MINING INDUSTRIAL LANDSCAPE.
EVALUATION AND ENVIRONMENTAL MANAGEMENT ELEMENTS

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Abstract: *Mining is a special human activity, indispensable for the exploitation of Earth's solid mineral resources. But modern extractive operations face environmental problems due to the emotional, subjective, and interpretable assessments of the impact generated, because, most often, in assessments the environment is reduced to something relative or vague. In the exploitation of useful mineral substances (u.m.s.) the operations are located in the Pedolitosphere, corresponding to the lower level of the atmosphere and the upper level of the lithosphere. This level implies a geographical approach to ecological studies at different spatial scales. Thus, although it introduces a disturbance in relation to the natural landscape, marking a relative fragmentation in the historical evolution of the geographical environment in which it develops as an economic activity, mining is still a pillar of development. It is the result of practices, decisions and activities that produce quantifiable plus-value, as an implicit cultural landscape through the multiple deposits of material values, technical knowledge and social memory that it includes, long after the cessation of mining activities.*

In this context, among the scientific concerns promoted during the 70 years of publication of the ***Mining Revue*** *let's mention those related to the sustainable development of mining areas, to the impact on environment and to the mine closure management. The paper aims to contribute to the understanding of the concept of landscape environment and the value assessment of mining, in the context of new paradigms debated in Europe.*

Introduction

Sustainable development, based on knowledge, generates a continuous revision of both the definition of landscape, as a generic intuitive notion that refers to human perception on a given territory, and the latest directions of study, pushing to extreme the boundaries of engineering disciplines. We observe the evolution of landscape typologies through cultural metabolization and the integration of fundamental traditional elements (customs, culture and/or tradition) in modern and contemporary sciences (geosciences, imaging and/or computer science). [12] Landscape typologies continue to develop over time and at all spatial scales of the geographical environment, through a variety of approaches, dictated by new lines of engineering research and the interdependence of emerging hybrid scientific branches. The landscape is "the outer part, the physiognomy collected by sensors directly to the visible surface of the earth in the form of a portion of an area defined by the homogeneity of natural and anthropogenic characteristics" (Cocean, 2010). [13] Cocean notes that the geographical landscape must be differentiated from the geographical environment defined by *the heterogeneity of its natural and human (cultural) characteristics*. [13] Due to cultural changes, the conceptual level of society is constantly changing too, developing new hybrid types of landscapes, such as: *historical and social*, *rural and urban*, *industrial and residential*, *material and immaterial* or *perpetual and ephemeral*, and these are just a few among the infinite possibilities created by natural evolution (transformation) and technical development (mining being a technical industrial branch). Throughout this palette, the industrial landscape is a particular case that results from the need for technical and technological development of human society, starting with the need for mineral resources (gold, silver, copper, iron, coal, construction materials, etc.) and ending with consumer goods. These activities have generated an unprecedented vertical and horizontal development of cultural landscapes by introducing more and more industrial elements into geographical systems. Thus, landscape becomes a universal term used in a holistic sense not only as a terminological link between different scientific fields but a major concern, a priority, of modern society for the ecology of landscapes. Carl Troll [4], the "father" of *Landscape Ecology* defined this concept as "*a combination of spatial-horizontal (geographical) analysis and vertical (ecological) functional analysis*", aiming to study the causal relationships between biota (living communities) and environment, structured as a landscape mosaic (Troll, 1971 cited by Wu, 2006). Based on these considerations, Turner (1990, 2001, 2005), improves Troll's definition by showing that in defining the analysis of landscape ecology we should focus on "*the interactions of mutual understanding between spatial heterogeneity and ecological processes*." [1] Thus, Turner changed the term **Environment**, considered vague, to the term **Spatial**

Heterogeneity, emphasizing the practical importance of correctly quantifying the uneven distribution of existing geographical elements in a complex landscape, when conducting environmental assessment and management. At the same time, the industrial landscape is assimilated to productive activities and brings together those natural or urban geographical territories in which essential components of the production process of one or more industrial activities are preserved [Law no.6 / 2008, Chapter I.Art.3. f.]. [13]

In this context, although it seems a *counter-landscape* in relation to the natural landscape, because it marks a break in the historical evolution of the geographical environment in which it develops, it is a result of practices, decisions and productive activities being a cultural landscape through its valuable multiple deposits of technical knowledge and social memory that it includes. In its structure, in addition to the visible material part, there are also aspects related to the memory of the place, the social, technical memory (machines, machinery and equipment) and the public, etc. Defined as an open system, the industrial landscape has its *own structure*, within which natural, functional, social, technical and economic elements can be identified, grouping one or more industrial units and / or industrial areas with a high degree of complexity and diversity. The industrial landscape is therefore the one that gives value (aesthetic, historical, technical, social, financial-monetary, etc.) to human production activities and not vice versa (Preite, 2009, 2010). In turn, it is the *structure of the landscape* that imposes visible distinct physiognomies and, therefore, distinct categories of landscapes, in the evaluation and management of which must be taken into account criteria such as industrial activity, stage of development, importance to society, location and geographical extension, number and type of industrial units, climate changing etc. From functional perspective, as a component of the industrial landscape, the industrial unit represents the most vulnerable structure to economic and political changes, this being the one that will register the first processes such as: merger, reorganization, restructuring, relocation or reconversion.

