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AL CENTRULUI UNIVERSITAR NORD DIN BAIA MARE

SERIA D

Exploatări Miniere

Prepararea Substanţelor Minerale Utile

Metalurgie Neferoasă

Geologie şi Ingineria Mediului

Volumul XXX Nr. 1

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LEGISLATIVE ASPECTS OF THE QUALITY OF SOIL AND SOIL PROTECTION IN ROMANIA, AS AN EU MEMBER STATE

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Abstract: *Currently, the legislative framework in Romania on soil and subsoil - understood as "the massive of earth" - includes a package with direct references to the issue of soil contamination and ways of investigation. Given that land can be both private and public property, in 2015 work is still undergoing in shaping a common EU policy on the management of contaminated sites, discussions and negotiations with national mark between representatives of various Member States being still not finalized. So the European Union has not yet developed a separate policy on the management of contaminated land existing in the Member States.*

The paper presents the current level of correlated law concerning environmental factor soil in Romania, EU member-state, and work in practice, based on the functions the soils fulfills in society. Current legislation in Romania shows that the soil functions are recognized and that civil society is interested in knowing the suitability of land for specific uses, health status and quality condition. With Romania's integration in the EU were established new regulations regarding reports on knowledge of the state and protection of soil quality in Romania. Although significant progress is made at a national level, there is no complete study on the suitability of current land in use, categories or maps on the nature and intensity of a given pollutant that contributes to the pollution level.

Key words: *soil, environmental legislation, quality, protection*

INTRODUCTION

Throughout history, the concepts of the role and importance soil has in the society evolved and then proceed gradually from concept naturalist at industrial, then the post-industrial, wanted to be perceived as a well-integrated concept in a dynamic society and also as a sustainable factor. Each of these concepts are based on knowledge of the characteristics and soil properties, quantified following approved methods of analysis and comparison within legislated limits.

The complexity of physical-geographical framework of our country and vegetation creates a wide variety of soil conditions and mezzo-climates. They determine, in turn, wealth distribution and representation habitats and natural ecosystems traditionally framed in a series of functional and economic classifications.

In the context of industrialized development, resulting mainly due to the exploitation and processing of natural resources and creating a growing number of synthetic chemicals, soil and groundwater pollution is an environmental problem today, but having old and complex roots. Referring to both the mechanisms of migration, transformation and absorption or neutralizing

various pollutants in soil and underground environment, and establish and implement remediation technologies enabling bringing quality parameters of soil and groundwater in the normal range and / or imposed by a particular use thereof. Also, the large amount and concentration of pollutants discharged regularly or accidentally both on the ground and other elements of the environment (bodies of surface water, wetlands, ambient air etc.) require an environmental review integrated and discernment application of remediation technologies or ecological restoration of a site. [1, 2]

Considering these aspects it should be stressed that so far the studies on soil and groundwater pollution are concentrated mainly on physico-chemical analysis of polluted perimeters affecting a specific user, rather than on detailed knowledge of the processes into pedoevolutive aspect. [3, 9, 10]

1. Legislative elements of the European Union regarding the environmental factor soil

Given that land can be both private and public property in 2015, EU is still working on shaping an environmental policy, a common management of contaminated sites, discussions and negotiations still being held between representatives of various Member States. The European Union has not yet developed a separate policy on the management of contaminated land existing in Member States. Steps taken so far are the development of a Thematic Strategy on soil protection and a project for the Soil Framework Directive. [9, 10]

Legal elements covered in the chapter on soil contamination in the draft directive is based on a systematic approach to the problem of soil contamination, with special focus on defining and implementing a policy which contains obligations properly formulated and applied in Member States. These obligations should be mainly the following:

- to identify sites that relate to activities that have the potential of contaminating the soil and subsoil;
- to prepare periodic reports on the state of soil and restore or rehabilitate contaminated sites.

European Directives referring to the issues of soil, subsoil or groundwater contaminated produced to date are as follows:

- Council Directive 2008/01 / EC on integrated pollution prevention and control;
- Directive. 2004/35 / EC on environmental liability with regard to the prevention and restoration of environmental damage;
- Directive. 91/676 / EEC on the protection of waters against pollution caused by nitrates from agricultural sources.

2. Romania legislative elements of the environmental factor soil

Romania, an EU member state since 2007, in accordance with the Government Decision nr. 1408/2007 on procedures for investigation and assessment of soil and subsoil, the subordinated units of the National Environmental Protection Agency (NEPA), performed since 2008 a full-permanence on preliminary identification of contaminated sites with the introduction of a database online, providing information on economic operators or landowners on whose premises the existence of such sites is a strong possibility.

Romania's natural resource wealth and industrialization policies prior to 1990 favored heavily polluting developing economic activities, especially in extractive industries, metallurgy, chemical and energy. As a result of these activities, we have polluted the soil and subsoil locally or even regionally with hydrocarbons, heavy metals, organic and inorganic substances of natural and synthetic, industrial waste and household isolated incomplete etc, causing the appearance and significant expanding of contaminated land. These sites are risk factors for the health of human communities in proximity and regional ecosystems, affecting the natural life of many species of plants and animals.

Currently in Romania the legal framework on the protection of soil and subsoil-understood as "the massive of earth" - includes a package with direct references to the issue of soil contamination and the procedures for investigation, as follows:

- **Law. 265/2006** for the approval **O.U.G. no. 195/2005** on environmental protection;
- **Law. 238/2004** respectively Petroleum Law;
- **Law. No 237/2004** amending the **Mining Act. 85/2003**;
- **Law. 444/2002** approving **Government Emergency Ordinance 38/2002** concerning the preparation and financing of agrochemicals and soil studies and financing and the National System for Soil Monitoring Soil;
- **Law. 107/1999** for the approval **O.U.G. no.81 / 1998** on measures to improve the forestation of degraded lands;
- **Order of the Minister of Agriculture and Rural Development no. 278/2011** regarding rules for soil studies designed to create and update the National System for monitoring the soil as land for agriculture;
- **Order of the President of the National Agency for Mineral Resources no. 175/2009** approving the Technical Instructions for the conservation of petroleum operations, abandonment and that lifting the abandonment / conservation of oil wells;
- **Order of the Ministry of Environment and Water no. 242/2005** approving organizing the national integrated monitoring system for ground surveillance, control and decisions to reduce the contribution of pollutants from agricultural sources and management of organic waste from livestock in areas vulnerable and potentially vulnerable to nitrate pollution and approval of the organization of the National System of Integrated soil monitoring, surveillance, control and decisions to reduce the contribution of pollutants

from agricultural sources and management of organic waste from livestock in areas vulnerable and potentially vulnerable to nitrate pollution.

- **Order of the Minister of Waters and Environmental Protection no. 756/1997** approving the regulation on the assessment of environmental pollution;
- **Order of the Minister of Waters and Environmental Protection no. 184/1997** approving the procedure for achieving environmental audit;
- **Government Emergency Ordinance no. 68/2007** on environmental liability with regards to the prevention and restoration of environmental damage;
- **Government Decision no. 856/2008** on the management of waste from extractive industries;
- **Government Decision no. 1408/2007** on procedures for investigation and assessment of soil and subsoil;
- **Government Decision no. 1403/2007** regarding the restoration of the soil, subsoil and terrestrial ecosystems affected;

Navigating the whole package of laws on environmental factor soil reveals that these are issued by different state institutions and that recent regulations on environmental protection establish clearer legal framework for activities of cleaning / decontamination, remediation and / or reconstruction of the ecological areas where the soil, subsoil and terrestrial ecosystems were polluted.

Also this legislation is to be understood by specialists in various fields. For example, according to Law 444/2002 approving Government Emergency Ordinance 38/2002 concerning the preparation and financing of agrochemicals and soil studies and financing and the National System for Monitoring Soil as land for agriculture and according to the Order 278/2011 - rules for developing studies on soil to create and update the periodical of the National System and the County System for monitoring soil-land for agriculture, the Offices for Soil Survey and Agrochemicals (OSPA), are designed to perform in collaboration with the National Institute for Research and Development for soil Science and Agricultural Chemistry Environmental Protection (INCDPAPM,) soil studies and studies on the state of soil quality in the county in question.

One of the results of the implementation of national environmental legislation are the indicators of soil quality. Using these indicators for assessing the quality of soil is needed in practice because it provides authorized information, useful both by landowners for production activities and by the authorities for activities to prevent, counteract, limit or remedial processes of soil degradation. We present this formal conclusions of the reports on the state of soil quality in the county of Maramureş: "In this county the soil quality in the critical areas in terms of soil quality is maintained at the same levels; quality of soil is determined in critical areas by historical pollution and the natural heavy metal load of the area" [11, 12].

Also this report officially acknowledges that "a number of economic activities carried out in the county induced or still induce a state of pressure on soil quality."

CONCLUSIONS

Compared to the functions soil performs in society, legislative acts existing in Romania show that soil is the basis for drafting legislative acts and that civil society is concerned regarding the suitability of soil as land for a specific use and the health status quality of one of the most prized natural resources.

Land suitability is determined only for their effective use of the time mapping of land. Also, for now, land suitability is determined only on demand from the owner or from the authorities. Under the law, however, it is mandatory to continuously monitor the soil quality. In terms of environmental protection, but in the course of monitoring soil quality, although respecting the law, it is not possible to summarize the areas affected by pollution induced by all kinds of economic activities, so a measurement of precision factors that act synergistically polluted and deserted, most often on the same area.

Reported to the quality indicators of soil should be noted that current legislation covers sufficiently the subject, leaving to the experts the art of dealing with actual conditions in the field or with the use of land with natural processes specific (wind erosion, rain , landslides etc.), soil mining techniques (agriculture and forestry), natural evolutionary tendency of soils etc.

Following legal regulations, since Romania's EU integration, progress is being made on knowledge of the quality state and soil protection in Romania, but on a national level, there are no complete studies on land suitability by use or maps on the intensity of pollution for a given pollutant.

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THE COLLAPSE OF ROMANIAN MINING INDUSTRY IN THE PERIOD OF DEVELOPMENT OPPORTUNITIES THROUGH COHERENT STRATEGIES

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***Abstract**: The Romanian infrastructure for the mining has been impressive, with some shortcomings aggravated by the lack of state monitoring as regards the waste, the involvement of politics and the use of the miners as a political maneuver mass. The mining sector needed privatization, by models existing in other countries. A success model of a state mining company after the privatization is the case of the company KGHM in Poland which, currently carries on its business on three continents and became the largest employer in Lower Silesia. The paper presents, comparatively, the development strategies of states which have had a vision on the potential of the mineral resources capitalization, have taken account of the population and standard of living increase in, urbanization and hence of the consumption needs and the protection of the environment and sustainable development. These countries have consistently followed the achievement of the objectives set out in their strategies and at the moment the statistics confirm their predictions. Investments in mining activity, worldwide, have increased significantly in the period when Romania has decided to close by deactivating the existing mining capacities.*

***Keywords**: mining strategies, production capacities, mining closure, environmental protection, sustainable development*

1. INTRODUCTION

Romanian mining industry has suffered the greatest collapse of its history, in a favorable international context for development. When, in the world, it were thought to define the development strategy for mining industry which predicted productions until the 2020 and forecasts for 2050, in Romania there were elaborated strategies for mining activity closure. On the basis of the international context for the development of human civilization from different parts of the world, the continuous increase of the population and its needs, strategists well-informed, estimated the increase of raw materials prices.

The increase in the population and communities' development are based on mineral resources. The government of many countries have understood this and have acted in consequence, giving due attention to exploitation and capitalization of mineral resources. This paper presents a part of strategies and development actions for mining activity in the last period of countries which have had a vision regarding this topic. We have chosen for analysis in particular countries in Europe, both from the north and the south, from structures to which Romania has acceded, too, or outside them.

Mining in Romania of the years 1990 - 2000, needed a seating on other bases, reorganization, privatization, involvement of state institutions for monitoring and control, but it has been used as a mass of political maneuver, destruction, pillage and labeled as a source of losses for the economy of the country. In this mode, it has been deleted the history and nature of this millenary occupations, appreciated and respected in all civilizations and times. As regards the promotion, it was systematically induced the idea that we no longer need the extraction and processing of mineral resources, idea supported both by persons from the inside of the system or in connection with it and out of him, people with different training degree, by the mass media, NGO's, the political environment. By attacks consistently aggressive, it has been destroyed the spirit of this activity and of the school formed along the time, school that has evolved and developed under the conditions in which the exploitation of mineral resources became more and more difficult.

2. SHORT HISTORY OF ROMANIAN MINING AND MINERAL RESOURCES

Mining activity was and it is closely linked to the socio-economic development and social progress of human civilization. For many countries of the world, including Romania, mining industry has been among the most important sectors of industrial activity which has secured with significant quantities of useful mineral resources other industrial branches, horizontally (energy industry, building materials industry, chemical industry a.s.l.).

Extraction of solid mineral resources has a long tradition on Romanian territory (over 2000 years) being characterized by the capitalization of a variety of mineral resources. Until the end of the XX century the mining industry in Romania has recorded a continuous and emphasized development for the extraction of different fossil fuels, ferrous and nonferrous ores, precious metals and radioactive ores and a wide range of non-metallic mineral resources.

The deposits of mineral resources are spread across the whole territory of the country; ores are located in mountain areas and those of coal and non-metallic resources in areas of hill and depressions.

In 1990, the whole mining industry has had a maximum production of approx. 160 million tonnes (coal, ores and salt), there were 278 mines and quarries in operation and 70 processing plants of which 30 in the sector of metals ores, 34 in the sector of non-metallic ores and 6 in the coal sector. These industrial objectives have been spread in 41 mining basins located in the territory of the 23 Romanian counties [1].

Therefore the mining sector was, at that time, a socio-economic pole and a way of living for approximately 10 % of the Romanian population and it has an infrastructure well developed, the necessary logistics in the field expressed by units of research and design operating in the cities placed in the vicinity of the mining perimeters (Baia Mare, Petrosani, Cluj, Deva, Bucharest). In the same period, the education of the necessary staff for mining activities (mining workers, technical staff) was ensured by mining schools, technical profile schools and, the two Mining Institutes in Baia Mare and Petrosani and geological Institutes in the country university centers.

In the main seven mining companies in Romania (metals, salt and coal) the occupied staff, in the 1st of January 1997 was 175879 persons [1]. In this statistics there are not covered employees of the mining units specialized on useful rocks, aggregates mining, small careers. In the same period there were over 1500 aggregates mining and quarries with an annual production of more than 150 million tons of aggregates minerals and useful rocks ([2], [3]).

After 1990 mining activity enters into a process of permanent regress, dropping production up to approx. 70 million tons in 2005 and after 2007 when ores mining and partially coal mining were closed, the production decrease is much more obvious (Fig. 1).

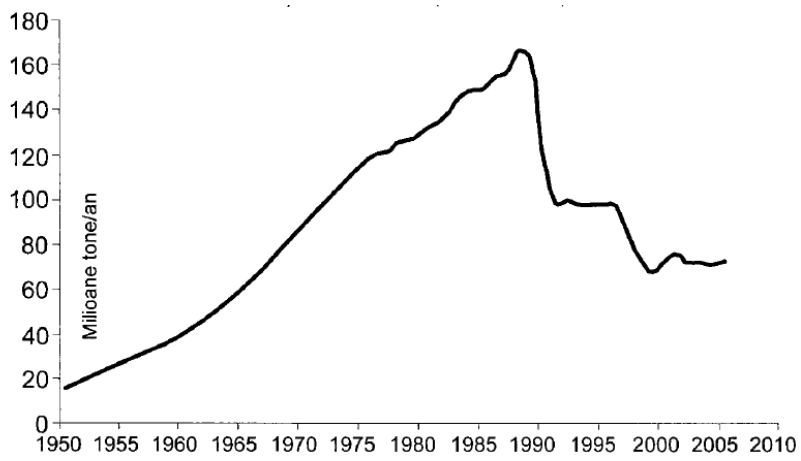

Fig. 1: Evolution of total annual production in Romania (mining mass) 1950-2010

Mining exploitations were organized in industrial centrals, independent entities, national companies and commercial companies that have had fluctuant periods of activity depending on the stage of the restructuring and reorganization of mining activity in its evolution ([4], [5]).

As an example, in 2005 there were 10 national mining companies, 7 commercial companies for exploitation and capitalization of non-metallic ores and 10 commercial companies with specialized geological research activity.

Romania has had a well-developed infrastructure in the field of mining and the decline of mining industry has begun even during the period in which the other states have decided to develop strategies for increasing production by mining existing capacities and the creation of new ones.

3. DEVELOPMENT STARTEGIES FOR MINERAL RESOURCES EXPLOITATION

Analysis of the mining sector development strategies in different countries reveals their vision, at a specific moment of time. Following the implementation of these strategies it shall be found the concordance between the actions planned and realities. The Nordic countries (Finland, Sweden, Norway, Denmark, Greenland and Iceland) have created a structure called NordMin in order to correlate their actions in both legislative level as well as scientific, financial, etc. For Finland, Norway and Sweden the exploitation and capitalization of mineral resources is very important and has become an expression of ambitious policies to promote and sustainable development, reflected in the adopted strategies.

Denmark has no active metal ores resources mines, extractive industry being orientated toward exploiting non-metallic minerals. The Greenland strategy for 2014 to 2018 expresses the intention of the government to have at least five long term mining entities exploitation of deposits of iron, copper, zinc, rare earth, gold and semiprecious stones. The mining potential of this country is high and the government actively promotes the development of this industry [6].

3.1 Finland Strategy

In 2010 Finland Government adopts a national strategy in view to improve the conditions and the mining sector competitiveness. In 2011 appears a new Law of Mines which replaces the old one from 1965, while increasing the opportunities of the inclusion of environmental and social considerations in the structure of the operation license.

Finland strategy is starting at global changes: the increase of the population, urbanization and increasing their standards of living which result in the growth, unprecedented, of mineral resources demand, taking into account, at the same time, the EU policy for mineral resources; the consumption is 23-30 % of the metals production and production represents approximately 3 %.

The text of the strategy presents the analysis of the mining sector and estimates the potential of its development. The document is scored of aphorisms which define the intention of Finland to efficiently administer the mining potential, ensuring long-term supply of mineral resources at the national level and the creation of conditions for regional sustainable

development in the future: "the diversity of mining sector provides competitive benefits for Finland"; "mineral resources extracted in Finland will be refined in Finland"; "global changes in the sector of mineral resources represents a major opportunity for Finland"; "Finland is a global leader in the sustainable use of mineral resources and this sector is one of the key fundamentals of the national economy" [7].

Exploration and exploitation of mineral resources implies long term large investments with high degree of risk. The Finnish mining industry is one of the few industrial sectors often checked by foreign investments. The Finnish Government is involved in the gradually increasing investments in order to become the owner in mining sector, actively promotes mining and, in general, local communities tend to have a positive attitude regarding new mining projects. In this way, Finland has developed infrastructure and the legislation in order to facilitate mineral resources exploration and exploitation. It has been developed strategies to enable the achievement of proposed objectives, including in the field of research and education, understanding the need of the specialists training and professional qualifications of the staff.

If the Finnish ore production in 2007, was 3 732 900 t, in 2013 this has reached 20 846 551 t proving the fact that the planning and coherent strategies are effective in this sector [7]. The gold production in 2008 was 4148 kg, in 2009 5749 kg, 2010 7628 kg and 2011 8461 kg in order to reach the 2012 at 10814 kg. The silver production was 59375 kg in 2008 and has reached the 128200 kg in 2012. In the case of nickel, production was in 2008 by 4303 t to reach in 2012 at 80000 t [8].

3.2 Sweden strategy [9]

Sweden has the largest mining industry from Nordic countries. In 2013 the Swedish Government has submitted a strategy of mineral resources with the aim of increasing the competitiveness of mining industry, in order to maintain and strengthen its position between the EU nations and the leadership in the field. Swedish mineral resources are exploited sustainably, respecting and protecting the environment.

The Swedish strategy Sweden for the year 2050 and 2060 take in consideration the premises of population growth and, implicitly, the demand for mineral resources to meet it. In 2011, the Swedish iron ore production was 68 million tones and for 2020 is expected to reach 120 million tones and in 2030 to 150 million tones. Between 1990 and 2010, Sweden produced between 45 and 50 million tons of iron ore per year. In 2010 the mining sector in Sweden occupies 8400 persons.

In the context of its strategy, Sweden grants an important place to school and research development in the field of mining. There is also a very clear structure of the economic significance of mineral industry: operation costs, salaries and pensions, profit, taxes and contributions to the state, dividends to state, dividends to the private owners, financing for urban transformations, financing for environmental remediation as well as the production for the main minerals and its share in the European economy.

3.2 Norwegian strategy [10]

Similar to the other Northern countries, Norway shall draw up in 2013 a strategy through which the government would like that the country become attractive for mining activities. Norway mining industry should be one of the most environmental friendly in the world and should seek active, on long term, solutions geared toward to the future. In establishing the strategy, Norway considers the fundamental role of mineral resources exploration and exploitation in the development of the human community. In 2011 the consumption of mineral resources in Norway was of 12 tones per head. Mineral industry has 6000 employees (of which 1060 in metallic mining) in 1104 mines and quarries managed by 833 companies.

During the period 2008 - 2013 the Norwegian iron production in concentrate has increased from 477 t at 3421 t; the production of Cd has increased from 178 t to 300 t; the production of refined copper increased from 32000 t to 36000 t; the metallic Zn production has increased from 145469 t to 153 000 t; the graphite production has increased from 4100 t to 7000 t [8].

4. EVOLUTION OF MINING ACTIVITY IN OTHER WORLD STATES

4.1 Mining activity in Spain

The Spanish mining sector has undergone many and drastic changes along the periods of metals prices fluctuations or periods of crisis. In Spanish mining strategy it is considered that the mining sector have prospects for strong growth. The most dynamic component, at this time, is the metallic mineral production: copper, nickel, zinc, lead, gold, tungsten and tin. For example, the Spanish production of copper has been 23058 t in 2009 and came to 100 310 t in 2012 [11].

For gold, in 2009 and 2010 there are no stated production values, in 2011 production was 529 kg, in 2012 it was 1529 kg and in 2013 reaches 1870 kg. For zinc, production begins in 2010 with 17358 t and reach in 2011 33199 t and 29000 t in 2013. For lead production starts with 52 t in 2009 and reach 4,000 t in 2013 (in 2011 the production was 7810 t) [8].

In the largest mining region of Spain, Andalusia, with an old mining activity of 6,000 years and with a population of 8 million inhabitants, there are 600 active mines. Andalusia is considered the richest and better preserved region in Europe. Here, the mining sector - strategic for growth and development - has created 5000 direct work places and 36000 indirect ones. In the 2010 – 2013 development strategy, the governmental Council plan provides: the maintenance and creating new jobs in mining; integration of mining activity in environmental protection; support and financing of education and research in the field of the mining; the modernization of the administrative management; strengthen training, qualifications and safety in mining sector.

The Andalusia mining strategy for 2014 - 2020, in addition to the diagnostic of actual mining, current analysis of the environment and the instruments for territorial planning, economic evaluation and determination of monitoring and evaluation criteria, identify, propose and promote opportunities for mineral resources. [12].

4.2 Mining activity in Portugal

In September 2012, the Portugal Council of Ministers have signed and published the strategic document "Portuguese Strategy for mining sector" and it is for the first time when the government issue such a document for this sector of activity. The document refers to the period 2012 - 2020. Its main guidelines are: redefining on new basis of mining sector, the role of the state, the revision of the rules, the activity organization and discipline; development of knowledge and assessment of the national potential by improvement of methods and systematization of information in order to improve the use of resources; the dissemination and promoting of national potential by communication and creation initiatives [13]

Copper in ore production was relatively constant, between 75000 and 86000 t in the period 2009 – 2013. For silver it is noted an increase from 22450 kg in 2009 to 37025 kg in 2013, but a significant increase it is recorded to zinc from 501 t in 2009 to 51026 t in 2013 [8].

4.3 Mining activity in Turkey

In 2016 the Turkish Government recognizes the mining potential of the country and start a legislative reform by which they intend to create conditions for growth and development [14] with all that already the development level of mining sector is significant.

Production of gold have increased from 1,4 t in 2001 (the first year with gold production ([8], [15]) to 14,5 t in 2009 and has reached 34 t in 2013, with all that in 1997 the Turkish State Council has decided to forbbiden the use of cyanide in gold production [16].

The Lead production has been 599705 t in 2009 and has increased up to 1491669 t in 2013 and the production of manganese increase from 141206 t in 2009 at 321785 t in 2013.

As regards the production of useful rocks, Turkey has a significant increase in the basalt from 1,9 million t in 2009 to 23.4 million t in 2013 and for dolomite from 11,1 to 20,3 million t in 2011 and to 17,3 million t in 2013 [8].

4.4 Mining activity Poland

Poland is a country with economic, politic, geo-mining conditions and a member of the European Community similar to Romania, which has found solution to adapt mining industry to the new trends of the economy market and the world trend relating to the exploitation and capitalization of mineral resources.

During the period 1961 - 1991 in Poland has been in activity the company ”Kombinat Górniczo-Hutniczy Miedzi – KGHM (Copper Smelting-Mining Combie)” and the state was the owner. After the decision of the privatization, which was a successful process, in 1991 in 1997 it has been displayed on the Stock Exchange of Warsaw (Warsaw Stock Exchange) [17] while it retains its name. In the forthcoming period it has become a big copper and silver producer, becoming the largest employer in Lower Silesia, with over 18 000 employees involved in the process of mining production and others 10 000 in additional activities. At the moment, the company KGHM has mining projects in Poland, Canada, the USA and Chile in the field of exploitation and processing while the metallurgical activity and refining shall be carried out fully, in Poland, producing Cu, Au, Ag, Zn, sulfuric acid, nickel sulphate, Pt and Pd (Palladium). The projects in development will scroll in Canada in two mining perimeters for Cu, Ni and Au. [18]

The copper production has increased from 31253 in 2009 up to 32215 t in 2013. The gold production has increased from 814 kg in 2009 at 1066 kg in 2013 and the silver was maintained around 1200 t. Iron and steel production has increased from 15573 t in 2009 up to 76730 t in 2013. The Lead production was maintained between 50000 t and 80000 t and the Zinc between 135000 t and 150,000 t [8].

In the period of the closure of the mining activity in our country, Poland succeeds, through a coherent policy, to extend the coal mining sector and to develop production capacities in three continents: Europe, the USA and South America.

5. CONCLUSIONS

The Romanian infrastructure for mining was amazing even if, in many cases, this has been supersized and with severe deficiencies of organization. These blemishes have been aggravated by the loss of responsible state monitoring as regards of waste, the involvement of politics and the use of miners as a maneuver mass. This sector needs privatization, with the involvement of the state, following the existing models from other countries. A success model of a mining state company after the privatization is the case of ”Kombinat Górniczo-Hutniczy Miedzi – KGHM (Copper Smelting-Mining Combie)” in Poland which, currently carries on its business on three continents and is the largest employer in Lower Silesia.

