BRIEF DESCRIPTION OF THE GOLD-SILVER ORE DEPOSIT MINING IN ROMANIA

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Abstract

The Romanian territory hosts several gold deposits which have been mined and processed until the beginning of the III millenium when because of the domestic economy decline, the gold mines were closed.

It is to be noted the situation of the gold mines at the time when the decision about their closure was made and it is to be discussed whether under the current economy circumstances, the Romanian State should or should not reconsider their sitution and to partly resume the gold deposit mining.

1. Introduction

The Romanian territory covering a surface area of 237,500 km^2, is characterized by a largely diversified geological structure. Most of the territory belongs to the Alpine orogene zone with tertiary volcanism and includes young mountains, hills, plateaux and field intercalated in tectonic depressions containig rich and varied useful mineral deposits such as: mineral fuels, precious metal ores, ferrous metal ores, non-ferrous and rare ores, non-metaliferous minerals, etc.

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The presence of the numerous useful mineral deposits on the Romanian territory much influenced the economy condition of the country. The metaliferous ore mining and processing has been developping or regressing throughout the time, but it had never been stopped completely as it happened some years ago.

The genesis of the Romanian metaliferous deposits as well as of many other deposits of Central and Southern Europe was much related to the volcanic events which accompanied the geological processes which resulted in the formation of the European continent. They are part of the mineralized eruptive chain developed from the North Africa, passing through the Iberic and Pyrinees Mountains to Jura and Vosges Mountains and continuing through the Sudet Mountains, Carpathians and Balkans and reaching finally the Pind Mountains of Minor Asia [7].

In Romania, the metaliferous ore deposits starts from the North part of the country, namely in Baia Mare zone and continues to the South with two branches: the East branch passing through the Oriental and Meridional Carpathians, getting to the South part of Banat Mountains, and the second one is the Western branch passing through the Apuseni Mountains and Banat Mountains,up to the South part of this region. The two branches unify to the SW part of Romania and passes to Serbia (fig. 1).

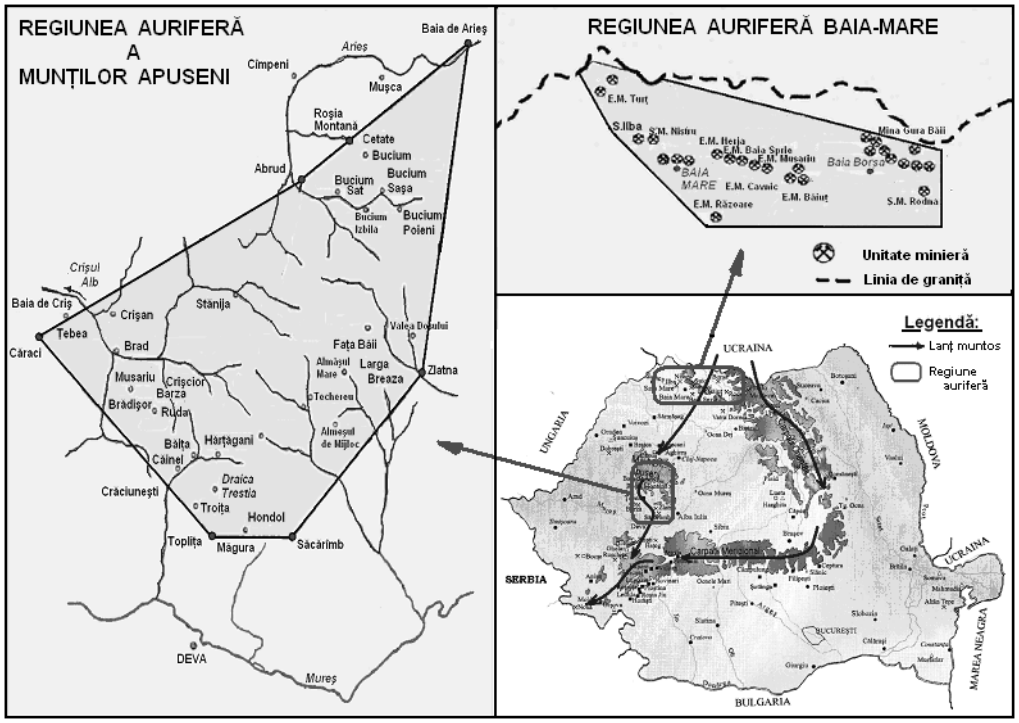

Fig. 1 *Mountaineering chains and main gold regions of Romania*

The gold-silver ore deposit occupy a special place among the metaliferous deposits of Romania.

Throughout the time, on the Romanian territory there were revealed and outlined eight zones with gold mineralization on the Romanian territory, some of them did not show any significant importance from economic point of view and others were mined out and depleted so far and a third category is represented by the deposits which have been mined after the year 2000 and at present they are under preservation phase within the mining enterprises that have been closed.

The most important gold region of Romania are: Baia Mare and the Golden Quadrilateral of Apuseni Mountains (see figure 1).

2. Geological and mineralogy – petrography aspects associated to the gold-silver ore deposits in Romania

Baia Mare Gold Region – is situated to the Southern part of Gutai Mountains, North part of Lăpuşului Mountains, including to the East Ţibleş Mountains up to Munţii Rodnei Mountains [7].

The metaliferous ore deposits of Baia Mare Region are part of the metal genesis province of the Neogen eruptive. They extend between Ilba and Botiza along 60 km and their maximum width is 12 km (see figure 1). The metaliferous deposits of this region include two main types of deposits: base metal sulphides and native gold deposits.

Copper, gold and silver are subordinately associated to the veins of the first category where lead and zinc are prevailing.

The main base metal sulphide ore deposits are found at: Ilba, Nistru, Herja, Baia Sprie, Cavnic, Văratic and Băiuţ.

The native gold deposits occurring as gold veins, at Băiţa, Săsar, Valea-Roşie, Dealul Crucii and Şuior are situated at the central part of the mineralized area being associated to the eruptions of andesites, thiolites and dacites which took place in the area.

The gold mineralizations are predominantly epithermal and it is indicated by the colomorphous textures and the presence of calcedonia among the gangue minerals.

The veins of Baia-Mare region are min imum 0.4 ÷ 1.0 m wide, their average width being 1.5 ÷ 3.0 m while their maximum width is 5.0 ÷ 10 m, and they reach depths of several hundreds meters and their length range between 200 ÷ 300 m and 1.000 ÷ 2.000 m. The gold content is ranging between 1.5 ÷ 2.2 g/t gold and 4.0 ÷ 4.5 g/t gold.