Environmental management

Concept

The general concept of Environmental Management System (EMS) is well established in the EU and is receiving increasing attention worldwide, where there are, in principle, two EMS certification schemes: ISO 14001 and EMAS (Eco Management & Audit Scheme). They are increasingly used in recognition of the fact that the EMS meets the generally accepted requirements of these certification schemes. It should be noted, however, that the existing international certification schemes (ISO 14001 and EMAS) only serve as Guides, recommended for achieving the proposed environmental goals and objectives, and are designed to provide sufficient flexibility in implementation. [2]

Benefits

Schiffman (1997) considers that there are three major benefits of implementing EMS:

- is established the environmental policy, which reflects the commitment of the management at the highest level regarding the compliance with the environmental legislation in force and the continuous improvement of the environment;
- integrates all management tools to more easily anticipate waste problems, avoid land reclamation costs and penalties, reduce toxic effluent discharges, avoid spills and reduce raw material consumption;

are planned measures to reduce the environmental impact and change the reactive approach to environment (which continuously responds mainly when penalties are applied) to a proactive one.

Integration & Strategic Planning

It is recognized that an effective pollution control cannot be achieved exclusively by technological solutions, but it must be approached based on Environmental Management System, integrated into the general management of the Company.

Integrating environmental considerations into strategic planning is essential for industrial activities because any omission/ negligence can generate a major disturbance and a severe reaction of the community, or additional remediation costs. The representative components of the EMS are presented in Fig.1. [2]

The specific requirements regarding the integrated approach, in accordance with the provisions of Directive 96/61 / EC, have been fully transposed in our country by OUG no. 152/2005 on integrated pollution prevention and control, approved by Law no. 84/ 2006 [5].

A number of direct legislative instruments have also been issued to implement the Directive. Both the Directive and the legislative documents by which it was transposed contain provisions on the procedure for authorizing certain categories of industrial activities. These legal provisions require a comprehensive, integrated approach to the potential pollution of an activity. The overall objective of such an integrated approach must be to improve the management and control of industrial processes so as to ensure a high level of environmental protection as a whole. An EMS should be integrated into the

strategic planning process in the form of a plan detailing at least aspects of:
- geographical fit of the industrial perimeter,
- mining, industrial and processing waste storage sites,
- the equipment and technology used and strategy for remediation of affected areas.

As the range of industrial activities is wide and complex, plans, procedures and all associated activities must be part of the general management system, which should include:
- a strategic management system,
- a safety and protection management system,
- an environmental management system.

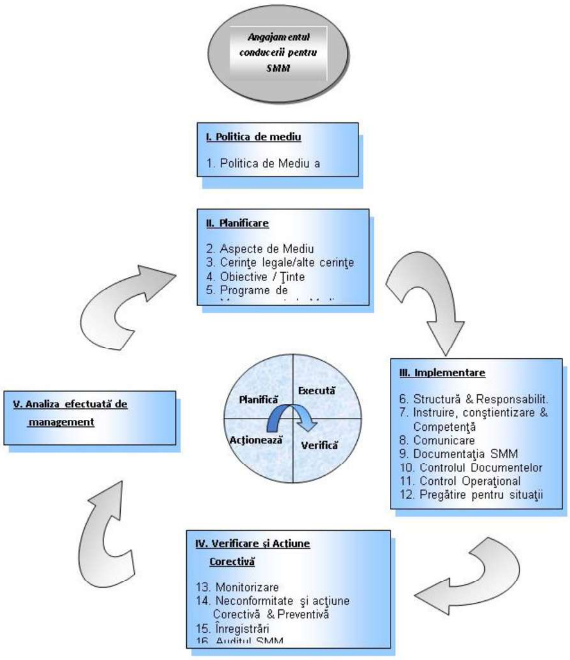

Fig. 1. **The components of E.M.S.**

Implementation of E.M.S.

