PARADIGMS OF COPPER EXPLOITATION AND CAPITALIZATION IN ROMANIA

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Abstract: *In Romania the sudden cessation of mineral resources exploitation and processing activity has caused a strong impact on both environment and community. After the closure of mining activity have remained many waste mining deposits, empty spaces, equipments and constructions, etc. managed faulty. In the last few years, the copper exploitation at Rosia Montana has proved that the activity of the mining sector is profitable even in the case of law content deposits and exporting concentrates. At the beginning of the years 2000, the exploitation of non-ferrous ores was considered a non-sense. This assessment has been one of the elements that led to the decision of closing non-ferrous ores mining activity. The destruction of the processing capacities and metal transformation plant in finished product had economic and social impact, losing added value obtained after mining concentrate processing and capitalizing the finished product.*

Key words: *Roșia Poieni exploitation, copper concentrate, law content ores, added value, nanofibre, dewatering*

1. Introduction

Copper is one of the most important metals used by humans since ancient times so far. It contributes, inevitably, to the future trends in the development of the community. If gold was the first metal used by humans, copper was the first metal melted, the first use wouldn't be dated certainly. Bronze age (4000 years ago) triggered the first great labour division. Along with this came about the need to transport raw materials over large distances, and complex technology to manufacture bronze (an alloy of copper and tin).

- Bronze has been known since the mid 4th millennium BC in Mesopotamia, and towards the end of III Millennium BC in Egypt. After it invention, it was currently used in Egypt and other civilized areas. In the Egyptian pyramids surgical instruments were found made of very tough bronze [1].
- In this era, it was considered that the bronze was more important than gold and silver through wider use in order to manufacture tools, weapons and ornaments.

On the Romanian territory were exploited, during this period, copper deposits in Oltenia, Banat and Apuseni Mountains.

The Thracians-the inhabitants of these territories - were recognised by historians as holding the bronze technologies state of the art.

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2. Partial closure of copper ore processing and exploitation in Romania

The action of split-up the metallurgical copper capacities was another destructive step for Romania during the periods of obvious opportunities for processing and capitalization of metal in ingot and finished products.

In addition, our country has the energy sources for processing, not being obliged to imports, thus creating a business chain that engage more production capacity and recovery. Environmental problems could be solved by organizing and upgrading improper flows.

Paradoxically, the exploitation Roșia Poieni resumed work, but has not found interested beneficiaries to purchase copper concentrate in the country.

The company obtains profit selling copper concentrate in China under charging the copper price with transportation costs, auto, railway and sea, the sale being made through a broker company.

Repeating the slogan "we don't sell our country" we come to export raw mineral material (as third-world countries) and to import finished products with high added value. A country that doesn't have its own economic potential and production capacity to obtain finished products is forced to sell raw materials.

Romania held production capacities to obtain finished products, but they have been blocked, terminated, disbanded. Such a case is very rarely encountered in world wide. As an example, Rosia Poieni export mining concentrates with low prices but with adverse consequences on the environment:
If mining copper concentrates would be processed up to the end product, it would be reached an added

value of 2-3 times higher, solving, in good measure, social problems caused by lack of jobs and developing new production capacities.

If in January 2016 the price of copper was 4450 USD/t, meaning 18556.5 euro/t (4.17 parity lei/USD) [2], and the price of finished product, the copper sheet was 45 lei/kg resulting a copper value in finished product of 45000 euro/t, and an added value of 26443.5 lei, meaning an increase of the added value from copper in ingot to finished product by 2.42 times. When the copper price increases at stock exchange, it will increase proportionally the finished product price and consequently its added value.

Continuing the reasoning, it is clear that if the concentrate would not be exported but processed to the finished product, it could be obtained an added value over three times higher.

Roşia Poieni mining exploitation in 2014 obtained the following indicators for the copper concentrate production [3]:

Ore mined	2.373.000 t
Ore processed	2.299.000 t
Copper concentrate	34.633 t
Cu in concentrate	7.264 t
Production merchandise value	147.021.091 lei

If the copper in concentrate would be processed in the country up to the stage of finished product the following values would be realized:

Finished product	Acquisition price 2014	Cu in concentrate production 2014	Production merchandise value (Cu in concentrate)	Cu value in finished product (sheet)
U.M.	[lei/kg]	[t]	[lei]	[lei]
Copper sheet	63	7.264 t	147.021.091	457.632.000

Accordingly, the amount of copper in the finished product would be 3.11 times greater than the amount of copper in concentrate.

The export of raw materials has negative impact on the community development - economic and social effects - and obvious environmental consequences. Extraction of a product unit has strong impact on environment especially in poor reserves conditions: small added value and important costs of extraction and processing.

If the product unit (e.g. ton of copper) is not high recovered (with high value added), the profit cannot enable the stabilization and rehabilitation of mining and metallurgical perimeters (landfills, mining areas, etc.) in accordance with actual technical standards.