The Gold Region or Quadrilater of Apuseni Mountains

The gold deposits situated between Mureş river, to the South and Arieş river to the North are hosted by a sub-unit well defined from structural petrography and morphology point of view known as **Metaliferous Mountains**, where the **„Gold Quadrilater of Apuseni Mountains"** is located (see figure 1), which comprise the localities: Baia de Arieş, Zlatna, Săcărâmb, Topliţa and Caraci [8].

The gold deposits of this region were the result of an intense metal genesis activity, a subsequent late magmatism determined by volcanic eruptions.

The neogene volcanism of Apuseni Mountains determined the formation of some rhyolite andesite and dacite massifs and of some volcanic breccia pipes. At Baia de Arieş and Roşia Monană, but also in other zones, there were identified several volcanic highly mineralized breccia pipes.

Within the metal genesis process, the explosion pipes role was a very significant one as they constituted the main acccess for the penetration of the hydrothermal solutions from which the metals were settled.

The mineralization distribution is rather uniform although many times, it can be noticed that the base metal sulphides are at the lower part of the mineralized zone while the gold is at the upper part.

It was noticed that pyrite is always present in free gold veins. Also, many veins developed with the depth along only one fissure getting closer to the surface and spreads in many veins and veinlets like the delta of a river. However, there were found many veins which have no branches and remained well defined. The veins are separated from the surrounding rocks and are well individualized up to the surface. The veins and the surrounding rocks are separated by salbands which are actually clayous fill resulted at the surrounding rock alteration.

The telluride veins are mostly found in the deposits of the gold quadrilater borders of Apuseni Mountains while the native gold veins occur in the deposits situated inside the quadrilater. The gold in vuggs occur as crystalls or crystall aggregats. In general, gold is the last mineral deposited and however, sometimes the gold is overlapped by quartz, baritine, calcite, blenda, marcasite, pyrite, native arsenic and pyrothine.

The vein mineralization of Metaliferous Mountains mainly consists of gold and only subordinately of base metal (lead, zinc, copper). The gangue consists of quartz, and very rarely of chalcedony. Quartz is present in all gold deposits even where the gangue is mostly formed of other minerals and it is constantly found together with the gold grains. So, it seems that quartz was the native gold transport agent. Beside quartz, in the gangue there is found also calcite, baritine, sericite, caoline, etc.

The pyrite – blenda - chalkopyrite association is common for all the deposits. The blenda often indicate the presence of gold and even the high grade of the gold vein.

The native gold occurs in nests impregnated in the gangue or sulphides. At some places, there are gold nests and veinlets as plates, threads or event octoaedric crystals, and at others, as small gold crystals wirth the side of 3 ÷ 4 mm associated to pyrite, blenda and galena and quartz, calcite and rodochrosite. In other deposits the gold impregnation occurs as fine particles with small sizes that after the gold washing there results a gold powder which hard to be seen.

The gold occurrence in the ores is very important from economic point of view the selection of the processing method depends on it.

As for the ore deposit type the following occurrences are identified: simple veins, vein networks, stockworks and impregnations.

In general, the veins are better defined such as Măgura or Hondol veins, and sometimes they form true networks such as those of Săcărâmb, Musariu-Brad or Roşia-Montană.

The veins of the gold quadrilater of Apuseni Mountains are 0.2÷2.0 m thick, varyable inclination which may reach $70 \div 80^0$, depth up to 450 m and length between several tens of meters up to 800÷1,000m. The grade is varying between 1.0g/t gold and maximum 5.0 g/t gold.

The stockworks are hosted by andesite breccia which presence is attributed to some volcanic explosions - explosion breccia, which unlike the tectonic breccia are located at the edge of the andesite eruptions.

The andesite breccia constitute the fill material of explosion pipes which penetrated the crystalline basement and the andesite resulted at the previous volcanic eruptions. In these cones there were agglomerates consisting of crystalline schists blocks of the region basement and andesite block. These were further caolinized and cemented by fine elements of the same altered material. The gold stockworks are bound to these cones and they consist of an intesly brecciated material occurring as blocks of several centimetres sizes up to several meters. The andesite blocks are silicified and mineralized from outside to inside. Between the blocks there are andesite fragments also mineralized as well as greyish quartz crust.

The stockwork mineralization consists of pyrite, marcasite, mispickel, quartz, chalkopyrite etc., the gold being bound to mispickel and pyrite..

Besides it, in the **„Golden Quadrialter of Apuseni Mountains"** there are many deposits of Porphyry copper type which show sub-volcanic bodies, mostly andesites of cylinder shape, crossing over the andesite – quartziferous formations of the basement, sedimentary formations and detritus sediments of the surface [9].

Most of the bodies, to the edge and to the upper part of the Porphyry copper mineralization gold-silver veins are developed and they are accompanied by argillaceous alterations (caolinite, montmorillonite, illite) and phyllic (quartz, sercite and clayous minerals).

3. Gold grade of deposits and productions achieved in different periods

The gold contained in the deposits hosted in Romanian subsoil represented and still representing one more of the main wealths of the country. These wealths had been mined out much time before our era by the Scyths, Agtharians, Dacians and later on the Romans [3].

After the Roman legions retreat (271 e.n.) from the territories situated to the North of Danube, gold mining of Dacia declined and this process continued until th Middle Ages.

After 1500 there was a revival of the mining activity for gold extraction and thus we noticed the enhancement and maintainence of high production rate of some thousands kilos per year.

Briefly, it can be noticed that since the gold mining start up on Romanian territories and until today there were mined and and rendered valuable more than 2,000 tons of gold, the production was varying during different periods as shown in the table no.1:

Table 1 *Gold production extracted from the Romanian territory*

PERIOD			GOLD AMOUNT (kg)
I	**Ancient Times**		720,500
II	**Middle Ages**	396 ÷ 1492	492,750
III	**Middle Ages and Contepmorary period**	1493 ÷ 1943	746,827
		1944 ÷ 1947	28,300
		1948 ÷ 1960	70,000
		1961 ÷ 2005	215,384
TOTAL			**2,273,761**

As a result of the long time mining of the gold deposits on Romanian territory, the gold grade of the mined out ores much decreased from one period to another while the involution with the time of the industrial grades is shown in table no.2:

Table 2 *Gold grade of ores mined out on Romanian territory*

No.	Period of time	Industrial grades g /t Gold
1	1920 ÷ 1940	10 ÷ 20
2	1940 ÷ 1960	4 ÷ 10
3	1960 ÷ 2006	1 ÷ 3

The deposits under mining operations initially contained significant amounts of high grade gold ores. With the time, further to the mining of rich zones of the deposits and to the attraction of new deposits with low grade of useful components, in the industrial process, the mined out ore tonnage and the ore garde decreased continuously. In fig. 2 it is shown the variation curve of the average gold grade in the industrial ore mined out of Apuseni Mountains mines between 1948-1998. The curve has a decreasing trend, with variations from one year to another and it ranged around the 1,0÷1,5 g/t Gold during the last 15 years.