The Shewart-Deming model

The implementation of an environmental management system or EMS requires a lot of preparation and effort for the analysis, measurement and continuous improvement of environmental performance. A conceptual model was proposed by Shewart & Deming:

"Plan, Do, Check, Act"

EMS components

The components of an EMS should include:
- Management commitment,
- *Environmental policy statement*,
- *Environmental impact assessment* (EIA is not a standard requirement but is usually included),
- Community consultation,
- Performance indicators,
- *Environmental management program*,
- SMM documentation and records,
- *Operational procedures* (including emergency situations),
- Responsibility structure and reporting,
- How to train, raise awareness and improve (competence),
- Removing the impact on the environment,
- Compliance with legal requirements and environmental performance audits,
- Monitoring and measuring environmental performance.

The recommended EMS in the mining activity is a hierarchical, pyramidal one on several levels (Fig.2). [2]

Fig. 2. **Content of EMS documentation**

The pyramid illustrates the recommended approach, best suggesting the volume of information, degree of specificity and volume of each section that become larger and larger as it descends from top to base, as follows:

Level 1 - Environmental policy, is a statement of the intentions and principles of the organization in relation to its environmental performance;

Level 2 - The EMS Manual, is a "roadmap" or a brief description of how the components of a merged EMS can be a useful tool that: (a) describes the essential elements of the system and the interconnections between them; and (b) provides guidance on associated documentation;

Level 3 - Procedures, classified into: (a) system / site-level procedures and (b) operational and emergency procedures, specific to industrial processes and activities (define the authority, responsibilities and responsibility for the implementation and monitoring of the EMS);

Level 4 - Working instructions for EMS, detailed, specific, describing the methods of achieving environmental objectives, and finally, compliance with environmental policy. These instructions are specific to each individual activity and process, and are addressed to the level of workers;

Level 5 - Records, that must be maintained to monitor the performance of the EMS and to demonstrate to the certification body that the EMS is working. Several elements of the EMS require the preservation of all related records. [2]

The value of landscapes

The problem of landscape assessment has developed a whole literature and, without a doubt, the most discussed areas are those related to management (administration and planning). The problem of the economic value of the landscape appears in the early '70s, with reference to the value of the land associated with the cost of housing located near a green space (forest, park, public garden). But the concept has been developed since the 1990s since the evaluation of agro-cultural and forest landscapes, then emerging as a new science - *Landscape Economy*. In this sense, the emergence of numerical modelling of the landscape using the price of a geographical area was associated with the "open landscape", respectively the landscape visible from a point. [8] [10]

Marangon & Tempesta (2008) propose a model for estimating the costs of landscape assessment, recovery and conservation based on "the desire that the landscape is a place of living and leisure for communities, but also provides specific services [7] These actions are of interest to both present and future generations", which is why the value of the landscape could be estimated as a cost-benefit assessment (CBA). Usually, benefits are obtained by grouping the values generated from:

- the areas that can be landscaped, taking into account the urban plans of the territory,
- the existing landscape, taking into account the activities: direct (tourist, recreation) and indirect (unusable) given by different monuments as architectural, historical, cultural, natural etc.

Costs can be mainly related to:

- landscape conservation / monitoring;
- maintenance (roads, buildings, green spaces, gardens, forests etc.).

According to the methodology, direct costs can be linked to an average hourly wage for each category of activity. At the same time, economic value is based on the marginal use of a good while cultural value is based on aesthetic, spiritual / religious, social, historical, symbolic and identity value (Throsby, 2001). [7]

Starting from the notion of cultural value, Throsby (2001) conceptualizes cultural capital as "a set that stores cultural value in addition to its economic value" and applies the theory of sustainable development to cultural capital, defining the "***intertemporal equity between generations principle***"). [9]

Thus, the thesis arises according to which if it is accepted that the current reserve of cultural capital to decrease, for various reasons (e.g., due to lack of investment in industry, environment, agriculture, etc.), *future generations will be deprived of the benefits produced by this reserve*, because their interests will no longer be reflected in the current market (Sache, 2009). Sache takes over this thesis and preserves the following evaluation methods, used by Bănacu [10] for the built cultural heritage:

- comparison of the sale price, which involves the identification of a property with characteristics similar to those of the valued patrimony (called comparable properties). The criteria for selecting comparable property refer to location, architectural style, size, cultural and historical characteristics. The valuation of the patrimony will be made in comparison with the sale price of the comparable property, the adjustments being made in case the evaluated patrimony requires restoration / rehabilitation works or in case it is the object of some contracts with restrictive provisions;
- income estimation, used in the case of built heritage that is able to generate commercial or rental income, its use in this regard being the most effective alternative. The assessment will take into account, in addition to the estimated income to be obtained, the possible restoration / rehabilitation works that may be required for the use of the good, the time required to obtain the necessary authorizations (if it is necessary to authorize the commercial use of the element). the respective patrimony), as well as the additional expenses with the patrimony conservation that appear as a result of its introduction / reintroduction in the economic / commercial circuit;
- cost assessment, based on the assumption that the constructed cultural heritage has intrinsic value (due to its appearance, certain characteristics or symbolic status). Its value will be determined taking into account the cost of producing a "reproduction" of the heritage element or, if this is not possible, the cost of carrying out a modernization with a similar purpose. The application of this method will take into account the cost of preserving the built heritage, as well as the reduced possibilities to adapt it to the specific needs of the occupant. If the company opts for a strict control of the phenomenon of environmental pollution, it will be necessary to specify the standard quality and the level of degradation. [7]

