving in time, because the drainage area upstream pond can lead to the loss of stability and so the environmental impact will be bigger. So only observing deformation of the dam through methods mentioned before, we can prevent any changes.*

Key words: *deformation zones, mining, stability, mining pressure, topographic measurements, environmental impact.*

INTRODUCTION

Ponds resulting from deposition of tailings and from the processing of minerals in preparation plants are relatively large, changing sometimes fundamental morphology of the zone, and the content of pollutants are that factors and sources of air pollution - the dust - and water - by suspensions , flotation reagents and metal ions.

Also in the material stored in settling ponds that is found useful fraction of processed minerals preparation plants yields resulting from the difference extraction technologies applied. Knowledge, in this regard, of the potential of tailing ponds in Romania they have, provide identification, strategic issues, types of useful minerals, their distribution regional value of their utility and, therefore, the future possibilities recovery in all sectors of national economy.

Between 1990 and 2008, were made field research on natural hazards (dynamics and evolution erosion inundability) on the Basin Viseu. In the period 2000-2008 were collected and analyzed evidence of support for determining water Heavy metal pollution. The studied area it has a very strong variety of relief dam volcanic and differential erosion) position and the nature of sedimentary rocks is modeled (foar molding agents).

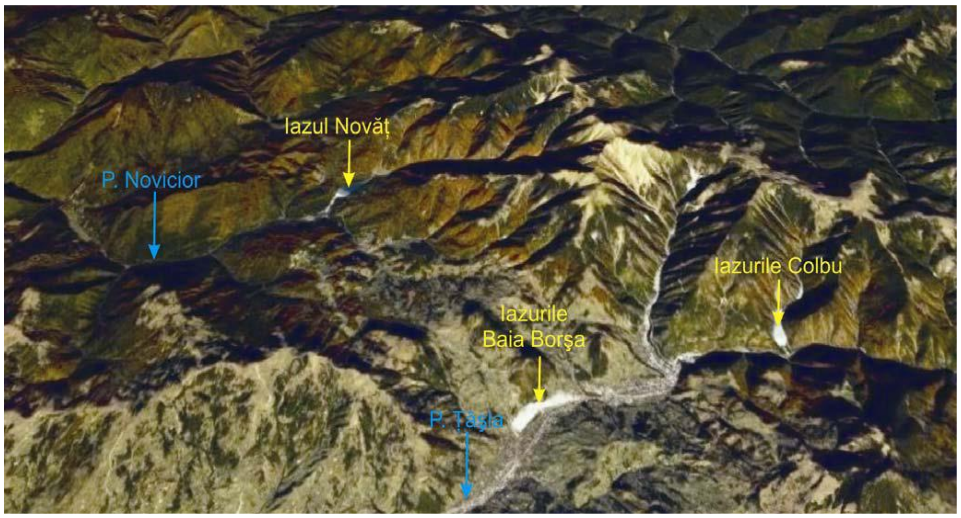
To be noticed that the liquidation of mining does not lead to the total elimination of the negative consequences on the environment. In many other countries around the globe,

decades after closing mines, continue to exist numerous problems of heavy metal pollution, imposing severe restrictions in land use, financial efforts in the treatment of mine waters, conservation mines and greening heaps and ponds , labor availability etc., imposing to find alternative solutions based mainly on harnessing local economic resources to ensure sustainable development under European Union law.

Located between the volcanic mountains to the west and southwest, Maramures Mountains and Rodna Mountains to the east and south, Maramures Depression covers an area of 1250 square km is one of the largest depressions Carpathian.

It has a very strong variety of relief as a result of complex origin (tectonic depression, volcanic dam and differential erosion) position between different mountain units as composing and age and the nature of sedimentary rocks is modeled. In northwestern Upper Cretaceous formations occurring depression, but most of the basin sculpted Paleogene and Miocene formations in different facies: conglomerates, sandstones, clays, marl, shale. The overall petrography, crossed by numerous tectonic lines offered conditions for the manifestation of differential erosion, so that depression appears as a combination of high hills and piedmont aprons, depressions and widening local color seduri terraces and alluvial valleys.

Mining activities (including its operating saying, flotation and preparation stations, ponds and dumps) are located in the upper basin of Viseu, sub-basins Taşlîc, Colbu and Novat).



