

Review paper

NINETY YEARS OF MINING AND METALLURGY IN TREPČA-SEVER CONGLOMERATE (PART I)

DEVEDESET GODINA RUDARSTVA I METALURGIJE U KOMBINATU „TREPČA – SEVER“ (I-DEO)

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Received: March 15, 2017

Accepted: April 21, 2017

Abstract: Present company Trepča-Sever is formed by foreigners after the bombing of Serbia and Montenegro in 1999, and it is a part of former Trepča Conglomerate located in northern part of Kosovo and Metohija, namely in three municipalities: North Kosovska Mitrovica, Zvečan and Leposavić. Main office of Trepča Conglomerate was always in Zvečan, flotation of lead-zinc ore (in the period of 1930-1985), lead smelting and refining plants (founded in 1939), laboratory, Institute, electromechanical workshops and other ancillary services. In Leposavić flotation, ores of Kopaonik mines are processed, while financial and commercial services are located in the North Kosovska Mitrovica.

Keywords: Trepča, ore, reserves, production, processing, smelting plant, lead

Apstrakt: Sadašnje preduzeće „Trepča-Sever“ formirali su stranci posle bombardovanja Srbije i C.Gore 1999. godine, a predstavlja deo bivšeg Kombinata „Trepča“ koji se nalazi u severnom delu Kosova i Metohije, odnosno u tri opštine: severna Kos.Mitrovica, Zvečan i Leposavić. U Zvečanu je uvek bila direkcija Kombinata „Trepča“, flotacija olovno-cinkove rude (u periodu 1930-1985), Topionica i Rafinerija olova (osnovane 1939.), laboratorija, Institut, elektromašinske radionice i druge prateće službe. U flotaciji Leposavić prerađuju se rude kopaoničkih rudnika, a finansijske i komercijalne službe locirane su u severnoj Kos. Mitrovici.

Ključne reči: „Trepča“, ruda, rezerve, proizvodnja, prerada, topionica, olovo

1. INTRODUCTION

Trepča-Sever company has two industrial circles, i.e. in Zvečan and Leposavić. Main office of conglomerate, central laboratory, Institute, commercial, financial, transport and other ancillary services of conglomerate in the last 90 years were located in Zvečan and North Kosovska Mitrovica. During this period, key plants that formed, developed and raised

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Trepča Conglomerate were the following: Trepča mine in Stari Trg, flotation and smelting plant with a lead refinery in Zvečan.

Trepča mines in Stari Trg, as well as Kopaonik mines were active since Pre-Christian era, and power of Serbia under the Nemanjić dynasty has largely been based on a highly developed mining and metallurgy in this region. With the arrival of Turks, especially after migration of Serbs in 1690, the industry in the then Serbia gradually faded, and it was renewed only after more than two hundred years, i.e. after the First World War, in the new state of Yugoslavia.

The Englishmen have purchased the concessions in 1926, and formed the company on September 9, 1927 under the name Trepča Mines Limited, which existed under that name until the end of the Second World War (Janjušević, 1974). The ore from Trepča - Stari Trg mine was transported to Zvečan flotation by aerial tramway 6,350 m long, and then Zvečan railway station, power plants and related facilities were built as well. Flotation in Zvečan commenced its operations in 1930. Until April 20, 1941 it has processed 5,907,501 t of lead-zinc ore from which is obtained 652,483 t of lead concentrate with 78.73% Pb, 700,000 t of zinc concentrate with 50.15% Zn, 461,102 t of pyrite concentrate, and 6,708 t of copper concentrate (Nikolić 1999; Gluščević 1974). By 1973, Zvečan flotation processed 24,000,000 tons of ore with an average content of Pb+Zn of 11.9% (Janjušević, 1974).

Exploitation of Kopaonik mine Belo brdo commences in 1937, while Crnac mine is put into operation during 1967 (Janjušević, 1974).

For several reasons, a new flotation is built in Prvi Tunel near Stari Trg (now Trepča - South) which starts to work in 1985, while the old flotation in Zvečan and aerial tramway are dismantled.