Inoculation of the public opinion with the idea that the mining industry is detrimental has been carried out systematically and with interest in the stealing of its patrimony and, moreover, impressive funds were allowed for its destruction under the mask of closing and conservation of mining perimeters. In contrast with this state of things, in other European and world countries in similar circumstances, the governments were involved in the development of strategies for sustainable growth of mining activity, convinced by the fact that the exploitation of national mineral resources is the key and the engine of the economy development. The premise from which all these countries have started is that the increase of the population and urbanization involve the increasing needs of mineral resources. In 2008 the EU realizes the role of mineral resources in the development of society and shall draw up a document which has been the basis for developing strategies of Northern States. Statistics show significant evolution in the countries that have relied on the exploitation and the capitalization of national mineral resources investing in the development of existing capacities and creating new ones. These countries have preferred to process and refine mining products in their own businesses and to transform them into finished products, avoid exporting raw material. Romania has had capacities for the transformation of mining products into finished products but they have been closed and are currently in the situation of exporting raw material as in the case of Rosia Montana exploitation, deposits of the concentrates in Baia Mare, other metallurgy and mining waste deposits for processing and metallurgy, in China.

The progress of the production curves in the mining strategies of Finland, Sweden, etc shows a substantial increase while, at the same time, in Romania curve is decreasing even if the geological potential is important.

The increasing trend of mining industry has been noticed in countries with different levels of development: USA, Canada, China, Australia, Chile, Russia, African, etc. the capital

invested, in the world, for mining has been increased from 16 billion dollars in 2001 to 80 billion dollars in 2011 [19], within a period of ten years the investments have increased by five times.

In Romania it was a need for a coherent strategy, a new Law of Mines through which the entrepreneurs take advantage of a clear and stable legislative framework, with simplified procedures, with distinction between the higher production capabilities and the small ones, including concepts and legislation for artisanal mining.

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ANALYSIS OF HEAVY METAL CONTENT OF DIFFERENT VARIETIES OF WINES

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***Abstract**: Heavy metals are important pollutant both of environment and of food. In wine, heavy metals can originate from natural and anthropogenic sources. In the paper the heavy metals concentrations of some wine varieties originating from two wine-growing region of Romania was assessed. The following heavy metals were analyzed using flame atomic absorption spectroscopy (FAAS) and graphic furnace atomic spectroscopy (GFAS): iron(Fe), manganese (Mn), zinc (Zn), copper (Cu), lead (Pb), nickel (Ni), chromium (Cr) and cadmium (Cd). The measured concentrations of heavy metals were compared with other studies about the heavy metals in wines and with the legal limits. The heavy metals concentrations in the analyzed wines are within the legal limits. The data were modeled in order to find possible correlations between the heavy metals content.*
***Keywords**: heavy metals, wine, FAAS, GFAS, correlations*

INTRODUCTION

Toxicology is an important chapter of environmental sciences. One of the major topic of toxicology is the increase of the heavy metals content in soil, water and in food due to the entrance in food chain [1-2].

Heavy metals are found generally in low concentrations in crop and food. In recent years, an increase tendency of heavy metals in food was observed due to the development of industry and the related industrial emissions, transportation, intensive agriculture that involves the use of fertilizers and metal-based pesticides [2-4].

Wine that is a widely-consumed alcoholic beverage made from the juice of grape, is also expose to heavy metal contamination due to the cultivation practice and also to winemaking technology and storage [5-7].

Some heavy metals like Fe, Cu, Zn, Mn and Cr are essential metals because they play an important role in biological systems, while Pb, Ni and Cd are non-essential metals being toxic even in trace amounts.

The analysis of certain metals in wines is of special interest due to toxicity in the case of excessive intake and also to the effect on organoleptic properties [6-7].

Iron is present in all the wines in concentration varying between 2-6 mg/L and several tens of milligrams per liter. The excess of iron in wines bring about unwanted changes of their

physicochemical properties and stability. The iron that comes from grape, also named physiological Fe is about 2-3 mg/L of the total amount. The remaining Fe comes from the dust deposed on the surface of grapes of form the contact of grapes, must or wine with the appropriate tools and unprotected metal containers. Other amounts of Fe are due to the treatments applied during must or wine processing or conditioning.

Until 5-6 mg / L, Fe in wine fulfills a positive role, participating in a series of reactions that support a good maturation and aging [8]. Excessive amounts of iron such as 10–20 mg/ L or more oxidized to the ferric form and can cause a precipitation of pigmented materials known as blue haze or with orthophosphate ions forming the white haze [8]. Above these limits, Fe causes instability and troubles known as the "ferric quashing". Thus, to produce a stable wine the level of iron level must be lower than 5 mg/L prior to bottling [8].

Copper enters in the composition of some enzymes or facilitate their action. It acts synergetic with Fe favoring its absorption and also its metabolism. His absence causes anemia and iron deficiency [9].

Zinc is an important bio-element. It enters the structure pancreatic carboxypeptidase, carbonic anhydrase, alkaline phosphatase, dehydrogenases polymerases etc. Through these enzymes zinc take part in removing CO2 from red blood cells, to protein synthesis, in the redox processes, mobilization of vitamin A in the liver. In addition zinc stimulates the pituitary gonadotropins through gametogenesis and also the reproductive development [9].

Lead adversely affects multiple enzyme systems with the body, as any ligand with sulfhydryl groups is vulnerable. Also lead causes a decrease in hem production [8]. The reduction of lead levels in beverages as in foods is a necessity to improve food safety [2, 8]. The Vine and Wine International Organization (OIV) established the maximum concentration of lead in wine to 150 μg/ L.

Cadmium is a toxic heavy metal due to the inactivation of enzymes containing sulphydryl groups and the uncoupling of oxidative phosphorylation in mitochondria. Also, cadmium, enters in competition with other metals such as zinc and selenium for inclusion into metalloenzymes [2,8]. The OIV established the maximum level of cadmium in wine as 10 μg/ L.

In order to assess the heavy metal contamination with heavy metals, 5 sorts of wines were analyzed. The concentration of Fe, Mn, Cu, Pb, Ni, Cr and Cd were determined. The data was compared with previous studies.

MATERIAL AND METHODS

Samples of wines selection

Five red wines varieties were purchased from local market: 2 varieties of Feteasca neagră wines demi-dry and demi-sweet, Cabernet Sauvignon demi-sweet, and also wines obtained by blending Merlot and Pinot noir.

All the studied wines originate from Romania vineyards. In Table 1 are presented the analyzed varieties of wines and the geographic area of the vineyard.

Table 1. The analysed wines and their characteristics, grape variety and area of vineyard

Nr. of sample	Grape variety	Wine characteristics	Area of vineyard
1	Feteasca neagra	Red, demi-dry	Vrancea
2	Cabernet Sauvignon	Red, demi-sweet	Recaș
3	Feteasca neagra	Red, demi-sweet	Vrancea
4	Merlot/Pinot noir	Red, demi-sweet	Recaș
5	Merlot/Cabernet	Red, sweet	Vrancea

Heavy metals analysis in wine samples

The heavy metals analysis was realized by flame absorption atomic spectrometry and by graphite furnace atomic absorption spectrometry using a Perkin Elmer spectrophotometer. Prior the analysis the wine samples were mineralized with concentrated nitric acid to organic matter digestion [9].

The mineralized sample is sprayed in the flame of the burner of the atomic absorption spectrophotometer. The formed free atoms absorb the resonance radiations emitted by the specific lamp with hollow cathode at a specific wavelength for each analyzed heavy metal.

The heavy metals present in the wine sample in low concentrations such as Cu, Cr, Pb, Cd and Ni are analyzed with the graphite furnace oven.

RESULTS AND DISCUSSION

Heavy metal concentrations in wines

The concentrations of the studied heavy metals in the 5 varieties of wine are shown in Table 1 were a primary statistics of data was realized.

Table 2.The primary statistics for the concentrations of heavy metals in 5 assortments of wines (mg/L)

Heavy metal/statistical parameter	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
Average	$3.14x10^{-5}$	$5.59x10^{-2}$	$3,9x10^{-2}$	3,81	1,57	$2,8x10^{-2}$	$1.358x10^{-2}$	0.4278
Standard deviation	$1.34x10^{-5}$	$2.98x10^{-3}$	$3.0x10^{-2}$	0,9668	0,712	$1.17x10^{-2}$	$0.327x10^{-2}$	0.0933
Minimum	$2.2x10^{-5}$	$7.34 x10^{-3}$	0,01913	2,78	0,84	0,01488	$1.047 x10^{-}$	0.2890
Maximum	$5.5 x10^{-5}$	$8.497 x10^{-}$	0,09313	4,98	2,49	0,0417	$1.856 x10^{-}$	0.5340

The average heavy metals concentration in wines showed the following order: Fe>Mn>Zn>Cr>Cu> Ni>Pb>Cd.

The measured concentration of heavy metals in the considered wines are shown in figure 1 a,b and c due to the different ranges in which the level of the metals ranged. The highest concentration of Fe was found in sample 1 (4.98 mg/L) while the lowest Fe content was measured in the samples 4 and 5 (2.85 and 2.78 mg/L).

The highest Cu concentration was found in the sample 3 being 0.09 mg/L but this value is lower compared to other reported data: 0.6 mg/L for Ukrainian wines [7] or 0.23 for Romanian wines grown in an area anthropic polluted [5]. Cu is used in the treatment of vineyard (grapevine). It is effective against a high number of crop pests and it is utilized as a fungicide, a bactericide and also as a herbicide [5,10].

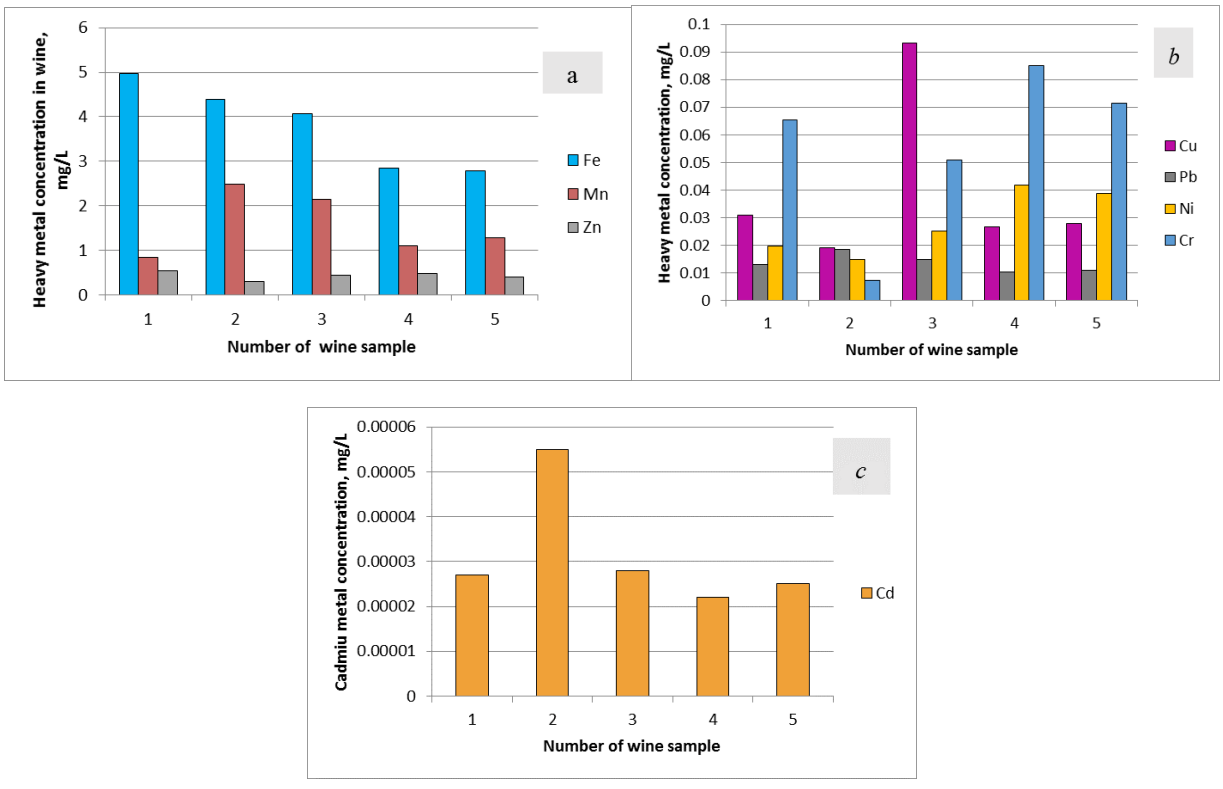

Figure 1. Concentration of heavy metals (Fe, Mn, Zn, Cu, Pb, Ni, Cr, Cd) in the samples of wines

In figure 2, the levels of heavy metals in analyzed wines are shown. Fe was found in the highest concentration followed by Mn and Zn. The other heavy metals (Cd, Cu, Cr and Ni) were found to be at lower levels. These metals come from soil where the vine is growing on being uptake by the Vitis vitifera plant. The trace metals may also come from the viticultural practices and also from the winemaking process including storage and ageing [5,6,11].

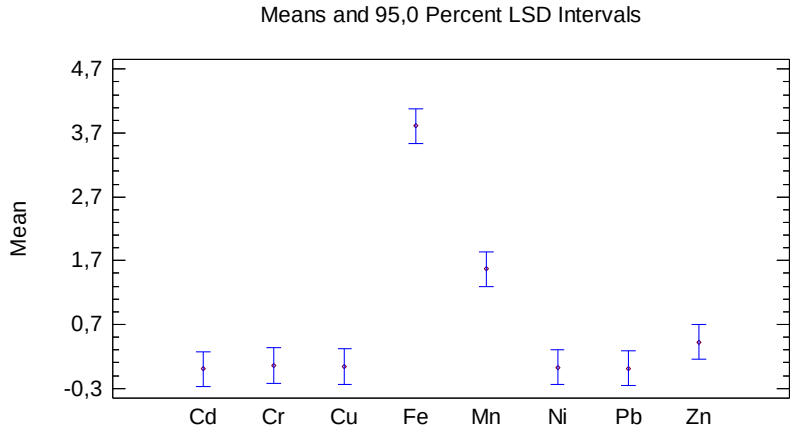

Figure 2. The means values and the 95% range of heavy-metals concentrations in wines

The cluster analysis is a procedure designed to group or variables into clusters based upon similarities between them. The distance between the observations (varieties of wine samples) or variables (heavy metals concentrations in wine) is calculated as squared Euclidean distance. Stagraphics program was used to perform the cluster analysis. Ward's method was selected.

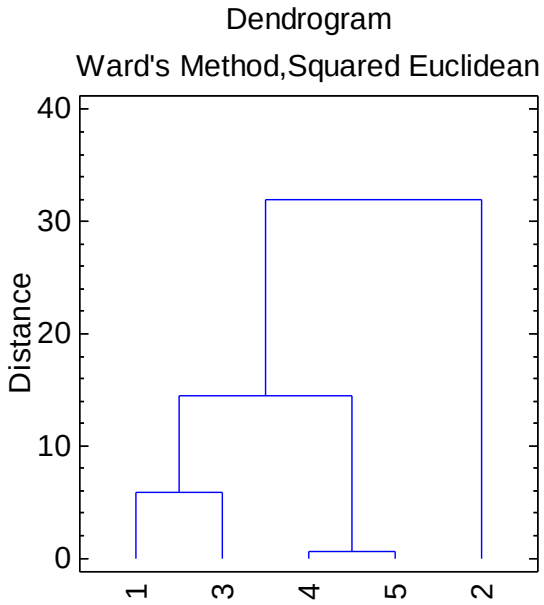

Figure 3. Cluster analysis of 5 varieties of wines related to the heavy metals content

The lowest distance between the wine samples and also the best similarity of wines regarding the heavy metals content was found in the case of sample 4 and 5 that are both blended

wines Merlot /Pinot. Wines 1 and 3 that are both Fetească neagră showed also a good similarity. The highest dissimilarity is shown by wine 2 that is Cabernet Sauvignon.

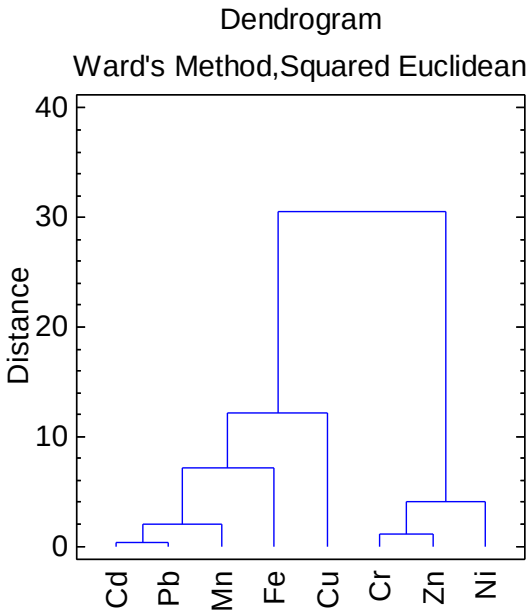

Figure 4. Cluster analysis of the variables (heavy metals concentration) for 5 varieties of wines

The cluster analysis of the variables (heavy metals concentrations in wine samples) showed a high similarity between the toxic elements Cd and Pb. These elements are linked to Mn and to Fe and Cu. Other cluster is formed by Cr-Zn pair linked to Ni. These in wines elements derived especially form the winemaking technology due to the contact with the stainless steel of the machinery, the bottles material (Cr), brass containers (Zn, Cu), tubes, fitting and traps [5,6,11,13]. The comparison of the values for the average heavy metals concentration in studied wines with those found in literature is shown in Table 3 reliving lower levels of almost all the analysed heavy metals (except Mn for Turkish wines) and lower that the limits established by OIV.

Table 3. Concentration of heavy metals in wines from different viticulture countries (mg/L)

Origin	Analytical technique	Fe	Mn	Zn	Cu	Pb	Ni	Cr	Cd	References
Romania,	ICP-MS[1]	nd[2]	0.81		0.50	0.038	0.055	0.254	nd[2]	[14]
Romania	FAAS	nd[2]	nd[2]	0.46	0.23	0.09	0.04	nd[2]	UDL[3]	[5]
Romania	FAAS and GFAS	3.81	1.57	0.428	0.039	0.0136	0.028	0.0560	$3x10^{-5}$	This study
Turkey Red wines	ETAAS[4]	1.7	0.70	0.389	0.131	0.0063	0.134	0.0386	0.0028	

White wines		0.7	0.10	2.099	0.158	UDL*	0.573	0.0294	UDL[3]	[12]
Ukraine	ICP-AAS	nd[2]	nd[2]	0.45	0.48	0.03	0.06	0.08	nd[2]	[7]
OIV				5	1	0.150			0,01	OIV (2013)

[1] ICP-MS –inductively coupled absorption spectroscopy; [2] nd – was not analysed in the reference study, [3] UDL - under detection limit, [4] ETAAS atomic absorption spectrometer equipped (AAS) with electrothermal atomization unit (ET).

Correlation between heavy metals content

Correlations between the heavy metals concentration in the analyzed wines samples were studied using T curve program.

The best correlation was found between Mn and Fe concentration. An equation of 3 degree was obtained:

$$y^{0,5}= a+bx+cx^2+dx^3$$

with the regression coefficient of R^2=0,999.

The function is showed in Figure 5.

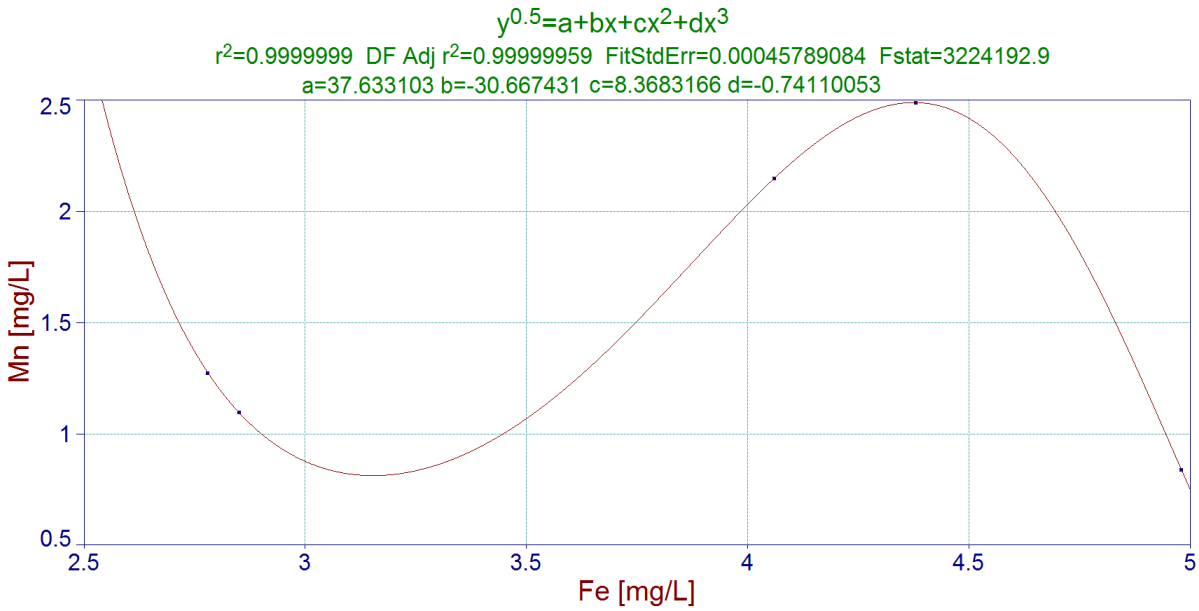

Figure 5. The correlation between Mn and Fe concentrations in the wine samples

An excessive content of Fe in wines is the result of careless contact of wine, after fermentation and during aging or processing.

The correlation between Cd and Pb concentration leads to an exponential function with the regression coefficient, R^2=0,9999.

The expression of the function is:

$$y=a+bx^{2.5}+c/x^{0.5}$$

Cd and Pb are both toxic heavy metals. The correlation between them is not a linear one due to multiple sources in wine for both elements. They can originate from soil of the vineyard, from seeds and skin of grapes. Cd and Pb differ in their accumulation behavior. Cd in soil is more mobile than Pb. Cd can be easily uptake by plants and can be accumulated while Pb is strongly bond to the soil.

Their content decreases after fermentation due to precipitation of the elements complexes with tartrates, polyphenols and sugars [7,11]. The bentonite may also increase the content of wine in Cd and Pb in the stage of wine clarification [11].

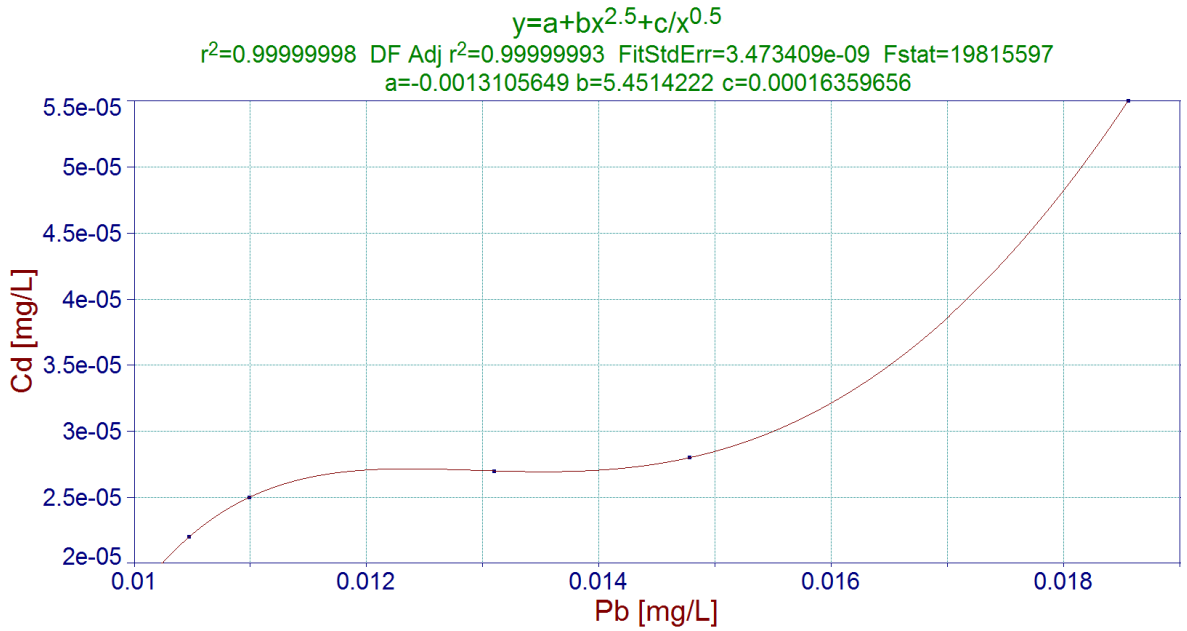

Figure 6. The correlation between Cd and Pb concentrations in the wine samples

By correlating Zn and Mn concentrations in wines, a logarithmic function was obtain with the regression coefficient of R^2= 0,9229.

The expression of the function is:

$$lnz = a+by^2lny+cy^3$$

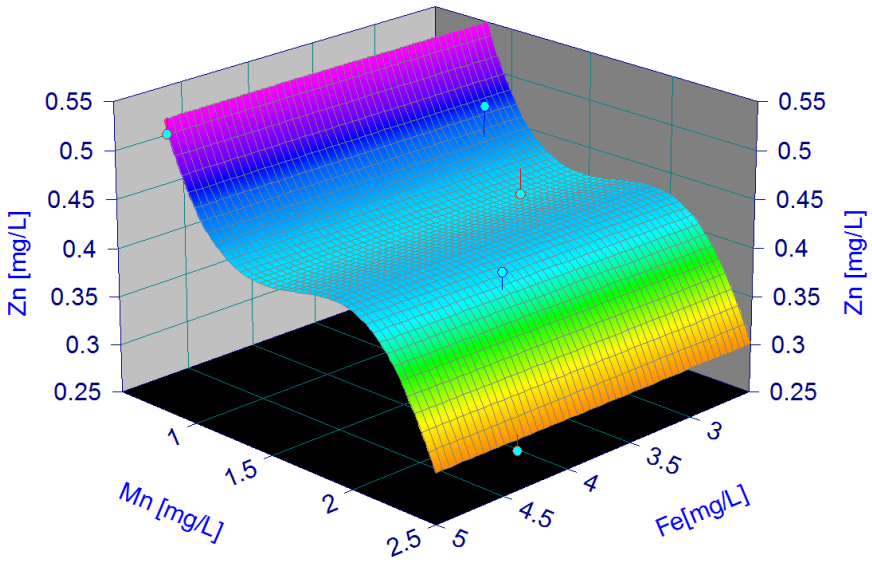

Figure 7. The multivariable correlation of Mn concentration Mn(y) and Zn concentration Zn(y) with Fe concentration , Fe(x)

Mn, Zn and Fe are considered minor elements present in the range of 0.1-10 mg/L [7,11,15]. Fe and Mn are responsible for changes in stability of old wine and modification of the sensory quality of wine after bottling by oxidation reaction of the organic compounds. But these reactions are limited by the complexes formed between the organic chelating ligands (such as amino acids, polyphenols and melanoids) and the cations of Fe, Mn and Zn [15].