As the criteria underlying their adoption are very different, divergent currents of opinion have emerged, starting from the total elimination of the effects on the environment to the abandonment of the affected perimeters in the form that exists upon cessation of activity.

Level of allowable pollution

For a unified approach, proponents of the conventional economy propose establishing an "optimal level of pollution" in terms of the cost function, given that any pollution process must be associated with both costs and benefits. This approach considers that it is very important to know the ability to recover and / or assimilate the changes that have taken place for natural-technical reasons, for each case. Thus, when this capacity is exceeded, the effects of landscape transformation appear and the pollution process begins to make economic sense, requiring the determination of the "optimal level of environmental pollution" [7] as the allowable economic value of the landscape.

In this sense, Ruijgrok (quoted by Iorgulescu, 2011) considers that the economic value of cultural heritage can be defined by the level of "well-being" it generates for society. When determining the economic value of cultural heritage, it must be taken into account that it may have a use value (generate benefits through its use) and / or a non-use value.

The value of the non-use can take at least three forms:

- the value of the option (for people who have not visited the respective cultural heritage site but want to do so in the future);
- the value of existence (for people who have not visited the site and do not intend to do so in the future, but who perceive the existence of the site as a positive fact);
- the value of heritage (the value of knowledge passed on by cultural heritage for the benefit of future generations). [9]

Thus, he notes that the economic assessment of cultural heritage allows the use of cost-benefit analysis when estimating the benefits of investments in heritage conservation and losses caused by the destruction of heritage elements, which can influence economic decisions and cause their destruction.

The Romanian school contributes to the development of this concept, Negrei (2004) proposing a model of determination having as objective the function of maximizing social welfare [7] [10], as follows:

$$[W] = [P] + [E] \qquad (1)$$

In this case [W] represents social welfare, respectively the value associated with the environment [E] respectively productive works, goods and services [P] (production).

Prof. Negrei analyses the relationship (1) and observes that the ideal situation is a P1 production that does not eliminate pollutants, does not generate effects on the E1 environment and does not produce an expense for environmental protection. Thus, he proposed two new relationships:

$$[P_1] - [P] = [C] \qquad (2)$$

and

$$[E_1] - [E] = [D] \qquad (3)$$

where [C] represents the cost of control or the amount of means used to combat technical pollution, and [D] represents the damage to the environment caused by technical pollution.

$$[W_o] = \{[P_1] - [P]\} + \{[E_1] - [E]\} = [C] + [D] \qquad (4)$$

where [Wo] represents the optimal welfare obtained by minimizing the total costs arising from the use of the means and eliminating the damage. [7] [10]

Hugett (2003, quoted by Offenberg, 2019) notes that a system of basic equations can be developed by considering each terrestrial sphere separately, as there is considerable feedback between them. Hugett recalls that the degree of vegetation cover influences the development of the relief; the relief affects the climate on scales ranging **from local to global influences**, and so on. For this reason, Hugett states that it is logical to define all terrestrial spheres as *variables of internal state*, leaving the forces of *Cosmosphere* and the solid mass of the *Earth* as driving variables. [3] This conceptualization can be formalized by defining the relationships between the component spheres, represented by symbols: *biosphere* (life) b, *troposphere* r, *atmosphere* a, *pedosphere* (soil) s, and *hydrosphere* h, which is called "brash".[3]

$$\frac{db}{dt} = f(b,r,a,s,h) + z \qquad \frac{ds}{dt} = f(b,r,a,s,h) + z$$

$$\frac{dr}{dt} = f(b,r,a,s,h) + z \qquad \frac{dh}{dt} = f(b,r,a,s,h) + z$$

$$\frac{da}{dt} = f(b,r,a,s,h) + z$$

Hugett points out that these spheres interact, so that a change in any sphere can be written as a function of the state of all other spheres, plus the effects of the z - driving variables, but, in turn, is unable to define **quantifiable spatial limits** for the environment considered impacted by an activity.