In mining industry there are two main technological and successive phases: ore extraction and processing. Extraction involves opening, preparation works and overburden and the result are important quantities of sterile rocks which is inert matter if it doesn't contain reactive material or reactive if it contains reactive mineralization. The phase of processing involves crushing, milling and concentration in which result fine material that requires strict conditions of storage to ensure physical stability.

After processing the resulting sterile material may contain certain quantities of reactive mineral (e.g. sulphurs), these are classified as hazardous wastes and generate a long reactivity. Such a deposit (tailing pond) assumes important works to ensure physical and chemical stability [4].

In the case of Rosia Montana, in 2014, in the extraction stage, production was 2 373 000 t ore from which they have been processed 2 299 000 t. This technological phase generates important environmental impact as a result of explosives use, transport, deposits and excavated spaces.

In the processing phase it has been obtained only 34 663 t copper concentrate that represents approx. 1,5 % of the processed ore. So, 98,5 % of the total mining weight processed represents the flotation sterile which is a reagent mining waste to be managed.

In conclusion for 7 264 t Cu in concentrate Romania remains with 2 264 337 t mining waste (tailing ponds) and serious consequences to the environment generated by excavated spaces and mining waste deposits, losing at the same time the added value of the finished products if they would have been processed in Romania.

3. Actual concerns regarding solutions to ensure mining waste deposits stability and backfilling excavated spaces

At European level there are concerns on reopening, development and safety of mineral resources exploitation, processing and capitalization. Another direction of interest is the recovery of metals from wastes and mining waste deposits (tailing ponds, mining waste deposits etc).

With the purpose of research and cooperation in the field it has been created a European platform called ERAMIN, a network of organizations which has as objective the management of raw mineral materials research programs- www.era-min-eu.org.

Within this framework CELMIN project is financed - The use of green chemicals on energetic extractive industry: Preparation of modified nanofibrillar celluloses (NFC) for flotation, flocculation and dewatering, and water purification in mining industry in which the coordinator is Oulu University, Finland and Technical University of Cluj Napoca, North University Center of Baia Mare is partner, together with Technical University of Lisbon, Portugal and four industrial entities.

Research in the framework of the European partnership is following the use of cellulose nanofibre produced in Oulu University laboratories for the purpose of raw materials processing and dewatering fine mineral material from tailing dams. The objective of the research in Baia Mare is focused to the use of cellulose nanofibre in facilitating drainage and dewatering of fine material from tailing ponds. The tailing pond physical stability is influenced by the capacity of the draining water from fine material located behind the retention dam. In this respect many experiments have been initiated with cellulose nanofibre sent by the Finnish partner on the materials taken on tailing ponds in Maramures area, particularly Aurul Tailing Pond. The research interest is following the drainage – dewatering behaviour of clay, dust and fine sand (samples taken from the central and marginal area of the tailing pond) in the presence of cellulose nanofibre, as compared with blank samples. At the end of the study, the results of the research may be extended and applied in similar situations in our country and EU.

The tailing pond resulted after ore processing at Rosia Montana provides a suitable framework for the implementation of the results obtained in this project. Cellulose nanofibre shall also be applicable to the materials from tailing dams used for backfilling excavated empty spaces. We believe that a study on the underground exploitation by backfilling method of Rosia Montana reserve under the limit of open pit is appropriate and desirable.

The backfilling of exploited empty space will be made with the sterile resulted in processing. Mixing it with cellulose nanofibre facilitates the process of backfill draining and enhances its stability. Funding and support of the research activity for the Romanian partner, in the frame of the CELMIN project is ensured by UEFISCDI - executive unit for financing higher education, research, development and innovation.

4. Conclusions

The aim of this work is to highlight the exploitation opportunity of mineral deposits in Romania, even those with low content. At the beginning of the years 2000, the project Rosia Montana was considered non feasible, similar to the whole non-ferrous ores extractive industry. In 2007 the activity of extraction and processing in the most important mining companies has been stopped with bad economic, social consequences and environmental problems. The mining activity stop has occurred in the period of significant and unprecedented growth of raw mineral materials prices on the international market.

Through its present activity, the exploitation Rosia Montana confirm the possibility of profitable mining activity in Romania even if the product is exported in concentrate, in absence of metallurgy and processing up to the finished product. As a consequence of mining closure, the entire chain of related activities and jobs for communities disappeared.

The sudden cessation of mining activity dismissed on the labour market qualified staff which could contribute, in an organized manner on the frame of mining companies, to the closing, greening and rehabilitation works of unprofitable mining perimeters. With the profit realized on profitable mining exploitations it would be possible to finance the environmental protection activities in the mining perimeters. Another consequence has been the destruction of the material basis of production capacity, the loss of professional experience gained over time. At the same time it has been strongly affected the research and education infrastructure which represents the most important component of the industries development. Each of these aspects is serious and with huge consequences on long term.

The inefficiency of the system which need subsidies for functioning was due to, in great measure, to the lack of organization at all levels and, at national level, the lack of coherent strategy of country project. To all these, a waste of financial and material resources are added, got out of control.

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