By multivariable correlation of Ni and Cr concentration with Cd concentration a function shown in figure 8 was obtained. The correlation coefficient was 0,988.

The expression of the function is:

$$1/z = a+bx+cx\ln x$$

In wine, Cr and Ni comes especially form winemaking process by contact with stainless steel and other materials such as brass in which these elements are contained as and also from the filtration and clarification procedures on silica filters, cellulose filters or bed filtration [11]. Cd was present in the wine samples in very low concentration deriving from soil and application of fertilizers, pesticides, and fungicides [6,11,15].

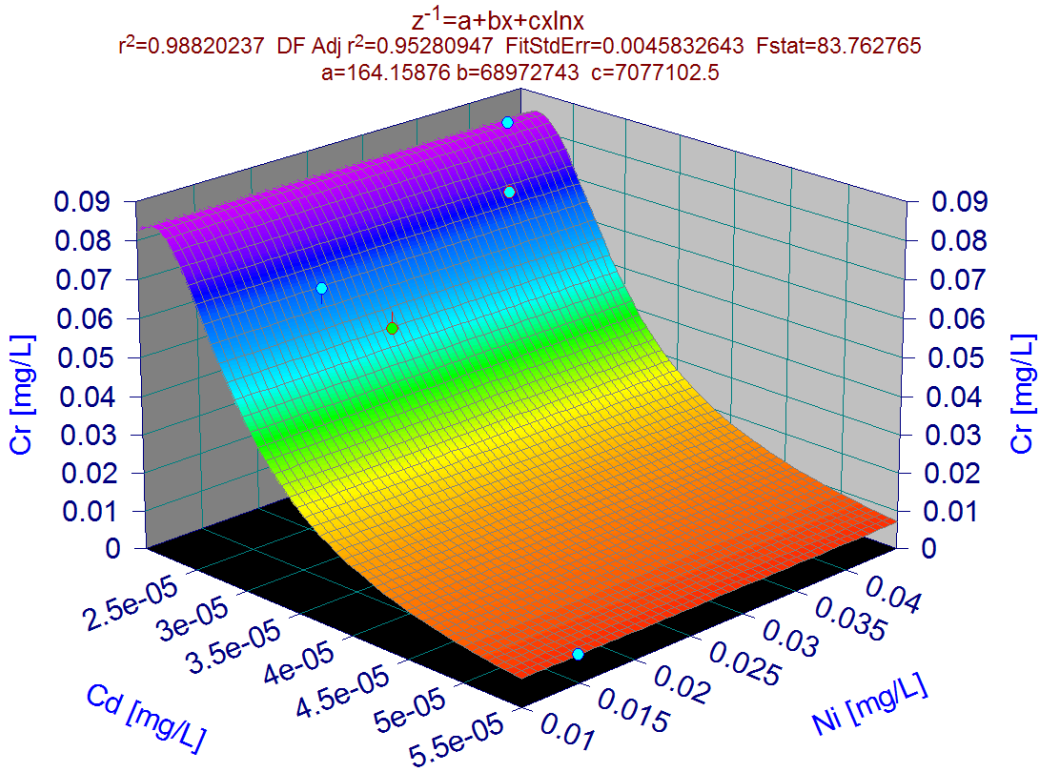

Figure 8.The multivariable correlation of Cd concentration Cd(y) and Ni concentration Ni(y) with Cr concentration , Cr(x)

CONCLUSIONS

The heavy metals concentration in some wine samples was assessed. In all the samples the heavy metals levels do not exceed the legal limit. Some correlation between the heavy metals were found using T curve program. Similar correlations were found using cluster analysis.

Comparison with literature shows that all heavy metal concentrations in the analyzed Romanian wines are below the limits designated by OIV (Vine and Wine International Organization).

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GAS OF THE THIN LAYERED LOW PENETRATION UPPER CRETACEOUS ROCKS (GAS SHALE ROCKS) OF THE UKRAINIAN CARPATHIANS

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Abstract*: This article analyzes the prospects of gas-bearing Upper Cretaceous deposits of the Ukrainian Carpathians. Lithological description and correlation of the surface geology and wells data are given. The results of exploratory drilling and testing of the Upper Cretaceous deposits in certain areas are analyzed. Prospects of gas-bearing Upper Cretaceous (Stryi) reservoirs of Ukrainian Carpathians are associated with non-traditional collectors, whose characteristics are similar to the shale formations.*
Keywords*: reservoir rock, gas content, argillites and sands horizons, layered low porous rocks, prospects of gas bearing.*

INTRODUCTION

On the territory of the western oil and gas region of Ukraine facts about oil- and gas-bearing capacity of Upper Cretaceous particular Stryi deposits have been known for a long time. The upper layer of the deposits of Stryi suite is oil- and gas-bearing in Bytkiv, Sloboda-Rungur and Kosmach (in Pokuttia), Skhidnytsia and Urytsk fields. Recently oil field has been discovered in Stryi formations of Verkhnomaslovetsk oil field situated not far from Boryslav. Gas condensate reservoirs were discovered in the Upper Cretaceous rocks in the arched section of Bytkiv underground fold. Within 60-70s of XX century gas bearing capacity of two sand and argillite packs was proved on Vyhoda-Vytvytska area and later on Shevchenkiv, Maksymiv and Tarasiv ones.

Therefore the investigation of oil- and gas-bearing capacity of Upper Cretaceous deposits is extra relevant especially in the view of possible producing gas-bearing capacity of foliated (shale) rocks with low penetration using modern methods and techniques.

In general Upper Cretaceous deposits consist of two suites Ilemkiv (Holovnynsk) and Stryi. Deposits of Ilemkiv suite are usually multicolour (red with green and grey seams) argillites, siltstones and sandstones. Argillites dominate in the section. These deposits are usually considered as cap rocks for potential oil or gas deposits in Lower Cretaceous fields.

GENERAL CHARACTERISTICS OF ROCKS UPPER CRETACEOUS

Deposits of Stryi suite are spread pervasively in the Chunks Carpathians and their thickness is over 2000 m. Stryi suite [1, 2, 3] is divided into three subsuites. The whole suite is represented by homogeneous flysch rocks in which facial differences are visible both in the section and in area during closer examining.

The lower Stryi subsuite consists of alternating arenaceous and clayish marly flysch. The middle Stryi subsuite is represented by more coarse alternating arenaceous and clayish flysch with separate layers of massive sandstones (the low part of the subsuite) and in the upper part arenaceous and clayish flysch with the layers of malmstone and limestone. The upper Stryi suite is a fine- and thin-bedded alternation of sandstones, siltstones and argillites. In some cases in the upper part of the subsuite thick-layered and massive sandstones occur that are difficult to be distinguished from Yamnenskiy ones. The colouration of lithologic varieties changes from grey (ashy) sometimes greenish to dark grey. The varieties which contain extra organic material are of the darkest colour. Such varieties are very similar to menilite shale. Stryi rocks are exfoliated on the outcrops.

GEOLOGICAL STRUCTURE AND GAS-BEARING OF ROCKS UPPER CRETACEOUS

Based on detailed correlation of geoelectric section of five wells (NN 1, 3, 7, 66, 67) in Vyhoda-Vytvytskyi field Z.V. Liashevych et al [4] identified three correlative packs taking into consideration micropalentologic researches performed in Stryi suite of Orivsk chunk that correspond to three subsuites of Stryi suite. Every subsuite corresponds one sand and argillite horizon (pack). Therefore sand and argillite horizons are separated from each other with argillite packs and that is a favorable factor for existing gas deposits in every sand and argillite pack particularly.

These data also are proved with the results of drilling wells Shevchenkovo-1, Tarasivka-2 and wells drilled on Maksymiv area, especially Luha-1 which showed the most detailed section of Stryi deposits. In the result of carried out by us data analysis of geophysical exploration of Luha-1, macro- and microscopical descriptions of the rocks and core samples, lithological features of the flysch rocks in the section of Stryi deposits clayed and sand packs are clearly identified. Thickness of these packs is following: argillite pack is appr. 200-220 m and sand-argillite one is 150-200 m [5].

Fractures of various directions are distributed in all rocks of Stryi suite. All rocks of Stryi suite are covered with fractures of various directions that can be clearly observed in exfoliations (Fig. 1, 2) [5]. Argillites and marls have flaglike structure (Fig. 1).

Fig. 1. Flaglike argillite of Stryi suite

There are arc cracks sometimes (Fig. 2) that could be caused by lateral pressure. Among the total mass of grey-colored rocks layers of dark colour can occur, which are exfoliated argillites rich in organic material (Fig. 3) that is very similar to menilite shale of Palaeogene.

Fig. 2. Arc cracks in argillite

Fig. 3. Layers of dark-coloured argillite, which are rich in organic material

Thickness of these layers is from several centimeters to several meters. The mentioned shales have fallacious structure. Fractures sizes, which can be seen on the photos, are usually much smaller but it is enough to improve filtration-capacitive properties of reservoir rock and that is also proved with explorations of core material and rock sections from the different depths. The description of the rock sections from the well Maksymivska-4 and their photos are given below (Fig. 4-6) [5].

Grey silty argillite is tough carbonate rock (interval 4492-4496 m). It is disturbed with thin carbonate fibres. Siltstone variation is shown by uniformly distributed in the rock quartz grains and single glauconite grains. Dissemination of black organic materials is seen obviously (Fig. 4).

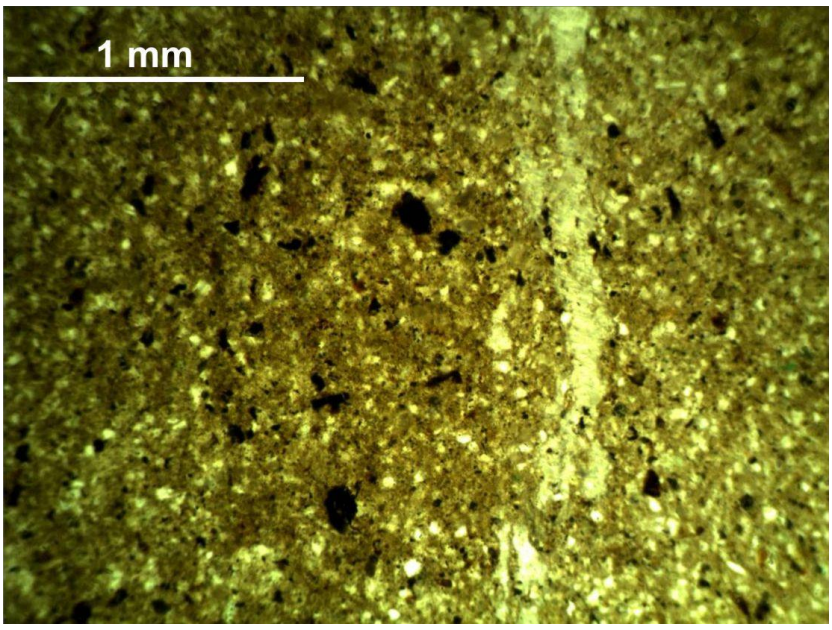

Fig. 4. Grey silty argillite with organic material dissemination

There is consertal quartz siltstone with porous mixed cement (interval 4494-4502 m). Quartz grains are angulated. Cement is siliceous and carbonate with adulteration clayed material and black organics. It is covered with fractures (Fig. 5).

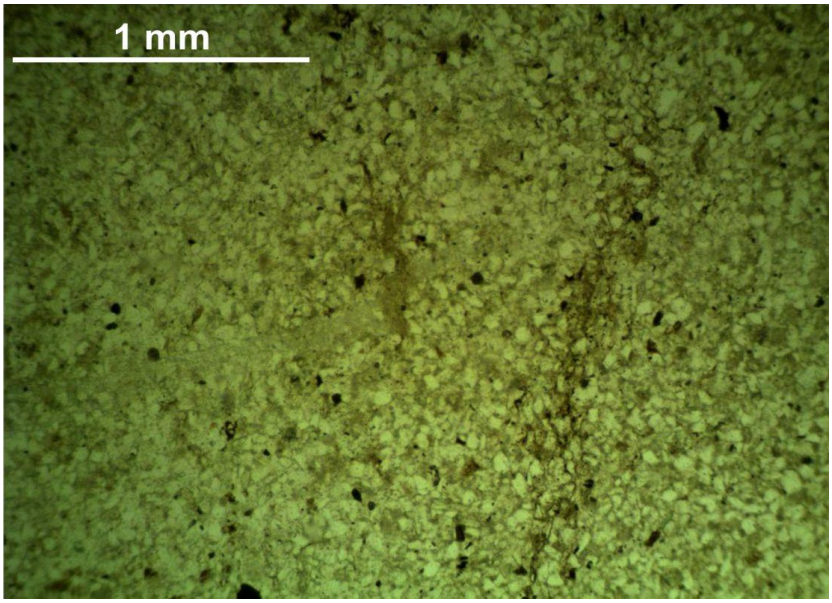

Fig. 5. Quartz siltstone disturbed with fractures

Sand siltstone has basal pore carbonate cement (interval 4654-4657 m). Its fragment is represented by angular grains of quartz. There is small quantity of impurities of pelitomorphic clayed material. Black organics could be found in the rock. The presence of micro cracks along the bedding is typical and therefore maximum concentration of organic matter occurs.

There is quartz sandstone with carbonate cement of porous type (interval 4660-4663 m). The contents of carbonate equals to a third of the thin rock section area. Rock fragmentation is presented by poorly sorted out grains of quartz. There are impurities of clayed material and black organics in carbonate cement. The rock is disturbed by small cracks which are filled with calcite (Fig. 6).

Rocks of Stryi suite of Upper Cretaceous as well as all rocks of the Carpathians folded structure are crumpled in various folds among which overlapped anticlinal folds dominate that are complicated by transverse tectonic distortions – sheers. Some of them can be observed in exfoliations. Such an anticlinal fold in Stryi deposits of Skoliv chunk is shown in Fig. 7.

Due to laboratory and geophysical studies of the drilled in the well profile, reservoir rocks are mainly represented by thin layered sandstones, siltstones and limestones, which porosity varies in the ranges of 0,5 to 5-6% and in some cases reaches 10%. The permeability of the mentioned rocks is usually 0,01 milli Darcy and sometimes to 2-5 milli Darcy.

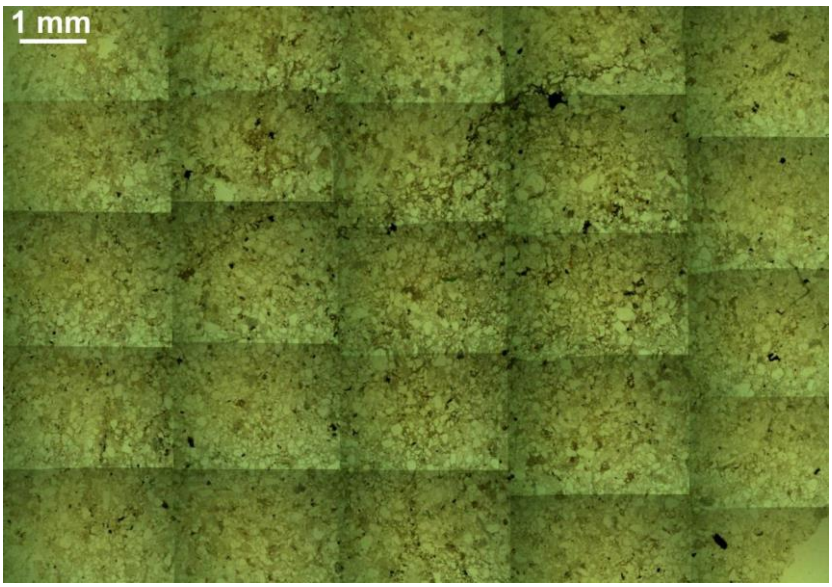

Fig. 6. Panoramic view of high-silica sand disturbed with micro cracks

Fig. 7. Dome of anticlinal fold in exfoliation of Stryi deposits

Rocks are heterogeneous in the layers and that can be observed in the above shown pictures of the thin sections. It caused lithogeneous fractures to occur and that together with tectonic ones increase the rocks permeability.

Gas saturation of such reservoirs ranges from 40-60 %. Water, which is in the pores, is bound and almost motionless.

The results of the tests showed low productivity of such type deposits. In other words we study low porous, layered (schistous) rocks with low permeability that defines characteristics of their geological study taking into account possible industrial gas bearing capacity.

Based on the above mentioned the following conclusion can be made that we deal with unusual reservoir rocks which are typical for shale rocks. Due to the type of voids the given rocks belong to fractured-porous or porous-fractures reservoirs.

Gas bearing capacity of poor-porous and low permeable rocks of Stryi Suite was defined in 60-70s of the last century on the area of Vyhoda-Vytvytsya, where according structural nature by Z.V. Liashevych, L.M. Kuzmyk et al [4] three anticlinal folders were identified (Vyhodska-I, II, III) that are divided into two blocks.

The section of Stryi deposits in Vyhodska-I fold is flooded. Gas bearing capacity of Vyhodska-II fold is connected with the first sandy and argillite horizon. While testing wells 66-VV and 67-VV which are situated in Hoshiv block gas was produced with its flow rate corresponding to 1900 and 9000 m^3 per day. Wells 66-VV and 67-VV are in the near dome part of the fold.

In the fold of Vyhodska-III gas was received from the second sand and argillite horizon in wells 1-VV and 7-VV from interval 2745-3172 m and keeping the well bore opened 50000 m^3 of gas per day was produced. In 7-VV well from the interval 2780-2982 m 4700 m^3 of gas per day was recovered during test. The third sand argillite horizon is flooded.

While testing the parametric well Shevchenkovo-1 from interval 6930-6058 m from low deposits of Upper Cretaceous 1 m^3 of mineralized with gas water was recovered and from interval 6210-6280 m low gas flow rate was received. In the interval 1300 to 3700 m four zones with increased parameters of gas were determined that correspond sand and argillite rocks.

While testing the well Tarasivska-2 from interval 1657-1667 m gas flow rate was 2300 m^3 per day and from interval 1705-1787 m it was 1500 m^3 per day. The mentioned intervals correspond to upper sand and argillite pack. Gas was received from other interval 3090-3190 m. The gas flow rate was 700 m^3 per day and from interval 3260-3322 m – 2000 m^3 per day.

Small gas flows and gas showings from Stryi deposits were also determined in wells 3-, 9- and 10-VV.

While testing well Maksymivska-4 water flow or slurry solution was recovered which was highly saturated with gas.

STUDY AND ANALYSES OF CONTENTS OF ORGANIC CARBON

Aimed at determing contents of organic carbon in the deposits of Stryi suite the thermogravimetric [6, 7] analysis of selected by field operations argillites, siltstones and sandstones was conducted.

The thermogravimetric research was carried out using device NETZSCH STA 449 F3 Jupiter [8] in the range of temperature 25-800 °C. The rate of heating was 20 °C per minute. The process of thermolysis was conducted in the argon atmosphere. Mass of weighted samples is appr. 300 mg. The measurement accuracy of temperature is 1°C, mass change is $1 \cdot 10^{-2}$ mg.

In Fig. 8 the typical thermogram of the studied samples is shown. It has been found multistaged nature of thermolysis [5]. The first stage, which was run in the temperature range up to 120 °C, followed by dehydration, i.e. output of free and bound water. On the curve of TAD endoeffects are recorded with extremes of 100°C. The second stage is characterized by exothermal effect and informs about the process of thermolize of organic components and namely:

- At temperatures of 120-325 °c there is output of free hydrocarbons;
- At temperatures of 325-435 °c there is output of bound hydrocarbons;
- At temperatures of 435-505 °c there is co_2 output formed by decomposition of higher kerogen.

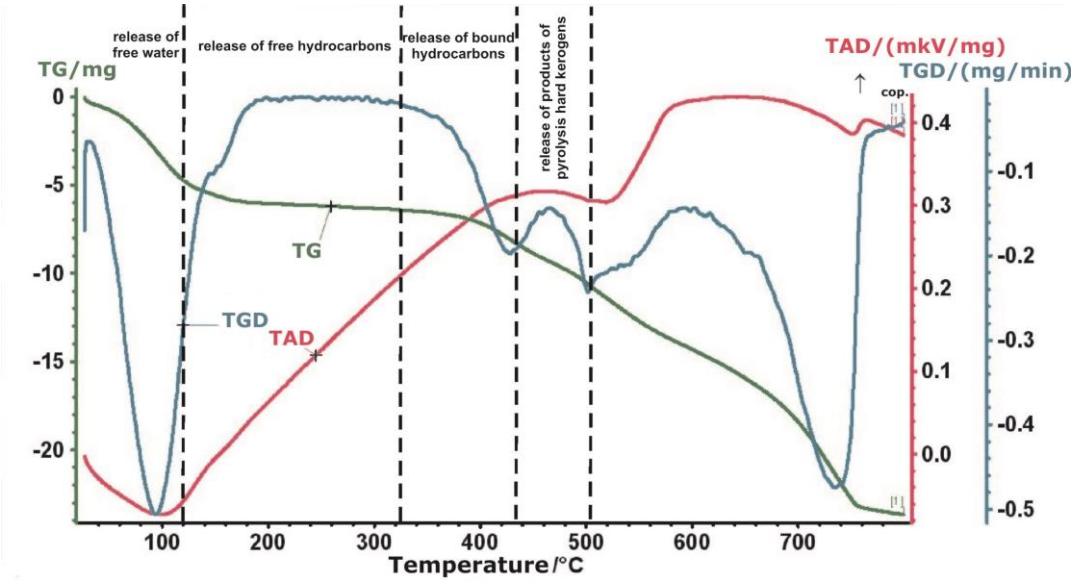

Fig. 8. Results of thermogravimetric analysis of argillite sample from Stryi suite of Upper Cretaceous of the Ukrainian Carpathians:

1 – Thermogravimetric (TG) curve; 2 – Differential and thermogravimetric (TGD) curve;

3 – Differential and thermoanalytical (TAD) curve

At higher temperatures transformation of clay minerals begins.

Monitoring the products composition of thermolysis was carried out by the means of infrared Fourier's mass spectrometer. The results of the research are shown in Table 1.

Table 1 – Summary of samples mass changes (%)

№	Sample	<120 °C	120-325 °C	325-435 °C	435-505 °C	TOC, %
1	1	0,56984	0,25965	0,11328	1,39686	1,76979
2	2	2,77329	0,90678	0,37421	3,37359	4,65458
3	2_3	2,05375	2,00675	0,40042	2,18164	4,58881
4	2_5	1,21867	1,20087	0,29978	2,16253	3,66318
5	3	2,56223	1,10098	0,56127	4,16105	5,8233

The yield of carbohydrates occurs most intensively at 150–400 °C however at appr. 275 °C the loss rate of the rock mass is up 0.1565 μV/mg and loss of the rock mass is 6.24 mg which corresponds to 3.64% of the sample mass. Within the temperature interval a linear form of TAD curve shows relative uniformity of dispersed organic matter that is produced.

It has been proved by the conducted research that during thermolysis up to 505 °C the yield of carbohydrates is up to 4-6 % from rock mass. It states that argillites are reached in organics and produced the gas which is in Stryi deposits. It should be mentioned that carbohydrates could penetrate into these deposits at the expense of sub-upright migration from greater depths along tectonic faults.

CONCLUSIONS

The nature of extending gas bearing capacity was determined by the researches of Upper Cretaceous deposits in the chunk area of the Carpathians (Orivsk and Skiolivsk chunks) within the range of Dolyna oil and gas region. Perspectives of gas bearing capacity of Upper Cretaceous deposits are connected with separate rocks packs of 150-250 m thick.

The estimated store of gas on the area of Vyhoda-Vytvytsya is 21 billiard m^3 according to calculations by Liashevych et al [4] by category C_2. Generally only within the range of Dolyna oil and gas region stores of gas in Upper Cretaceous deposits are assessed in volume more than 100 billiard m^3.

Thus development of gas store of the foliated (shale) rocks with low penetration of Upper Cretaceous (Stryi) deposits is urgent and in order to uncover gas bearing horizons and increase their productivity the advanced technologies should be used similar to ones being used at shale gas production.

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PRINCIPLES OF MAPPING THE MODERN ECOLOGICAL SITUATION

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***Abstract**: The environmental map – is a cartographic model of environmental conditions landscaped taxons that together reflect the current environmental situation in the area. The ecological map – is a set of discrete values geosystems condition that gradually changes from point to point, covering the entire study area. Limits on maps held by environmental izo-concentrates clark, background and anomalous values of the content polluting substances.*

***Keywords**: ecological map, ecological condition and ecological situation geochemical background anomalies.*

ACTUALITY AND ANALYSIS OF PREVIOUS MATERIALS

Analysis methods for geoecological mapping [1] shows that over the past two to three decades had a significant number of environmental maps – they are: general, sector, element by element, component-wise, etc., such as a examples can be found in the works of V. Baranovsky [3] L. Rudenko [5] V. Gutsulyak [6] I. Voloshin [4] O. Adamenko [2], H. Rudko [1] I. Kovalchuko [8] L. Mishchenko [9] and many other authors. The most complete collection of these maps contained in "National Atlas of Ukraine" [10] and "Environmental Atlas of Ukraine" (2009). From the analysis of these materials, we see that the great variety of environmental maps can be reduced to a number of types of unit, component-wise (sector) anthropogenic load distribution of environmentally hazardous man-made objects, modern ecological situation.

FORMULATING GOALS AND UNSOLVED ISSUES.

Element by element the ecological and technogeochemical map (Pic. 1. d) showing the spread of a toxic pollutant elements in a particular area within a particular component of the landscape.

Component-wise eco-technogeochemical maps (Pic. 1. b) illustrate the environmental condition (all identified pollution by toxic elements) of a component of the landscape (Pic. 1. k) – soil or vegetation, groundwater or surface water, air and others.