Under these conditions, a mining company will have to bear both the costs of the effects of technical transformations [ET] and the costs of the effects of changes and / or landscape transformations that occur exclusively for natural reasons [EN] (climatic, hydric, morphological, biotic, abiotic and a). This means that environmental issues must be analysed holistically by taking into account all complementary and / or synergistic influences added / reduced to the technical ones, but using ***geo-ecological damage*** [DG]. In this case, the skills and inadequacies generated in the landscape by the natural-technical activities in the analysed mining **perimeter must be related to a well-defined geographical extension of the disturbed system** (Geo-form, Geo-top, Geo-facies, Geo-system, Region, Domain or Area). [1] [2]

From a Geo-ecological perspective, the new relationship of optimal well-being becomes:

$$[W_o] = \{[P_1] - [P]\} + \{[E_I] - [E_T \pm E_N]\} = [C] + [D_G] \quad (5)$$

where

$$[E_I] - [E_T \pm E_N] = [D_G] \quad (6)$$

In turn, the geo-ecological analysis can be formalized by descriptive relations of the components of the Geo-system (geographical environment), where we find: *pedolitosphera* - p, *relief* - r, *biosphere* - b, *hydrography*- h, *society*- s and *climate*- c. [3]

Thus, Offenberg (2019) proposes a new conceptual form for Hugett's system of "brash" equations, which becomes "prbhcs" [1]:

$$\frac{dp}{dt} = f(p,r,b,h,c,s) + z \qquad \frac{dh}{dt} = f(p,r,b,h,c,s) + z$$

$$\frac{dr}{dt} = f(p,r,b,h,c,s) + z \qquad \frac{ds}{dt} = f(p,r,b,h,c,s) + z$$

$$\frac{db}{dt} = f(p,r,b,h,c,s) + z \qquad \frac{dc}{dt} = f(p,r,b,h,c,s) + z$$

Simplified conceptualization can be also obtained by using matrix relations, such as:

$$\frac{dx}{dt} = f(x) + z \qquad \frac{dx}{dt} = f(x,I) + z$$

where x is a vector of state variables describing the studied geo-system, *f(x)* is the matrix that defines interactions between state variables and z is a vector of driving variables. [3]

The interaction between the components of the Geo-system can be defined by parameters of type aij, complete set of parameters can be written as an interaction matrix (I), of type "*nxn*" that can be added to the equation. The economic assessment of the value of landscapes should therefore highlight the cost dynamics generated by:

- *the degree of uniformity*, respectively the structural diversification and / or the different mode of development (fast - slow, discreet - continuous, etc.) generated by the disturbing processes,
- *the potential for regeneration*, respectively the risk of removing natural components from the geographical environment through substantive changes (natural) or natural and cultural transformations (natural-technical),

as follows:

$$g = f(D, P, \tfrac{dD}{dt}, \tfrac{dP}{dt}) \quad (7)$$

where g is a property of the Geographic environment G, D is a set of dynamic vectors, P is a set of passive vectors and dD / dt and dP / dt are the rates of change over time, identified in the *Disturbed Mining Geo-system*. [1]

Conclusions

Despite all attempts by economic theory to model as accurately as possible a *maximum allowable level of pollution* ("optimal pollution"), there are no generally accepted models. The trend of optimization cannot have a real and complete support if it does not capture the processes of transformation of some "*free goods*", considered for a long period of unlimited time (e.g., natural resources, soil, water, air, wind, sun), in *economic goods*. This process of reconsidering free goods into economic goods is becoming increasingly important as their limited nature is highlighted. Even if the free goods are not diminished quantitatively by use in the production processes, the quality (purity, accessibility, allocation and others) can undergo transformations in the sense of diminishing (we rarely find clean air and pure water). Under these conditions, environmental externalities occur when "private" costs differ significantly from "social" costs, distorting the mechanism of optimal resource allocation. Social costs can include the direct or indirect effects borne by a community through hospitalization, medication, sick leave, stress, and population relocation due to economic activities aimed at maximizing profits and minimizing technical costs. All these costs are found in the costs of technical transformations [ET]. [8] [10]

In order to identify the optimal point of social welfare of the landscape, the environmental assessment should involve, but not be limited to, the following aspects:

- control costs, such as investments and the means needed to control environmental factors,
- geo-ecological damage, loss / deterioration and / or transformation of the geographical system (geo-system), as skills / unfitness's of the landscape to produce.

Thus, it is recommended that in mining the economic assessment be made on the basis of a Geo-ecological analysis after prior identification of the extension, landscape structure (assimilated factors) and changes in landscape structure (assimilated impact), including lists (sets) of induced skills / disabilities. in the geographical environment, consisting of: Pedolitosphere, Relief, Biosphere, Hydrography, Society and Climate, including the environment. They will have to be continuously adjusted according to the type of system disturbed by the mining or industrial activity, in order to highlight as accurately as possible, the reality on the ground and to eliminate ambiguities. [8]

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CONSFĂTUIREA SECȚIEI „MINE" AST BAIA MARE.