Colbu perimeter corresponding to the two tailings ponds is placed on the stream thalweg Colbu, at 830-970 m. altitude, 2 km east of Baia Borsa. On sharp slopes (35 degrees - 45 degrees) are colored torrents and avalanches. The two ponds became functional in 1986 (Colbu I) and 1989 (Colbu II). Colbu Valley, carved in hard crystalline rock has steep wooded slopes with. Erosion and low permeability and the deforestation increased in recent years favoring the rapid outflow of water from rain or melting snow and even triggering avalanches, risk of natural accumulation on the surface of ponds large volumes of water being considerably.

MATERIAL AND METHODS

Moreover, on 6 May 1997, as a result of particularly large debts resulting from melting snow on the valley slopes Colbu, adjacent pond and the discharge of their pond perimeter, which led to growth fluidity in the sterile storage, was produced I Colbu crumbling dam of ponds and Colbu II and involve a volume of about 52 000 m3 solid and liquid material which affected more than provement. In July 2008 following heavy rainfall, high water volume accumulated in two pools again put in danger the stability of the embankment front. To prevent a new technological accident, county and local authorities have decided to discharge tailings pond through a controlled gap of Colbu I.

At Borsa mining exploitation, ecological restoration plans and programs included:

- Renewed technology and stabilization work D1 and D2 tailing ponds.
- Work to reduce the risk to the pond Novat.
- Closure and rehabilitation work at D2 pond.
- Closure and rehabilitation works in ponds Colbu I and Colbu II.
- The mouth of the mine closure and rehabilitation Superior Bath (closures galleries, eight dumps, mine water treatment system-drained limestone, dismantling buildings, ecological restoration at D1 and D3 tailings ponds);
- Plan termination activity in the mining area of Macarlau, Colbu and Novat.

The Colbu pond is located about 3 km upstream of Borsa flotation facility, downstream pond Colbu 2 (integral with it), the valley Colbu, left tributary of the Viseu river. Ponds operating activities was stopped in 2003, the year in which they crossed in conservation. Stabilization works referred to in were:

- Reshaping the pond embankment Colbu 1;
- Controlled channels to direct runoff falling on the surface of the slope adjacent beach surface and the surface slope.
- Additional stream flow Colbu transit to the ability of under-crossing transport system through a spillway to the point of outlet conduits in the channel open at the bottom of the pond Colbu.

There had been done some work to secure the pond in the short term:

- In the first phase were carried intervention works and were eliminated the effects of the flood on Colbu ponds 1 and 2 (emergency response after disaster).
- Continue to secure the ponds in winter, required some additional work. These additional works are:
- Clogging silt retaining existing thresholds.
- Excavation of material for access to "trunk intake" to "under-crossing system".
- Removing material upstream routing dig waters "under-crossing system".
- Routing dam waters "under-crossing system".
- Dike pond front inside Colbu 1.
- Filling in the ravine up in dam.
- Dismantle pipe tunnel undercrossing.
- Monitoring ponds, cleaning grills and reverse probes.

During the field research I will track and observe if the next points for closing waste dumps have been followed.

Restoration of the landscape degraded by the presence of quarries and waste is an attribute of the concept of sustainable development and ensure a favorable natural environment evolution of human society. After reaching the maximum storage, abandons

dumps in terms of technology and enter the rehabilitation phase to restore the natural landscape. Playing in productive economic circuit ash dumps is done in two stages:

- technical-mining stage, carried out by mining enterprises consisting of: leveling, layout and fixing dumps embankments, regulation of surface water;
- biological stage, complex technique which must be distinguished from dump to another, a minimum of 4-5 years. Ecological reconstruction of areas affected by mining activities is made by arranging and securing landfills after their closure by performing special works on increasing stability in operations requiring a large investment.