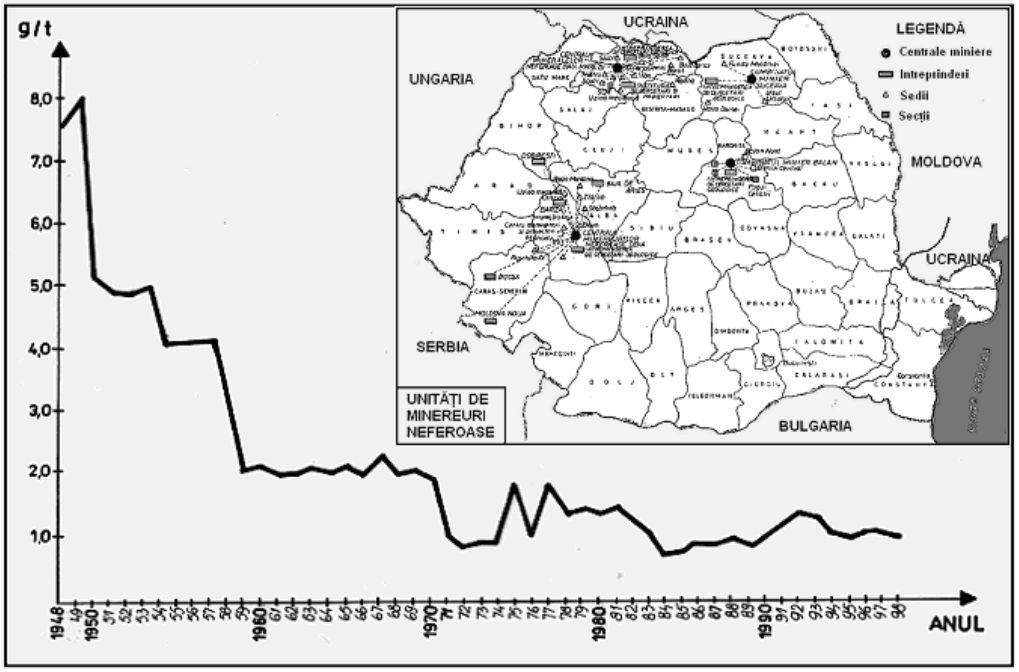

Fig. 2 *Variation of the gold grade of ores mined out in Apuseni Mountains – România*

Taking into account the average grades of our deposits and the estimated reserves disclaimed on different occasions by the entitled Government authoritie, it can be stimated that Romania still has more than 100 million tonns of gold-silver ores on its territory which can be mined out and sold with profits.

4. Opening, preparation and mining of gold-silver deposits

During the alst decades, the gold-silver ore reserve mining in Romania was carried out by mining works eprformed in the underground mines of Brad, Baia de Arieş, Zlatna, Certej-Săcărâmb, Bolcana, Şuior, Săsar, Baia-Sprie, Ilba, Nistru, Herja and Băiuţ as well as by open pit operations in Roşia-Montană, Valea - Morii, Coranda - Hondol, Şuior and Bolcana [2].

The particular variety of Romanian deposit occurrence as well as the surrounding land shape required the use of adits or vertical shafts for the opening of the deposits in order to prepare them and for their underground mining.

Most of the mines included a developed and complicated network of works with horizontal extension over several horizons which determined the difficult organization of activities and high transport expenses ,a eration, water discharge, maintenance and lighting.

The figure 3 presents, as an example, the layout of the I.M Barza deposit opening during the final mining stage.

