

МАКЕДОНСКО ГЕОЛОШКО ДРУШТВО

ТРЕТ КОНГРЕС

на

Геолозите на Република Македонија

ЗБОРНИК НА ТРУДОВИ

-КНИГА 2-



Уредници:

Лепиткова, С. & Боев, Б.

Струга, 2016

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THE VRSHNIK ORE BODY A POSSITIVE EXAMPLE FOR EXPLORATION, EXPLOITATION AND FILLING IN THE BUCHIM COPPER MINE, EASTERN MACEDONIA

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Abstract

Within this paper we are pointing out to a positive example of the Vrshnik ore body (as one of the four ore bodies in the Buchim Mine) through three stages of its "life" (exploration, exploitation and partial inner backfilling). Since the early beginnings of the geological exploration of the Buchim deposit, the Vrshnik ore body was given special attention. However, that attention intensifies in the period from 1972 until 2010, when the most detailed data for qualitative-quantitative characteristics of the ore body Vrshnik are given in Study of 2010, where total calculated reserves of about 13 Mt were highlighted while additional mining project confirmed that exploitable will be 9 Mt of ore. The exploitation in the ore body Vrshnik commenced in 2011 and until June 2015 exploitation has ended in the southern part of the deposit at mine level 615/630 m. In this southern part just over 2 Mt of ore were exploited, which created the real possibility that final pit be reclaimed. For the purposes of this reclamation is planned to use so-called solid mine waste. Open surface mine in southern Vrshnik gradually was filled with waste material, which by additional mining project can be stored in a total volume of about 3 million tons.

Key words: Buchim, Vrshnik, exploration, exploitation, filling, copper, gold, porphyry ore

INTRODUCTION

The ore body Vrshnik as a constitutional part of the Buchim ore deposit is the most complex and completely zoned of all four of them. There strictly were distinguished three main ore types: oxide, sulfide and mixed. The oxide ore, that is of major interest within this paper, mainly was developed in shallow or near surface parts, i.e. in the first 20 m from the surface to depth (E660/675), than mixed oxide-sulfide or so-called cementation zone that stretches up to 50m in depth, while below elevation 630 m continues sulfide primary (hypogene) ore. Total quantity of oxide and mixed ore is 5 Mt with an average content of 0,342 % Cu and it represents an important copper raw material for copper leaching facility within the Buchim mine. Total ore reserves within the Vrshnik ore body were calculated at approximately 14 Mt with an average content of 0,305 % Cu..

GEOLOGICAL SETTING AND MINERALIZATION

More than three decades of study of this deposit have shown that it is characterized by a complex mineral assemblage and mineral

paragenesis (Cifliganec, 1993; Serafiimovski, 1990, 1993; Serafimovski et al., 1996). Based on data of detailed geological exploration of copper mineralization it was determined that the Buchim deposit consists of four ore bodies: Central, Bunardzik, Vrshnik and Cukar (Figure 1), spread over an area of 10 km² (Cifliganec, 1993). The Vrshnik ore body that is located east of Central Ore Body is with an oval shape. The main mineralized part is deposited in the intrusive. The ore body reaches depth of about 80 m, while at the the surface is long 300 m and wide 200 m (Cifliganec, 1993). In the ore body "Vrshnik" were allocated three andesite phases (Cifliganec, 1993). The opinion of several geologists is that andesite breakthrough within the Vrshnik ore body is cross-cut by small and sterile andesite apophyses, which results in uneven mineralization. Andesite breakthrough in the ore body Vrshnik is the largest compared to the other within the deposit and reaches 0.5 km² in area. In the southeastern parts of the Vrshnik ore body occur serpentinite, but they are of small dimensions (1-10 m), which commonly occur along fault zones (Cifliganec, 1993).

The secondary enrichment mineralization is located in the Precambrian rocks while the primary and secondary mineralizations are located within the andesite. Mineralization within the Vrshnik ore body has been divided into zones (Filev and Kostadinov, 2008):

1. Oxide zone (oxidation zone): a) Sub-zone of oxide ore; b) Sub-zone of ore leaching; c) Sub-zone of rich oxide ore with content of copper over 1% Cu, this oxide ore contains oxide copper up to 40%, and at the moment it has been leached. At level

E675/ 660 m are excavated up to 2.1 Mt of oxide ore.

2. Cemented zone or zone of secondary sulfide enrichment. Oxide-cementation zone in southern parts of the Vrshnik ore body is located in muscovite finely stratified gneiss and ends at level 600. At depth occur poor sulfide mineralization <0,1% Cu.
3. Area of primary ore (hypogene sulfide mineralization) starts, in the northern part of the Vrshnik ore body, at level 630 m and continues into depth.