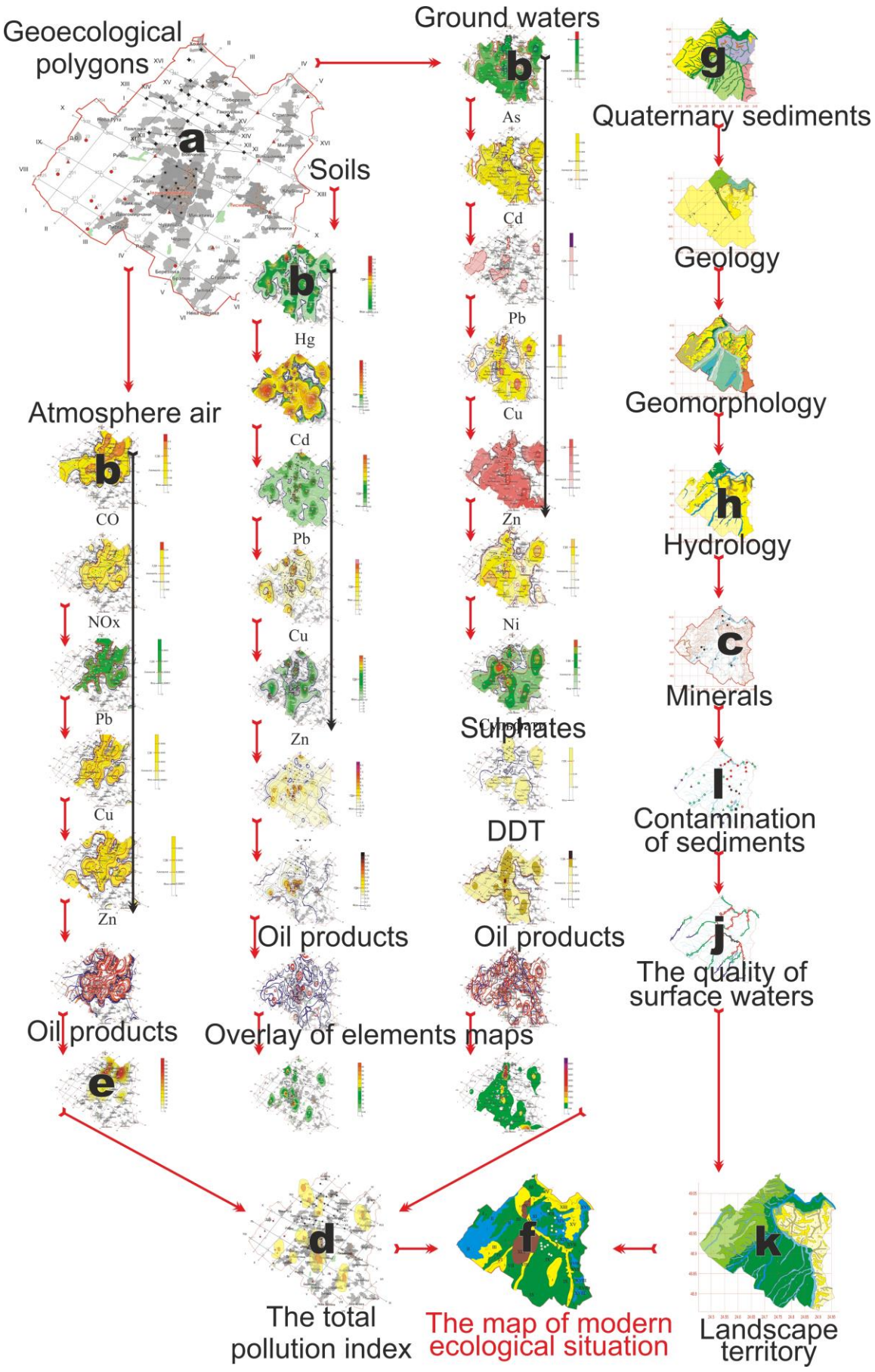
The environmental maps spread of environmentally hazardous man-made objects reflect only one thing – the man-made component of the environmental situation without its natural basis. Examples of such maps are environmentally map of Rivne, Sumy, Poltava, Kyiv, Kherson and others cities. The general scale of maps is 1: 200 000, published by the State Scientific and Production Center "Nature" National Space Agency of Ukraine. To call them "ecological" is not quite correct, because they depict man-made objects – oil pipelines, railways, power station, nuclear power plants and others. against the background of administrative units – districts without specifications natural component of ecosystems (Pic. 1. c).

The environmental maps of anthropogenic load the most common type of environmental maps, although they are not quite "environmental" as showing the only man-made component, the level of contamination of a territory (region, district) emissions of pollutants into the air, discharges into water or placing domestic and industrial waste. These maps are according to statistical reports, showing emissions or discharges of industrial enterprises of the region or area and "bind" them to one point on the map. According to this principle made up most of the maps contained in the above-mentioned atlases. Clearly, this is important information, but it reflects only part of man-made ecological state of this or that territory, and therefore to call these maps "environmental" is impossible (Pic. 1. d).

Indeed, in our view, emissions into the air, which "settled" on the ground, can not yet indicate the content of pollutants in this component. The ecological state of soils usually depends on the volume and composition of emissions, but how many and which includes component that we can know only after the analysis of soil samples taken in the respective monitoring network.

Maps of the modern environmental situation. All previous types of maps can not be called "ecological", because they contain only a few elements of ecological maps – showing the distribution of a pollutant in the territory; contamination of soil, surface and groundwater, air and vegetation; placing environmentally hazardous man-made objects, and so on. al. All it takes to map the modern ecological situation, but the latter should provide a comprehensive assessment of landscapes – from their natural state to the changes that have arisen in the anthropogenic impact.

Therefore, we propose to call "ecological" only those maps that reflect the integrated state of the environmental situation in the investigated area. That environmental map – *is a model of the modern environmental situation.* It should be allocated not only to man-made objects that cause pollution and environmental conditions and landscape taxa.



Picture 1 – The main principles of construction of geological maps

Ecological conditions [9] – is a degree of transformation of primary natural landscape (zero environmental background) under the influence of both natural and man-made (anthropogenic) factors (changes over time). The sequence of changes and their intensity creates a progressive series of conditions, which may be 4 [4] 6-8 [10]: normal, solid, intense, complex, poor, pre-crisis, critical, catastrophic.

The environmental situation – is a space "mosaic" of landscape taxon (geosystems or parts) of different ecological condition (shift in space) that are created on a given territory simultaneous existence of different degrees of peretvorenosti areas shown on the environmental map. Hence it is clear that the environmental map must be characterized as an ecological situation and environmental conditions in a particular area.

Environmental map [9] – is a model of environmental conditions cartographic landscape taxon that together reflect the current environmental situation in the area. The ecological map – is a set of discrete values geosystems condition that gradually changes from point to point, covering the entire study area. That is, this set of values should reflect not something that fell to the ground from the air, and that directly contained in the soil, in its various horizons, determined its overall environmental condition (Pic. 1.f).

PRESENTING MAIN MATERIAL

On any map, including environmental, is the border separating the object depicted in it. *The environmental maps* – show the contours of equal concentrations – izo-concentrates (ic) content of chemical elements-pollutants border distribution of geochemical background G_b, C_a anomalies and MPC maximum permissible concentrations (Pic. 1). How did we get these options and how to conduct border between them?

First of all, the investigated territory is justified optimum network of geo-ecological landfills – sampling points that appear on the map of factual material (Pic. 1.a). The results of chemical analyzes (samples of water, air, soils and so on.) are grouped in computer database, allowing programs through *Sorfer, MapInfo, Arccad, Corel Drew* and others. build electronic (computer) item-component-wise and environmental-tehnogeochemical maps [1, 2, 9].

If the distribution of pollutants exist even in the area of research, their izo-concentrates portrayed by uniform interpolation, as in topography horizon. With appropriate izo-concentrates will coincide G_b, C_a and MAC. These parameters are calculated by the authors [1, 2, 7, 9] method. So geochemical background G_b considered average of 2/3 of all analyzes, with 1/3 of the smallest and largest content is discarded as uncharacteristic or "hurricane."

But nature is not distributed evenly and is often detected contaminants like a wave-nature form, that even nature geochemical field broken "shustkamy" and "dilution" is desirable that we identify and portray the eco-tehnogeochemical map. Such uneven distribution of background we call typical and find them by calculating the average content G_b grouped in specific intervals. The obtained value of G_b and C_a are depicted on eco-tehnogeochemical maps unevenly across different distances izo-concentrates, not since the uniform distribution.

Limits on environmental-componentwise tehnogeochemical maps available, because these maps show the average pollution APs and their distribution contour depicted with equal distances from each other horizontally as on topographic maps. Then perform ranking APs allocation to environmental conditions of a component, and it has in Ukraine, as has been shown above. Therefore, the environmental-componentwise tehnogeochemical maps can be up to 7 boundaries between the different ecological conditions.

CONCLUSIONS

The contours of different environmental conditions of natural landscapes bring to map the modern ecological situation, which will be the basis for geoecological zoning and long-term development and operational measures to protect the environment.

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COMPOSITION AND GEOGRAPHICAL SPREAD OF HERPETOFAUNA IN THE MARAMURES MOUNTAINS NATURAL PARK

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Abstract: *The Maramures Mountains Natural Park is located in the north-eastern part of the county of Maramures (between 47°35'5'" and 47°58'20" northern latitude and 24°8'12" and 25°2'38" western longitude), and it has been a protected area for preserving the natural and cultural heritage since 2005. The perimeter of the park shows a great diversity of landforms, due to its geological, tectonic and climate complexity, which generated a wide variety of habitats favorable to the herpetofauna.*

This study summarizes the results of field and laboratory research on the area of the Maramures Mountains Natural Park during the period of May- September 2015, with a fortnightly frequency, within 8-18 hours. We have used the transect method and the active search in order to map the herpetofauna. Thus, 74 randomized characteristic habitats have been identified and investigated.

Nine species of the herpetofauna were identified subsequent to the land observations and laboratory analyses. Out of those ones, there were six species of amphibians (Salamandra salamandra, Mesotriton (Triturus) alpestris, Lissotriton (Triturus) montandoni, Bombina variegata, Bufo bufo, Rana dalmatina) and three species of reptiles (Lacerta agilis, Zootoca (Lacerta) vivipara, Vipera berus).

Key words*: distribution and frequency of amphibians and reptiles*

INTRODUCTION

Recent studies show that amphibians (Houlahan et al.,2000; Stuart et al.,2004; Hartel, 2008) and reptiles (Petranka şi colab., 1994; Alford şi Richards, 1997) are in alarming numerically decline.

For Romania, most of the native species of amphibians and reptiles are considered to be vulnerable, threatened or endangered (Iftime, 2001, 2005). As a result, mapping and effective conservation actions are required for these species (Ghira et al., 2002; Strugariu et al., 2007).

The purpose of this paper is to determine the specific wealth of herpetofauna and its distribution on the territory of the Maramures Mountains Natural Park, useful working tools in developing strategies for conservation in the protected areas.

The Maramures Mountains Natural Park is located in the north-eastern part of the county of Maramures (between 47°35'5'" and 47°58'20" north latitude and 24°8'12" and 25°2'38"

western longitude), and it has been a protected area for preserving the natural and cultural heritage since 2005. **(http://www.muntiimaramuresului.ro**).

The perimeter of the park shows a great diversity of landforms, due to its geological, tectonic and climate complexity, which generated a wide variety of habitats favorable to the herpetofauna.

MATERIALS AND METHODS

This study includes the results of field campaigns on the spatial-temporal dynamics of the amphibian and reptile communities of the Maramures Mountains Natural Park during the period of May-September 2015.

We have used the transect method and the active search in order to map the herpetofauna (Cogălniceanu, 1997). Thus, 74 randomized characteristic habitats have been identified and investigated, focusing on: Valea Crasnei river, Valea Rica river, Valea Socolău river, Valea Rea (Vaser) river, Făina (Vaser) river, Valea Babei (Vaser) river, Toroiaga (Vaser) river area, Baia Borșa, Prislop area.

The species were released into their native habitats after they had been assessed and photographed.

In data processing and their interpretation, a significant weight had also the bibliographic documentation and the discussions with the locals.

The importance of the herpetofauna conservation is certified by O.U.G. 57 / 2007.

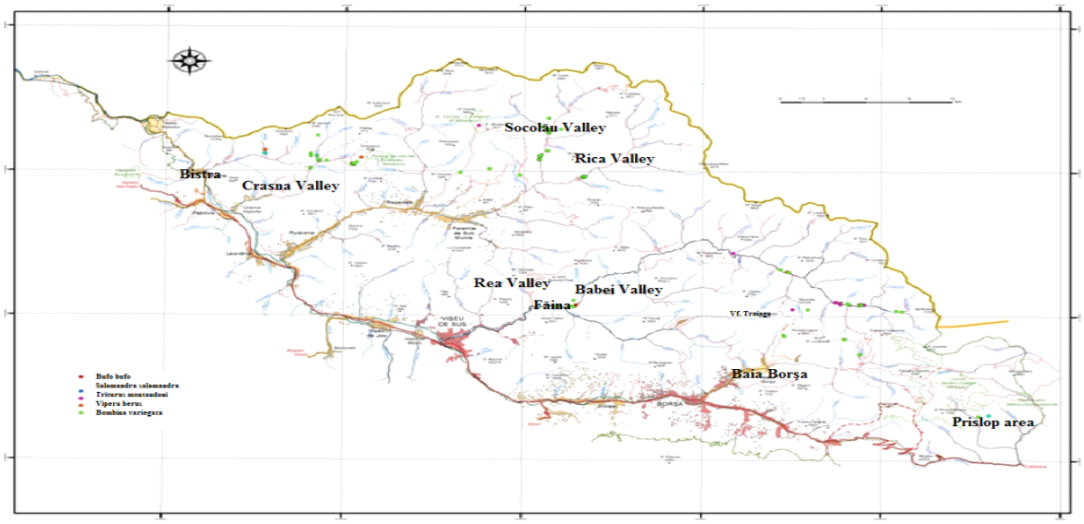

Figure 1. Location of the sampling sites in the Maramures Mountains Natural Park (adaptation from http://www.muntiimaramuresului.ro)

RESULTS AND DISCUSSIONS

Nine species of the herpetofauna were identified in the surveyed area. Out of those ones, there were six species of amphibians (*Salamandra salamandra, Mesotriton (Triturus) alpestris, Lissotriton (Triturus) montandoni, Bombina variega*ta, *Bufo bufo, Rana dalmatina)* and three species of reptiles (*Lacerta agilis, Zootoca* (*Lacerta*) *vivipara*, *Vipera berus*).

Salamandra salamandra (fire salamander) (*Linnaeus*) is considered a common species, mostly found in birch forests, being mentioned in all bibliographic literature on Maramures (Bereş, 1990; Ardelean, 1993; Bereş, 1997; Ardelean şi Bereş, 2000). During the survey works in 2015, this species was reported in one location, near the Bistra village, at an altitude of about 710m (N: 47°52577; E:24°15246). It is a cryptic species; probably it is more common than it may meet in the park.

Mesotriton (Triturus) alpestris (alpine newt) *Laur*. is mentioned for its wide distribution in the Maramures Depression. However, for the perimeters of the Maramures Mountains National Park it is generally mentioned, without specifying certain locations. Thus, Ardelean and Bereş (2000) appreciate that the species is frequent in the mountain area (700-800m) up to the alpine level (1880-1900m).

During the survey works from 2015 in the Maramures Mountains National Park, the species was observed in four locations. Two of these points are located at an altitude of about 600- 650 m and they were situated on the rivers of Valea Rica and Socolău, respectively. The other two points were identified at much higher altitudes, on the Vaser river between Făina şi Valea Babei (at an average altitude of 800m) and in the Vinderel lake (altitude of 1684m).

Lissotriton (Triturus) montandoni (Carpathian newt) (*Boulenger*) is an endemic species of the Carpathian Mountains and Sudeten Mountains, it is being present in Romania only in the Oriental Mountains between the altitudes of 500-1900m. Ardelean (1993) found it on the Valea Vaserului river at Făina.

Ardelean şi Bereş (2000) consider that *Lissotriton (Triturus) montandoni* is a triton species which is frequent in the Maramures Depression at altitudes of 300-1800m. These information are also confirmed by the research carried out in 2015, the species being uniformly spread in the surveyed area. Thus, the species was signaled in the following areas: Crasna Vişeului, Valea Rica, Valea Socolău, Valea Rea-Vaser, Făina-Vaser, Valea Babei-Vaser.

Bombina variegata (Yellow – Bellied Toad) (*Linnaeus*) is considered a common species in Maramures from an altitude of 211m to 1300m (Ardelean, 1993; Bereş, 1997).

Subsequent to the surveys of 2015, the species was observed in the most of the permanent or temporary ponds which were analyzed, as it is a relatively common species. Thus, it was signaled in the following areas: Crasna Vişeului river, Valea Rica valley, Valea Socolău valley, Valea Rea-Vaser river, Făina- Vaser river, Valea Babei-Vaser river, Fântâna Stanchii –Prislop river.

The presence of the species of *Bufo bufo* (European Toad) (*Linnaeus*) on the territory of the Maramures Mountains National Park was signaled by Ardelean (1993) at Făina Vaser. The surveys from 2015 confirm the presence of this species strictly in this area.

Rana dalmatina (agile frog) (*Bonaparte*) is considered to be a common species in the Rodnei mountains up to 1300-1400 m. altitude. This species was observed during the land campaign performed in 2015, north of the Rodnei Mountains, but only in the Prislop pass area.

Bereş (1997) signals a large distribution of *Lacerta agilis* (sand lizard) (*Linnaeus*) in the Maramures Depression from a low altitude of 250m-300m up to higher altitudes of 1200m-1300m. The species was signaled at an altitude of 622m only on the Valea Rica river during the land observations in 2015.

Zootoca (*Lacerta*) *vivipara* (viviparous lizard) (*Jacquin*) was observed in the roadside vegetation of Valea Crasnei river (at an average altitude of 600m), Făina - Vaser river and Valea Babei –Vaser river (at an average altitude of 800m). Ardelean (1993) found it at Făina Vaser river. We appreciate that *Zootoca vivipara* is a relatively rare species, as it is being present in a small number of sites in the investigated region.

Vipera berus (*Linnaeus*) is considered common and abundant, especially in melanistic forms in the Maramures Mountains at Făina-Vaser, Comanu - Vaser (Ardelean, 1993; Ardelean and Bereş, 2000). It is also widely spread in the Maramures Depression from an altitude of 600m up to 2000m.

Vipera berus, ecologically, is a forest species, but it occupies different habitats in need of a vast area (including fringe forest or marshy areas). It has been observed in few points, as it is a shy species (Bistra; Valea Crasnei and Vaser; Făina; Valea Babei; Tomnatec). We suppose that the intense anthropogenic activities generated the withdrawal of species towards isolated places, and it is probably more common than it was observed, in the study area.

Following investigations carried out in terrestrial and aquatic habitats in the Maramures Mountains, one can say that *Bombina variegata* is the most common species of all communities herpetofauna analyzed the frequency with which was observed reaching a value of 72.72% of those 74 monitoring points (Fig.2).

The species *Lissotriton (Triturus) montandoni* was found in numerous points corresponding to permanent or temporary ponds located mainly near water courses in the park. It is also a common species (54.54%) (Fig.2). The species *Lacerta agilis* (9.09%), *Zootoca* (*Lacerta*) *vivipara* (9.09%) are more rarely reported, achieving low frequencies (Fig.2).

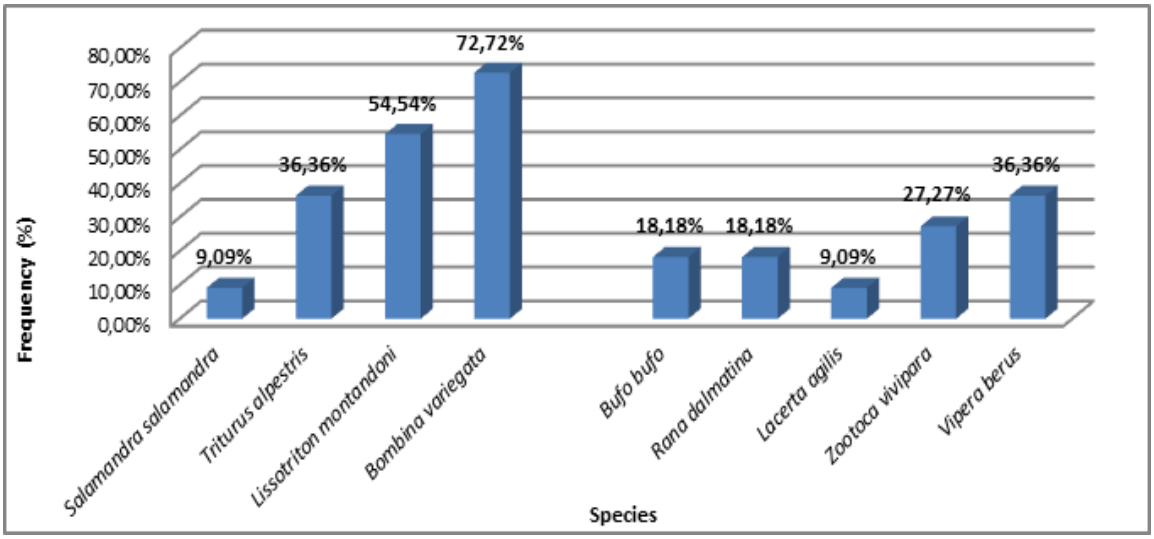

Figure 2. Herpetofauna frequency in the habitats located in Maramures Mountains Natural Park in 2015

Analyzing the conservation status of the herpetofauna of Maramures Mountains Natural Park, the following were found: 4 species have the status of "strictly protected species"; 5 species have the status of "protected species"; 4 species have the status of "species of community interest"; 4 species have the status of "species of national interest" (Table 1).

Table 1. Conservation status of the native species of amphibians and reptiles in the Maramures Mountains Natural Park (adaptation after Iftime A. and Iftime O., 2010)

SPECIES	Legal framework and protection status / bibliographic reference, notes
Salamandra salamandra	OUG 57/2007: Annex 4 B
	Berna Convention: III
	National Status *: VU
Mesotriton (Triturus)alpestris	OUG 57/2007: Annex 4 B
	Berna Convention: III
	National Status *: VU
Lissotriton (Triturus) montandoni	OUG 57/2007: Annex 3, 4 A
	Berna Convention: II
	CEE Habitats/NATURA 2000: II, IV
	National Status *: EN
Bombina variegata	OUG 57/2007: Annex 3, 4 A
	Berna Convention: II
	CEE Habitats/NATURA 2000: II, IV
	National Status *: NT
Bufo bufo	OUG 57/2007: Annex 4 B

	Berna Convention: III
	National Status *: NT
Rana dalmatina	OUG 57/2007: Annex 4 A
	Berna Convention: II
	National Status *: VU
Lacera agilis	OUG 57/2007: Annex 4 A
	Berna Convention: II
	CEE Habitats/NATURA 2000: IV
	National Status *: LC
Zootoca (Lacera) vivipara	Berna Convention: III
	CEE Habitats/NATURA 2000: IV
	National Status: VU (2006:NT)
Vipera beru	OUG 57/2007: Annex 4 B
	Berna Convention: III
	National Status *: EN

LEGEND:

OUG no. 57/2007: Annex 3A: species of Community interest whose conservation requires the declaration of special areas of conservation

Annex 4A: strictly protected species of Community interest

Annex 4B: strictly protected species of national interest

Berna Convention /Law no./1993: Annex II: strictly protected

Annex III: protected

CEE Habitate/Natura 2000: Annex II: species whose conservation requires the declaration of special areas of conservation

Annex IV: strictly protected species

***Red Book, Romania's Red List (with modifications according to the National Report CEE 2006):**

LC (Least Concern)

LR/cd (Lower Risk, conservation dependent measures)

NT (Near Threatened)

VU (Vulnerable)

CONCLUSIONS

Nine species of the herpetofauna were identified in the surveyed area. Out of those ones, there were six species of amphibians (*Salamandra salamandra*, *Mesotriton (Triturus) alpestris*, *Lissotriton (Triturus) montandoni*, *Bombina variega*ta, *Bufo bufo*, *Rana dalmatina)* and three species of reptiles (*Lacerta agilis*, *Zootoca* (*Lacerta*) *vivipara*, *Vipera berus*).

Bombina variegate is the most common species out of all the analyzed herpetofaunistic communities (**F**=2.72%), followed by the species of *Lissotriton (Triturus) montandoni* (**F**=54.54%). The species of *Lacerta agilis* (**F**=9.09%), *Zootoca* (*Lacerta*) *vivipara* (**F**=9.09%) are more rarely signaled, with reduced frequencies.

The results have high conservative value, which requires the need to preserve the aquatic habitats and also the adjacent terrestrial habitats, as the only way to ensure the proper conservation of amphibian and reptile communities.

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«GREEN» INVESTMENT CAPITAL

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Abstract: *The following article shows the critical characteristics of renewable energy and the ways of revival of the bonds. This burning issue brings together economics, energy and environmental protection. The author proposed to revive the energy sector through the issuance of so-called «green bonds». The author believes that Ukraine has all the prerequisites for entry into this type of loan which may attract foreign investment is not left industrial companies but also banks.*

Keywords: *bond rate, energy*

INTRODUCTION

The financial and economic crisis, resulting in the lack of liquidity, could revive the circulation of bonds in Ukraine. Today bond – is a security that represents a particular form of existence of the debt, which has its advantages and shortcomings. Bond as security has its own characteristics. It is, above all, maturity and redemption, shape or form being the issue, issuer, method of income calculation interest rate risk and security.

Bonds are somewhat similar to each other, but each has its own specific characteristics. For example, most corporate bonds can provide the issuer (borrower) the right of early repayment, but the options may differ for different bonds. This suggests differences in contractual terms, as well as the stability of companies that issue bonds. This leads to differences in the degree of risk of bond prices and their expected profitability [1].

Study the economic substance of the bonds as debt securities helps to clarify the interpretation of bonds for accounting as equity securities that do not give the right to participate in enterprise management, but released to raise funds includes bond issuer to pay the holder a specified period bonds guaranteed an amount equal to the par value of bonds with fixed interest rates due under specified conditions location, which helps eliminate inconsistencies definitions and methodological approaches provides improvement of accounting operations with bonds.

In recent years the world's increasing popularity is gaining a financial instrument as – “green bonds”. Thus, in 2012 the total market of such bonds amounted to around 4.5 billion euro’s, but in the first six months of 2014 year it rose to $20 billion (as the economist). Thus,

according to forecasts of market participants, in 2016 the total volume of offerings will be more than 100 billion [2].

Two years ago, Ukraine was not in the list of advanced countries, developing trend of «green energy». Today, amid signals of weakening state stimulation of alternative energy is projects in Western Europe, Ukraine «at risk» to get the status of a regional center of activity in this area of the World segment.

At the beginning of 2012 the world had 565 GW of capacity transformation of energy from alternative sources, including 240 GW of wind generation, small hydro-generations 184 GW, 73 GW of generation of solar and 57 GW bio-generations.

The centers of activity «green» energy and energy efficiency is the European Union, the United Kingdom and Japan. US, China, India is also among the leaders of the segment, but in those countries, according to the ECG, the environmental incentive of playing a much smaller role.

According to European program of alternative energy segment NREAP (New Renewable Energy Action Plan), by 2020 in the EU from alternative energy sources has produced 1217 TW of electricity. It will be about 35% of electricity consumption in 2020-m. Achieving this indicator - in the plans, including by sector solar power (103 TW, 101 GW capacity) wind energy (495 TW, 213 GW) and bio-energy (232 TW 43 GW). Thus, for example, solar power plans can provide double existing capacity today.

Key segments of incentives – is State programs that are implemented through tools such influence as «green» tariff, government procurement, 'green bonds' tax breaks, subsidies, private funding.

«Green» tariff – is the most common form of direct financial incentive segment. The model implies setting higher prices for alternative energy compared to traditional. Along with the obligations of the wholesale electricity market to buy the entire amount of «green» energy, «green» tariff allows times to reduce the payback period. For example, in Ukraine the maximum cost of electricity derived from solar energy is 505.09 kop./KW, while the traditional electricity costs to consumers of voltage class (maximum value) to 93.46 kop./KW. The difference is more than five times recoup projects solar power allows for four or five years. In practice advanced countries, «green» tariff periodically revised downward. This contributes to the endeavor of the electricity markets do not overheat and maintain an adequate balance of wholesale prices. For

example, in Germany the evolution of «green» tariff in solar power led to its decline of $ 0.77/kW in 2004 to $0,07-0,32/kW in 2012 [2].