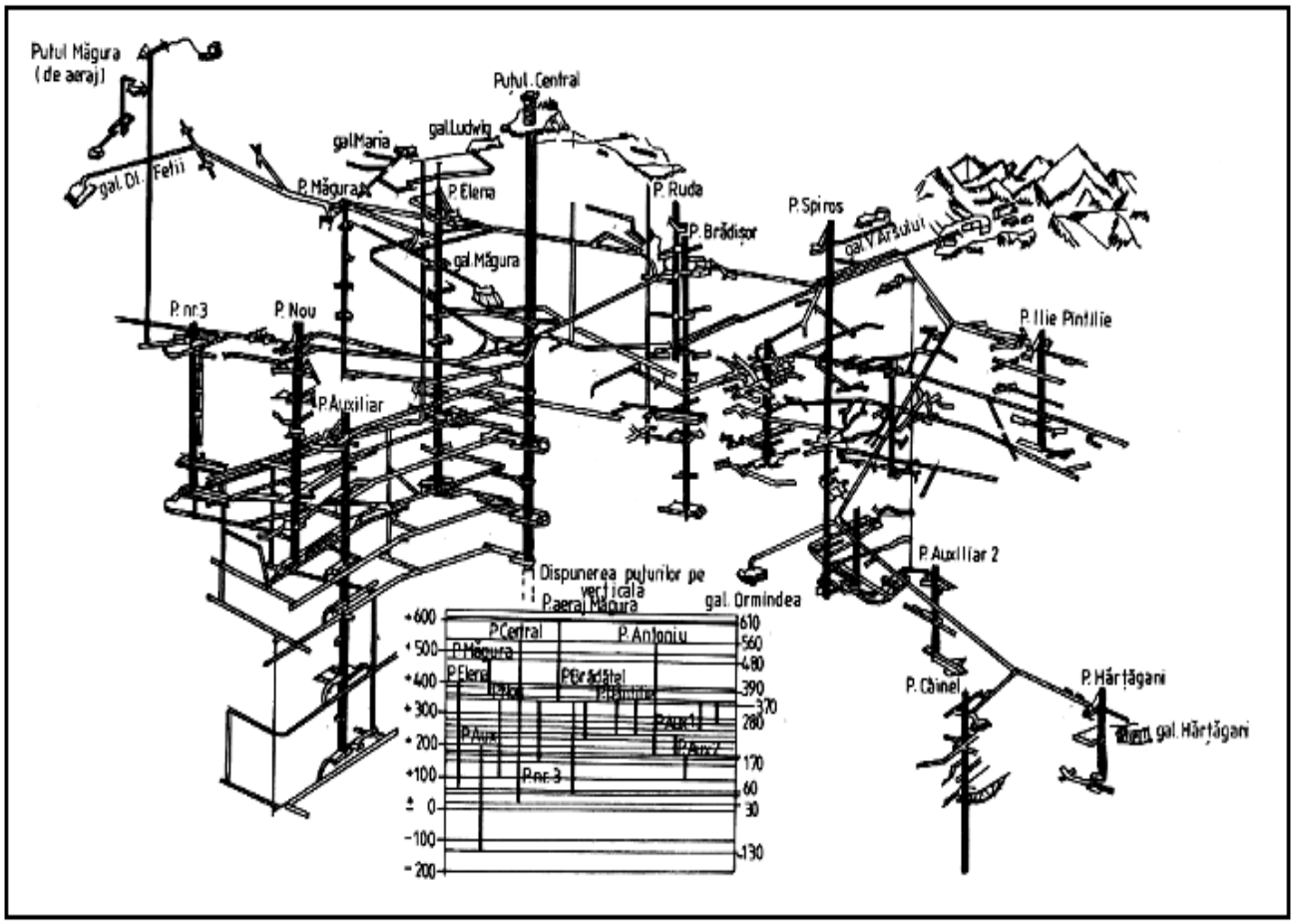

Fig. 3 *Opening of the vein deposit of Barza – Brad*

The open pit opening works was carried out using some trenches and semi-trenches with complex routes and spiral return ways sor one lane traffic (figure 4), as the deposits are situated in monatineering zones characterized by uneven relief with deep valleys and steep slopes.

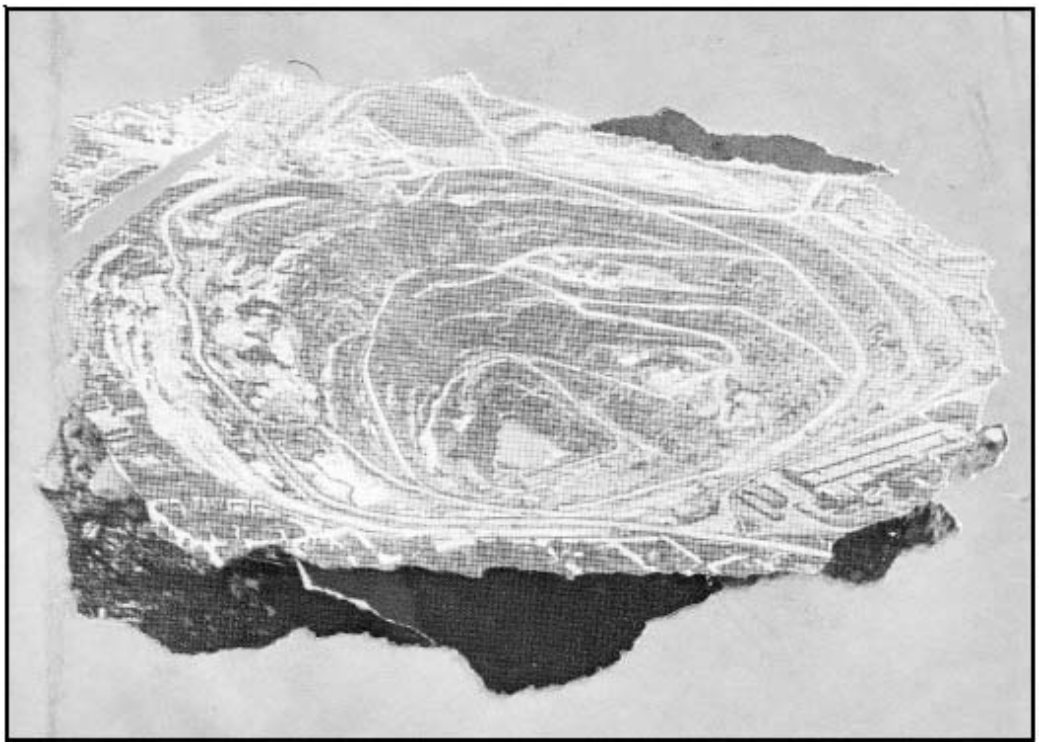

Fig. 4 *Opening of Roşia Poieni open pit with semi-trenches on the internal roads*

The high gold-silver ore amounts mined out on annual basis, with a relatively low gold grade worldwide and determined the mining enterprises to rationalize as much as possible the underground mining methods in order to reduce the cost price of the metal.

To this aim, there were implemented modern mining methods, mechanization and automation of the main production processes with ever better results of production and costs.

The mining methods and technologies used in our mines have been developed and implemented considering the technical and mining conditions, the existing financial opportunities and resources for purchasing the range of machines and equipments necessary for the technological process.

If the mining methods were the most suitable ones for the deposit, the equipments used for drilling, blasting, loading and transport have not caught up with the modernization and consequently, a whole range of machines and equipments were much less reliable than the ones used worldwide by famous companies in the field.

The particular variety of the deposits indicated by the accumulations of ores in the fissures as stocks and lens developping over hundreds of meters horizontally and vertically as well as the resistance of the surrounding rocks determined the design and putting into practice of a wide range of mining methods.

In our country, the most significant gold-silver deposit were the vein gold-silver deposits with steep slopes and low thickness which best suited the underground mining. As a result, at national level, there existed a continuous concern so that the most used methods used lately have been the followings [10]:

- Mining methods with remaining voids on sub-levels (fig. 5);
- Sublevel caving methods (fig.6);
- Ore stockpiling exploitation method (fig.7);
- Backfill exploitation method (fig.8).