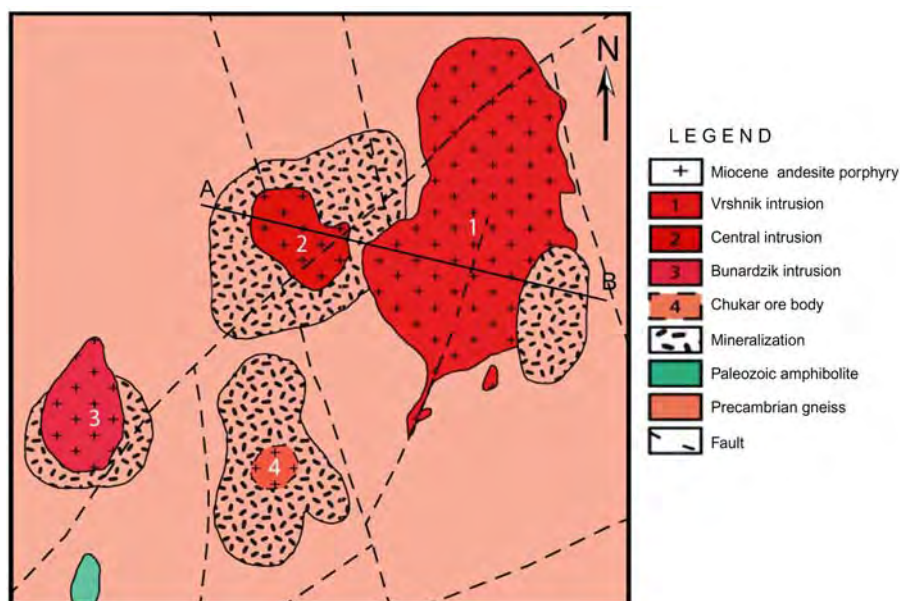


Fig. 1 Geological map of the Buchim deposit (modified by Serafimovski et al., 1996).

With all the microscopic studies conducted so far for the Vrshnik ore body were found following metallic minerals pyrite, chalcocite, chalcopyrite, pyrrhotite, magnetite, Fe-hydroxides, covellite, ilmenite, sphene, martite, hematite, limonite, cubanite, valeerite, sphalerite, galena, molybdenite, enargite, anglesite, malachite, cassiterite, bornite, etc., most of which have character of a mineralogical occurrence (Cifliganec, 1993). Unlike in other ore bodies in the Vrshnik ore body particularly distinctive is an appearance of widely disseminating supergene chalcocite and the mineralization is deposited in andesite and partly in gneiss (Cifliganec, 1993).

QUALITATIVE-QUANTITATIVE FEATURES OF THE VRSHNIK ORE BODY MINERALIZATION

From the results obtained for the Vrshnik ore body, especially the exploration drilling by 50 x 50 m and 50 x 33 m grid, was possible

to categorize ore reserves into so-called B and C₁ categories. By synthesizing the exploration results following amounts of ore and the degree of geological reserves has been confirmed (Table 1)

Table 1. Geological ore reserves in the Vrshnik ore body.

Cat.	Q (t)	Cu (%)	Au (g/t)	Ag (g/t)	Fe ₃ O ₄ (%)
B	9 459 606	0,327	0,192	0,91	1,32
C ₁	4 117 661	0,253	0,157	0,91	1,16
B+C ₁	13 577 267	0,305	0,180	0,91	1,27

The results obtained for the Vrshnik ore body, especially with exploration drilling on a grid 50 x 50 m and 50 x 33 m allowed categorization of ore reserves into B and C₁ category (Filev and Kostadinov, 2008). Total ore reserves in amount of 13 577 267 t has been calculated down to level 330 m mostly according to a single deep exploration drill hole (ID-31A, 345 m) below the level E

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525/510. Mineralization of this drill hole is of high importance for further geological explorations of deeper parts of the Vrshnik ore body (see data left to the Figure 6 below). Concentration of oxide copper in those ores reaches above 20%. During 2011 it was started with special exploitation of oxide ore

	Ore (t)	Content of Cu %	Cu metal in ore (t)
Rich oxide ore (Cu>0,15%)	3 600 000	0,441	15 876
Poor oxide ore (Cu=0,1-0,15%)	1 800 000	0,144	2 592
Total ore for leaching	5 400 000	0,342	18 468

During the period of exploitation of this particular ore body there has been a systematized review and data record by the geological survey of the mine about the exploited ore reserves from the Vrshnik ore body

Table 3. Exploited oxide ore from the Vrshnik ore body with Cu, Au and Ag concentrations at mine levels.