In zilele de 10 și 11 Decembrie 1949 a avut loc în centrul minier Baia-Mare prima consfătuire pe țară a tehnicienilor din secția „Mine" a „Asociației Științifice a Tehnicienilor" din RPR.

Scopul acestei consfătuiri a fost acela de a înlesni tehnicienilor un schimb de experiență și o punere la punct a principalelor probleme legate de îndeplinirea și depășirea Planului de Stat în acest sector, precum și pregătirea viitorului congres pe țară al tehnicienilor din AST.

Rapoartele expuse au fost următoarele:

„Mecanizarea în exploatările miniere metalifere din RPR;

„Mecanizarea în exploatările carbonifere din RPR."

S'a arătat gradul de mecanizare al diferitelor operațiuni miniere, mașinile folosite, accentuându-se asupra sarcinilor care stau în fața tehnicienilor în privința sporirii producției miniere, a productivității muncii, a reducerii prețului de cost și a ușurării și îmbunătățirii condițiunilor de muncă ale muncitorilor subterani.

S'a subliniat obligația combaterii pericolului pe care-l prezintă praful degajat în timpul perforării, introducând sistemul de perforare umed pentru combaterea silicozei.

„Ligniții ca sursă de combustibil mineral pentru electrificare în RPR.". S'a arătat rolul ce revine ligniților în electrificare și în alte întrebuințări, înlocuind alți combustibili mai prețioși.

In raportul *„Problema armării în minele de cărbuni"* s'a subliniat importanța tehnică și economică a introducerii armării metalice în minele noastre de cărbuni, experimentată cu succes în exploatările din Valea Jiului.

Raportul colectiv despre *„Problemele geologice și miniere în legătură cu Canalul Dunărea—Marea Neagră"*, a arătat aspectele de specialiate legate de această măreață înfăptuire, lucrările realizate de ACEX sub îndrumarea specialiștilor sovietici în fixarea traseului celui mai indicat.

Problemele standardizării în sectorul minier au fost expuse în rapoartele:

„Planul de standardizare pe 1949 și perspectivele planului pe 1950";

„Standardizarea minereurilor și a utilajului minier;

„Standardizarea cărbunelui".

In discuțiunile avute s'a arătat caracterul special pe care-l are standardizarea cărbunelui ca produs natural, asupra căruia voința și munci tehnicianului sunt restrânse față de produsele fabricate din alte sectoare.

Problemele productivității muncii, ale întrecerilor socialiste și al protecției muncii, au fost tratate în rapoartele:

„Productivitatea muncii în legătură cu mecanizarea".

„Principiile de organizare ale întrecerilor socialiste".

„Protecția muncii".

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PROBLEMA ARMĂRII IN MINELE DE CARBUNI

de Ing. PISO

Problema armării în minele de cărbuni trebuie privită, în general, sub 3 aspecte: siguranța personalului, calitatea tehnică și condițiile economice de folosire a tipului de armare ales.

Rezolvarea care satisface în modul cel mai rațional și armonios aceste condiții, se poate socoti ca cea mai bună.

Din punctul de vedere al siguranței personalului, se cere dela un sistem de armare ca să fie destul de rezistent pentru a putea prelua sarcina provocată de presiunea terenului, cu o deformare minimă, adică armarea să mențină profilul necesar a lucrării miniere respective.

Din punct de vedere tehnic, se cere ca armarea să permită introducerea de metode de exploatare cu o înaltă productivitate a muncii, să se execute cât mai ușor și în timpul cel mai scurt, să aibă rezistență suficientă în funcție de durata lucrării și să permită lucrări de întreținere și de reparații în modul cel mai ușor și simplu.

Menționăm că lucrările de armare necesită până la 20% din totalul timpului efectiv de lucru în abataje.

Din punct de vedere economic, se cere ca să se utilizeze materiale cu un cost cât mai redus, iar calculul de rentabilitate care are în vedere atât materialul utilizat, cât și salariile aferente precum și amortizarea unei armături, cu lucrările de întreținere necesare, să dea un reezultat acceptabil și avantajos.

Privind problema armării din toate aceste puncte de vedere, situația la minele de cărbuni din *Valea Jiului* se prezintă în felul următor:

Armarea utilizată atât la înaintări, cât și în abataje până acum cca 10 ani, a fost *lemnul de molid și gorun, betonul bătut* sau *blocuri de beton*, în lucrările cu durată mai lungă ca: puțuri, galerii principale, camere, basine, etc.