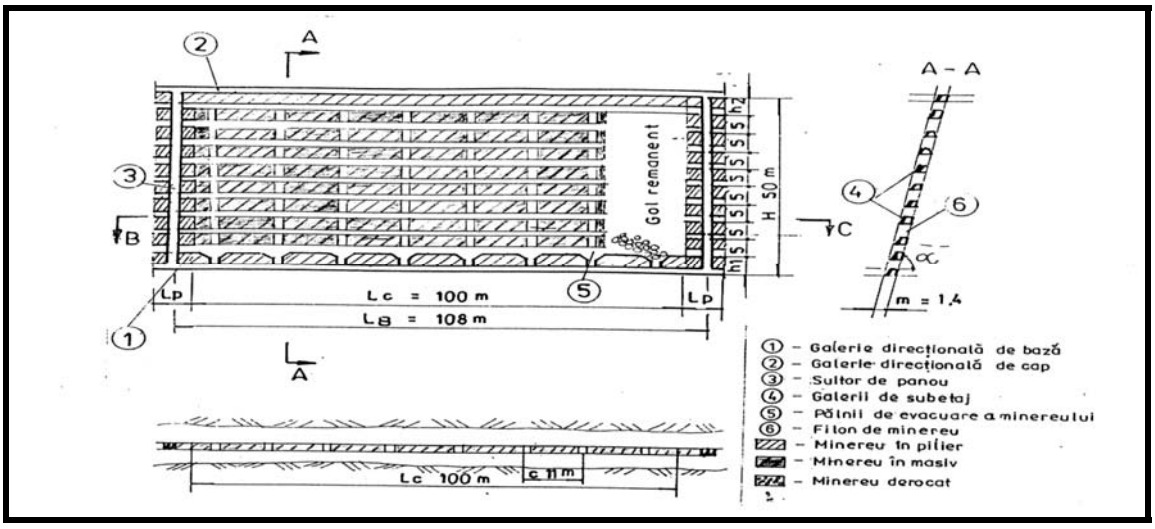

Fig. 5 *Sublevel open stoping mining method applied at the deposits of Măgura and Săcărâmb of Apuseni Mountains*

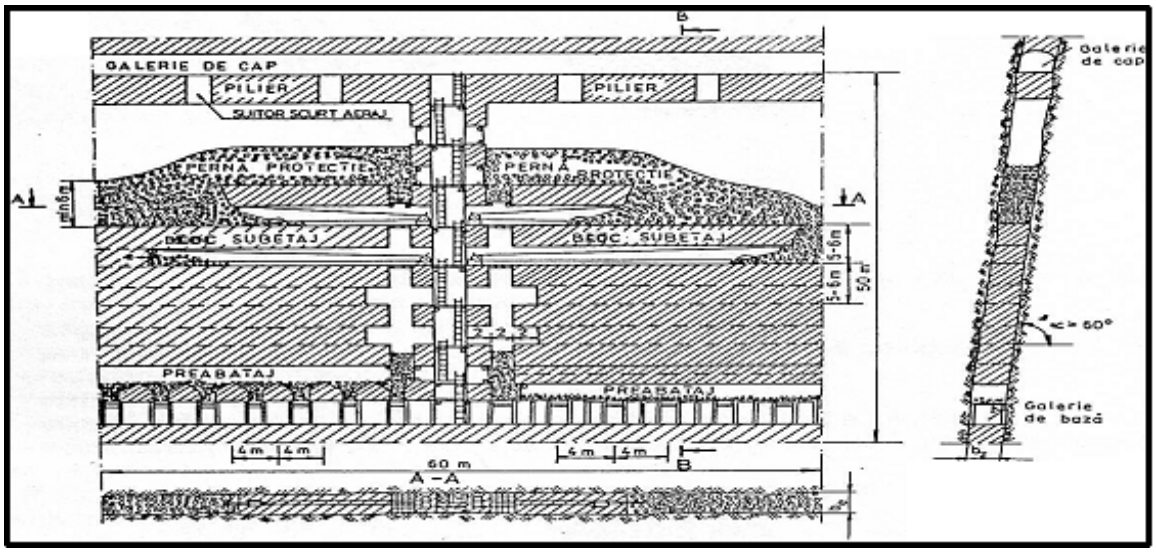

Fig. 6 *Sublevel caving mining method applied at one deposits of the gold region of Baia Mare*

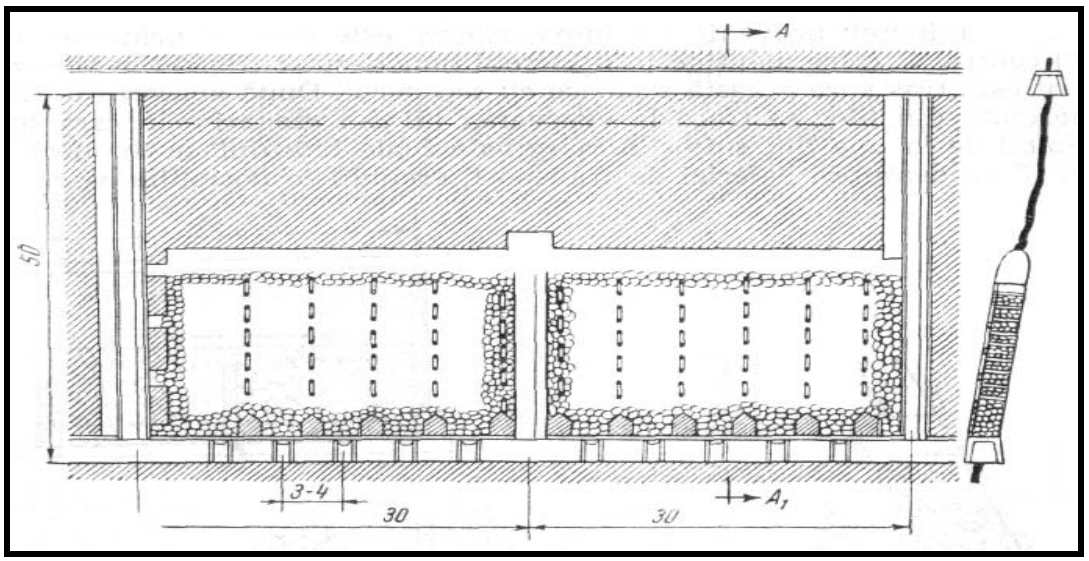

Fig. 7 *Shrinkage stoping mining method applied at Săcărîmb, Brad, Roşia Montană, Băiuţ, Herja, Ilba, Nistru, Săsar, Şuior and Turţ deposits*