New flotation in Leposavić processes the ores from Kopaonik mines (Belo Brdo, Crnac, Koporčić, Žuta Prla, Jelakce), and it started its operations in 1973.

Right next to flotation in Zvečan, in 1939 the lead smelting and refinery plants were built including six tank furnaces, chimney 122.5 m high, and three boilers per 280 t for refining lead concentrate, one cupellation furnace for the production of anode silver, filters and other ancillary facilities. Lead concentrate was transported to smelting plant directly from the flotation by rubber belt conveyor (Nikolić, 1999).

The annual capacity in 1940 amounted to 28,000 t of refined lead. In the next 40 years, production capacities are several times increased and modernized, and at the same time, supporting facilities were built, including facilities of social standard, restaurants, apartments, and similar.

With the development of Trepča, Kosovska Mitrovica with neighboring settlements and municipalities were developed as well. There were several first league members from Kosovska Mitrovica (kayak, football, basketball, etc.) in the former Yugoslavia. During

70-ies of the last century, Kosovska Mitrovica was among the cities of Yugoslavia with the highest standards.

During the war in 1999, KFOR representative ordered the termination of Trepča lead smelting plant in Zvečan, supposedly for environmental reasons. Even today smelting plant does not work, because Kosovo and Metohija are still occupied by international forces.

So far, in Trepča lead smelting and refining plants in Zvečan, about 3,300,000 t of refined lead and 4,130 t of refined silver and 3,300 t of refined bismuth were produced.

2. MINING IN THE PERIOD FROM 1927 TO 1945

The most significant deposits of lead, zinc, silver and iron, which are the largest in Serbia, are located within the mining region of Kopaonik. This area includes terrain between Željina at the north and Ajvali at the south. The terrain of this large mining area was exposed to a very complex volcanic and tectonic disturbances, so that the Kopaonik massif was given today's geological and mineralogical characteristics.

In the period between the two world wars, the only active mines in this area were Kopaonik and Trepča. In the area of Kopaonik there are numerous mineral occurrences of lead and zinc, which were, in the second half of the 20th century, the subject of investigations of many geologists, miners, archaeologists and geographers. Kopaonik and its peripheral parts are covered with numerous mineral occurrences and deposits of lead, zinc, iron and copper. The emergence of lead ore, as well as the visibility of old mining works, indicate that in many places the lead was exploited and melted, such as the cities: Kozja glava, Badanj, in the area of Rudnjak and Tiodže, near Jošanička Banja, Predol, Plana, on the heights of Belo Brdo, Gobela, Vojetin, and above Kosovska Mitrovica is the most important Serbian deposits of lead and zinc - Trepča.

These deposits are usually found in quartz areas filled with galena and other sulfides of metals. Based on the results of the analysis performed, galena in most cases contains a significant amount of silver and occasionally gold, which can be separated from lead.

♣ **Trepča – Stari Trg Mine** is located about 9 km northeast from Kosovska Mitrovica. Trepča ore region was known and active as early as the time of the medieval Serbian state, and later, when this area was ruled by the Turks. In the period of Austro-Turkish war (1683 - 1689) the mine was destroyed, so that any serious mining activity was ceased. After the Balkan wars, Nikola Pašić got concession on Kopaonik and Trepča mines. By the beginning of World War I and during the war in these concessions nothing serious was done.

After World War I, British company *Selection Trust Company* was interested in concessions owned by R. Pašić (son of N. Pašić). In 1925, for assessing the true value of the concession, the Englishmen engaged F. Tućan, Professor of mineralogy from Zagreb. After review of deposits and analysis, Professor F. Tućan concluded that "Trepča is a grandiose

deposits of argentiferous, lead, auriferous, zinc and copper ores, and that no amount that is invested in its exploitation is too high" (Tućan, 1931).

