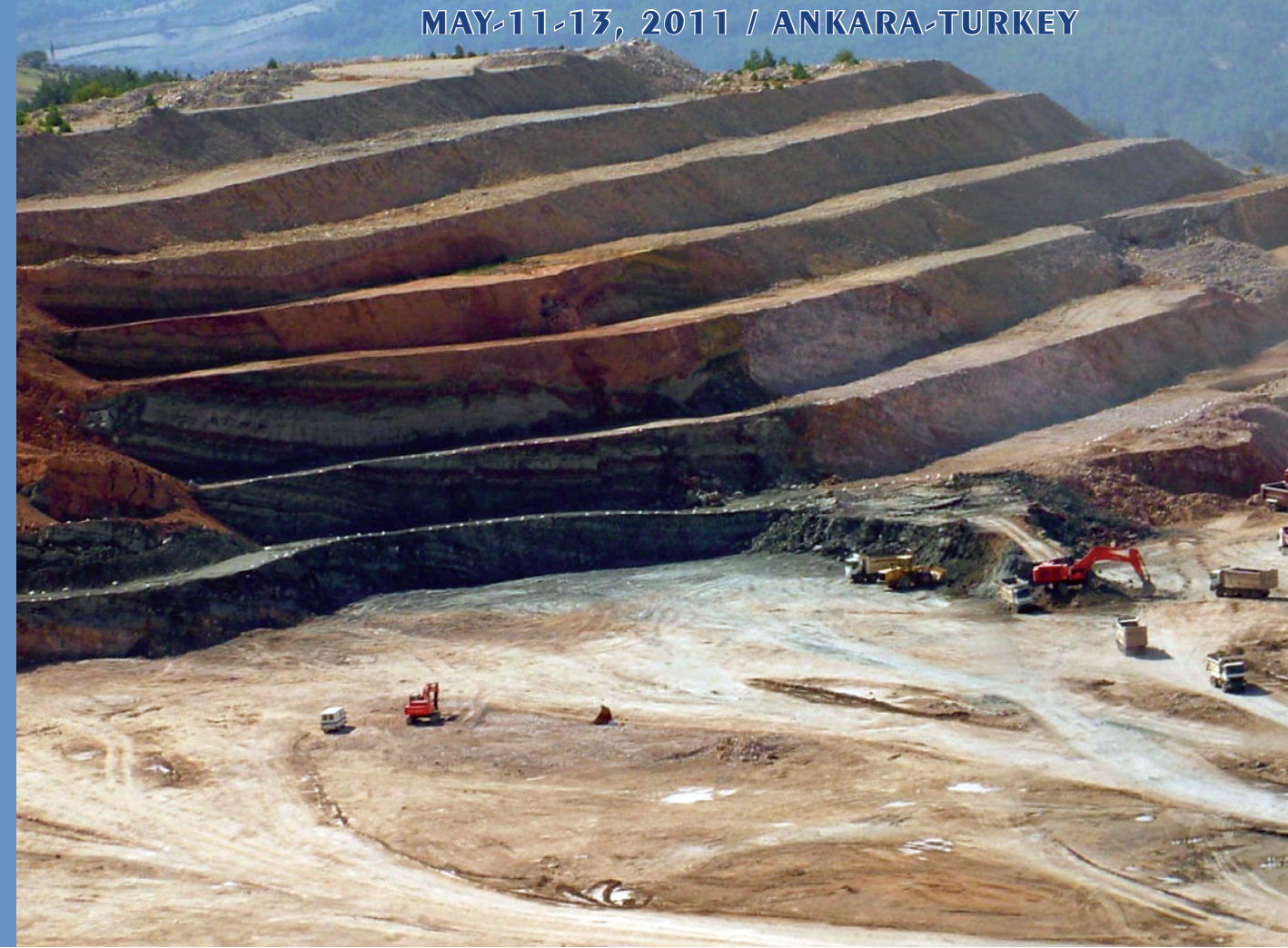




PROCEEDINGS OF THE 22ND INTERNATIONAL MINING CONGRESS OF TURKEY

MAY-11-13, 2011 / ANKARA-TURKEY



PROCEEDINGS OF THE 22ND INTERNATIONAL MINING CONGRESS OF TURKEY

Nuray DEMİREL

EDITORS
Ömer ERDEM

Mustafa ERKAYAOĞLU



UCTEA The Chamber of Mining Engineers of Turkey
ISBN: 978-605-01-0103-4

IMCET
2011



UCTEA
THE CHAMBER OF MINING ENGINEERS OF TURKEY

IMCET 2011 / ANKARA / TURKEY / MAY 11-13

**PROCEEDINGS OF THE 22nd INTERNATIONAL MINING
CONGRESS AND EXHIBITION OF TURKEY**

EDITORS

Nuray Demirel

Ömer Erdem

Mustafa Erkayaoğlu

**PROCEEDINGS OF THE 22nd INTERNATIONAL MINING
CONGRESS AND EXHIBITION OF TURKEY**

**MAY 11-13, 2011
ANKARA**

Edited By,

**Asst.Prof. Nuray DEMİREL
Ömer ERDEM
Mustafa ERKAYAOĞLU**



**UCTEA
THE CHAMBER OF MINING
ENGINEERS OF TURKEY**



This Congress is supported by TÜBİTAK (The Scientific and Technological Research Council of Turkey)

All rights reserved © 2011

No parts of this book may be reproduced in any form or any means, without written permission of the Chamber of Mining Engineers of Turkey

ISBN : 978-605-01-0103-4

Published by : Korza Matbaacılık

Phone : 0312- 384 20 04

Address : TMMOB Maden Mühendisleri Odası
Selanik Cad. 19/4 Kızılay-ANKARA

Tel : 0312 425 10 80 Faks: 0312 417 52 90

İnternet Adresi : www.maden.org.tr

E-Posta : maden@maden.org.tr

MINING ECONOMY

Aspects on the Macedonian Mine Industry through exploitation of the metallic ores in the Mines of Bučim and Sasa

Prof. Dr. Risto Dambov,

Dr.Sci., University "Goce Delcev", Institute of Mining, Stip, R. Macedonia

Marija Petroska,

Macedonian association for mining (MAR), Economic Chamber of Macedonia

Nikolajco Nikolov,

MAR President, Mine Bučim, Radovis, R. Macedonia,

Maxim Prohorov,

MAR, Mine Sasa, M. Kamenica , R. Macedonia

ABSTRACT In this paper work are given some aspect of the exploitation of metallic ores and production of the colored metals from poly-metallic ores resulted from their processing and enriching in some of the more important Mines in the Republic of Macedonia.

We present the two biggest mines for production and processing of lead – zinc ores (Sasa) and copper ore (Bučim) in the view of the existing Mines, the assessment of the present state of art and produced capacities and results in the recent few years.

In short, we have set up the parallel of the existing legislation in the Republic of Macedonia which regulates this activity and development tendencies in mining in the view of the new investments, efficient and economical production, concession and other compensations.