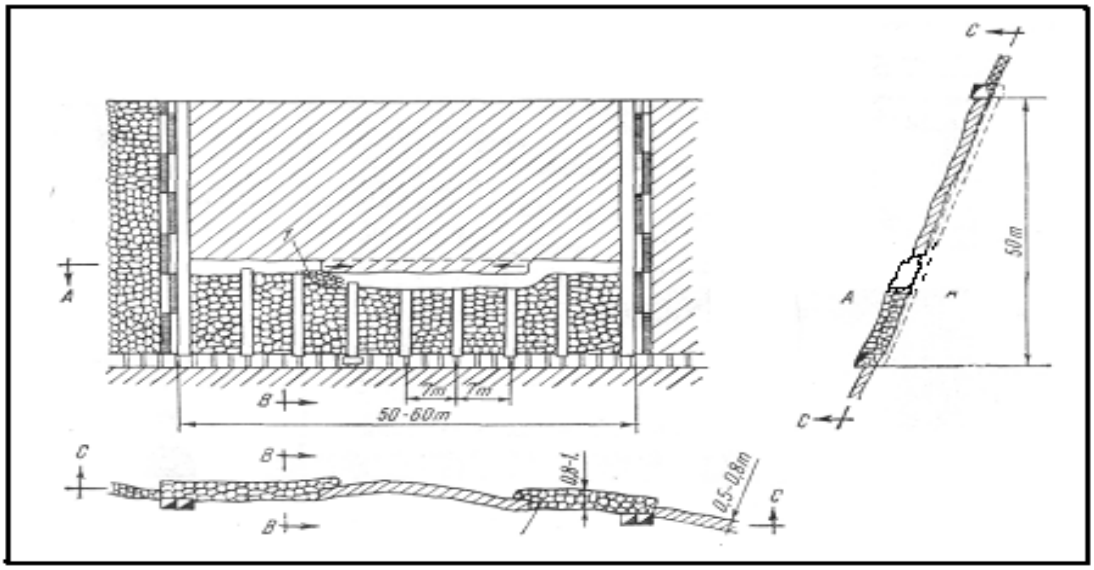

Fig. 8 *Cut and fill mining method applied at Băiuţ,Baia Sprie,Barza,Băiţa, Baia de Arieş, Herja,Săcărîmb deposits*

As seen in figures above, the preparation works necessary to be completed and the four working methods of the stope are difficult to use because of the low mechanization rate.

The table 3 presents the exploitation methods that were used for the most important production units of Romania and the gold grade of the mined out ores of Romania.

Table 3 *Exploitation methods applied at the production units of Romania and the gold grade of the mined out ores*

No.	Ore deposit	Exploitation methods	Gold grade of mined out ore (g/t gold)
1	Barza	Cut and fill	1.45
2	Baia de Arieş	Horizontal slice caving	1.57
3	Zlatna	Horizontal slice caving	1.35
4	Roşia Montană	Open pit	0.98
5	Certej	Open pit	1.30
6	Săsar	Sublevel caving	1.3 ÷ 1.5
7	Şuior	Sublevel caving	1.4
8	Bolcana	Sublevel caving	1.3 ÷ 1.5
9	Valea Morii	Open pit	0.8

According to the above data it has been noticed that the gold grade of the ores mined out in the gold deposits regions of Romania much decreased and in most cases it is less than 2g/t gold.

So, for continuing the gold deposits mining operations with profits, technical, economic and organisational measures are required to significantly cut the exploitation and processing costs, to increase the ore mining rate and the metal recovery rate in the processing plant.

The main technical and economic parameters obtained with the mining methods mentioned above, are given in table 4, and further to their review, the advatages of the sublevel caving method, are obvious from both work productivity, dilution and ore losses and of material and power consumptions.

Table 4 *Technical and economic parameters obtained at the underground mining method*

No.	Specification		M/U	Mining method		
				Sublevel caving h=6.0m	**Horizontal slice caving h=2.5m**	**Directional slice backfill**
1	**Stope work productivity**		t/shift	4.5÷9.20	3.5÷6.0	1.8÷5.89
2	**Average stope production**		t/month	2500÷3500	1200÷2200	500÷2000
3	**Dilution**		%	15÷20	10 ÷15	7÷20
4	**Losses**		%	0.7÷14	3.0÷19	2.8÷22
5	**Material consumption**	- Explosive	kg/t	0.3÷0.4	0.25÷0.4	0.50÷1.3
		- Electric caps	pcs/1000t	100÷600	160÷650	650÷1958
		- Mine timber	m^3/1000t	0.25÷6.5	19.0÷25.02	4.47÷18.15
		- Drill rods	kg/1000t	7.0÷18.0	10.7÷17.63	17.4÷25.19
		- Detachable buttons	pcs/1000t	2.5÷9.0	2.41÷6.79	8.11÷17.87
		- Diesel fuel	tone/1000t	0.0034÷0.536	0.561÷0.977	0.44÷0.56
		- Electric power	MWh/1000t	19.0÷40.0	27.05÷39.41	30.5÷49.7
6	**Cost of stope works**		%	100	180	240

In gold ore mines, the most used method was ***„open pit mining method and waste haulage to external dumps”*** (fig..9).