Level	Quantity (t)	Cu (%)	Au (g/t)	Ag (g/t)	Cu (t)	Au (kg)	Ag (kg)
675/690	68 000	0,170	0,11	0,42	116	7	29
660/675	2 100 000	0,362	0,28	0,74	7 602	588	1 554
645/660	1 931 800	0,350	0,28	0,74	6 761	541	1 430
630/645	619 251	0,290	0,10	0,45	1 796	62	279
615/630	200 949	0,280	0,09	0,45	563	18	90
Total	4 920 000	0,342	0,25	0,69	16 837	1 216	3 381

Positive effects can be seen through the data given in Table 4 below, where are shown geological, exploitable and exploited (until June, 2015) ore reserves within the Vrshnik ore body. As can be seen, exploitable reserves projected at 4 700 000 t where increased during the process of exploitation at 4 920 000, which makes an increase of 220 000 t or 4.68% of initial exploitable reserves. This

Table 4. Total geological, exploitable and exploited ore reserves (until June, 2015) within Vrshnik ore body

Type of ore reserves	Geological ore reserves	Exploitable ore reserves	Exploited ore reserves
Category	B+C ₁	B+C ₁	B+C ₁
Quantity (t)	5 400 000	4 700 000	4 920 000
Cu (%)	0,342	0,335	0,342
Au (g/t)	0,19	0,20	0,25
Ag (g/t)	0,69	0,68	0,69
Cu (t)	18 468	15 745	16 837
Au (kg)	1 026	940	1 216
Ag (kg)	3 726	3 196	3 381

from the Vrshnik ore body and formation of heap leaching piles, layered by polymer cover at the bottom. The facility for production of cathode copper has been located just below the dump No. 1, and it has been functional since 2012 (Figure 2).



Fig. 2 Facility for production of leaching solutes rich with copper.

during the period starting from 2011 until June, 2015, when exploitation of oxide ore in southern parts of the Vrshnik ore body officially ended, at level 630/615 m (Table 3).

also makes a positive economic benefit to the mine operating company where even at today's low copper prices at ~6300 US\$/t that makes a substantial 5 million dollars plus and when calculated additional gold of 276 kg, per 39 US\$/gram valued 10 764 000 US\$, the whole economic package increases for astonishing ~16 million US\$ net value.

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As the exploitation in the southern part of the Vrshnik ore body ceased with over 2 Mt of ore excavated, that created the real possibility that final pit can be reclaimed. For the purposes of this reclamation had been planned to use so-called solid mine waste from the northern part of this particular ore body. With this idea the Buchim Mine Company prepared expert documentation

(additional mining project) for refill of the southern part of the ore body Vrshnik. Design of the backfilling space, from geological, mining and environmental aspect allow un-interrupted re-cultivation of former open pit in the southern part of the Vrshnik ore body and it is in accordance with legal regulations in the Republic of Macedonia (Figure 3).