Define the new findings and verification of the geological reserves, reconstruction and expansion of the present production capacities, opening or extension of the new exploitation fields and reverses, ecological aspect at mine exploitation, etc.

1 INTRODUCTION

Geographical position of Macedonia and geological conditions, caused to form the formations of many different rocks masses ranges with the presence of a large number of useful mineral resources.

Although relatively with small area Republic Macedonia is rich with a lot of different mineral resources metal ores, non metals, rare minerals, dimension stone blocks for the architecture, energy raw materials (coal) and other raw materials that make Macedonian mining industry.

More significant research works to define the larger ore reserves to which were initiated and carried out in the middle of the XIX Century. Since then today is made lot of numerous geological researches,

mining research activities to a smaller extent and be established the new mineral fields with economic significance.

All of these activities contribute to create conditions for development of mining industry as an important segment in the overall economy of the Republic of Macedonia.

1.1 Brief review of mining in Macedonia

As a result of the quality of ores and quantitative contents of mineral resources in existing mines, and their technological–technical condition, the same mines in the transition period (after 1990) are not under gone significant changes.

Existing mines of non - ferrous metals (copper, lead, zinc, etc.) after the transformation of the capital and social changes, in the period after 1990, especially after 2000 year, went up reactivated, to set up to high levels in terms of management, technical equipment, the level of geologic explorations the organization of work as well and stable standard of the workers.

Also there are lot of different types of travertine, granite blocks and slabs, and semi – precious stones of onyx which are characterized by their characteristic cappuccino colors.

Existing mines of nonmetallic mineral resources are also significant potential for the development of this economic branch.

These raw materials are almost with various entities throughout the territory of Macedonia and a large number of different quantitative and qualitative characteristics.