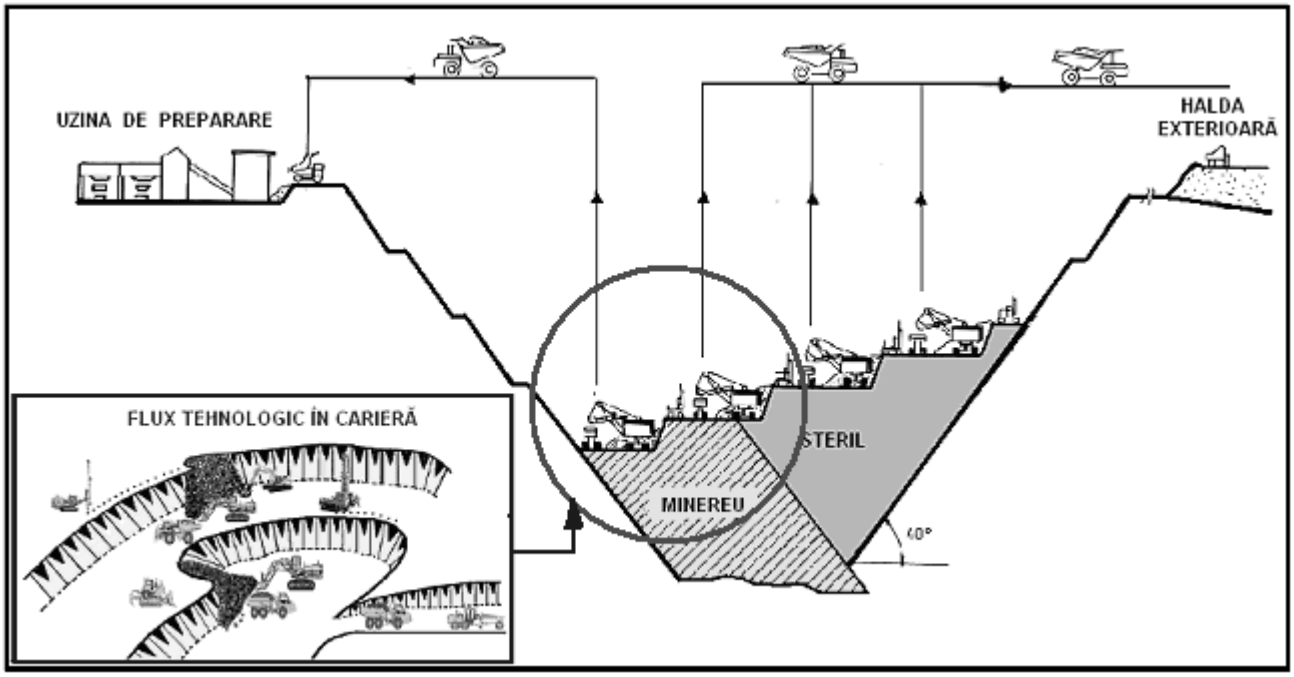

Fig. 9 *Open pit mining method with waste haulage to external waste dumps*

The working technologies consisted of the tailings and useful material extraction by drilling-blasting operations with explosives of nitramon type placed in large diameter boreholes.

The blasted material was loaded with excavators and it was trucked with high capacity and medium capacity trucks of 27t, 40t and 55t. Most of the equipment used were manufactured either in the country or in the ex-USSR. The open

pit mechanization rate, the performances and reliability of the equipment used allowed productivities of only 50÷80 t/shift at maximum and it was completely inadequate to what other world companies obtained under similar work conditions.

The technical – economic parameters obtained in the gold ore open pit of Romania are presented in the table no.5

Table 5 *Technical – economic parameters obtained in the gold ore open pits*

No	Specification		M/U	OPEN PIT		
				Valea Morii	**Roşia Montană**	**Coranda Certej**
1.	**Number of open pit benches (geometry parameters of the benches)**		Pcs.	Useful:2; (h=20m; $\alpha = 74^0$) Waste:2; (h= 20m; $\alpha = 74^0$)	Useful: 4; (h=8-19m; $\alpha = 75^0$) Waste: 4; (h= 8-23m; $\alpha = 75^0$)	Useful:2; (h=15m $\alpha = 80^0$) Waste:6; (h=15m;$\alpha=50\div60^0$)
2.	**Flowsheet**	Drilling	-	Roller bit drills Ø=250mm	Roller bit drills Ø =250mm Rotary drills Ø =115mm	Roller bits drills Ø=250mm
		Loading	-	Bucket shovels of 5m^3	Bucket shovels of 5 m^3 or 2.8 m^3	Bucket shovels of 5 m^3
		Transport	-	Trucks of 16 and 27 t	Trucks of 16 and 27 t	Trucks of 27 t
3.	**Average production during the last years, (tonnes)**		Waste (tone)	1300000	1700000	1200000
			Useful, (tonnes)	440000	420000	530000
4.	**Specific consumptions :**	Electric power	MWh/1000t	2.10	2.47	1.22
		Explosives in TNT equivalent (e_{TNT})	kg/t	0.20	0.28	0.30
		Fuel	t_{ec}/1000t	0.9	0.6	0.35
		Work productivity	tonnes * / shift	34	41	46

(*) – refers to ore and waste.

The technical - economic parameters obtained for the open pits were the most advantageous of the whole minin sector for the gold deposit mining and recovery.

5. The processing methods used

The processing operations of the gold-silver ores to obtain gold ingots are grouped as follows [1], [6]:

- The first group includes the processing of the ores which results in ore upgrading as gold concentrates (sulphide gold-silver concentrates, gold and silver amalgam with mercury, gold mud, etc.);
- The second group of operations include the metallurgical recovery to obtain the metal ingots from concentrates.

The processing technologies applied for gold-silver ores were based on flotation, the gold and silver being predominantly blound to sulphides. In case of the ores where free gold occurred the combined technologies were used. For instance [4], [5]:

- At Brad – for the ore containing 1÷2 g/t gold amalgamation on tables followed by flotation, the products obtained being an amalgam with 25÷30 % gold and a pyrite concentrate with 14÷18 g/t gold;
- At Baia de Arieş – flotation followed by concentrate cyanidation obtaining a gold pyrite concentrate with 23÷25 g/t gold and a cyanidation precipitate (slurry) containing over 2g/t gold;
- At Roşia Montană – drum amalgamation of free gold settled during the grinding – classifying circuit, periodically collected and flotation obtaining a gold pyrite concentrate with 23-24 g/t gold and amalgam with 20-35 % gold.

The gold production of Romania continuously decreased. Thus, in the period between 1944-1947 approximately 7.0 tonnes of gold by year, in the period 1948-1960 it decreased to 6.0 tonnes per year and between 1961-2000 the production was of 5.0 tonnes per year. Since 2000 until 2005 approximately 2.5 tonnes of gold per year were obtained and since 2005 up to now, the production has been only 500 kg gold per year and this amount resulted at the processing of secondary resources [9].

6. Restructuring of gold mining in Romania

Since 1990, several strategic concepts about the basic restructturing of the gold mining industry were established and they included among others :

- Technological and production restructuring, resulting in the increase of the mining and processing of the richest precious metal deposits of Romania; enhancement of the gold-silver ore production in open pits; increase by 10÷15% of mining product quality by the modernization of exploitation technologies and processing plants; beneficiation of precious metals by waste and tailings processing etc.;
- Organisational and managing restructuring, first, consisting of the auxiliary or even basic activities separation and their organisation as distinct commercial companies;
- Restructuring of the employment of the mining enterprises and particularly the high diminution by the use of three basic methods:
  - Separation of some activities and organisation as commercial companies maintaining the employees within the mining enterprises;
  - Going for retirement based on the work time diminution;
  - Redundancy granting compensations.
- Restraining or cessation of production activity at some mines with depleting geological reserves as well as under particularly difficult geological and mining conditions where the production costs were high and very high.

As a result of the difficult geological and mining conditions of the mineable deposits, of the low grade ores and low reliability of the technological equipment, the total production costs of most mining products were after 1989, higher than the metal selling price and thus, the Romanian Government had to provide funds as subsidies to maintain these activities, of precious metal ore mining and recovery. The subsidies rate granted by the Romanian Government to the mines for the gold they produced, was calculated so as the price obtained further to the product sales plus the subsidy covered entirely the production costs of those times.