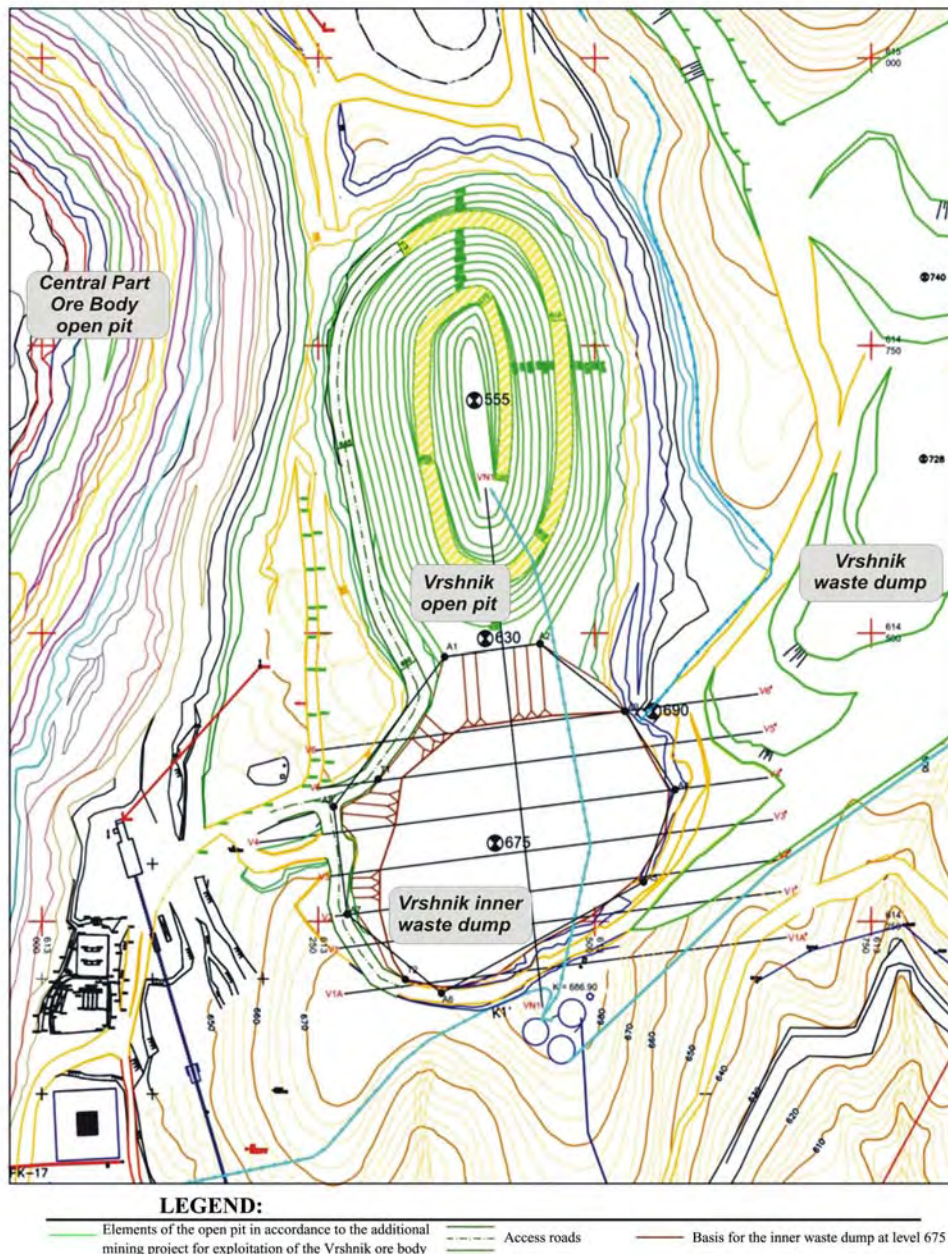
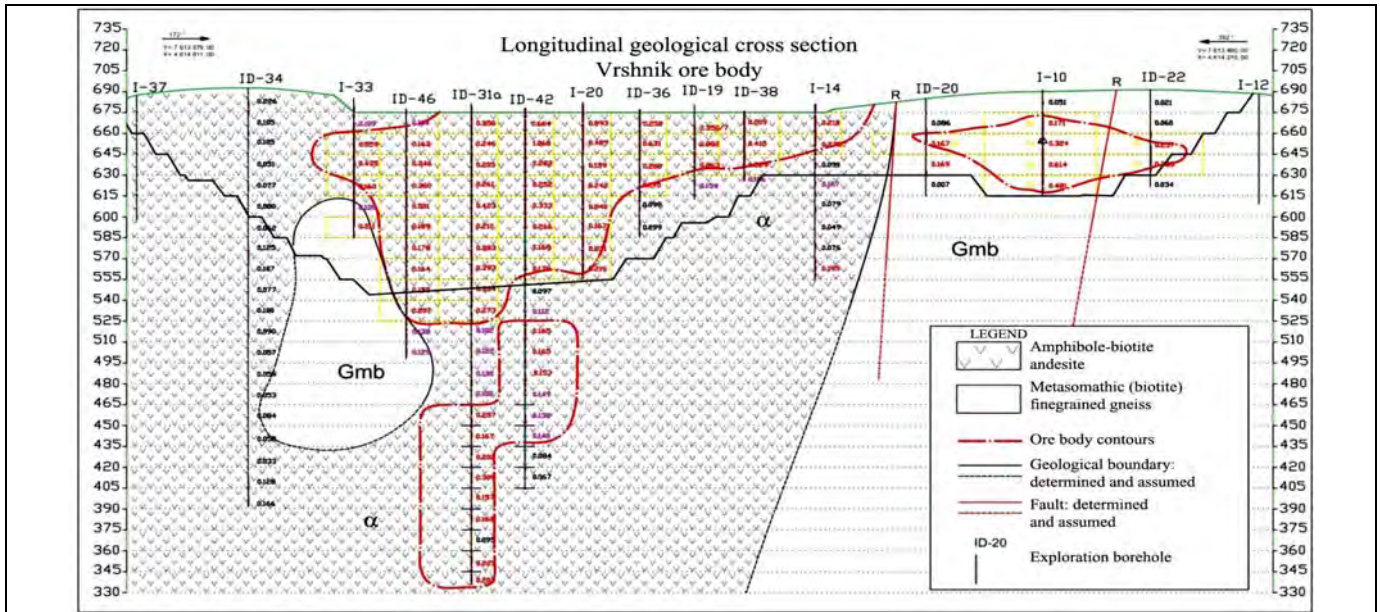