After these first positive reports on Trepča deposits, *Selection Trust Company* in early 1926, sent one of its team of experts to explore the deposits. Following its positive report, the company purchased concession rights of the heir of Nikola Pašić. Some time later, the concession right in the area of Kopaonik was purchased as well. In order to takeover all the rights, during 1927, *Selection Trust Company* have established two separate companies: *Trepča Mines Limited* and *Kopaonik Mines Limited*. In 1938, concessions on Kopaonik was merged with Trepča concession, so that Vojetin mine in Kopaonik went under the management of *Trepča Mines Limited*. Before World War II, all the company's mines in Serbia were under the management of Trepča.

During 1926 the company *Trepča Mines Limited* has started exploration works by undermining the elevation K-830 m. Exploration works were intensively continued, so that in 1928, the reserves of 500,000 tons of ore were proven, and already in 1930 the mining reserves in Trepča amounted to 1,750,000 t of ore. Thanks to the terrain configuration, the upper parts of the deposits are opened by adits at the elevations 865, 795 and 760 m, which were in the early years used for the purposes of exploitation as well (Figure 1) (Glušćević 1974; Trajković 2010).

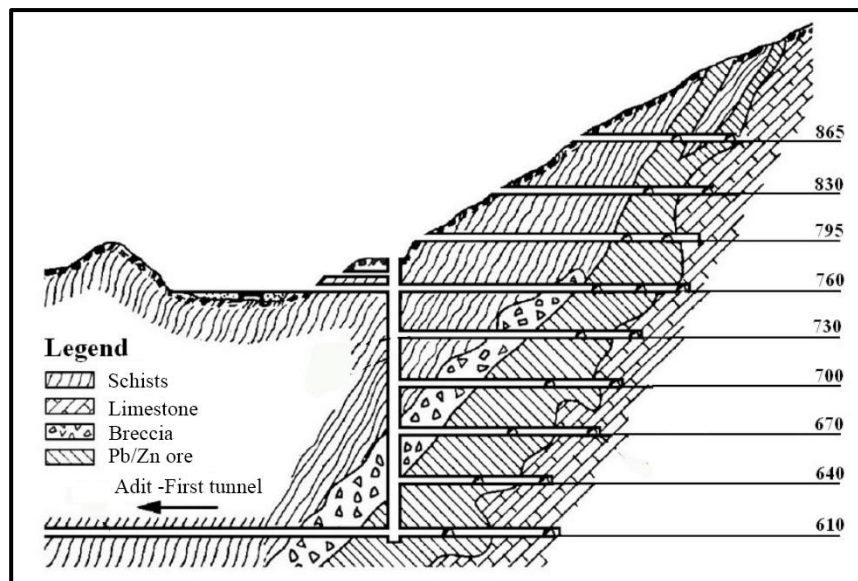


Figure 1 The vertical section through the ore body at the opening of upper parts of deposits

Further exploratory works have found that the deposits are extended to the depth, which required the performance of an adit 2,660 m long at the lowest elevation of 610 m. By creating Trepča adit (from Prvi Tunnel settlement) at an elevation of 610 m, dewatering, transport of materials and workers were facilitated. For better ventilation and other needs, by

creating one mine shaft, Trepča adit was connected with horizon at elevation 760 m. Further exploratory borings were performed from an adit at the elevation 610 m, whereby it was noted that the ore body extends at least 300 m below an adit at a level of 610 m. The opening of the lower area of the deposits is carried out by slopes at an angle of 40°, whereby three more horizons were opened at elevations of 545, 485 and 435 m.

To transport the ore from the bunker on the Trepča mine, an aerial tramway was made with a length of 6,350 m, which transported the ore to flotation in Zvečan. For the purpose of provision of electricity required for operation of flotation, a power plant was built in Zvečan, which used lignite from Obilić as fuel.

By construction of the mine and related facilities, Trepča stabilizes its production, and such steady production lasts until 1941 when the mine was taken over by German company Mansfeld A.G. from Eisleben, and managed by this company until the end of the Second World War.

Production of ore and average content of metal in the ore for the period from 1930 to 1944 is shown in Table 1 (Jovanović, 2008).