They represents a potential raw materials for the development of small quarries, small businesses for processing and shaping, which is have already been proven and in previous decades. With relatively small investments, limited resources and rapid turnover of the capital for several years, in these existing facilities are established stable low capacity, high quality raw materials and

teams succeed for management and appearances on local and world market.

Especially here invoked the large number of low capacity for receiving and processing (large number of fractions with granulation from several microns up to several centimeters) of different types of limestone, igneous rocks of technical stone, and especially set as acquiring queries and processing of decorative white marble, with high quality with trade mark.

2 SOME PARAMETERS FOR MINING PRODUCTION

In the past two - three years the export of mineral resources has a high share in the total exports of RM from about 35% - 40%.

These percentages expressed in cash through 1.100.000 dollars. For the same period the imports of this branch will move to over 800 million dollars and the percentage share of around 20%.

According to the latest parameters and tendencies which are expressed in the last three four years there is tremendous interest in the concessions, particularly in the area of non-metallic mineral resources and in recent times, with interest from several world companies have come in more attractive concessions for detailed geological research for metallic ores such as the copper, gold, lead, zinc, ferronickel, etc.

Table 1. Production of some ores of the active mines for copper, lead, zinc, and ferronickel

Products	Unit measures	2007	2008	2009	I-IV-2010 (≈2010)
Copper ore	t	4109464	4239500	3766500	1407500
Concentrates of copper	t	33467	38337	35430	12761(39000)
Lead Concentrates	t	48702	67401	63227	19624 (60000)
Zinc concentrates	t	61913	77473	77296	23654 (72000)
Ferronickel	t	15321	15026	12000	4531(13500)

* Source: State Statistical Office of the RM

In the previous period (the last two-three years) and according to the set priorities of the Government, is awarded through

public tender more than 300 new sites under concession for research and exploitation of a large number of different mineral resources.

In Table 1 are presented the results of production of some mineral resources of the active mines for copper, lead, zinc, and ferronickel.

As it is seen from Table 1 the production of metal ores in recent years is constantly increasing. Exception can be said for the year 2009 decreasing for all metals shown in the table because the world economic crisis is reflected in the direct production and sales due to reduced purchasing of large companies and major consumers, the drop in prices of metals on world markets.

We can see that in just the first quarter of 2010 the production will go up for certain parameters, and will exceed production in the previous year.

In Table 2 are given the parameters of the production of some non-metallic mineral raw material that represent an important segment of the mining. Although these mineral resources do not have an important financial share in the overall mining industry and there are still important from the aspect of working labor, appropriate participation in the export performance of RM with direct products, or indirectly through the semi finished or finished products obtained in other industries.

This part in getting the finished products for purposes and general consumption (pharmacy, getting on the cement, porcelain, plastic mass, isolations materials, asphalt, etc.) can not affect the ordinary figures and all sorts of their would be unrealistic because the these products are taking part and other components.

3 LEGISLATION

Geological research of any type and volume, the mining of mineral raw materials, supervision and control as well technical inspections are regulated by the Law on mineral resources. (Official Gazette of RM no. 24/07, 88/08, 52/09)

According to this Law which so far has a few changes and supplements in the last year of the regulated manner of obtaining the concession for detailed geological research,

mining permit, concession fees, necessary technical documentation for all permits related to this activity, as well as penal provisions prescribed by this Law.

As part of this paper to briefly give the method of obtaining the concession for exploration and exploitation. The procedure for a new concession of detailed geological research starts with getting a license for geological research, which in turn is achieved by applying the published public tender conducted by the authority in charge of this activity in the Ministry of Economy.

At this public auction stand out (publish) a number of concessions - new locations of raw materials of general interest such as: all kinds of metallic non metallic materials and resources, groundwater, thermo mineral waters and others.

All these concessions are public in the year general program adopted by the government after a request for research by interested domestic and foreign legal entities.

After the conclusion of a concession contract for detailed geological research, entity has the opportunity of two to four years (depending on the type of mineral raw materials) to perform geological surveys and preparation of report for mining reserves on the particular areas, a major mining project for exploitation, elaborate on the impact of environmental and other documents required by this law to obtain permission for the exploitation of mineral resources.

The granted concession for detailed geological surveys are paid one-time charge which offered the concession granted to the public tender, while the exploitation of mineral raw material is paid an annual fee according to the space occupied by mining activities and compensation for the exploitation of mineral raw material obtained by annual amounts and type of the mineral resource in the percentage that ranges from 0,5 to 1,5%.