So try to understand in detail what is «green bonds» who produces them and who buys, and most importantly – when they expect in Ukraine.

RESULTS AND DISCUSSION

«Green Bonds» – is a debt instrument, money from the sale that is used solely to finance so-called «green projects» (both new and existing). The main, and in fact the only criterion for such projects is their «environmental friendliness». In a broad sense, «environmental» project can be defined as the preservation of environmental sustainability (including energy efficiency), the biodiversity of the planet, and the absence of any negative effects on the climatic environment as a result of its implementation.

The main buyers of «green bonds» – is European institutional investors, for which funding of environmental projects is a demonstration of their socially responsible investment policy that takes into account both financial and other aspects.

In addition to relevant national laws, issue «green bonds» regulated «green bonds principles» (Green Bond Principles), which are formulated by the International Capital Markets Association. Of course, some organizations engaged in or planning issues such bonds may have their own selection criteria/requirements applicable to such issues.

Speaking generally accepted set of rules, principles include such basic components as:

1. Terms and permissible uses of funds;

2. The process of evaluating and selecting projects;

3. The means;

4. Reporting.

According to the generally accepted rules relevant sections should be included in the prospectus.

The fundamental issue in the future and turn «green bond» is the question of permissible uses of funds received. Thus, according to the rules of use of funds (point 1 above), funds from the bond issue should be directed to energy efficiency projects (including by increasing the thermal insulation of houses and the development of alternative energy sources),

waste management, efficient use of land resources, conservation of flora and fauna, water resources, improving environmental transport of people and goods.

If necessary this list may be supplemented main condition here is clearly marked «environmental benefits», who are describing and (if possible) quantitative and/or qualitative assessment.

The process of evaluation of the project involves the allocation of specific funding criteria for selecting the object in terms of its compliance with environmental principles and uses of funds.

Stages of management of funds and strict monitoring reports suggest the use of which requires full disclosure (ideally – with the assistance of an external auditor). It is also recommended to use specific quantitative and/or qualitative indicators that have evaluated the degree of influence the implementation of various funded projects on ecological environment (for example, the decline in emissions, lowering energy consumption, the number of people who have access to clean drinking water and etc.). Now there are four main types of «green bonds» that meet generally accepted criteria (principles):

• Green Use of Proceeds Bond - standard debt with recourse to the issuer. Competence of funds received as a result of the issue, the issuer is ensured by their location in a given sub-portfolio (or otherwise) and confirmed by internal testing procedures in the context of financial and investment operations of the issuer. Issuer encouraged informing holders of securities regarding anticipated trends investments unused funds.

• Green Use of Proceeds Revenue Bond – is the debt without recourse to the issuer. The credit position holder of securities provided cash flows of the financed project (projects), as may be specified in the prospectus, the use of dedicated funds. Competence of funds received as a result of the issue, the issuer is ensured by their location in a given sub-portfolio (or otherwise) and confirmed by internal testing procedures in the context of financial and investment operations of the issuer. Issuer encouraged informing holders of securities regarding anticipated trends investments unused funds.

• Green Project Bond – is the bonds, according to which the investor has direct credit risk associated with the financing of a project (projects). It maybe considered as the recourse to the issuer or without.

• Green Securitized Bond – is bonds secured by one (or more) specific projects, including mortgage and other asset-backed securities, securities (covered bonds, ABS). The

initial source of payment on bonds of this type is typically cash flow generated by the assets underlying the issue. Examples of such assets may be solar panels placed on roofs or other devices to improve energy efficiency.

The question is: «Is it possible to «green bonds» appeared in Ukraine»? Suppliers' money could be state-owned banks, but the results of their operations and significant need for capital increase shows that state-owned banks are not always the right tool resource allocation.

Perhaps the program of energy efficiency and green technologies in Ukraine must deal with international organizations among the above – in a fair and transparent manner, avoiding corruption. The state should provide conditions in the financial markets so that international organizations could borrow in local currency at reasonable rates and fund projects that are vital to the state.

Assessing the prospects of alternative energy development in the Carpathian region, should wash the area is wind potential of the region has an average annual wind speed 6.5-7.5 m/sec, allowing to build industrial wind power (wind farms) (Fig 1) [3].

For wind farms should be used wind turbines (windmills) with 2,0-4,0 MW capacity which are made by various foreign manufacturers and Ukrainian companies listed above. Technology above wind turbines mostly similar – it is three blades of the gondola held on a metal tower height of 120 m. The mountains have to carry large amounts of excavation work for the construction of access roads to the wind farm site, industrial sites for the installation of wind turbines.

The Carpathian region has good opportunities for the implementation of small wind farms (up to 50 kW), including the areas of private houses up to 30 kW of electricity sales energy transmission organizations («Oblenergo») in the «green» tariff (20 cents per 1 kW • h) but such schemes wind farm is not yet implemented.

Introduction of facilities using wind power promising is rather important component of sustainable development of Carpathian region. For the development of wind energy in the Carpathian region one need no objective resource, technical, operational, environmental and economic obstacles [4].

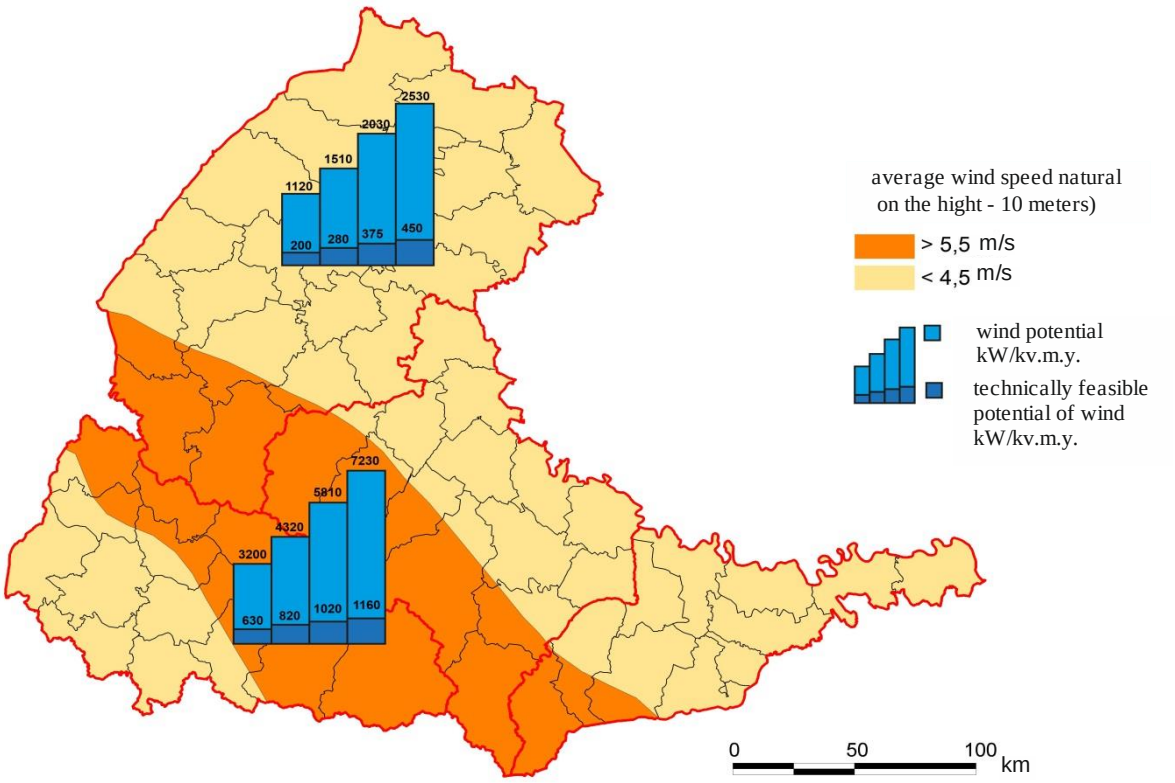

Fig 1. The potential of wind energy in Carpathian region [3]

Carpathian region may exploit sufficiently usable solar energy. The annual flow of solar radiation for the Carpathian region is 1000-1115 kW/m^2 [1], which is good for the construction of solar energy small as well as industrial and scales (Fig. 2) [3].

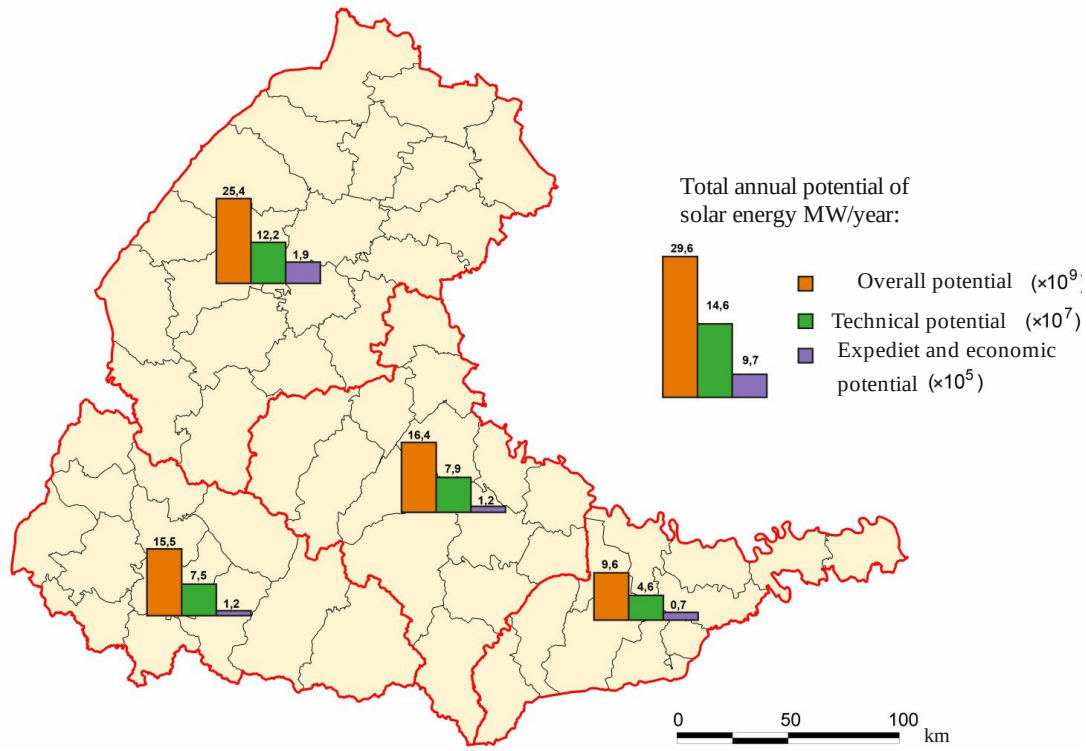

Fig 2. The potential of solar energy in the Carpathian region [3]

CONCLUSIONS

The low proportion of alternative sources in the energy balance, along with the attractive «green» tariff and the relevant geographical conditions, have also promising market of Ukraine. Widespread use of renewable energy sources will reduce Ukraine's dependence on imported gas, and therefore increase the level of energy security.

Facts are not excluded massive displacement «green» investment capital from Europe to Ukraine. Constraining factor is the risk of long-term investments in our country. That is why the current large number of small players, and they are mostly residents (with actual, rather than a legal point of view). The participants of the energy market are not yet considering the alternative energy segment as able to influence the energy balance. But this is its advantage: it can grow virtually unchecked high rates for at least another three to five years.

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INDUCTION OF THE CARPATHIAN REGION ENVIRONMENTAL SAFETY LEVEL CHANGE USING THE ALTERNATIVE SOURCES OF ENERGY

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Abstract. *Based on the undertaken researches it is suggested to make the integral assessment of the territory environment safety level on the basis of the modern organiozation structure control and information model by involving specially formed enviromental condition indicators such as quality factors and indexes. These indicators are connected with evniromental risk level and allow to make quantitive assessment of the environmental safety level and enviromental risk level. The selection of the environment safety indicators and the environmental safety level change of the Carpethian region by using alternative sources of energy are scientifically grounded and analyzed.*

Keywords: *environment, environmental risk, environmental safety indicator, alternative sources of energy.*

INTRODUCTION

Environmental problems significantly limit the socio-economic development of the society that is in direct relationship with the environment. That is why the development of the national resources rational use system combining with adequate structure of the industrial capacity reconstruction that takes into account the anthropogenic impact minimization and provides social security system will be the foundation for securing sustainable social development. The environmental risk assessment concept virtually in all countries and international organizations is seen as the main mechanism for the environment protection development and decision making management [1-6]. For this reason the environmental risk assessment is considered to be the most promising approach for evaluating environment safety degree of the territory. The question of environment safety induction level change of the regions by using the alternative sources of energy are studied insufficiently. That is why the aim of this research is to study the choice of the environment safety indicator with the help of which the region environment safety level change using alternative sources of energy can be analyzed.

PRESENTATION OF THE FUNDAMENTAL MATERIAL

The development of the methods for setting environmental footprint limits from renewable sources of energy were performed due to the Commission on sustainable development under UN and Commission on global ecology recommendations based on which the new approach to the environment safety theory was suggested that is based on the ecological paradigm. The advantage of the new approach, unlike the generally accepted old one that bases on "polluting-resources" paradigm is that integral assessment of environment safety level is suggested to be carried out on the basis of environmental control organization structure and information model by involving specially formed new indicators of environmental conditions that are the quality factors and indexes. These indicators are associated with the environmental risk level and allow to carry out the quantitative assessment of environmental safety level and the environmental risk level [1]. Such approach also differs from the generally accepted one by the fact that it does not require the involving of maximum allowable concentration as the basis for calculations that are known to be sanitary-toxicological norms not the environmental ones [2].

The indicator is the pointer and the symbol at the same time; the magnitude process, property degree and measurement process are set to it. Index is the magnitude that characterizes the deviation from the level that is considered to be the basic one. The quality index additionally is brought in use for the investigated object that is expressed through the indicators and is correlated with the risk level. The environmental indicator mathematical core lies in the fact that it can be scalar, vector and complex magnitude that can be represented as a matrix.

Environmental safety is traditionally interpreted as the protection and preservation of environment [3]. Under the environmental safety the lack of the actions, states and processes that directly or indirectly cause substantial damage to environment, population and material objects is understood [2]. By A. Skrynnyk definition the environment safety is the population living comfort level at the certain area within economic and natural landscape and the level of its protection from environmental impacts [4]. However in most cases the definition of environmental safety officially accepted by IAEA is followed, according to it the environment safety is "the protection of all people or environment from the excessive negative effects" [5].

The aim of research in the field of environmental safety at the initial stage is the formation of indicators system, databank for calculations and comparison of environmental safety magnitude degree with average level of these figures in other countries.

Today in the world there are three centers that are working on the subject indicators and indices – New York center, led by the World Bank and UN organizations, the European Union and

the Union of Asian countries. Upon the recommendations of these centers the indicator (environmental safety criterion) must meet certain criteria:

1) be scientifically substantiated;
2) have predefined responsiveness;
3) have simple interpretation;
4) have agglomeration properties;
5) comply with the set of national priorities and the concept of sustainable development;
6) be source element of information on which quantitative evaluation can be carried out;
7) be representative and constructive;
8) have high information capacity and carry new valuable data for decision support systems [2].

American and European centres use similar principles in simulation environmental safety of the territory. Most frequently territories are selected in urban areas in which main component of environment such as air is specified and research is conducted on one or on the group of pollutants according to the scheme "load - state - response". The response is understood in this context as the inclusion of control parameters, which include technical, technological and administrative controls governing either positive or negative retroactions, resulting in minimized or neutralized negative effects that change the ecological state of the considered object to the right direction [2].

Analysis of energy impact on environment for EU and CIS countries is conducted by using 12 environmental indicators. The list includes:

1) GDP, million $US USA;
2) Specific consumption (power capacity) (kWh / $US. USA). In the CIS there are 2 notions:

a. the power capacity of standard fuel(t.s.e. /$US. USA);
b. electric capacity (kWh / $US. USA).

3) Electrical power generation, bln. KWh;
4) Station capacity;
5) Fuel consumption rate, mln. Tons of fuel oil equivalent or million. t.r.e. (1t.r.e. = 0.7 t.o.e.);
6) Gross emissions of pollutant agents, th.tonns;
7) Gross CO_2 emissions, th.tonns;

8) Specific pollutant emissions, t / kWh, t / t. in. n., t / t. n. e. (considering the specifics of production);

9) The volume of the formation of bottom ash waste, th.tonns;

10) The volume of recovery of bottom ash waste, th.tonns;

11) Waste productions of sulfur filter plants, t;

12) Data on the implementation of environmental management systems (EMS) in power plants, MW, MWh.

To study changes in the level of environmental safety of Carpathian region using alternative energy sources as indicators of ecological safety sections 6 and 7of this list were selected:

- gross emissions of pollutant agents, th.tonns;
- gross CO_2 emissions, th.tonns;

By calculating the value of these indicators, we can conclude how much emissions of pollutants into the air will decrease with implementation of wind-solar system in the study region.

Thus when selecting indicators the approach based on a comparison of the amount of pollutants generated per unit of energy was applied. So, after the analysis of existing lists of indicators of environmental safety ecosystems was performed, following indicators are provided for assessment of environmental safety:

- I_a – an indicator of changes in the level of air environmental safety which characterizes the amount of gaseous emissions into the atmosphere of traditional sources of energy per unit of energy;
- I_s – an indicator of changes in the level of soil environmental safety that characterizes the amount of solid waste in traditional sources of energy per unit of their power, g/J.

The value of these indicators can be calculated by the following functions:

$$I_{am} = k_в - \frac{E}{Q_E} \cdot k_в$$

$$I_{гп} = k_в - \frac{E}{Q_E} \cdot k_{тв}$$

$$I_{am} = K_в - \frac{P}{B} \cdot K_в$$

$$I_{гп} = K_{тв} - \frac{P}{B} \cdot K_{тв}$$

I_a – an indicator of changes in the level of air environmental safety, g/J;

E – energy saving effect, provided by introduction of wind-solar systems, J;

Q_E – general energy requirements, J;

K_v – volume of gaseous air pollutants of traditional sources per unit of their power, g/J;

B – amount of fuel resources for energy requirements, kg;

K_{vm} – volume of gaseous air pollutants of traditional sources per unit mass of fuel used, g/ kg;

I_s – an indicator of changes in the level of soil environmental safety, t;

K_{sw} – the volume of solid wastes of traditional sources per unit of their power, g/J;

R – resource-saving effect, provided by the introduction of wind-solar system, kg;

K_{sw} – the volume of solid wastes of traditional sources per unit of used fuel mass, g / kg.

Further assessment of environmental safety of Carpathian region is based on the determination of environmental risk. Risk assessment in this case is the differential, using individual indicators that characterize safety properties, namely, air and soil environmental safety.

RESULTS

Using developed methods of calculation of ecological safety indicators and the results of simulation of energy and resource saving effect from implementation of wind solar systems in Ivano-Frankivsk region, values of selected indicators of change in ecological safety of the region were calculated (table 1-2).

Table 1 – Value of the indicator of open air ecological safety relating to greenhouse gas emissions from traditional and renewable energy source

Type of traditional energy carrier	**$I_{ат}$ depending on greenhouse gas emissions in equivalent CO_2, g/kW*hour**	
	Traditional source of energy	**Renewable energy source with compensation of energy gap from traditional fuel**
Coal	265-357	91-122
Oil	219-264	75-90
Natural gas	120-188	41-64

Table 2 – Value of indicator of top soil ecological safety from traditional and renewable energy source

Type of traditional energy carrier	**$I_{гп}$ depending on size of solid wastes formation**	
	Traditional source of energy	**Renewable energy source with compensation of energy gap from traditional fuel**
Electricity produced by Burshtyn TPP that operates	41,6g/kW*hour	14,2g/kW*hour

on coal		
Black coal	130g/kg	44,3g/kg
Brown coal	350g/kg	119,5g/kg
Black oil	3g/kg	1,03g/kg
Natural gas	-	-

There were calculations of reductions of air pollutants emissions in the atmosphere and solid wastes formation on the condition of usage of resource saving effect from implementation of alternative sources of energy in Ivano-Frankivsk region that pointed out to reduction of greenhouse gas emissions in equivalent CO_2, t.tonns/year:

- for coal by 448,24-603,9;
- for oil by 370,46-446,58;
- for gas by 202,99318,02.

Reduction of volumes of solid wastes emissions by t.tonns/year:

- electricity produced byTPP by 59,9;
- black coal by 39,22;
- black oil by 0,38.

CONCLUSIONS

Thus, suggested indicators allow to estimate changes in the level of open air and soil covering ecological safety during implementation of alternative sources of energy. Detection of mechanisms of ecological safety formation of certain environmental components will allow in future to develop methods of conduction of territorial ecological safety in general and to minimize authenticity of negative environmental effects outbreak.

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STRATEGIC DIAGNOSTIC ANALYSIS SERVICES OF WATER AND SANITATION IN ROMANIA. EXTERNAL ENVIRONMENT ANALYSIS

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***Abstract**: One of Romania's current priorities is to expand and improve the services of centralized water supply so that the entire population to benefit from the water line EU of drinking water. The greatest savings of investments in expansion and improvement of water services can be made in the establishment of the development strategy. An important part of determining the development strategy of water supply services is a strategic diagnostic analysis of the service in which it analyzes internal and external factors affecting such services. Strategic diagnostic analysis is usually done in companies, in this case the water operators. In this study intends expanding business analysis and the outcome operators namely water supply services and sewerage water. This study concerns the analysis of external environment and its influence on water supply services.*

***Keywords:** water supply services, strategy, external environment analysis*

INTRODUCTION

The word "diagnosis" is of Greek origin and means "able to discern". Diagnosis was taken in management of human medicine and suggests the need for periodic consultation systems to identify health and ability to adapt to foreseeable changes in the environment. Diagnosis managerial unlike medical diagnosis, research is not limited to the symptoms exhibited by the patient and the causes they generate, but also prescribe appropriate treatment [1].

Diagnostic analysis is a broad investigation of major economic, technical, sociological, legal and management. It aims to identify strengths and weaknesses and the opportunities and risks of the external environment that fosters or threatens the development and the causes that generated them [2,3].

Finally, diagnostic analysis provides recommendations character development for capitalizing the strengths and opportunities or corrective recommendations to eliminate or mitigate the weaknesses and dangers [4].

The analysis consists of an external analysis and internal macro-environment analysis micro-environment. Analysis of macro-environment means monitoring to identify positive trends of present and of future that is the opportunities and negative trends or imminence that may affect services. [5,6]

Micro-environment analysis is performed to understand better the situation services.

This article is a study analyzing the external environment affecting water supply services and sewerage in Romania.

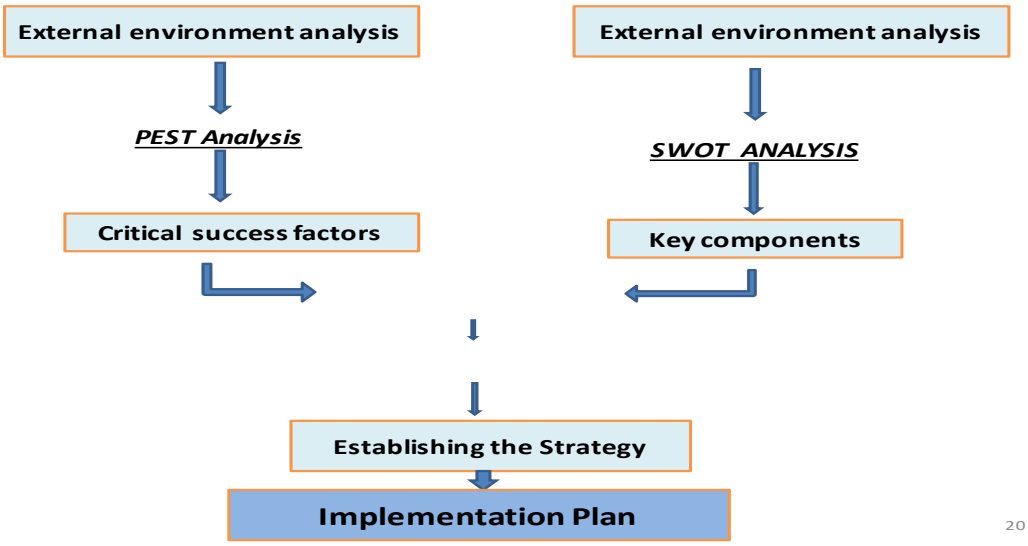

Fig 1. Diagnostic analysis

Methods

Macro-analysis and PEST analysis is an analysis of the impact and general trends in the external environment, viewed through the lens of political, economic, social and technological. The acronym stands for the Political, Economic, Social and Technological issues that could affect the development of services. It analyzes the influence of each factor in part on the development of water services and sanitation [7,8].

The result of the study

The following is shown schematically the components of each factor influencing the development of services (figure 2).

Legislative-political factors

The political environment refers to all government actions affecting the economy and business in general. Government regulations and policies that impact business include commercial law, labor, fiscal, environmental laws and regulations, trade restrictions, tariffs trade, infrastructure and development policies. The degree of political stability also has a huge impact on business and the economy in general [9]. Romanian legislation in the water and wastewater sector is generally harmonized Community environmental Acqui site.

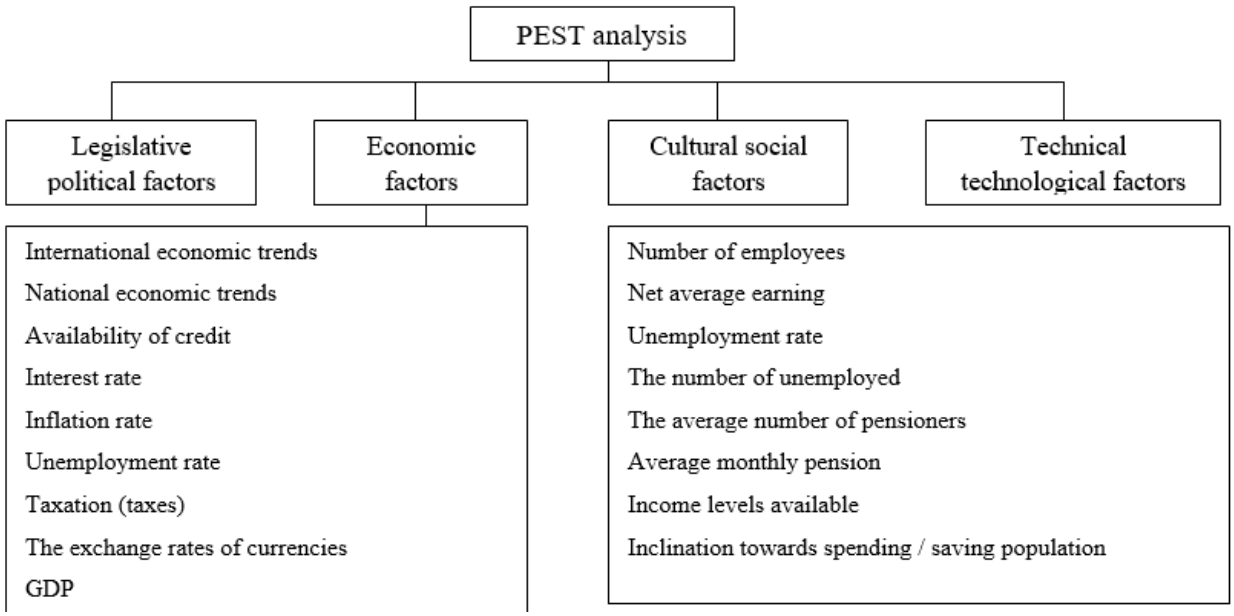

Fig 2. PEST analysis

Legislative-political factors influence the supply services, water and sanitation positive and negative. Political factors may positively influence the water supply services and sewerage, given that the shareholders of water operators are legal factors.

