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# VERTICAL DISTRIBUTION OF CU IN OLD FLOTATION TAILING POND IN CITY OF BOR, (FIELD 1 AND FIELD 2)

**Vladan Marinković[1a], Miroslava Maksimović[1b], Milenko Jovanović[1c]**

[1]Mining and Metallurgy Institute Bor, Alberta Ajnštajna 1, 19210 Bor, Serbia

[1a] vladan.marinkovic@irmbor.co.rs, https://orcid.org/0000-0002-2974-9563,
[1b] miroslava.maksimovic@irmbor.co.rs, https://orcid.org/0000-0002-5001-238X,
[1c] milenko.jovanovic@irmbor.co.rs, https://orcid.org/0000-0002-6757-4143

## Abstract

*The Old Bor flotation tailing pond was formed in the period from 1933 up to 1987 when the Bor flotation plant delayed tailings in the Bor river valley.*

*Based on former prospecting works, the tailings consist mostly of alumosilicates, pyrite, quartz, kaolinite, sericite, until present copper minerals are covellite, chalcocite, chalcopyrite, bornite and enargite. Part of copper sulphides was transformed in sulphates (brochantite, chalcanthite) and copper oxides (tenorite).*

***Keywords**: The Old Bor flotation tailing pond, drilling, Cu content.*

## 1. INTRODUCTION

The Old Bor flotation tailing pond was formed in the period from 1933 up to 1987 when the Bor flotation plant delayed tailings in the Bor river valley. During this period the flotation pond was divided in to three fields each other connected with hydro cyclone sand dams. The field III was strewing with the open pit waste rocks and Bor heating plant ashes. So, for eventual future valuable components valorization stay the fields I and II of flotation tailing pond (Figure 1).

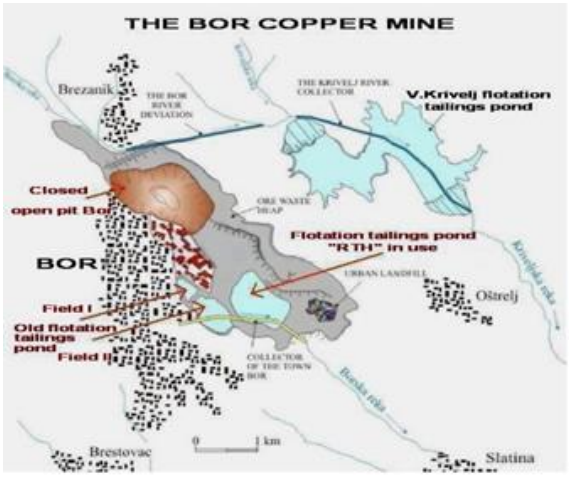



**Figure 1.** *The Bor copper mine layout*

The flotation tailing pond in Bor, named as the "Field 1", is located in the near vicinity (about 100 m) of the Bor railway station (former riverbed of the Bor river).

According to the literature data, dumping of flotation tailings in the north part of the Bor river was started by the French in 1933 until coming of the Germans in 1941, who continued with dumping of the tailings in its south part [1,2,3 i 4].

After the Second World War and restoration of the Copper mine Bor, the flotation tailings dumping was continued, so that today a part of the riverbed of the Bor river is filled up to the flotation dam in the south part, up to the elevation 357, and this part of dumped flotation tailings was named as the "Field 1".

In the south of the Field 1, downstream about 600 m, between the buildings of the Bor flotation plant and just north of the slaughterhouse, a dam of flotation sand was formed.

Width of the dam is about 30 m. at about 800 m from the dam 1 downstream was formed the dam 2. Between the dam 1 and dam 2, the flotation tailings was deposited so that the coarsest particles were separated and deposited on the banks of the Bor river and dams, while the central part of the space between the dams was filled with finer flotation tailings. The upstream dam 1 at the facility of the flotation plant was completed at the elevation of 372 m, while the downstream dam 2 was completed at the elevation of 373 m. In the area between the dam 1 and dam 2, the Field 2 was formed. The terrain on the Field 2 was flattened at an approximate elevation of 368 m.

As it was formerly known, this flotation tailing pond contains a significant percentage of copper, so it was many times the subject of detailed prospecting works that started in summer 1961.

Prospecting drillholes are set per square network 40x40, and 77 prospecting drill holes in total were developed, and in March 1963, the prospecting works were added with 10 new prospecting drill holes.

As the results, the prospecting works in all stages were relatively favourable and the prospecting works were continued in later period.

Based on former prospecting works, the tailings consist mostly of alumosilicates, pyrite, quartz, kaolinite, sericite, until present copper minerals are covellite, chalcocite, chalcopyrite, bornite and enargite. Part of copper sulphides was transformed in sulphates (brochantite, chalcanthite) and copper oxides (tenorite) [1,2,3 i 4].

## 2. COPPER DISTRIBUTION IN OLD BOR FLOTATION TAILING POND (FIELD 1 AND FIELD 2)

In contrast to deposits of metallic mineral raw materials that were formed naturally due to the action of physico-chemical processes, deposits of secondary (technogenic) mineral raw materials formed as a product of industrial processes. The old flotation tailings pond Bor (Field 1 and Field 2) is no exception.