Consumul de material lemnos în medie pe Valea Jiului a fost următorul: molid de mină rotund și jumătăți: 0,04 m^3/t, gorun de mină 0,005 m^3/t, margini de molid: 2,5 ml/t, molid de construcție: 0,006 m^3/t, gorun de construcție: 0,0003 m^3/t.

Costul materialului lemnos pentru armarea în abataje, reprezintă deci 60—80 lei/t. (inclusiv marginile).

Dacă din punctul de vedere al siguranței, armarea în lemn prezintă avantaje prin elasticitate și prin semnele prevestitoare a pericolului de surpare, din punct de vedere tehnic și economic are o serie de desavantaje.

Armarea în lemn necesită timp lung de execuție și nu rezistă în cazul când se cere o durată mai lungă; asemenea armături sunt scumpe și nu permit introducerea metodelor de exploatare concentrate în unități cu producție mare, mecanizate și cu o productivitate mai mare.

Adăugând la acestea și lipsa din ce în ce mai accentuată a lemnului de mină, problema trecerii la armare cu fier s'a pus la minele de cărbuni din Valea Jiului acum cca 13 ani, când s'au introdus abatajele frontale armate cu stâlpi de fier.

Armarea abatajelor cu stâlpi de fier reprezintă un pas important în perfecționarea metodelor de exploatare, putându-se aplica metode perfecționate din punct de vedere a concentrării și mecanizării.

Referat prezentat la Consfătuirea secției „Mine" AST din Noembrie 1949, ținută la Baia Mare.

The first scientific paper of Revista Minelor / Mining Revue – issue 1 / 1950
"The problem of reinforcement in coal mining" – author eng. I. PISO

In linii mari, rezultatele obţinute în aceşti 13 ani de încercări, în condiţiile special de grele a exploatării stratelor groase cu tavan artificial. sunt următoarele:

Primele încercări s'au executat cu stâlpi elastici, sistem *Schwartz*. Un asemenea stâlp are intercalată între pana stâlpului şi partea superioară mobilă a stâlpului, o pană de lemn moale.

Din cauza presiunii repartizate neuniform, a tavanului artificial, precum şi a mărimii acestei presiuni, rezultatele n'au fost satisfăcătoare, stâlpii nerezistând decât la cca 40 t/m², după o deplasare prea mare a tavanului se îndoiau sau se rupeau.

S'a trecut din acest motiv la folosirea stâlpilor sistem *Schwartz, întăriţi,* confecţionaţi cu o secţiune mai mare, care putea să ia o sarcină până la 50 t./m². Insă din cauza presiunii neuniforme şi acestea se rupeau într'o proporţie prea mare.

Pe baza acestor observaţii, s'a abandonat în parte principiul elasticităţii, renunţându-se chiar la asigurarea tavanului cu funii vechi puse sub poditură, trecând la sisteme de *stâlpi semi-rigizi.*

La început s'a renunţat la adausul de lemn între pene, iar mai târziu s'a făcut încercări cu sistemul de stâlpi *GHH semi-rigizi,* putând prelua o sarcină de 60—70 tone/m².

Azi avem introduse în cele mai multe abataje acest sistem de stâlpi semi-rigizi şi rezultatele de până acum sunt dintre cele mai bune.

Stâlpii metalici fiind uşor demontabili, s'a putut trece la abataje cu front lung, cu productivitate mare şi cu o producţie ciclică.

Din punct de vedere economic, armăturile de fier sunt avantajoase. După datele statistice, avem cca 0,8 stâlpi distruşi sau pierduţi în surpare şi o grindă din funii vechi la 1000 tone producţie; ca întreţinere se consumă pentru repararea stâlpilor şi grinzilor cca 0,2 kg fier şi tablă şi 0,15 posturi pe tonă.

Preţul unui stâlp de abataj GHH fiind de cca 11.000 lei şi a unei grinzi cca. 2000 lei. revine pentru materiale pentru armare pe tonă de producţie, cca 10 lei.

Materialele pentru întreţinerea şi repararea stâlpilor şi grinzilor, cu salariile aferente, revenind la cca. 45 lei/t, costul armării metalice în abataje se ridică la cca 55 lei/tonă, ceea ce ne dă o economie faţă de armarea cu lemn, de cel puţin 5—10 lei/t.

Luând în considerare că timpul de ridicare al unei armături în fier reprezintă numai 20—30% din timpul necesar pentru armarea în lemn. armarea în fier în abatajele frontale reprezintă un avantaj economic apreciabil.