Table 2. Production of typical materials for civil engineering and non-metallic products

Products	Unit measures	2007	2008	2009	I-IV- 2010
Marble and travertine, cut into blocks	m ³	19.925	22.857	24.100	8.789
Marble panel (slabs)	m ²	395.365	389.532	301.654	/
Gypsum	t	255.500	242.400	154.654	39.788
Limestone	t	848.498	827.100	694.968	148.243
Dolomite	t	96.723	75.855	78.523	17.000
Silicate sand	t	151.019	131.712	112.106	19.019
Sand for civil eng.	t	45.774	63.295	49.009	/
Crushing and broken stones	t	69.216	56.445	108.724	28.036
Bentonite	t	22.509	13.689	9.033	77
Volcanic tuffs	t	80.910	103.476	113.064	17.472
Quartzite	t	12.599	21.083	1.135	/
Sodium feldspar	t	32.814	28.920	19.377	4.327

* Source: State Statistical Office of the RM

4 BRIEF DESCRIPTION OF IMPORTANT METALLIC ORE MINES

This section will present two mines with their main parameters and certainly most important for the mining industry in Macedonia. The purpose of this item is given by numbers and technology of obtaining the basic features of these mines in order to obtain an impression of technical technological level, management attitude towards work, the results achieved in recent years, the prospective development of them, improving the conditions for facilities etc.

4.1 Mine for copper ore "Buchim" - Radovis

Mine's location in south-eastern part of Macedonia near the town of Radovis and only 3km away from the highway Strumica-Radovis-Stip. Mine copper ore "Buchim" is working more than 30 years.

After unsuccessful transformation of capital into bankruptcy the mine was buys from the company Solvej published an international tender in 2005 year. Since the company established by the management team worked successfully for 5 years to meet the foreseen production capacity and doubled the capacity of waste.

The existence of this mine and successful work had great importance for the city and in general for RM. This is the only mine in Macedonia for the copper ore from which gets a quality copper – clear metal, and a certain quantity of gold and silver.

Quantities of waste rock and ore in the last 5 (five) years the options presented in the Figure 1.

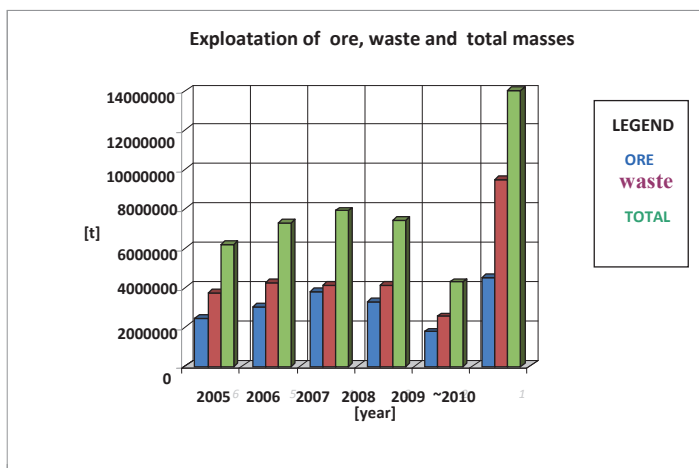


Figure 1. Production of ore and waste for period of 6 years

4.1.1 Technological process

The open pit is exploited copper ore containing copper, which despite small percentage of gold and silver. The quality of ore varies depending of ore body, copper mineralization and recent years have been exploited by average ore content of 0,235% Cu, 0,22 g/t Au and 0,72 g/t Ag.

According to these values this mine is classified in the group of poorest mines for copper in the world.

The exploitation is carried out on the lot of slopes and working more ore bodies, as follows: RT Čukar I and II, RT Central ore body, RT "Northeast" and RT Vršnik (new).

Year capacity of copper ores is more than 4.000.000tons, with the possibility of increasing the same because there are real

possibilities and potentials. Capacity realized in the last year (2010) on the total weight of distracted from the open pit mine is about 15 million tons.

Exploitation is carried out in the open type of surface height-depth type of slopes with height of 15 meters. Drilling is performed with powerful drilling machines with a diameter of 250 mm of drilling. In an average week are done after 3 to 4 blasting series to ensure sufficient quantities of ore mass or waste.

Charging system is mechanized with Slurry and AN-FO type of explosives. Initiation is done by initiating Nonel system which provides quality blasting, safety at work and increasing cost per ton blasted mass.