The distribution of Cu in the flotation tailings pond was primarily influenced by the quality of the ore that was mined at a certain time, and then the place where the tailings were placed in the flotation tailings pond, as well as the passage of time since the formation of the tailing pond began in 1934.

As is known since the beginning of mining in Bor in 1903, there were many Cu deposits in exploitation. At first, the richest deposits were exploited so that the Cu content in the remaining deposits would gradually decrease. At the time when the disposal of the flotation tailings began in 1934, the Cu content in the ore ranged between

6,5% Cu and 7,0% Cu, but at the time when the disposal of the flotation tailings ended in 1987, this content fell below 1,5% Cu (Figure 2).

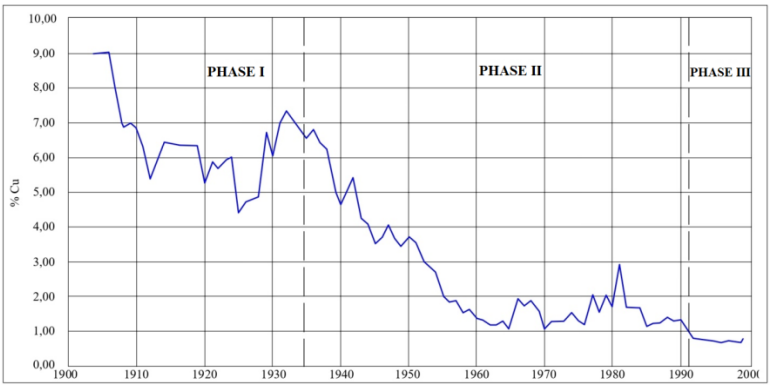



**Figure 2.** *Diagram of copper content in ore since the beginning of exploitation*

The content of copper in the ore is one of the main reasons for the increase in the content of Cu by depth, that is, for a much higher content in Field 1, which was formed first, than in Field 2, which was formed later.

Another reason for the increase in the Cu content per depth is the passage of time during which Cu was leached due to atmospheric action and its migration into the deeper parts of the tailings in the form of alkaline solutions, which is best represented by the Cu distribution diagrams in the drillholes shown in Figures 3 and 4.

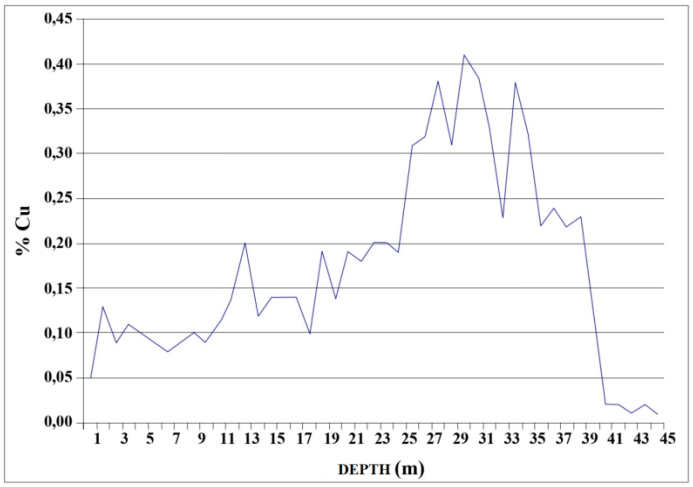



**Figure 3.** *Diagram of copper distribution by depth in drillhole B-34/2 drilled in Field 2*

As can be seen from the distribution diagram shown in Figure 3, the Cu content gradually increases with increasing of the depth. This gradual growth is noticeable up to 24 m of depth, where there is a transition from Field 2 to Field 1. After 24 m of depth, the Cu concentration jumps sharply, which can be explained by the significantly higher Cu content in the ore that was mined and floated during that time frame.

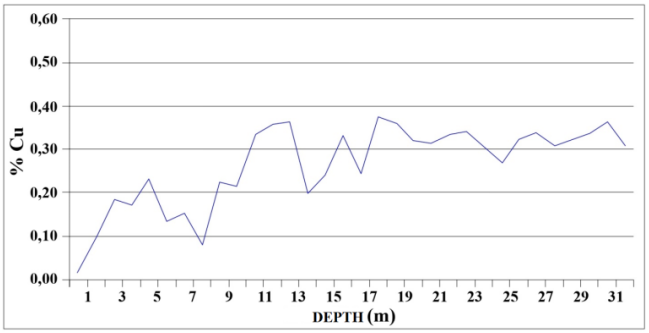



**Figure 4.** *Diagram of copper distribution by depth in drillhole OT/1-02 drilled in Field 1*

In the diagram shown in Figure 4, a gradual increase in the Cu content can be observed up to a depth of about 9 m, after which the Cu content becomes generally uniform. In this example, you can see Cu migration in depth due to leaching under the influence of rainwater.

## 3. CONCLUSION

The distribution of Cu in the case of flotation tailings is very important from the point of view of the future valorization of the metals found in them. In the case of the Old Bor flotation tailing pond (field 1 and field 2), previous geological investigations indicate that more than 24 million/t of tailings with an average copper content of 0,224%, a gold content of 0,385 g/t and a content of silver of 2,325 g/t present in this tailing pond.

Bearing in mind the increased demand for metals both in the EU and in the world, it becomes clear that mining waste, which includes flotation tailings, already represents a significant source, and very possibly in the near future, the backbone of metal production.

## ACKNOWLEDGEMENTS

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