In vederea reducerii timpului improductiv din schimbul cu mutarea instalaţiilor şi cu răpirea armăturilor, s'a pus la punct un sistem de abataj, cu transportorul între front şi primul rând de stâlpi, aceştia fiind mutaţi printr'o simplă deplasare. In modul acesta se realizează o economie importantă de timp şi de braţe de muncă.

Tot în acest sens, pentru a putea obţine 3 schimburi productive, se studiază în prezent aplicarea armăturilor mobile, nişte carcase metalice articulate, asigurate cu stâlpi de fier, care se deplasează cu instalaţiile de transport la fiecare fâşie scoasă.

Deasemenea Ministerul studiază actualmente nişte scuturi metalice mobile pe şine, care vor fi încercate la minele din Valea Jiului.

Paralel cu armarea metalică în abataje, se pune problema armării metalice a galeriilor, lipsa de lemn de gorun fiind din ce în ce mai mare.

In minele din Valea Jiului încă acum 10 ani, s'au încercat armaturi metalice din şine de 30 kg/m. Rezultatele n'au fost satisfăcătoare, din cauză că materialul fiind casant, la îndoire se produceau crăpături, care reduceau rezistenţa armăturilor.

In anul 1942, au fost încercate armături din fier „pocal"-profil cu un modul de rezistenţă mare — care, prin experienţele noastre, s'au dovedit a fi potrivit în cazul presiunilor moderate armăturile metalice putând fi recuperate şi reutilizate.

Cum în prezent cheltuiala lunară de întreţinere a galeriei armate în lemn se ridică la cca 100 lei/m armăturile de fier care costă cca 8000 lei/buc. sunt rentabile, ele având o durată de 10—15 ani.

Armăturile de fier sunt cele mai potrivite pentru galeriile de aeraj, unde lemnul putrezeşte după 1—2 ani.

Faţă de armarea cu beton bătut, sau cu blocuri din beton cu adause de rosturi de elasticitate din lemn, armăturile metalice sunt mai ieftine.

In timp ce galeria armată în beton e mai scumpă de 3—4 ori, faţă de galeria armată în lemn, aceiaşi galerie armată în fier este numai de 1.5—2 ori mai scumpă, necesitând şi un volum de săpare mai mic pentru acelaş profil.

Problema ce se pune în privinţa armării metalice, se reduce la studierea unor profile adecuate cât şi la găsirea unui material mai rezistent decât cel actual, (OL 60—70), pentru a putea reduce greutatea armăturilor.

Dacă preţul materialului feros se va reduce, investiţiile vor fi mai mici.

In acest scop, este nevoie de o colaborare cât mai strânsă cu industriile metalurgice din ţară, în vederea găsirii unei soluţii cât mai bune, din punct de vedere technic şi economic.

Problema armării metalice atât în galerii, cât şi în abataje, trebue pusă în primul plan al preocupării technicienilor din industria minieră, aceasta având o influenţă asupra productivităţii minelor, fiind şi o chestiune impusă de considerentele economiei naţionale, pentru care folosirea raţională de material lemnos are o importanţă din ce în ce mai mare.

Резюме

Проблема креплений в угольных шахтах

Автор подвергает обследованию проблему креплений в угольных шахтах с трех точек зрения: безопасность персонала, техническая и экономическая сторона вопроса.

Деревянное крепление представляет, с точки зрения безопасности, определенные преимущеетва, благодаря упругости и сигналам безопасности в случае провалов. Однако, с точки зрения технической и экономической, этот род крепления представляет ряд невыгод.

Прогрессом в области усовершенствования эксплоатационных методов является крепление разработок при помощи железных столбов, а также при посредстве столбов неподвижного типа и большего сечения; было доказано, что система столбов (опор) полунеподвижных может снести нагрузку до до 60—70 т/м², в сравнении с 40—50 т/м² у других систем.

Автор перечисляет преимущества использования металлических полуподвижных опор с точки зрения технической и экономической, как при разработках, так и в подземных ходах.

Résumé

Le problème de soutènement dans les mines de charbon

On examine le problème du soutènement dans les mines de charbon du point de vue de la sûreté du personnel, du point de vue technique et du point de vue économique.

Le boisage — avantageux au premier point de vue, à cause de son élasticité et de ses signes prévenant le danger de foudroyage — présente une série d'inconvénients, du point de vue technique et économique.

Le soutènement métallique dans le fronts de taille représente un progrès important. Les essais avec des étançons métalliques élastiques et rigides ont montré que le systeme de soutènement métallique semi-rigide résiste aux charges plus fortes — 60—70 t/m² au lieu de 40—50 t/m², pour les altres systèmes de soutènement.

On examine enfin l'application de ce système dans les abatages, ainsi que dans les galeries de mine.