Any company that conducts public services is affected by legislative decisions, public services constitute a major point of interest in the work of legislative bodies, due to the increased interest of citizens towards this aspect of social life [10].

Current legislation setting helps IDAs (IDA), which are associations of local authorities created to solve common problems of water supply services and sewerage. IDAs delegate water services and sanitation a regional operator.

The formation of IDA influences positively the establishment of water supply services and sewerage on the following considerations:

- extend services in all localities members of the association
- due to the increasing amount of water sold can reduce costs specific intelligence as fixed costs remain constant
- management of water services in a regional system allows operators to have a unified concept on the development or rehabilitation of water supply system and sewerage and hence lower investment costs

Romania's orientation towards Western democracy and values to align European policies as a result of joining the European Union is a factor conducive to the development of water supply services and sewerage efficient, customer-oriented needs [11].

There is a concern of political factors, to harness the full potential of its subordinate units, the principle of efficiency and effectiveness, to get maximum funds budgeted for the expansion and rehabilitation of water and wastewater services [12].

The Treaty of Accession of Romania to the European Union under Chapter 22, transposition of the acquis on environmental protection in national law and its implementation are major goals. Regarding urban waste water treatment in Romania were granted transitional periods following deadlines: 2015 for agglomerations with a population equivalent of more than 10,000 inhabitants and 2018 for agglomerations with a population between 2,000 and 10,000 equivalent inhabitants.

Moreover, throughout Romania it was declared as a sensitive area in terms of urban waste water treatment. Thus, all agglomerations with a population equivalent of more than 10,000 inhabitants should be equipped with wastewater treatment plants to ensure efficient treatment.

In order to meet the commitments of both the EU Accession Treaty of Romania and the Government co-financing investments in the field of water supply and sanitation this has a positive impact on services [13].

Political factors may also affect negatively the services, given the repeated legislative changes.

Unfortunately, in Romania factor legislature does not constitute an important pillar of support for the achievement of medium-term programs and long as the legislation is highly fluctuating changes of normative acts being performed often dramatically from day to day.

In conclusion we can say that political and legislative factors are very good for the development of water supply and sanitation because it encourages their expansion and improvement including the provision of grants.

Economic factors

The world economy is in a difficult period. This affects negatively the Romanian economy.

Economic international trends (trends):

The global economy has deteriorated significantly in 2009, and the recovery is expected to be uneven. The EU is foreseen to be among the weakest performers. Economic growth is expected to recover, but unevenly internationally. The viability of this return remains affected by uncertainties in the short term.

Economic national trends (trends):

Although economic growth expected to recover water operators must act cautiously because it is possible to further reduce water consumption to undertakings and institutions.

Availability of credit:

Given the status of water operators, that is public limited company with shareholders territorial administrative authorities, there is a potential risk to accessing credit.

Interest rates:

Monetary policy interest rates have reached historic lows. Reducing interest rates applied by banks allow water operators the opportunity to engage development investment credit for services on favorable terms.

Inflation rate:

According to the forecast made by the National Commission for Prognosis inflation is on a downward trend. The decline in inflation will have a positive effect on operators by reducing water losses caused by inflation if late collection for the services provided.

Unemployment rate:

The ILO unemployment rate at the national level also has a downward trend.

Taxation (taxes):

Income Taxes 16% still remains. Employment taxes also remained unchanged. A major change was the Government share decrease T.V.A. Lowering taxation already positively influenced the services of water supply resulting in lowers their price.

The exchange rates of currencies:

The average exchange rate lei / euro predicted by C.N.P. will increase by currency depreciation against the euro. The average exchange rate lei / dollar forecast of C.N.P. will increase by currency depreciation against the US dollar.

It is expected that Romania not to adopt the European single currency earlier than 2020.

If the above scenario, a credit will be currency risk, currency depreciation expense being water operators, especially given that they did not export drinking water.

GDP: Estimates C.N.P. GDP (in current prices, real growth) will increase. Structure of GDP by industry will not change significantly, the most important share in GDP represents about

50% ie services, and industry about 25%, construction 8%, agriculture 6% and net taxes on products about 10%. Given the current situation, it should be implemented a viable strategy for development of water supply services and sewerage to take into account all the positive and negative aspects to pursue in permanent damage to the emergence of new economic factors. We can assume that consumption will fall further water companies and institutions. Although water operators have the opportunity to take a loan on favorable terms, should analyze carefully the loan amount. The loan should be taken in RON and its value should not exceed financing projects financed from European funds.

Social-cultural factors

Socio-cultural elements are a set of features for maximum heterogeneity in terms of effects and action area. Changes in such factors are slow. Entities with a regional and local level are of great interest for this environment.

Even emphasize the importance of conserving the natural environment can be interpreted as also a cultural problem. Environmental movement has developed into a cultural context favorable to developed countries, which have realized that it is correlated with the standard of their people's life and their long-term success [13].

To better illustrate the socio-cultural factor, we present below a number of indicators:

- The number of employees is a continuous decline with the aging population and the phenomenon of youth starting to work abroad. Population decline hampering the development of services of water supply and sewage as it will reduce the amount of water sold.

- Net average earning will increase continuously due to lack of manpower. Will increase capacity to pay public service.

- The national unemployment rate has also indicating a downward trend that will increase capacity to pay subscribers

- The number of unemployed is decreasing which leads to decreased debt by private person`s water operators and hence improved service

- The average number of pensioners and average monthly pension of state social insurance. Although average monthly pension is increasing ability to pay for services is falling due to the fact that the average number of pensioners increases due to aging.

- The level of disposable income (left) and inclination towards spending / saving population:

Uncertainty about income trends from previous years has boosted savings, particularly for purposes of caution. Even if the population is geared towards saving the potable water

consumption will have a dramatic drop to jeopardize the stability of services foodstuff water and sanitation, because the analyzes shows that since 2009 the potable water consumption liters/person/day remains approximately at the same level that is 100 liters/person/day.

From the social point of view the situation is negative, many of the indicators: number of employees (down), the average number of pensioners (increasing) indicates that it significantly reduced the power of the majority of beneficiaries thrift. While envisaging a decrease in unemployment and an increase in wages in the coming years water operators must make spending cautiously because as long as the limit for the population is reduced, not shown an increase in tariffs and the level of collection of the services supplied will decrease. All this has a negative impact on water services and sanitation.

Technical-technological factors

Technological factors are underlying the formation of the technological environment. Technology in the broad sense of the term is the component of the macro-environment represented by a set of processes through a combination of resources is transformed into products. It is known that technological developments affecting the overall development of services. The opportunities existing technology must become a permanent activity [12].

Romania is fed largely on international level equipment and technology standards, known as minimum gap due to limited financial capacity and not protectionist barriers or other.

The technological environment is particularly affected by disseminating IT (SCADA) services in the production processes of water supply and sanitation, and the emergence of new IT industries. On the other hand, globalization has interesting embodiment technological environment. Technology transfer is fast and the products, the services are transported, transferred in a short time at any point in the EU.

By implementing SCADA systems can achieve substantial reductions in staff costs and the energy, which is the first two costs as the largest water operators. The cost of investment in SCADA systems is relatively inexpensive and recovered very quickly.

Development of technologies for renewable energies will be an opportunity for water operators because they are relatively large consumers of energy and have significant sources of new technologies that can be achieved with thermal or electrical energy. Including the drinking water or wastewater are important sources of heat or electricity.

Considering the above factors can be technical and technological support services for development of water supply and sanitation. Water operators must identify and seize the opportunity generated by rapid development and transfer of technologies in the European Union.

Conclusion

Of the many existing external elements that were identified, the mind can influence decisively the development of services of water supply and sanitation. These elements are so-called opportunities, chances, opportunities and threats respectively, risks, dangers.

Opportunities:

Government and the European Union encourages the expansion and improvement of services including providing grants

Banking institutions are willing to lend water operators on favorable terms

Rapid development and transfer of technologies in the European Union allows upgrades that lead to significant reductions in the cost of services of water supply and sanitation

Risks:

Legislation highly fluctuating changes frequently normative acts and laws preventing water operators to prepare in time for its implementation

Romania has not come out yet certain of the financial crisis, for which it will further reduce water consumption in companies and institutions

Reducing household incomes lead to the reduction of collection of the services supplied.

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MIOCENE GEOLOGICAL-PALEONTOLOGICAL PROTECTED SITES AND AREAS IN VASLUI COUNTY: NEW PROPOSALS

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Abstract. *From structural viewpoint, Vaslui County is located at the contact of two main platforms of Romania, i.e. the SW side of the East European (locally named „Moldavian") at North and a sector of the Scythian one at South. Of interest for this study are the deposits of the last sedimentary megasequence, which offers fair opportunities for studying the Neogene land vertebrate communities. Such faunas lived in the Dacian Basin region in proportion as the emerged land gradually extended to the detriment of the marine-brackish realm, mainly since Middle Miocene (Sarmatian). Among newcomers, one can notice mainly reptiles and mammals that arrived either from east, or from southwestern regions. If such fossils were once discovered only due to fortuitous finds, in the last decade some new localities of large national or international interest were set on by systematic diggings. Among these ones, the most noticeable are: Draxeni (Late Bessarabian), Crețești-Dobrina 1 (Khersonian), Pogana, Mânzați and Ghergheşti (Meotian). All yielded rich vertebrate assemblages, including new taxa for this region and for Romania. Due to these discoveries, Miocene environments could be better reconstructed, as long as among these taxa some are useful markers. Herein, we propose new geological-paleontological protected sites and areas based on these localities. For instance, they are extremely scarce in Vaslui County, none of them concerning Miocene deposits. In this manner, the geological heritage of this region would be better show to good advantage, mainly for the wellbeing of the local communities. A series of protection and conservation proposals are underlined.*

Key words*: geology, vertebrate paleontology, Middle-Late Miocene, Moldavian and Scythian platforms, geological heritage, Romania.*

INTRODUCTION

The palaeontological field missions carried out in the last decade by our team in the central sector of the Bârlad Plateau (Vaslui County) focused on Miocene terrestrial vertebrate localities, either already pointed out by previous geologists, or mainly on new ones, recently discovered. Some exposures yielded a lot of such fossils: their richness in number and systematic diversity is amazing promising. Theis area shares from structural viewpoint, a part of the southwestern region of the East European Platform (locally named 'Moldavian') and a western sector of the Scythian one (Săndulescu, 1984).

Among the most promising sites for such discoveries, there are local open-pits where locals are mining sand (in Romanian, '*nisipării*') or various other rocks ('*chietrării*'). Such kind of places is spread in whole Moldavia, but in Bârlad Plateau they are really numerous, due to

favourable geological structure. The sedimentary strata of the last megasequence (Miocene-Pliocene "cycle" in Ionesi, 1994) are exposed as a monocline dipping from northwest to southeast. This specific structure controls the erosion, forming asymmetric hills with an abrupt slope due to interleaving of various rocks (hard *vs.* soft ones), and a gentle opposite one. The open pits are always located on the abrupt slope. This mining is simple, usually involving only a single open pit bench. From paleontological viewpoint, the main advantage is that the rock extraction is manually driven. In this manner, the fossils can be easily observed and collected. In the large open pits where the rocks are mined with specific gears it is a completely different situation, usually the fossils being lost (*e.g.* the coal open pits from the Southern Carpathians Foredeep, in Oltenia).

The fossils are part of the geological heritage of our country, each one being unique and irreplaceable. In such circumstances, they should be protected in clear bounded areas. As a matter of fact, this target is a European priority, and several regions in Romania already have several protected areas, some of them especially dedicate to the geological-paleontological heritage (Lista ariilor protejate, 2016).

But in Vaslui County, actually the situation is not such one at all. The geological-paleontological protected areas are specified by the Law 5/2000, updated by the Establishment Plan of the Departamental Territory in Vaslui County (PATAJ) coined by URBAPROIECT Bucharest in 2004-2005. According these documents, in this county there are enacted only two geological-paleontological protected areas: i. the paleontological reserve Măluşteni (Decision 220/1973 of the Executive Comitee of the Popular Council of Vaslui County, code 2.2773) and, ii. the fossilferous site Hulubăţ (Decision 129/14.09.1994 of the Departamental Council Vaslui, code 2.774) (Table 1). This situation remains unchanged at least since fourty years ago (Bleahu *et al.*, 1976)

Table 1. List of the paleontological protected areas (after the yearly report of the Environment Protection Agency – APM- Vaslui, 2014)

Nr.	Natural Protected Areas of communitary or national interest	Habitats		Species	
		Conservation status	Impact	Conservation statuls	Impact
21	Fossiferous site Măluşteni 2.773	Favourable	Insignificant	Favourable	Insignificant
22	Fossiliferous site NisipăriaHulubăţ 2.774	Favourable	Insignificant	Favourable	Insignificant

Photo 1. Mălușteni, Românesei Creek. Left: view captured in 1997; right: same area in 2007; middle: explanatory panel in the natural reserve.

It is worth to have a closer look on the actual status of these natural reserves. The paleontological site of Mălușteni is located on the southwestern slope of Lacului Hill, at the source of Românesei Creek. It concerns 4 ha, with an area including the main outcrops related to the fluvial-lacustrine Pliocene deposits (Liteanu, Ghenea, 1966). At the beginning of 20th, the former school master Viorel Ursu collected a rich sample of vertebrate fossils firstly studied by Athanasiu (1915) and Simionescu (1922, 1930). Originary considered as Late Pliocene (Romanian; *e.g.* Codrea, 1993, 2000; Codrea, Todiriță, 2003; Rădulescu *et al.*, 2003, 2003a and references therein), these deposits should now to be considered as Early Pliocene (*i.e.* Dacian; Andreescu *et al*., 2011, 2013).

The Photo 1 is illustriative for the site evolution. In only a single decade, the place was covered by invasive plant species. The most aggressive is *Robinia pseudoacacia* L., a plant that every year is expanding its area in whole country. The same tendency could be noticed also in other protected areas too, as some from the Hațeg Basin in 'Dinosaurs' Geopark'.

The second paleontological reserve at Hulubăț, is located on the lower river terrace of Vasluieț River. Once, these deposits yielded Upper Pleistocene vertebrates (mainly large herbivores) indicative for a cold Weichsel episode, firstly reported by Prof. I. Miulescu (Bleahu *et al.*, 1976; Horeanu, Cogean, 1981). These vertebrates were studied by the famous paleontologist Ion Simionescu. Actually, the protected area refers to 0.98 ha, far lesser than the originary one (2.5 ha). But, is also true that the actual status of this site doesn't justify the initial surface: the area is covered by herbs and the rocks are hardly visible. Therefore, this place is just keeping a rather theorethical paleontological value and potential, if since around a whole century no new diggings had been done.

In such circumstances, it is necessary to outline new geological-paleontological protected sites and areas in Vaslui County, because the potential of this territory is really important and significant. Moreover, this is the aim of this contribution, mainly based our recent discoveries.

PROPOSALS FOR NEW PALEONTOLOGICAL PROTECTED SITES AND AREAS

1. In Vaslui County there is an emblematic paleontological site for the whole Romanian vertebrate palaeontology, at Mânzați (Ibănești commune), on the Scythian Platform. There, Ștefănescu (1895, 1899, 1910) found a nearly complete large sized Meotian (Late Miocene) deinothere skeleton (*Deinotherium proavum* EICHWALD 1831, 1835 [=*D. gigantisimum* ȘTEFĂNESCU 1895]; about species' synonymy, see Codrea, 1994 and Pickford, Pourabrishami, 2013 and references therein), now exposed at 'Grigore Antipa' Museum in Bucharest. Although this fossil is worldwide famous, the site was never a protected area. Even Ștefănescu's digging place (herein named **Mânzați 1**) was forgotten, in proportion as time grows. Now, its exact location cannot be exactly placed in the field, but after our survey we presume that it was on the eastern bank of the Ibănești Valley (Fig. 1; more details in Codrea *et al.*, 2016, *in print*, and references therein).

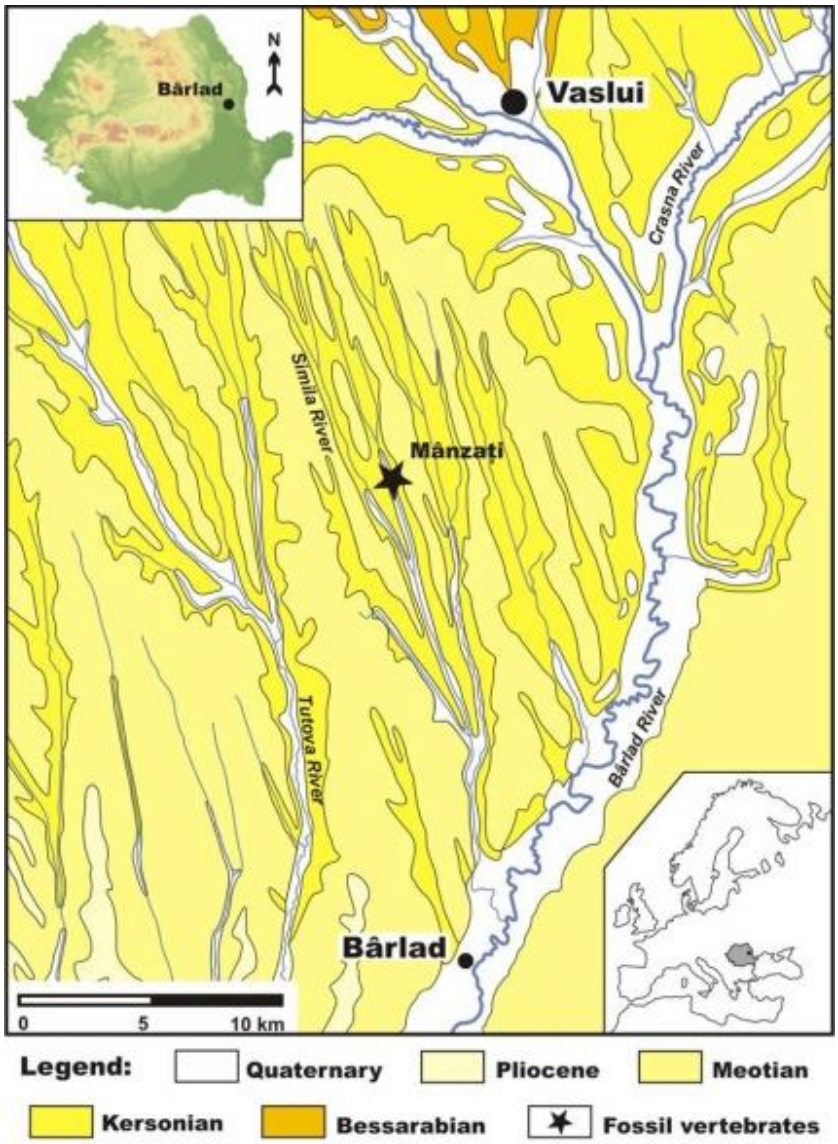

Fig.1. Location of Mânzați on the geological map (after Sava, Codrea, 2012).

Some years ago in the same locality, a fragmentary large sized rhinoceros skeleton was unearthed by the geologist Gabriel Milan Sava from Bârlad (in a place herein named **Mânzați 2**). The fossil was discovered also in Meotian fluvial deposits as the deinothere skeleton and was assigned to *Dihlopus* sp. (Sava, Codrea, 2012). This discovery is important not only from systematic viewpoint, but also because it demonstrates the potential of Mânzați area for further similar finds. Obviously, in the Meotian fluvial deposits of this locality other similar skeletons preserving even anatomical connexion of bones of large herbivores can occur too, in future. Apart Mânzați, such discoveries are reported only in the neighbour locality Gherghești, where similar Miocene deposits are exposed (Codrea *et al*., 2015; Rățoi *et al*., 2015).

Therefore, we propose a new paleontological protected area (ca. 9 km^2) as monument of nature (IUCN III category) in this locality, including all the erosion area actually evolving mainly on Ibănești Valley (Fig. 2). The valley, as well as its tributaries is sectioning both the Quaternary loess and the underlying Meotian rocks.

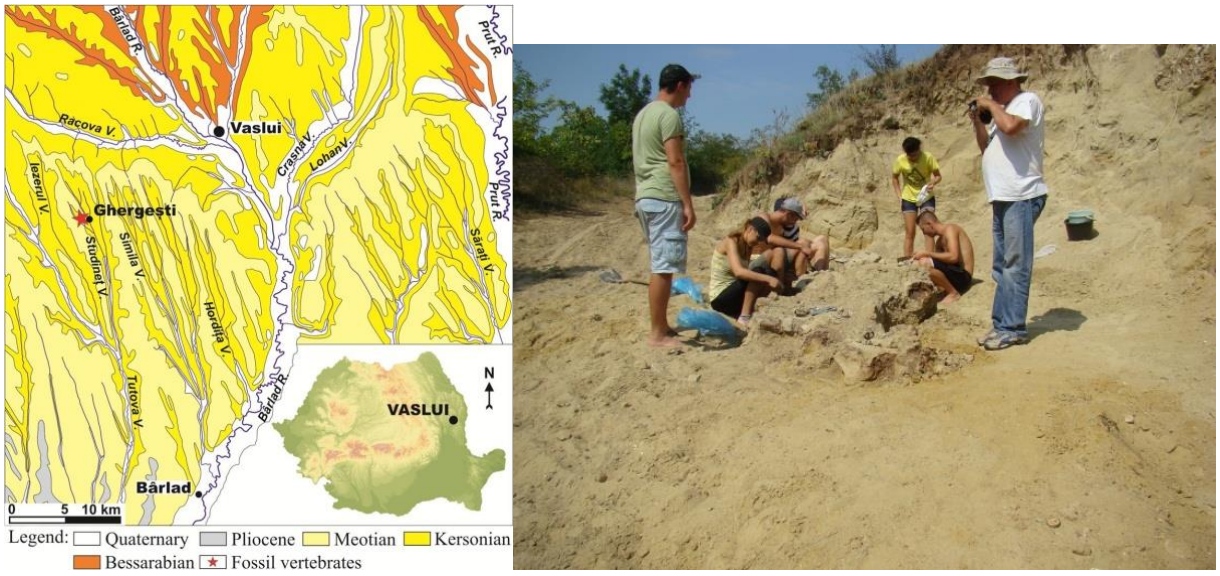

Fig. 2. Location of Gherghești on the geological map and view of fiedworks on the deinothere skeleton location at Ghergesti 1.

2. Another Meotian locality, probably coeval with Mânzați is Gherghești. As the previous locality, the commune Gherghești is located on the Scythian Platform. Same Meotian deposits dominated by sands document an early Upper Miocene fluvial environment. Two sites are for instance of interest for Miocene vertebrates (named herein **Gherghești 1** and **Gherghești 2**). The first one yielded a fragmentary skeleton of *D. proavum* (Codrea *et al.*, 2015, 2016, *in press*; Rățoi *et al.*, 2015) unearthed in the place named ”La Chircă”, on Zaharoaia road, between Studineț Valley and Poiana Hill Plateau (central-western sector of the locality). The second one is located also on the Studineț Valley right bank, just close to the orthodox church of this locality (work in progress, already medium sand small herbivores are unearthed).

The first site was exhausted in 2015, all the deinothere bones preserved in rocks being recovered. The finding place was marked in the field by a panel. Another panel, containing scientific explanations was erected in the centre of the commune. Therefore, for Gherghești 1 no additional protection is actually necessary.

In Gherghești 2, the works will continue in the following years. Specific site protection proposals will be available after extended diggings. Depending on results, it is possible that a rather large area (ca. 10 ha) will be bounded. For instance, only few hundreds of square meters are proposed for protection in Gherghești 2 as fossiliferous sites (according to Law 5/2000). This locality is shearing with Mânzați same Meotian fluvial environments, probably of similar paleontological potential.

3. The last Meotian site of interest that we are proposing here, in located also in the Scythian Platform, in **Pogana** commune. The site of interest concerns the local sand open pit located 15 km north to Bârlad town, nearby the departamental Road 243, conecting Bârlad to Bacău. The open pit (figure 3) is situated south of Pogana locality , on the western slope of Vii Hill (‘*Dealul Vii*’). The Meotian deposits are also of continental type, documenting fluvial environment. The exposure in this case is close to the basalmost section part of the Meotian sedimentary succession, just above the Ruseni (=Nuțasca-Ruseni) Tuff (andesitic) marking the Khersonain/Meotian boundary both in the Moldavian and Scythian platforms (Ionesi, 1994). From the sands of Pogana open pit some fossil vertebrates had been collected in the last years, documenting large herbivores as *Chilotherium* sp., *Hippotherium* sp., Proboscidea indet. (Codrea *et al.*, 2011). Although the sample already collected is not a very large one, the site is promising as long as each year –when the locals are mining the sand- new remains are collected.

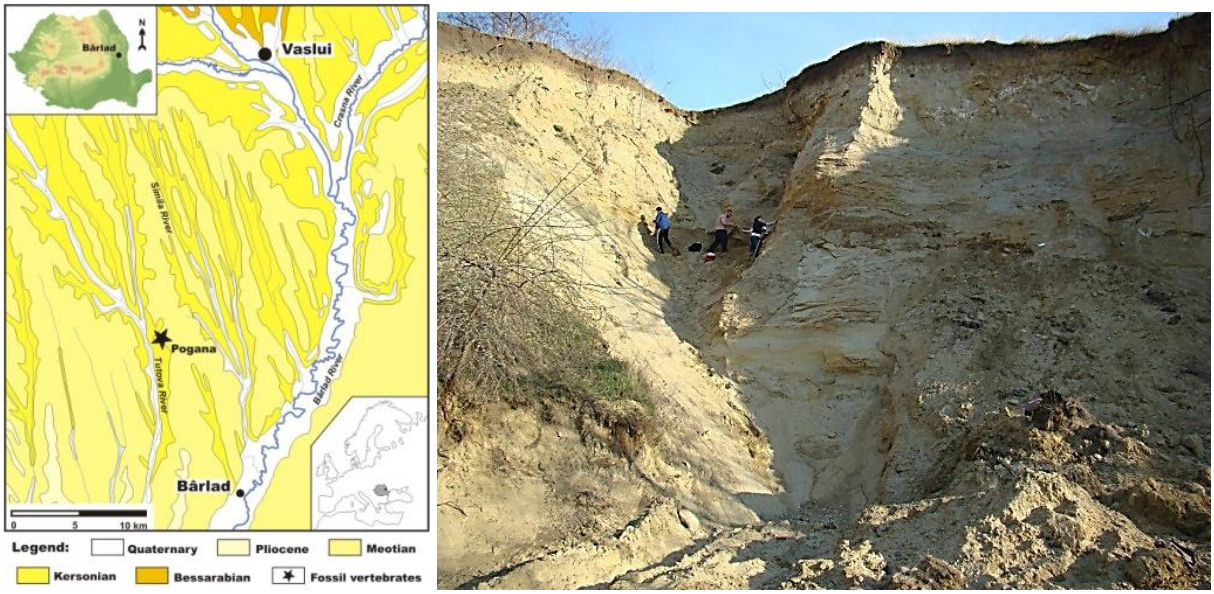

Fig. 3. Location of Pogana on the geological map (after Codrea *et al.*, 2011) and view of the sand open pit.