After the liberation, Trepča-Stari Trg mine becomes the property of the state and takes one of the leading places in the plans of the new Yugoslavia when it comes to production and processing of lead, zinc, precious and rare metals.

Table 1 Ore production for the period from 1930 to 1944

| Year | Ore produced, (t) | Average content of metal in the ore | | | |
|----------------|-------------------|-------------------------------------|-------------|----------------|---------------|
| | | Lead, % | Zinc, % | Silver, g/t | Bismuth, % |
| 1930/31 | 274.218 | 12,30 | 7,51 | 146,808 | - |
| 1931/32 | 397.963 | 9,67 | 8,83 | 113,527 | - |
| 1932/33 | 335.869 | 8,91 | 8,66 | 93,216 | - |
| 1933/34 | 589.081 | 8,85 | 8,56 | 92,006 | - |
| 1934/35 | 597.188 | 9,06 | 8,62 | 92.822 | - |
| 1935/36 | 588.594 | 8,93 | 7,74 | 96,307 | 0,0043 |
| 1936/37 | 638.729 | 9,12 | 6,08 | 102,303 | 0,0073 |
| 1937/38 | 655.892 | 9,08 | 5,97 | 106,063 | 0,0083 |
| 1938/39 | 616.073 | 8,73 | 4,91 | 111,664 | 0,0117 |
| 1940-Nov. 1941 | 595.211 | 7,99 | 3,42 | 115.492 | 0,0165 |
| 1942 | 344.459 | 7,33 | 3,19 | 108.180 | 0,0152 |
| 1943 | 394.402 | 7,30 | 2,57 | 111,960 | 0,0171 |
| 1944 | 272.031 | 7,46 | 2,63 | 108.600 | 0,0162 |
| Total: | 7.198.470 | 8,796 | 6,01 | 106,900 | 0,0119 |

Belo Brdo Mine – is situated in the region of the central part of Kopaonik mountain, in the space below the mountain peak Vojetin (elevation 1561 m), at 3.5 km south-east of Suvo

Rudište (elevation 2017 m). Belo Brdo deposit and mine is in exploitation since 1937, with shorter or longer interruptions, to this day.

In 1927 exploratory works have been initiated in this area, and completed in 1934. Until 1934 in Kopaonik concession have been identified 614,000 tons of ore, with an average of 8.9% Pb, 6.3% Zn and 120 g Ag/t (Author group, 1979).

Belo Brdo mine is formed in reef limestone, and only partially in Triassic sediments. The ore bodies are located at the contact of limestone and Triassic sediments, in the form of lenses and steep columns. The surface of ore bodies ranges from 100 to 2,000 m². Among ore minerals, the most significant are sphalerite, galena, pyrite, arsenopyrite in smaller quantities, siderite, rhodochrosite, native gold and others.

The point of mine opening is surrounded by many old works that are grouped around Caričina reka, Vojetin, Kamenica, Belo brdo, Marušić and Zaplanina. A privilege for this area was owned by Nikola Pašić until it was bought by *Selection Trust Company*. After taking over the Kopaonik concession, the Englishmen have established in Kopaonik a branch called *Kopaonik Mines Limited*.

In 1936, work began on the opening of the mine in the vicinity of Belo Brdo, from elevation 984 m by an adit in the length of 2.710 m. An adit from the village Belo Brdo was connected with with an adit executed from the northeast side of Vojetin hill, near village Zaplanina by the means of blind shaft. Thanks to good organization and well-paid workers, an adit with a length of 2,710 m, is made in 13.5 months, which was by the then conditions, a very big success. Table 2 shows the progress during adit driving by months.