Figure 2. Part of open pit „Bucim”

In this open pit mining has been done the biggest blasting series on the Balkans (1989) by applying 143 tons of explosives laid in 375 drill holes is obtained when the masses distracted from more than 800,000 tons.

Loading of blasted mass is done with electric and diesel excavators where the buckets are with a volume of 8 to 11,5 m³. Excavators are from world famous companies P&H, O&K, and are successfully operating since the beginning of mine with made the necessary repairs.

The transport is done with the dumper trucks of different types (Caterpillar, Wabco, Terex) with a payload of 100 to 130 tons. With these trucks to be transferred the blasted ore to primarily crushing which is the capacity of 1000 t/h.

The same can accommodate size of a piece of max. 1 m³.

After the primary crushing the pieces with a size up to 203 mm are transportation through the storage of an open line with capacity of 800.000 t.

From there by adding ~ the ore and is worn on the secondary, tertiary crushing continue to the mills (two number) to be have the granulation (0,074 mm) for appropriate flotation process.

After flotation and three level purification is obtained copper concentrate with a content of moisture from 7 - 8%, copper by 21% and gold 10 -15 g / t. This concentrate is transported to a smelter in Serbia and Bulgaria, from where it gets pure copper, gold and silver.

4.1.2 Development Perspective

In further period of operation in the Bucim mine are exploration of the adjacent ore bodies for their definition and classification of mineral reserves. During this year are expected beginning of the exploitation of the new ore body Vrsnik, where are defined ore reserves of over 10 million tons.

This ore, which the majority is oxide would be particularly manufacturing with technological Plants within the limits of the mine itself. Underway is the preparation of technical documentation for these previous mentioned plans and the only preparation of technical documentation and new agreements to obtain new concessions for geological exploitation of copper ore in the wider environment of the mine.

From the ecological aspect of the mine Buchim is given appropriate attention that show and the specific activities of this field.

Tailing dump from flotation process is under reclamation process and its is constantly under the existing project for reclamation with the trees and grass. Last year built is also a filter station for collecting the unclear water and catchments water from widest region of the mine in which part of this water will be used as technical and part will be already clear in the existing river for the biological minimum.

4.2 Mine for lead - zinc ore "Sasa" - Mac. Kamenica

The mine is placed in SI part of RM, 8 km from the city. The mine is situated in elevation from 800 to 1600 meters.

According rendered geological explorations and persistent in depth which are carried out continuously be ascertained ore reserves that are classified in the appropriate categories.

The main ore reserves were limited in scope zone between the level XIII and XIVb. Based on the indications for the emergence of new ore reserves at the depth, and in correlation with the existing concession agreement for detailed geological research approaches to the realization of program for detailed geological research in the Zone between level XIVb and zone "Kozja reka" and a level of 830 to the zone "Golema reka."

This zone presents a natural continuation of the ore bodies by the deep which can be seen from the vertical cross-section given in Figure 3.

On the basis of established, quantitative and qualitative parameters of mining reserves is defined technology for mining operations dynamics of preparation and production, and values of the ore.

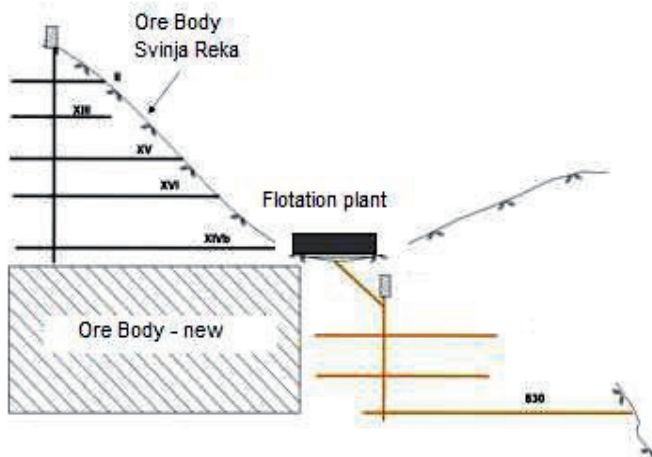


Figure 3. Vertical cross section of exploring area with objects for opening and development

4.2.1 Description of technology for exploitation, and development of the ore

Based on the results obtained from geological surveys and detailed analysis of possible ways of opening, development and excavation of ore zone between the horizons XIVb and 830, defined a way for basic mining and joined to the preparation of technical documentation level of additional mining project.