Fig. 3 Situation map of final contours of inner waste dump within the open pit Vrshnik

As we already indicated earlier, based on the prepared technical documentation, and as the exploitation of ore from the northern part of the ore body Vrshnik proceeded, waste material from that area was gradually land filled in southern part (former open surface

mine of that part of the Vrshnik ore body) and effects were multiplied (Figure 4). By the data stated in the additional mining project there can be stored in a total volume of about 3 million tons of waste material.



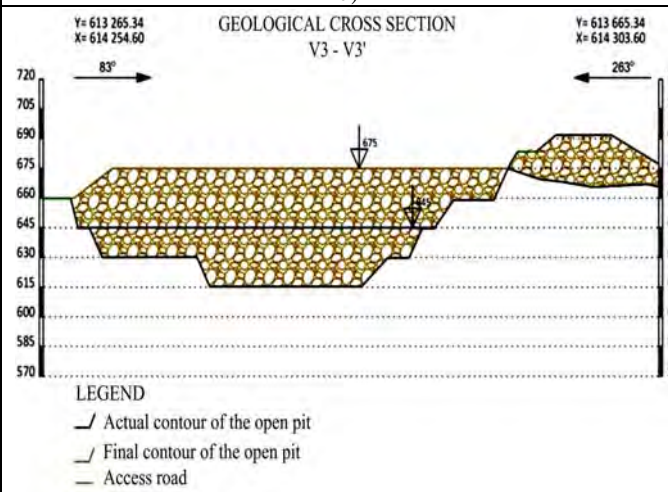
a)



b)



c)



d)



e)

Fig. 4. a) Longitudinal geological cross section through the Vršnik ore body (including northern open pit-left and southern open pit-right); b) Final exploitation level at the southern open pit-Vršnik ore body; c) Actual exploitation at the northern open pit of the Vršnik ore body; d) Geological cross section suggesting how the backfilling would be processed; e) Process of filling the inner waste dump within the open pit Vršnik (southern part)

CONCLUSION

From all mentioned above it can be concluded and emphasized that the ore body Vrsnik is a really positive example in the Buchim Mine where for a longer period of time successfully were completed geological research, in the most appropriate timing for the company initiated its exploitation, while

after phased completion of exploitation, first south and then the north part of the ore body Vrsnik, phase has started and re-cultivation of the area, ie in this case land fill with solid mine waste or overburden material mainly comes from the north side.

REFERENCES

- Filev, K. and Kostadinov, Gj., 2008. Results of exploration of the Vrsnik ore body, Buchim Mine. In: (Eds: Boev, B. & Serafimovski, T.) Proceedings of the First Congress of Geologists of the Republic of Macedonia, Macedonian Geological Society and University "Goce Delcev"-Stip, Ohrid, pp. 211-214 [in Macedonian]
- Cifliganec, V., 1993. Copper Mineralization in the Republic of Macedonia: Types and distribution patterns Faculty of Mining and Geology-Stip (Spec. Issue No1). 303 p.
- Serafimovski, T., 1990. Metallogeny of the Lece-Halkidiki zone. Doctoral thesis, Faculty of Mining and Geology, Stip, 390 p (in Macedonian)
- Serafimovski, T., 1993: Structural-metallogenetic features of the Lece-Chalkidiki zone: Types of deposits and zonation. Faculty of Mining and Geology-Stip, Special issue No. 2, 235 p.(in Macedonian)
- Serafimovski, T., Cifliganec, V., Jankovic, S., Boev, B., 1996. Genetic model of the Buchim Porphyry Copper Deposit, Republic of Macedonia. In: Plate tectonic aspects of the alpine metallogeny in the Carpatho-Balkan Region The University of Mining and Geology "St. Ivan Rilski", Sofia, pp. 63-74.