The main area of closure in mining industrial sites involve the following activities:

- decommissioning and removal of underground equipment, plant, machinery or equipment, and if these recovery activities were not economically profitable, flooding the lower horizons;
- execution of works to divert water from the underground mine;
- closure of mining in relation to the surface (slopes) with dikes and plugs embankment between dams or collapse by blasting (for: suite, collecting ore or tailings extraction wells or ventilation) by filling embankment and covered with concrete slabs;
- decommissioning and demolition of buildings in construction or surface mining or mining premises (stations ventilation, extraction wells, compressor stations, workshops, warehouses, cement silos, social groups);
- cleaning of enclosures mining waste;
- leveling, reducing the angle of slope of dumps mine, cover with topsoil, planting saplings, grassing areas, the implementation of channels for collecting water from the slopes (the contact between the landfill and slope);
- correction of torrents, works to regulate water, slope stabilization and waste with retaining walls and gabions, sewers, drains water from the slopes, strengthen retention dams silt basins gauging;
- filling the gaps on the surface and fencing these areas;
- building new water treatment stations mine

Ecological restoration of degraded lands

- renewed technology works and stabilization of tailing ponds D1 and D2;
- risk mitigation works pond novation;
- closure and rehabilitation works at the pond ;
- closure and rehabilitation works in ponds Colbu I and II Colbu;
- mine closure and cleaning mouth Superior Bath (closures galleries, eight dumps, mine water treatment system - drainage limestone dismantling buildings, ecological restoration tailings ponds);

Ecological restoration and land rehabilitation measures:

- improving the stability of morphological activity perimeter mining sites;
- stabilization of waste dumps and physically fixing tailings dams, it is recommended to forest plantations with heavily branched root system (locust, birch, sea buckthorn);
- compaction roller platform dumps that did not meet the technical standards of construction, in order to achieve the slopes descending towards the outer edge of the dump, to ensure water run off from the berms;
- carrying out geotechnical works to stabilize heaps and ponds in a state of instability with potential risk of collapse and guard channels to evacuate rainwater that can produce the tailings spills over dams or gravity shifts;

- design and construction of treatment plants and the mine water from ponds;
- water treatment technologies based on natural processes designed to function as "self-regulating systems";
- harnessing the deposits of tailings reprocessing and use as raw materials for construction materials and earthworks (roads and railways, sports and industrial construction, embankments);
- execution of uncontaminated water flows separation of contaminated seepage (ditches diverting runoff water collection);
- minimizing volumes and surfaces slope of waste rock dumps (removal of heaps of reduced height occupying large areas of land and relocating them in a single location).

CONCLUSIONS

In the upper basin of fluvial processes occurring Novat erosion, transport and accumulation evolved along valleys but also processes manifest as early erosion runoff and erosion manifested as erosion and gully erosion.

Mining exploitation from Borsa, have known during time some changes, some mines were closed due to high operating costs, but they have not taken measures to stabilize land in time and to secure the dumps.

In this subject the main objective will be monitoring the behavior of land to various factors that can affect the Colbu dump in time. The results of this field work will be represented by the analysis methods for measuring and analyzing known.

ACKNOWLEDGMENTS

This paper was published under the frame of European Social Fund, Human Resources Development Operational Programme 2007 – 2013, project no. **POSDRU/187/1.5/S/155631.**

BIBLIOGRAPHY:

[1] ANASTASIU, N., RĂDULESCU D. (1979), Petrologia rocilor sedimentare, Ed.D.P., Bucureşti.

[2] HERBEI M. V., HERBEI R. C., POPESCU C. A., BERTICI R.(2015), Domogled – Valea Cernei National Park monitoring using satellite technology. Ecoterra 12(3):73-78

[3] HERBEI M. V., HERBEI R. C., RADULOV I., (2015) Topology of spatial data, SGEM2015 Conference Proceedings, ISBN 978-619-7105-35-3 / ISSN 1314-2704, June 18-24, 2015, Book2 Vol. 2, 1175-1182 pp.

[4] FOCŞA, I., BIRA, M., ARION M. (1959), Raport geologic asupra lucrărilor de prospecţiuni pentru sulfuri complexe în bazinul văii Vaser (între valea Ivăşcoaia şi valea Novicior). Arhiva Comitetului Geologic.

[5] MIALL, A.D. (1984) - Principles of Sedimentary Basin Analysis. Springer-Verlag, New York.

[6] www.mappm.ro

[7] www.arpmnv6.ro/serv05.htm

[8] www.wikipedia.org/wiki/Borşa.