The proposed protected area is around 0.5 ha (as fossiliferous site, according to Law 5/2000), but it is only a preliminary estimation. It is possible that either some other outcrops located on the same slope of the Vii Hill will confirm in future their palaeontological potential, or the sand mining will extends further and new vertebrate fossils will be collected. Both scenarios will support an extension of the protected area, if necessary.

4. Older deposits, documenting the Late Sarmatian (Khersonian) are known from the southernmost sector of the Moldavian Platform in Vaslui County in **Crețești** commune, near Satu-Nou village. The diggings carried out between 2011 and present yielded a rich sample of vertebrate fossils, documenting an assemblage with amphibians (frogs), reptiles (lizards, snakes, and turtles), birds, mammals (insectivores, rodents, lagomorpha, artiodactyles, perissodactyles, mastodons, carnivores etc.). This locality was named **Crețești-Dobrina 1** by Ursachi *et al*. (2015). Due to rarity of this fauna, the fossil assemblage is also of international interest. The fossil bearing Khersonian deposits are exposed near the national Road 24, northeast to Satu-Nou, in a place named 'La Stejar' ('At Oak Tree'), on the left bank of the Lohan Valley (Fig. 4).

The sand and clay from this locality document also fluvial deposits, marking the contraction tendency of the immerged area of the Dacian Basin at the end of the Sarmatian.

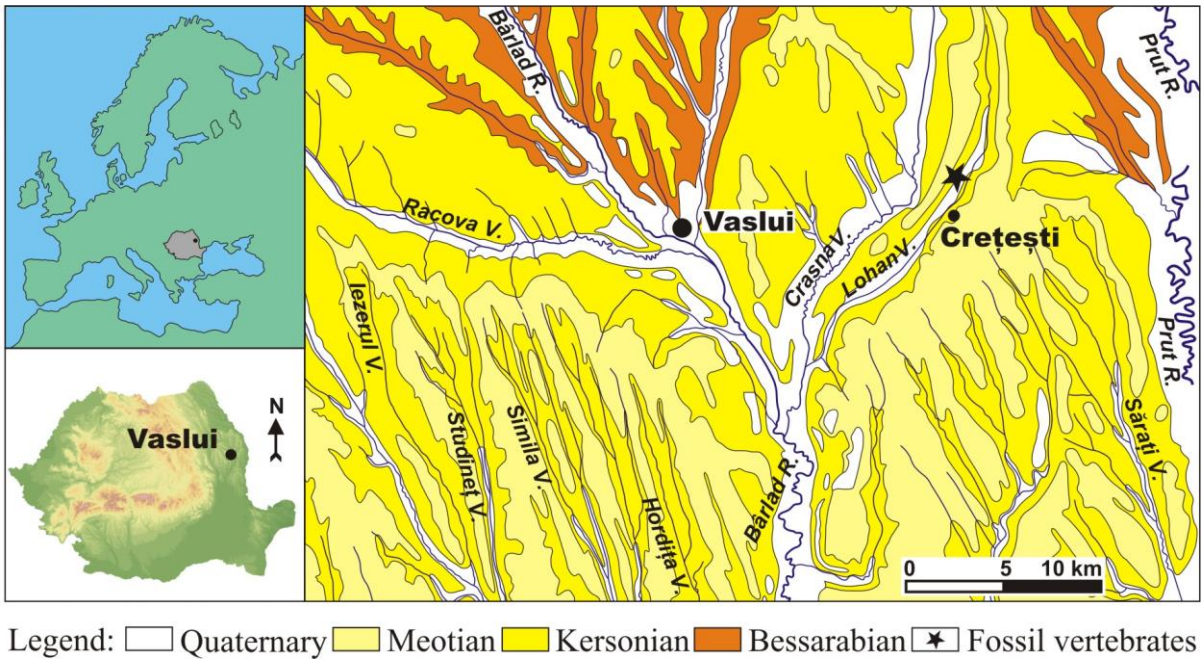

Fig. 4. Location of Crețești-Dobrina 1 on the geological map.

For instance, only a small area was studied. As results are extremely promissful, the excavations will continue in the following years. Therefore, now we propose only 0.5 ha (as fosiliferous site, according to Law 5/2000) to be protected, but this surface could probably increase in the next years.

5. The last locality herein proposed for protection is also the oldest one from geological viewpoint, concerning the Middle Sarmatian (uppermost Bessarabian). This is **Draxeni** village (Rebricea commune), located in one of the northernmost areas of Vaslui County, just near the border with Iași County. This one it is situated on the Moldavian Platform. The Bessarabian deposits of the Șcheia Formation are exposed in a small sand open pit ('**La Nisipărie**') located on the southeastern side of the village (basal slope of the Cârlești Hill, left bank of Draxeni Valley), documenting littoral environments.

Fig. 5. Location of Draxeni on the geological map (Codrea, Ursachi, 2007) and view of the sand open pit.

Although these rocks are of marine origin, several terrestrial vertebrate remains had been collected. It is a clear evidence of the nearby emerged Bessarabian land. The taxa concern reptiles (turtles), a mastodon species, perissodactyls (tridactyle horse, acerathere rhinoceros) and small-sized artiodactyle species (Codrea, Ursachi, 2007).

The mining works in the sand open pit are not very large for instance. However, the open pit is extending a bit each year. It worth to mention that above the Sarmatian rocks, there is an archaeological site documenting the Cucuteni culture, still uninvestigated but visibly rich in pottery fragments. We think that archaeological systematic diggings should be made before completely destruction due to the sand mining works.

Herein, we propose a protection area (fossiliferous site according to Law 5/2000) not exceeding 0.5 ha. As in the other localities above mentioned, this surface could be extended in the following years, depending on scientific results.

CONCLUSIONS

At first glance, it is an obvious paradox inVaslui County: although this territory is depositary of an exceptional geological heritage, with a lot of localities and sites of paleontological interest, only few of them – for instance, just a couple – have a legal protected status, as protected areas. In fact, this situation is not too difficult to explain, as long as for long time naturalists and especially geologists and paleontologists were either very few, or completely absents in the departamental or local museums, and the professionals from universities paid feeble attention to this area. The fossils found usually fortuituous, reached collections from Iași and Bucharest, too few aggrandizing the county's collections. But this situation is not new at all: this kind of acting is a long lasting one. One may not forget that the famous deinothere skeleton now emblematic for the 'Grigore Antipa' Museum in Bucharest is originating from Mânzați…Nothing else but the result of a ludicrous tendency of centralism in our country - but also the same in other small countries in this part of Europe - that acted in such manner for over a couple of centuries.

However, the stream changed and now, in accord with the European legislation and tendencies, in some counties (*e.g.* Hunedoara, Mehedinți, Alba, Bihor etc.) of Romania, the number of protected geological-paleontological areas considerably increased in the last couple of decades. Therefore, same measures should act as soon as possible in Vaslui County too. That explains why we are proposing these new Miocene localities as protected areas. They are bearing rich vertebrate assemblages, including rare taxa for our country and even from this part of the continent. Likewise, new taxa may be expected from these localities in the following years. Such results would enrich the Miocene vertebrate taxa repertory of Romania. All these faunas evidence the gradual emersion of the Siret-Bug land across Middle-Late Miocene (Popov *et al.*, 2004).

The human activities in these areas should not be ceased in any case. At Pogana and Draxeni, the mining works should continue, because only in this manner new fossils could be collected. In all localities, rangers (selected from home-born people) should be engaged and instructed in order to supervise the protected areas, announcing the local (local council, police) and departamental institutions (museums) about the field monitoring. In this way, the fossils will be neither lost, nor object of the black market.

The protected areas should be regularly cleaned against the plant invasive species. In special cases as Crețești-Dobrina 1 the erection of a protective dome is recommended, in order to protect the site against rainfall erosion. On all sites, panels exposing scientific results should be exposed (Photo. 2 is illustrative for Ghergheşti) and in the neighbor localities, these data should be available on the touristic information desks. Last but not least, it is essential that specific

education promoting the value of the geological heritage not only in Vaslui County but in all country should be a national priority.

Photo 2. Explanatory panel at Gherghești, the locality that yielded deinothere remains. Two authors are in this photograph: Laurențiu Ursachi (first line, at right) and Bogdan Gabriel Rățoi (same line, at left).

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PROTECTED NATURAL AREAS IN MARAMUREŞ COUNTY WITH SPECIAL EMPHASIS ON THE GEOLOGICAL ONES (I)

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Abstract: *Nowadays, protected natural areas, geological reservations, water and soil analyses, rocks petrography, carbonate microfacies, are terms often used in all social domains and not only. The need of approaching this research topic aroused directly from direct observations in the field, during field campaigns in protected natural areas in Maramureş County, especially in the geological reservations. The main educational role of the geological protected areas is represented by a better understanding from the general public of geology as a science, by presenting the petrographic, mineralogical, sedimentological and paleontological diversity of planet Earth. Here we present the follows natural areas: Creasta Cocoşului, Babei Gorges and Fossiliferous reservation from Chiuzbaia.*

Key words*: protected natural areas, geological reservations,*

The need of approaching this research topic aroused directly from direct observations in the field, during field campaigns in protected natural areas in Maramureş County, especially in the geological reservations.

One could notice the trend of simplifying the approach of the natural heritage, but also the lack of knowledge and its public valorization, with special emphasis on the lack of minimum amount of information on protected natural areas, represented by the lack of advertising panels, leaflets, and complex popularization actions.

The local economic development plans do not include, even at the information level, these protected natural areas which in fact show a multivalent potential: scientific, recreational, educational, economical etc.

These plans should include programs for establishing the needed background and facilities for a better understanding of the scientific value but also the Eco-touristic features (guided tours, explanatory panels, publications, thematic exhibitions etc.).

Besides these administrative issues, monitoring the protected natural areas concerning the presence of heavy metals in the water and soil of these perimeters also became evident, when taking into account the high potential of heavy metal pollution in the vicinity of Baia Mare town, where there is a long tradition in mining and metal ores processing.

The thesis, via its content and issues approached, intended to point to some problematic aspects of environmental protection especially within the protected natural areas, with special emphasis on the geological ones.

For achieving this goal, water and soil samples were collected from the geological protected areas, as well as rock samples from each petrographic type occurring in these perimeters.

Water and soil samples were measured for heavy metal contents in particular, but also for the specific components in each case: pH, conductivity, total hardness, sulfates, carbonates etc. content for water samples, and pH, organic carbon and humus content for soil samples.

The rock samples of each petrographic type in the case of each geological reserve were investigated under the microscope (in thin sections) by using specific methods.

The laboratory investigation was completed by other typical issues related to protected natural areas such as management system, tourism and other external factors that may affect the optimum conservation and preservation conditions for the representative elements within each protected area.

The main educational role of the geological protected areas is represented by a better understanding from the general public of geology as a science, by presenting the petrographic, mineralogical, sedimentological and paleontological diversity of planet Earth.

Unfortunately, the human activities in the natural environment are more and more frequent and leave long-term signs even if they are very short in time.

"CREASTA COCOŞULUI" GEOLOGICAL RESERVE

Gutâi Mountains are located in the north-western extremity of the volcanic arc on the Romanian territory. The structural units composing the basement of the area belong to the internal and medium Dacides and to the Pienides (Săndulescu, 1993).

The reservation is located in a spectacular natural location, at high altitude, providing fantastic views on the Maramureș Depression and on the northern slope of the Gutâi Mountains.

It represents "a significant geological reservation, with laced, monumental features that give a clear cross-section of the result of external factors on a volcanic crater" (Iancu, 1982).

„Creasta Cocoşului" continues eastwards with Gutâiul Mic, Gutâiul Mare (1443 m) and Gutâiul Doamnei peaks. As in general at high altitudes in the area, this crest is covered by junipers, blackberries and lingonberry.

Currently, the area of Gutîi Mountains includes 10 defined flora and fauna reservations, the special landscapes being protected by law.

Creasta Cocoşului reserve was established in 1954 by the decision of the Council of Ministers no. 514, being considered as protected natural area of monument of nature type.

The reservation is located within the Gutâi Mountains, in Maramures County, at a distance of about 35 km from Baia Mare, close to Baia Sprie and Cavnic towns, between the basins of Cavnicului and Mara Valleys.

The geographic coordinates in the central point are 470 16' 13'' north latitude and 230 30' 40'' east longitude.

It corresponds to the 3rd category of I.U.C.N. (International Union for Nature Conservation) and has a surface of 50 ha, of which: cliffs 3.2 ha; forest 36.5 ha; alpine area 10.5 ha; the maximum altitude is 1438 m.

The reservation is located in Gutâi Mountains, Maramureş County, at a distance of about 35 km from Baia Mare. The most prominent feature is represented by "Creasta Cocoşului" crest that also gives the name of the reserve, consisting of a steep, uneven hill slope about 200 m in length, located at an average altitude of 1200 m, with an almost vertical display along the NW – SE direction. The relative height is about 100 m in the northern slope where it starts with a massive block and continues with a modelled surface interrupted from place to place by clearly-evidenced vertical fissures.

South from the main crest the mining centers Baia Mare, Baia Sprie and Cavnic are located, as well as the tourist centers Mogoşa and Şuior, while north from it the Chendroaiei and Morărenilor lakes.

The Creasta Cocoşului geological reservation is meant to protect the rocky, wavy rest of about 60-80 m height, with an outline perfectly described by its name ("Cock's Comb"), referring to the channels that model both the ridge and the slopes.

These spectacular morphologies represent volcanic necks, i.e. the infilling of volcanic emission centers that released incandescent lavas that pierced the plate of older volcanic agglomerates consisting the neighboring plateau (Bleahu, 1976).

The volcanism had a chalk-alkaline character, being generated by magmatic processes in the seductions area at the border of the European Plate (Rădulescu, 1973; Szabo et al., 1992).

In both cases: island arc or continental margin, the volcanic activity associated to seduction areas has a complex character. Its complexity is mainly represented by the large number of factors involved in parental magmas generation, but also by the factors that affect the subsequent evolution of the magmas during the basement piercing associated with seductions (Kovacs, 2002).

In the view of monitoring the current pollution degree of the area, samples of soil and water were collected from several sites in the Creasta Cocoşului reserve.

Water samples were collected from two springs located on the tourist route leading to the entrance to Şuior mine, i.e. the "de sub Stâncă" "Masa Pintii" springs.

The water analyses were performed in the laboratory of the Maramureş Agency for

Environmental Protection and they were interpreted according to the reglementations of Law 458/2002 on drinking water quality (* marks the indicators used for the evaluation of the quality of drinking water in the monitoring programs and for the identification of the causes in the case of values exceeding the legally accepted limits). As compared to the values indicated by the above-mentioned law, the data for the two springs has shown a good quality for the water, all the measured parameters having values lower than those reinforced by the law.

The soil samples evidenced a remarkable excess of the amounts of Pb, both the alert, and the intervention thresholds being exceeded.

The values for the Pb indicators in soil samples show variations for the two-years of monitoring, but a constant excess as compared to normal, and even intervention limits could be noticed.

The intervention threshold was exceeded for the depth of 5 cm in all the sampling points, pointing to a more intense pollution at the surface, decreasing toward depth. In the higher sites of the reservation pollution is stronger, as a result of the effect of air currents that circulated the polluting elements.

The main goal for the establishment of the Creasta Cocoşului reservation was the protection and conservation of some special geological, ecological, scientific and landscape features. The mining or industrial activities based on natural resources contradicted the conservation principles, thus they are under the strict control of the curator of the reservation and

of the institutions with attributions in this respect. However, specific traditional agricultural activities are allowed to be performed. Aesthetic aspects are also present in the reservation; the eolian processes have led to a human-shaped profile sculptured in the rock on the border of the pass near the „la Masa Pintii" area.

BABEI GORGES

The natural area Cheile Babei (Babei Gorges) is located on the territory administrated by the Coroieni commune, Baba village, on the county road 109 F connecting Gâlgău and Tg. Lăpuş localities, at 2 km distance from Baba village and at 3 km from Poiana Blenchii – Sălaj County.

The gorges are of epigenetic type and they were cut by Poienii Brook in Eocene epicontinental lime stones.

The Babei Gorges (3.2 km in length) are located on the middle course of Poiana Brook, between the villages Baba and Poiana Blenchii; they represent the most impressive gorge-type landscape in the northern area of the Someş Plateau.

Babei Gorges was declared as geological reservation of IIIrd category IUCN (International Union for Conservation of Nature) with a surface of 15 ha, by the Decree of the Maramureş County Council no. 204/16.03.1977 and by Law 5/2000.

Babei Gorges represent a sector of the eastwards morphostructural border of the Purcăreţ-Boiu Mare Plateau, one of the most representative subdivisions of the Someş Plateau showing specific physical and economical-geographical features (Savu, 1986).

The open space between the Ileanda and Poienii valleys is much larger, being modelled in Miocene formations, on the top of the partly exhumed Dăbâceni-Baba anticline, showing somespecific landscape features; for these reasons, this sector of the Purcăreţ-Boiu Mare Plateau was individualized under the name of Dăbâceni-Baba-Drăghia Crest (Savu, 1986).

In the upper part of the gorges the valley expanded and led to the formation of a small depression where the Baba locality was settled.

The source of Poiana Brook is located in the western part of Breaza Crest, in the Someş Plateau, and it flows southwards, joining the Someş River in Gâlgău commune. At about 6 km from its sources, Poiana Brook crosscuts the Dăbâceni-Baba Crest and forms spectacular gorges, 3.2 km in length.

At the end of Poiana Blenchii village the valley gets suddenly narrower and both slopes crop out as cliffs in coarse limestones displaying thick banks covered by extended layers of boulders on a length of about 3 km, until the first dwellings belonging to Baba village.

The left slope is cliffy and several quarries where limestone was mined for lime in the furnaces located at the base of the right slope, at the entrance in the gorges, can be noticed. The right slope is covered by forest, and shows isolated limestone cliffs.

The previous existence of extended forests is evidenced by the presence of forests: luvic brown soils, albic podzolic clayey-illuvial luvisoils with islands of rendzines on limestone surfaces (Savu, 1986).

For obtaining the corresponding amount of lime for one furnace volume also large amounts of wood are needed for firing at the base of the furnace.

The Dăbâceni-Baba Crest represents an anticline developed between the Someşului Valley and Coştila, an effluent of Poiana Brook. The carbonate deposits in which the Babei Gorges were cut are located in the NW area of the Transylvanian Depression.

The experimental data of the study of soil and water (spring) samples are presented below, as well as some considerations on water and soil quality. The data on metal content in soils are reported to dry matter content.

In these samples also the humus content is lower due to the alkalinity, as mentioned when the parameters obtained for the water samples are interpreting. The heavy metal content is usually between the normal values and the alert threshold in the case of Pb, Cd and Cu and below the normal values for Zn and Mn. It is possible that the relatively higher content of Pb, Cd and Cu to result from distal atmospheric pollution in connection with the metallurgic plants from Baia Mare (Cu and Zn metallurgy).

The data indicate that the soil samples, except those collected in the upper part of Babei Gorges are alkaline, as a result of the carbonate composition of the country rocks, possibly also due to the pollution with fine lime powders resulted from the traditional furnaces (“vărăştini”) that were active in the area.

The analyses performed for testing the water quality on samples from the springs in Babei Gorges have been compared to the reference values included in Law 458/2002 on the quality of drinking water (as spring waters, they are closer to the conditions fixed for underground waters, than to surface ones).

In general we may appreciate that the water in this area is of good quality as chemical composition is concerned but sometimes with excess accumulations of some salts. The water hardness has high values, 2-5 times higher than the admitted values, as well as the content of Fe and Pb.

The same influences of the carbonate rocks in the area may be considered responsible for the neutral-slightly alkaline character of the pH of the investigated waters. The Pb and Fe values exceeding the values admitted even for the surface waters may also indicate that these waters might cross some mineralized areas in the underground.

„RĂZVAN GIVULESCU" FOSSILIFEROUS RESERVATION FROM CHIUZBAIA

The fossiliferous site is located at 6-7 km from the intersection of Baia Mare – Firiza road with the forest road going upstream, to the feet of Igniş Mountains, along the Jidovia Valley

The Middle Pliocene forest was preserved in the diatomite interlayers within the impressive volcanic complex of Igniş. It was called "the Chiuzbaia flora". An analysis of the vegetation shows that even if preserved on a small area, the forest was spread along the whole landscape created by the Jereapăn andesite or by other volcanic formations of that time (Givulescu, 2006).

The Chiuzbaia sedimentary basin is located on an E-W aligned anticline consisting of Eocene, Sarmatian and Pannonian deposits, pierced by several typical volcanic necks. A thick (200-500 m) volcanic flow follows from the northern slope of Chiuzbaia anticline that crops out unconformable and locally only between the Jidovia and Plopilor valleys, an interlayer of diatomite with cinerites.

Both the volcanic flow and the sedimentary succession are covered by the Igniş andesitepyroxenic lava flow representing the final product of the volcanic activity in the region (Givulescu, 1990).

The lakes were located in a volcanic region with intense volcanic eruptions. The intensification of the volcanic activity in the close neighborhood of the lakes led to an increase of the amount of accumulated volcanic ash, which at a certain stage became the exclusive sediment that filled the whole basin.

A total number of 235+5 taxa, 107 genera and 55 families were identified. Many of these taxa, genera and families are new for the fossil flora of Romania, Europe and for science. Many

of these taxa were so evolved, that they can be easily compared to the present day comparative material (Givulescu, 1990).

The water and soil analyses did not show substantial changes of their values in time, during the two sampling years of the monitoring.

According to the legal reglementations, these waters can be perfectly classified as quality waters from all points of views.

Some small variations of the values may be noticed, but they do not exceed the admitted limits and they do not represent a significant environmental impact.

These values may be also influenced by the sampling conditions, the sample collected in 2006 was taken under high humidity conditions, while the one collected in 2007 under dry conditions (and after a long interval lacking significant precipitations).

The soil analyses evidenced the concentrations of heavy metals, for comparing the values with the normal ones, or with the alert and intervention thresholds.

An efficient comparison of the measured values involves that each element is considered separately, especially as far as the heavy metals are concerned, thus:

- for Pb, if in 2006 the values were greatly exceeding the intervention threshold for both depth that were monitored, in 2007 the same values were almost double

- for Cd, the values were constant during the two years of monitoring, however the alert threshold are exceeded for both depth from where samples were collected.

- for Cu, in 2006 some values exceeding the normal values were registered, however in 2007 these values increased at extreme values, even exceeding the intervention threshold, at both depth of sampling.

- for Zn, the normal values were exceeded in 2006, while in 2007 the intervention threshold was exceeded, at both depth of sampling.

- for Mn, the excess registered reverse trends in the two years of monitoring. If in 2006 the values exceeded the intervention threshold at both depth, in 2007 the values were remarkably low, being below the normal limits.

The excess over the normal, alert and intervention values can mainly be explained by historical pollution in the area around Baia Mare, which represents a genuine „environmental hot spots" due to its long mining history and non-ferrous metallurgical industry (Cordoş et al, 2007).

However, it is not easy to explain the annual variation of the values for some elements, in spite of the fact that the polluting source, the metallurgical plant located at about 4 km distance did not work at maximum parameters in this interval.

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COUNTY MUSEUM OF MINERALOGY ”VICTOR GORDUZA” BAIA MARE – CUSTODIAN OF PROTECTED AREAS

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***Abstract**: The paper outlines the three natural protected areas of geological importance from the Baia Mare area for which the Mineralogy Museum filled documentations in order to obtain their custody: The Limpedea Columns, The Stone Rosette from Ilba and The Fossil Reserve from Chiuzbaia. All the problems that were identified in these areas are detailed and there are also issued proposals for resolving or improving them.*

***Keywords**: natural protected areas, custody procedures, mineralogy museum, Limpedea, Chiuzbaia, Ilba*

CUSTODY OF PROTECTED AREAS – A LEGACY

For the Mineralogy Museum the subject of protected areas was always very close to home. When the Natural Science Department was founded as part of the County Museum of Maramureș beside the specific duties of the department, it has also been entrusted with coordinating all activities within the protected areas from the Maramureș County. This department represents the Museum's ancestor, the structure on which the Museum developed.

Another important reason for applying for the custody of protected areas is represented by the presence of a program called ”Management of the geological sites from northwest Romania” in the current management plan. This program involves taking custody of natural areas of geological interest, conserving and promoting them for their scientific and touristic value.

LEGAL PROCEDURE FOR AWARDING CUSTODY OF PROTECTED NATURAL AREAS

The first session for awarding custody of protected areas was opened at the end of February 2016 by the National Agency for Environmental Protection. In order to obtain the custody of a protected natural area all applicants had to put together a candidacy file as stated in article 29 from the Minister Order no. 1052/2014.

The application file had to include several documents in order to prove the applicant's ability to implement custody. All these documents that need to be provided have to prove the applicant's financial and scientific capacity.

The Mineralogy Museum filled candidacy papers for three protected areas: Coloanele de la Limpedea (The Limpedea Columns) – code 2591, Rozeta de piatră Ilba (The Stone Rosette from Ilba) – code 2592 and Rezervația Fosiliferă Chiuzbaia (The Chiuzbaia Fossil Reserve) – code 2565.

In order to obtain custody of these protected areas, the documentation had to be filled and registered at the National Agency for Environmental Protection until April 1 2016 [1].

The Limpedea Columns

Coloanele de la Limpedea (The Limpedea Columns) were declared a protected area by Law 5/2000 on the approval of the National Spatial Plan, Section III, Chapter 2.0 ” Reserves and natural monuments”. It is a protected area of national interest, classified as category III by IUCN - ”Natural monument”.

The protected area is in the Maramureș County, Baia Mare municipality, District Ferneziu. The objective (fig.1) is represented by an artificially created outcrop determined by exploiting rocks used in construction [2]. It is developed on a north-south direction over a length of 230 meters, with a maximum height of 33 meters [3].

Fig.1 The Limpedea Columns

The problems identified, while establishing the current state of conservation, at this protected area were:

- the lack of a management plan and of regulations for the protected area;
- the lack of a visitation strategy;
- the access inside the protected area is not restricted and this makes the objective vulnerable because this makes it possible for vehicles to enter inside the protected area dangerously close to the protected objective;
- there are no markings or information boards indicating the limits of the protected area;
- lack of informative panels on all access roads to the protected area;
- makeshift hearths in the immediate vicinity of the area indicate it is used as camping area.

In order to implement the custody we proposed a plan that consists of a series of actions that once taken will help protect, conserve and preserve this natural objective.