Given the past positive experiences with modified excavation methods they planned to apply for the excavation in this ore zone.

According to the technical characteristics of the method, ore zone is divided into 6 blocks with height of about 80 m and 300 m wide, for two of each horizon.

The main system for ventilation is diagonal with two main fans (Korfman) for separately ventilation where are used most modern systems of fans (Zitrone) and flexible pipelines.

The realization of this production will be adequate done with preparation, which includes construction of service blocks ramps, hallways, ventilation objects, and ore / waste finch.

According to the operational plans of the mine, and on the basis of the available ore reserves the ability of the applied methods and technologies of exploitation is defined.

Mining dynamics of individual blocks for the entire period of exploitation for the next 15 years.

For the exploitation used most modern equipment for drilling (Atlas Copco - Bommer 281, Simba), freight transport machine Atlas Copco Wagner LHD STD 3.5, mining trucks Atlas Copco MT2000 as a whole series of service and auxiliary machinery (for anchoring Boltec, installation of shotcrete - Putzmeister, transport of raw materials with MINKA etc. All equipment is modernized, by applying with diesel engines.

The method of exploitation in the zone "Golema reka" is a method of keeping the

grill and method of the backfill of excavated area with flotation tailings. The transport of the ore to the plant for primary crushing is done with export transport tape. After secondary and tertiary crushing the ore is done to smelting in two separate stages.

Flotation is a process of selective flotation on the main lead and zinc minerals. Flotation is obtained from two separate concentrates on the lead with over 73% of lead and zinc concentrate with over 50% with humidity of about 6 - 6,5%. The organization of the work is supported by appropriate systems for telecommunications and monitoring throughout the pits. For all workers will be provided with most modern equipment and personal protective equipment, as well as ongoing training. Sasa mine works with great success with annual capacity of 850 000 tons of lead - zinc ore, which is obtained from more zone and level. The quality varies according to ore level and zone - horizon of the average amounts, for A - Reserve Pb = 5.06%, Zn = 4.33%.

In the exploitation phase mine disposes over 10 million tons of ore reserves of A and B categories and with over 80 million tons of potential reserves, which in future should be done with surface deep drilling.

Besides the systemic organization of the technological process, all processes in Sasa mine be systematized and are prescribed according standard procedures and guidelines, in accordance with quality standards ISO 9001-2000, which was obtained in 2008 from the renowned Institute for Quality of Slovenia.

- Perspective

The perspectives for the development of this mine is great. These is done permanent investigative drilling developments in spaces with be done and detailed the ore bodies.

At the same time performing at the surface investigative drilling developments with a plan for research for a longer period.

To prepare technical documentation for obtaining a new concession for research as well as documentation for the expansion of the existing concessions.

According with NVP and long-term plan are planned investments in all technological phase of over 30 million.

5 CONCLUSION

According to all the knowledge and perspective that are projected from expert in this field, it is emphasized that mineral resources in Macedonia as well as in the whole world, will be a basic ranged human potential for the development of the overall economy of a country.

Respective mining companies, government and ministries should be done for these tendencies to be achievable in the further period. The perspectives for the development of this activity in Macedonia as well in the world, directly depend on the activities

undertaken in the sphere of legislation, prepared by laws - regulations and the appropriate documents (Tariffs) for regulation the basic duties, taxes and fees.

With the introduction of incentive measures, appropriate interest rate policy of the commercial banks and similarity of the legal provisions for new concessions and appropriate the technical documentation of mining only part of the measures should be taken in this important economic activity.

With the growth of prices on world markets for metals, greater demand in world terms, in the future will be created better conditions for the already existing mines and will give incentives for investment activities of domestic companies and even before the entry of foreign capital in the most active capabilities for their promotion of technological process, obtaining concessions for geological researches and opening of new mines.

REFERENCES :

- Journal "Macedonian mining and geology",
N^o 8/2008, 10/2008, 11/2008, 12/2009,
15/2009, SRGIM, ISSN 1409-8288, Skopje,
Journal "Minno delo i geologija", No.9/2006,
"Zemja 93", ISSN 0861-5713, Sofija, R.
Bulgarija
Data base from Republic Statistical Office of
the R. Macedonia, Skopje, R. Macedonia
Technical documentation from Bucim – mine,
(period 2005 – 2010)
Technical documentation from Sasa – mine,
(period 2005 – 2010)