On permanent basis, the main target of the Romanian Government and mining units was to cut the production costs so as to get closer to the profitableness. This option determined the implementation of some difficult and strict measures particularly for the mining communities. The gradual diminution of the mining activity and the massive redundancy of employees mainly led to tje increase of the local unemployment rate, the life standard diminution and migration of the labor force to other industrial zones.

To increase the profitableness of the precious metal mining process and to reduce the state budget subssidies and based on the provisions of the Mining Act, after the year 2000 the mine closure process started including here some mining sectors and even unprofitable mines.

A significant number of mines were closed gradually, and even mines from the gold region of Baia Mare and Gold Quadrilater of Apuseni Mountains were closed; it was mutually agreed that the mines which remained in operation would implement rehabilitation programs and minimum investment start up.

In our opinion, the decision to close the mines was a quick one and it was not based on a due dilligence review of each project and it was made by people and bodies which had not much to do with mining. Consequently, we think it was a big mistake, as it proceeded directly with the mine closure instead of their preservation to be able to resume the mining activity when gold mining became more profitable as happened in other European countries.

The disadvantageous circumstances occurred could be also attributed to the National Bank of Romania which in the year 2000, refused to buy the gold produced in the Romanian mines motivating that the bank could not afford to hold a reserve of precious metal bigger than 15% of the currency reserve of the country. By those times, the mines were not allowed to sell the gold to other entities but only to the National Bank because they were subsidized by the Government; until new legislative and marketing opportunities were created, the mines economic situation had become critical and rushed up to the production closure.

Since the 1st of January 2007 once Romania adhered to the European Union, they proceeded with the mistaken decision and most of the mines which activity dealt with gold ore mining and processing and which had been still in operations were closed although the activity of some of these mines could have been rendered profitable.

And most of all, the industrial plants and the mine supplies were sold and decommissioned while the main mining projects (open pits, shafts, underground mining workings) were irreversibly undergoing the closure process and the so-called environmental rehabilitation.

Based on the slogan pf some ***voyager politicians,*** according to which *„The State is not a good administrator of the national wealth"* the gold mining field was left aside easily although the Government, by full right. Considered that the large coal, uranium or salt mines had to be supported and consequently, they had to continue their operations for the benefit of the national economy.

7. Conclusions

We think that gold deposit mining and processing in Romania must be reconsidered and the Romanian Government must provide the legislation, technical, organisational and economic measures to resume the research and exploitation operations both through private and state mining operators taking into account the favorable circumstances of the current economy when mining development is a profitable option. The most important issues are presented below:

- Gold price increased in a spectacular manner, reaching even more than 1,900 $/ounce;
- World consumption of gold metal has increased to about 4,500 tonnes/year, in comparison with the achievments of about 2,500 tonnes/year;
- Mining and processing technologies were much modernized ensuring the profitable surface mining of some deposits with contents below 1.0 gram of gold per ore tonne;
- The ever increasing demand of precious metal in different national economy activity;
- The need of an economic and banking stability for each country to which the gold reserves of the National Central Bank also contribute to a large extent, represents a permanent target.

At the same time there can be organized and crystallized two main sectors in gold mining field, namely the state owned sector and the private owned sector, by establishing powerful and stable economic companies. It is preferred to encourage the „joint venture" type companies and thus, the risk rate associated to this type of activity will be easier for each associate.

Both sectors should focus on the con struction of high capacity mines and modern mining. The mining units should be equipped with reliable equipments and the use of modern production methods.

We think that state would like to obtain maximum profits further to the gold deposit beneficiation and it must make financial efforts to reopen and provide equipments to the old mining enterprises or for the construction of new mining enterprises so that it is the sole shareholder. The practice showed that, because of the high risk associated to the large investments in gold ore mining field it is wise that the state associates with a private partner which has expertise in the field where the operations management should be left to its charge to obtain the expected success.

Referring to the production units, several comments are made:

- Because the gold deposits of Romania have average grades less 3 grams of gold per tonne of mined out ore, there will be investigated in detail, the main ore deposits which match their mining – geological conditions for the global exploitation by open pit methods. The exploitation methods are cheaper and the operations required to implement the methods match best the big mechanization;
- Under some circumstances, when the exploitation methods require it, there will be used combined working methods both in underground and at surface; the option is selected after a detailed technical – economic analysis of each case separately;
- All the mining exploitation, transport and ore processing operations will be sized so that to allow the production capacities of more than 1 million tonnes/year;
- When available, there will be used the pre-concentration methods which in combination with the used exploitation methods result in the highly profitable economic beneficiation.

We think that it is best that the state establish very clearly whether in Romania, this activity is necessary in future, we consider that, for the domestic mining industry resuming, the following main issues have to be considered:

- The development of an accurate strategy of gold mining growth on short, medium and long term and the said strategy should indicate the conditions of the existing gold ore mining, production levels and maximum cost values;
- Due technical – economic dilligence of each gold deposit taking into account the existing deposit conditions, mining methods and processing methods to make the exploitation operations profitable;
- After the analysis, the deposits which are suitable for mining and processing under economic profitableness must be equipped accordingly with modern machines and equipments at the level of the similar deposits mined out worldwide;
- Taking into account the high risk of investments, there should be provided economic facilities for gold mining industry to be attractive both for investors and staff who would like to reopen the activity in this field;
- The gold deposits which are to be mined on the Romanian territory regardless the organization form will have to provide maximum benefits to the state budget, estimated and calculated profit for each deposit separately depending on the real value of the deposit and the risk associated to the investment so that potential investors don't get discouraged.

We appreciate that, in order to make an accurate and fair judgement of the opportunity, importance of such mining activity, it is absolutely necessary to reveal the accurate situation and to make a pragamatic review of the following issues:

- The net profit obtained by the beneficiation of a gold ore deposit being aware that the profit os the

difference between the sold metal value and the total expenditures during the opening, preparation, production, closure and post-closure stages regardless the financing source.

- The collateral advantages of the basic activity, clearly indicating the benefits of the Romanian state, local communities, mining operator and last but not least of the employees to obtain a sustainable development of the mining zone.
- Disadvantages resulted of such activity, the impact of the adopted technologies on the environment, the exerptise, and history of the mining operator, its implications on the local communities and general impact on the society.

Finally, we hope that the gold mining activity can be resumed successfully and based on modern and efficient facilities if the analysis are performed by the staff with exterise in the field, if the above measures are correcly applied.

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