The first matter that needs to be attended is represented by the Management Plan and the Visitor Management Plan. Both documents must be drafted and then approved by the competent authority in environmental protection.

The next steps that need to be taken are represented by measurements in order to determine the exact limits of the protected area and mark those limits appropriately.
Another aspect that needs special attention is related to educating tourists: first measures to be taken in this regard refer to placing information boards and warning signs that present the rules that need to be observed inside the limits of the protected area.

Other measures to be taken to ensure the protection and promotion of this area are: demarcation of a well-established parking area, landscaping and sanitation works of the area, monitoring the flow of visitors and the impact of tourism, education activities, promotion and awareness and promotion of the protected area as part of the local identity.

In order to accurately promote and protect the objective a series of scientific studies are required. The following actions have been proposed: evaluating the conservation status of the rock columns, geological and geotechnical studies on the outcrop and the surrounding area, micro tectonic research to identify the spatial development of the cracks and also the dissemination of the scientific studies by attending conferences and publishing in specialized journals.

For each of the three protected areas one large project was proposed. For the Limpedea Columns the large project is called „Outdoor Museum” – in the idea of diversifying the tourism offer and to ensure cultural and educational information we would like to build an outdoor

Museum, as an annex of the Mineralogy Museum that would contain large exhibits of geological nature in order to complement the image of the Baia Mare area.

The Stone Rosette from Ilba

Rozeta de la Ilba (The Stone Rosette from Ilba) was declared a protected area by Law 5/2000 on the approval of the National Spatial Plan, Section III, Chapter 2.0 ” Reserves and natural monuments”. It is a protected area of national interest, classified as category III by IUCN - ”Natural monument” (fig.2) [4]

It is situated in Ilba village, Cicârlău Township in Maramureș County. The area is represented by an artificial outcrop of rocks that rise to the exploitation of stone used in construction. The geological formation is composed of Ilba pyroxene andesite or gray color. The cracks developed during the lava cooling lead to the separation of the rocks in a formation of polygonal columns with lengths of 5 meters and up to 0,5 meters in diameter. The geological structure reveals divergent columns around a central area, giving the appearance of a ”rosette”, and this represents the main objective of conservation [2].

Fig.2 The Stone Rosette from Ilba

The problems identified, while establishing the current state of conservation, at this protected area were:

- the lack of a management plan and of regulations for the protected area;

- the lack of a visitation strategy;
- the souther boundary of the protected area is marked by a wooden fence, partially degraded and on the other sides there are no markings indicating entering the protected area;
- traces of fire from makeshifts hearths made in the immediate vicinity of the outcrop;
- overgrown vegetation;
- uncontrolled waste disposal;
- the presence of a seasonal torrent which crosses the outcrop perpendicular, located on the sedimentary contact (E) and the eruptive (W), which is a key enabler for exogenous erosion and alteration;

To counteract the problems we encountered in the protected area we proposed series of actions that need to be taken. The first things that must be done are the Management Plan and the Visitors Management Plan.

Another pressing problem is represented by the adequate marking of the protected areas borders. Certain actions need to be taken to encourage the visitation of the protected area: landscaping and sanitation works, installing information boards, media involvment in activities to promote the protected area and a flyer about the importance of the protected area.

The scientific studies proposed for the Stone Rosette from Ilba consist of evaluating the conservation status of the outcrop and the deposits and micro tectonic studies to identify the spatial development of the cracks.

The major project proposed for this protected area consists of integrating the protected area in a GeoTour Circuit. This will mean organized visits of tourists accompanied by specialists from the Museum that will offer all the scientific information about the objective.

The Chiuzbaia Fossil Reserve

Rezervația Fosiliferă Chiuzbaia (The Chiuzbaia Fossil Reserve) is a protected area of category III IUCN which was established to protect the deposits of fossil leaf impressions formed about 6-10 million years ago[5]. It is situated on the southern slopes of Igniș Massif and it has 50 hectares in size [6] (fig.3).

Fig.3 The Chiuzbaia Fossil Reserve

The problems identified, while establishing the current state of conservation, at this protected area were:

- the partial lack of markings for the protected areas limits;
- the partial lack of informative panels;
- visible traces of timber transportation on the territory of the protected area;
- degradation of the F outcrop due to works on the forest road nearby;
- degradation of the fossil outcrops due to animal transit (sheep) through the protected area;
- the presence of improvised fire hearths;

The proposed measures for implementing custody in this protected area aim primarily completing the approval procedure for the Management Plan and the Visitors Management Plan and implementing them.

Other actions proposed for this protected area target adequately marking the objective's limits, landscaping and sanitation works, consulting activities, awareness and informing the local community regarding conservation and sustainable use of the protected area.

The scientific studies taken in consideration for this protected area include: evaluating the conservation status of the outcrop and the deposits, paleontological studies in the territory of the protected area and in other perimeters in the vicinity and developing a geological study of the area.

Promoting the protected area as a component of the local identity is an important goal and it will be put into practice by creating an informational flyer, organizing themed tours for students and developing a special section on the Museum's website which will act as a promotion and information portal.

The main project proposed for the Fossil Reserve consists of creating a research center inside the protected area. This will facilitate the achievement of scientific studies in situ.

CONCLUSIONS

To fulfill all the objectives set for the protected areas beside the team of experts from the Mineralogy Museum, we also benefit from partnerships with prestigious institutions that will be involved in the development of scientific studies: The Environmental Protection Agency from Baia Mare, „Babeș Bolyai" University from Cluj-Napoca, North University Center from Baia Mare.

Other institutions that we signed partnership agreements with are: EcoLogic Association, "Emil Racoviță" High school, "Mihail Sadoveanu" School, Montana Speleology Club,Maramureș Forestry Division, Mara Natura Microregional Association, Baia Sprie Township.

On May 17 2016 the Custody Conventions were signed for all three protected areas, with a duration of 10 years. This represents a new and important step for the Mineralogy Museum towards protecting and promoting the geological heritage of the Baia Mare area.

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REGARDING THE EXPERIMENTAL ANALYSIS OF THE MEANDERING PHENOMENON GENERATED AT A RAILWAY WAGON

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Abstract: *During running, the railway vehicles are subjected to external excitation generating vibrations. These vibrations have a negative impact on the quality of travel and can endanger road safety. Vertical and transverse unevenness of the track and its discontinuities are the main source of vibration from railway vehicles. Another source of vibration is the rolling stock defects such as eccentricity and flatness tread. Mathematical modeling by random processes of the excitation induced by the path irregularities and dynamic response generated by the vehicle in motion. This method was used in the dynamics of railway vehicles in the last period, being facilitated by the expansion theory of random vibration and the continuous improvement of equipment. In the present study, using method correlation coefficients between measured accelerations in three directions applied for both signals unfiltered and filtered signals especially, we have asceratined a strong correlation of acceleration horizontally and poor correlation between transverse and vertical.*

Keywords: *vibration, flexuosity movement, numerical processing*

1. INTRODUCTION

Currently still a significant part of goods and passengers traffic from Europe is carried by rail. The rail system already provides solutions for the transport all over the world, in terms of safety, environment, total journey time, low emissions and low energy. It has the potential to offer attractive urban, regional and long distance mobility [8]. Innovation resulting from technology added value is steadily contributing to strengthen all market segments and their seamless connections as well as contributes to environmental efficiency, security and safety, and intelligent mobility.

The impact of today's rail technology in high-speed is outpacing the increase in aviation for journeys; high-speed trains are therefore the preferred passenger choice for journeys of this distance [8,9]. Intensive development of modern technology and increase goods traffic and speed of travel, the increased noise and vibration level and specific rail transport while traveling. Noise generated during train movements acting adversely on passengers, service personnel and the population in areas crossed by rail. In addition, intense noise makes it hard to distinguish the sound signals and verbal commands and thereby worsening security conditions rail transport. Railway equipment presents a number of specific issues in terms of shock and vibration, as few vehicles that run on a runway apparently so smooth [9].

Shocks and vibrations from vehicles by rail can occur due to variable speed drive, the game at the ends of the rails, bumps, curves and elasticity ways, taper, eccentricity and deviations from appropriate form of bandages guidance rock rolling on the rail by wheel flange, jerk during braking maneuver and wantonness. The suspension system rolling stock is intended to cushion the shock and vibration, reducing them to acceptable levels [1-3].

Sources of noise and vibration from railway vehicles can be external or internal. The most important sources of noise and vibration are running outside wheel itself, suspension systems and coupling elements, the action of air on the outer walls wagon braking action etc. Rolling noise is produced by all elements in direct contact when running the rails and metal wheels with their bandages [3].

If the suspension chassis is not effective enough, it is possible that the entire steel structure of the wagon to come into vibration. Stoppages and changes speed, the various couplings can become new sources of noise and vibration. Air action against the walls of the wagon produces aerodynamic noise, particularly those giving birth at the front walls and protruding parts of the wagon. Sources of noise and vibrations occur particularly inside the railcars (Fig. 1). These sources are the main internal combustion engines, power generators, air compressor and transmission systems.

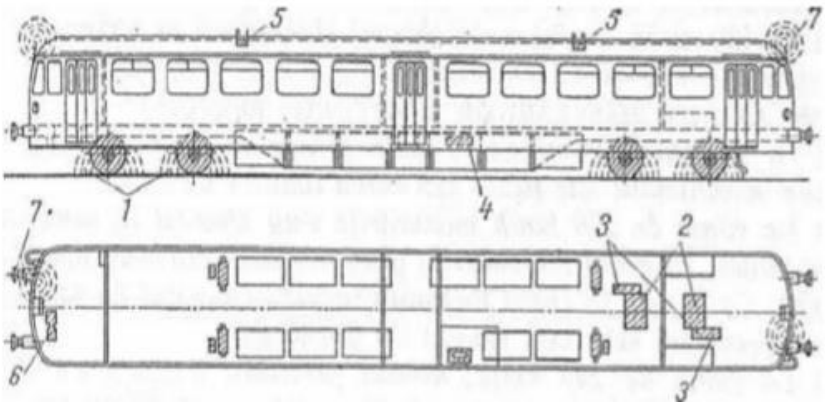

Fig. 1. The main sources of noise generated at a vagon
1 - rolling and suspension systems; 2 - driving motors;
3 - reducers; 4 - transformator;
5 - exhaust; 6 - air compressor; 7 - horn .

Noise transmission outside to the inside of the wagon is done in three ways: by air - ventilation channels or other holes and leaks (air noise); the wagon structure as vibration (sound structure of the wagon) and acoustic waves by the action on the dividers exterior of the wagon.

Railway wagons required as the noise level in compartments to be as small and yet not be an adjacent track, to avoid disturbing residents concerned. The first problem could be solved largely in the last 15 years, based on systematic research, the constructive nature in various parts

of wagons as floors, walls and windows. As normative for new wagons at average speeds of 80 km/h are taken into consideration following noise levels: fast trains 55 dB(A), fast trains 60 dB(A), cars for short 65 dB(A) in field free and 75 dB(A) in tunnels. To double the speed of movement, the noise level increases inside the wagons around 6 dB (A), so the cars fast trains that develops a speed of 200 km/h consider a noise level of 62 dB(A) [10].

On the other hand vertical and transverse unevenness of the track and its discontinuities are the main source of vibration from railway vehicles. Another source of vibration is the rolling stock defects such as eccentricity and flatness tread [11]. Also, due to constructive peculiarities of railway vehicles can generate and support vibrations on the vehicle. The increase in velocity and increased payload imposed also need to describe in a more rigorous way of complex phenomena that occur at the interaction vehicle-runway, vehicle response to irregularities path, with implications for improving vehicle stability and hence the comfort of passengers.

Modeling processes induced irregularities random excitation path and the vehicle dynamic response allows a more precise description of the interdependence between vehicle vibration and statistical and spectral properties of irregularity path. This method has been increasingly used in vehicle dynamics railway last time, being facilitated by the expansion theory of random vibration and the continuous improvement of equipment, methods of measurement and vibration analysis of low frequency (Fig. 2) that appear in the tread [4].

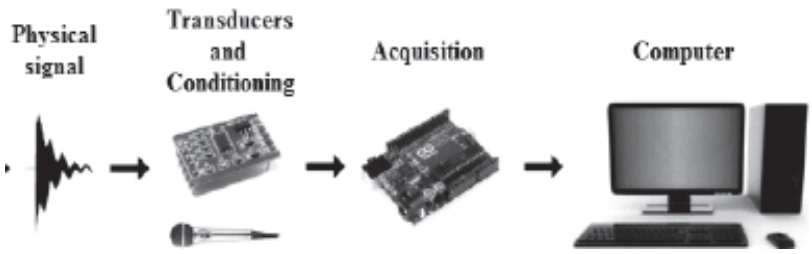

Fig. 2. A system of measurement, acquisition and processing of vibration signals

2. ASPECTS OF EXPERIMENTAL ANALYSIS FOR MEANDERING MOVEMENT

2.1 Issues concerning realization of vibration records

For experimental analysis of the vibrations have been recorded simultaneously on the magnetic tape acceleration of vibration to the different components of the vehicle at the three levels of interest, the container, bogie and axle of the vehicle in three orthogonal directions considered in the reference system of the route, namely, x along the path, y and z are about transverse vertical.

On an additional channel were recorded simultaneously throughout the record, comments on the specific conditions of their time, both in terms raceway and the details

regarding the parameters of the measuring system used. In **Fig. 3** transducer arrangement can be distinguished on the three masses vibrant and measuring system components consisting of transducers T, preamplifiers load and visualization devices and data storage, a tape recorder and a digital oscilloscope.

The transducers "T" are the type piezoelectric vibrating elements are mounted properly. Before recording, signals were amplified, thus achieving a coarse filter. As I stated earlier, to record and store data has been used a tape Bruel & Kjaer, every time there were three parallel acceleration, one of the channels recording was used for additional comments on rates and the areas where measurements were made. Fluke digital oscilloscope type of measurements used to monitor and ensure their accuracy. For further study in specialized programs is necessary analog-digital conversion of these accelerations.

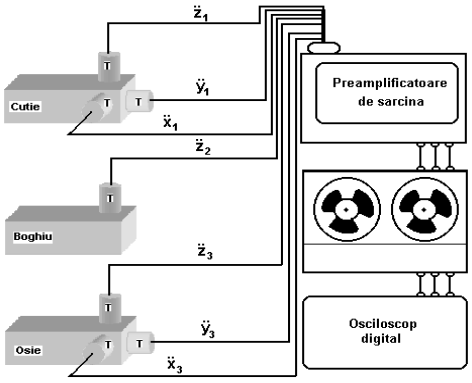

Fig. 3. Measurement scheme of vibration records

Either $t_1 = 0,\ t_2, ...,\ t_N = T,\ \ t_k = (k-1)h;\ \ k = 1,\ 2, ...,\ N$ set of digitized data that are obtained by analog-digital conversion and established a sampling step h. This raises problems because too small a sampling step involves a heavy workload both for data collection and numerical processing them. On the other hand, a step too large sampling results in an interference between low frequency components and high frequency in the analyzed signal which is a great source of errors in determining the spectral densities of data studied.

Since at least two samples are needed in order to define a cycle frequency component of signal analysis that the highest frequency that can be highlighted using the sampling step h is called the Nyquist frequency associated sampling step considered $f_N = \frac{1}{2h} = \frac{N-1}{2T}$. The f_N components of frequencies higher than the analyzed signal will interfere with the frequencies below this frequency.

To avoid interference errors there are two methods. The first method is to choose a step sampling small enough so that it is physically impossible analyzed signals contain frequencies

higher than the Nyquist frequency associated and it is recommended that this frequency to choose one and a half to two times higher than the frequency of the anticipated maximum, and the second method is the use of low pass filters before they are sampled so that frequencies beyond the range of interest should not be included in the analyzed signal in this case can be chosen f_N equal to the maximum frequency interest.

Whether $u(t)$ a signal measured under the conditions above. Since the frequency range of interest is up to 100 Hz, then consider imposing a sufficient $f = 200\,\text{Hz}$ sampling frequency resulting in a $\Delta t = 0{,}005\text{s}$ sampling time to provision and this frequency. And the sampling period $T = 60\,\text{s}$ meaning that the average speed of the train $V = 138\text{km/h}$ is the length of the sampling $L = 2{,}3\,\text{km}$. The signals were converted into numerical data using a data acquisition boards National Instruments BNC-2120 and stored in the computer.

2.2 Rail vehicle dynamics problems analyzed the records of vibration at high speeds

Based on measurements of vibration described above can be highlighted a number of important issues for railway vehicle dynamics. The expressions presented below summarizes the main problems that can be studied by processing of vibration measurements performed:

$\ddot{z}_1, \ddot{z}_2, \ddot{z}_3 \Rightarrow$ Estimating the dynamic forces of the wheel-rail contact

$\ddot{z}_1, \ddot{x}_1, \ddot{y}_1 \Rightarrow$ Estimating passenger comfort

$\ddot{x}_3, \ddot{y}_3 \Rightarrow$ Highlighting the movement flexuosity

$\ddot{z}_3 \Rightarrow$ Tread spectral density estimation

Physical phenomena encountered in the operation are generally characterized by representing the amplitudes while quantities. In this way can be represented sizes and displacements, velocities, accelerations, forces, moments, pressures, temperatures, by varying amplitudes over time.

Much of the physical phenomena can be characterized by temporary diagrams showing a signal a fraction repeatability. In this case the phenomenon is called deterministic and knowing the initial parameters of the signal characterizing the phenomenon investigated, can accurately predict the size desired amplitude at one time located a temporary baseline.

Through such simple graphical representation can monitor any deterministic phenomenon, knowing all the data needed to fully characterize the phenomenon studied. Also it can be said that an important part of engineering the physical phenomena of wide interest, not

deterministic, ie each graphical representation of the phenomenon considered is unique, unlike any other. In this case it is impossible to say exactly where the amplitude magnitude followed at some point of time. However in this case we can say with sufficient precision, after studying the phenomenon closely, the signal sought does not exceed a certain amplitude but is found behind many records that are within this range, but it is impossible to specify where does to the time it is within that range limitation.

Going a little further, you can even make laws which bind the membership and the recorded signal distribution within the range of amplitude. This seemingly illogical expounds allure of a random signal and sets a number of parameters and signal characteristics.

For statistical analysis of these signals characterizing the accelerations measured on a railway vehicle that random processes, it took several simplifying assumptions. Thus to reduce the volume of records for characterization widest possible these random processes and thus to reduce the workload required of this operation, it was considered that these signals are of ergodic which had to be shown to reinforce the correctness work on these records that were put under analysis.

Data from the measurements are processed in the original program and provides statistical information on the characteristics of these signals, and actual calculations were made in Excel. The repetition of these measurements may also provide statistical information time course of any type of new or existing rail vehicle in operation. One can appreciate the degradation of structures such as vehicles, finding and how it degrades by discovering the causes that produce degradation.

3. NUMERICAL PROCESSING OF RECORDS. RESULTS AND DISCUTIONS

This section illustrates methods of numerical processing carried out simultaneously records of vibration in the vertical direction, the transverse and longitudinal with a triaxial accelerometer mounted on the outer axle grease. By processing these records can reveal flexuosity movement characterized both time domain and frequency. Figures 4, 5 and 6 contains samples of acceleration records made on 3 directions.

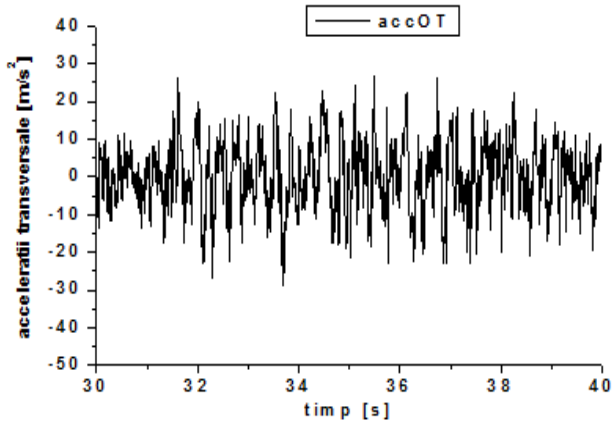

Fig. 4. Samples of records accelerations measured in the transverse direction

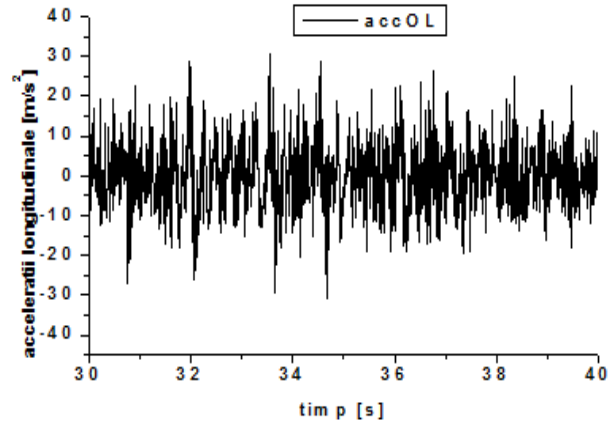

Fig. 5. Samples of records accelerations measured in the longitudinal direction

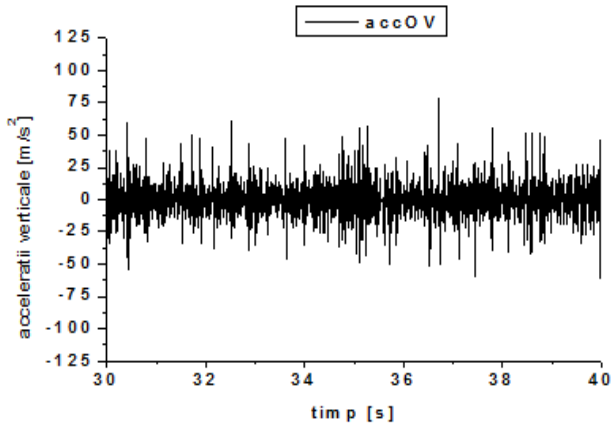

Fig. 6. Samples of records accelerations measured in the vertical direction

Following the calculations were obtained the following correlation coefficients r_{TL} =0.3, r_{TV} = -0.014 and r_{VL} = -0.033. It is noted transverse and longitudinal accelerations That is correlated in a statistically much better than in the horizontal direction Those recorded vertical to the recorded ones. The F = 3.2Hz frequency is found in the transverse accelerations amplitude spectra (Fig. 7) and longitudinal filtered (Fig. 8), which does not happen if the amplitude spectrum of vertical accelerations filtered (Fig. 9).

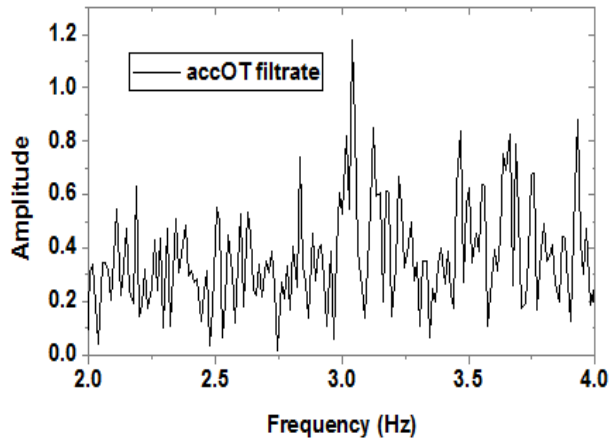

Fig. 7. The spectrum of amplitude transverse accelerations filtered

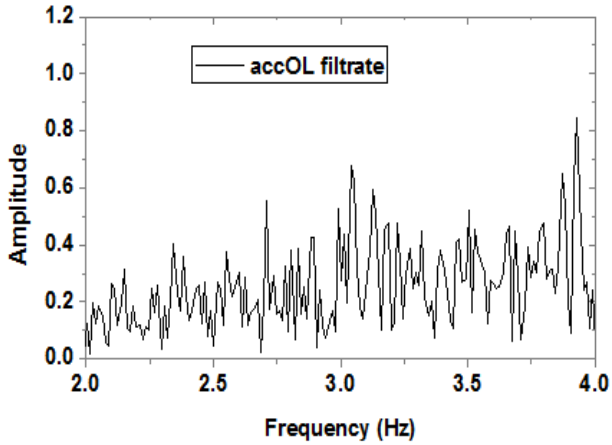

Fig. 8. The spectrum of amplitude longitudinal accelerations filtered

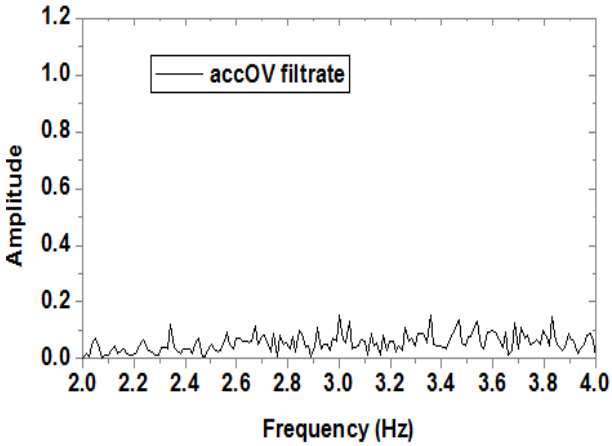

Fig. 9. The spectrum of amplitude vertical accelerations filtered

The values of these correlation coefficients show that transverse and longitudinal accelerations are strongly correlated filtered, while their correlation with vertical accelerations filtered is much weaker, what underlines once again that the movement analyzed in the frequency range 2-4 Hz is movement corresponds flat as meandering phenomenon.

CONCLUSIONS

Simultaneous measurement in three directions (longitudinal, transverse and vertical) of the accelerations at the box axle grease, can provide useful information for highlighting the phenomenon as hunting. This type of measurement is virtually the only possible real operating conditions since the use of other types of sensors such as travel or gear is not feasible. It is recommended piezoelectric acceleration transducer given that are robust and have a reduced size.

Methods of processing acceleration signals recorded and processed in this paper can reveal flexuosity movement. By determining the amplitude of signals recorded spectra can specify the frequency of occurrence as hunting movement. By filtering signals in this frequency range it appears clearly as hunting movement, one can determine the dominant frequency sufficiently precise as hunting movement velocity corresponding to the entries that were made.

Method correlation coefficients between measured accelerations in three directions applied for both signals unfiltered and filtered signals especially highlights the strong correlation of acceleration horizontally and poor correlation between them and vertical.

Numerical processing of experimental data is very necessary because the study is done on real situations, that vehicle is studied under realistic conditions, and the results easily contain useful information about both the vehicle studied and about raceway on moving such a vehicle.

In case if instead of using a tape recorder and oscilloscope measurement laptop scheme is greatly reduced, the data are digital data processing can be instantaneous. In this way the measurement results can be obtained quickly, reducing working time user. So someday you can check a large number of vehicles and can count the integrity of any vehicle or track on which it runs. The statistical data in a database, obtained by successive measurements over time may provide important information about the sub-assemblies to the vehicle.

For a larger number of vehicles can see which parts fail in a shorter time and the causes of their deterioration, upgrades subsequent vehicle may consist of simple replacement of subassemblies old with new, redesigned that appropriate conduct all claims arising in operation.

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