Table 2 Progress during adit driving

| Year and month | Progress m/month | Year and month | Progress m/month | Year and month | Progress m/month |
|----------------|------------------|----------------|------------------|------------------|------------------|
| 1936 | | 1936 | | 1937 | |
| January | 118,0 | July | 203,0 | January | 260,0 |
| February | 130,0 | August | 250,0 | February | 77,0 |
| March | 152,0 | September | 215,0 | Works on adit | |
| April | 170,0 | October | 230,0 | completed in mid | |
| May | 190,0 | November | 210,0 | February 1937 | |
| June | 210,0 | December | 295,0 | | |

The British company *Kopaonik Mines Limited*, during the phase of preparation for the opening of mine, purchased and installed the most modern mining equipment. From mining plant an aerial tramway with a length of 10.5 km was built, which was used to transport the ore from the mine to railway station in Lešak, where it was transported to flotation in Zvečan

by railway. For the purpose of supplying the mine with electric current, hydropower plant was built in Belo Brdo.

The mine was taken from the Englishmen in 1941 by German company Mansfeld A.G. from Eisleben. The mine works for a very short period of time, because fightings of the rebels disabled the mine and destroyed electrical power station, so that, for these reasons, the mine had to suspend further production.

After World War II, the works were restored in the area of Belo Brdo, and new company established under the name Work Organization Rudnici and Kopaonik flotation comprising of the following mines: Belo brdo, Jelakce, Žuta Prlina, Koporić and Crnac with administration in Leposavić.

Flotation plant – after the construction of ancillary facilities at Stari Trg mine, flotation is built in Zvečan as well. Commencement of flotation work is related to the end of 1930. Flotation was constantly increasing the production of lead and zinc concentrates. Since 1934 there was a sharp increase in the production of pyrite concentrate, and since 1936 the production of copper concentrate also started, containing a low percentage of copper (14.58%), while it contained more iron (34.47%) and sulfur (33.64%). The Table 3 presents the production of concentrate in flotation for the period from 1930/31 to February 1941.

Table 3 Production of concentrate in flotation for the period from 1930/31 to February 1941

| Year | Lead concentrate | | Zinc concentrate | | Pyrite concent., (t) | Copper concent., (t) |
|---------------------|------------------|-----------|------------------|-----------|----------------------------|-------------------------|
| | Quantity, (t) | % of lead | Quantity, (t) | % of lead | | |
| 1930/31 | 43.587 | 75,29 | 33.773 | 50,22 | 256 | - |
| 1931/32 | 48.566 | 76,27 | 62.192 | 50,24 | 6.302 | - |
| 1932/33 | 58.852 | 77,51 | 83.297 | 50,40 | 892 | - |
| 1933/34 | 63.027 | 79,23 | 92.166 | 50,41 | 9.390 | - |
| 1934/35 | 64.874 | 79,91 | 94.146 | 50,08 | 39.340 | - |
| 1935/36 | 63.131 | 79,52 | 82.234 | 50,02 | 57.037 | - |
| 1936/37 | 70.486 | 79,39 | 69.863 | 50,02 | 70.851 | - |
| 1937/38 | 72.989 | 79,23 | 70.120 | 49,79 | 100.027 | 1.863 |
| 1398/39 | 65.561 | 79,47 | 53.182 | 50,16 | 85.072 | 2.101 |
| 1939/40 | 73.803 | 79,39 | 44.100 | 49,91 | 74.964 | 2.508 |
| X.1940 – II.1941 | 25.462 | 79,94 | 14.730 | 80,03 | 16.971 | 236 |
| Total: | 650.338 | 78,73 | 699.803 | 50,15 | 461.102 | 6.708 |

During World War II, the flotation in Zvečan is also not working at full capacity. Flotation capacity amounted to 800,000 tons of ore per year, and it has worked at 50% capacity. Therefore, occasionally, primarily due to energy savings, flotation was stopped for two-three days, which was reflected in the operation of smelting plant. The total production of flotation and smelting plant is shown in Table 4.

Table 4 Total production of flotation and smelting plant

| Type of product | Production period | | | |
|------------------------|-------------------|--------|--------|--------|
| | 1941 | 1942 | 1943 | 1944 |
| Lead concentrate (t) | 27.780 | 30.614 | 35.305 | 24.160 |
| Zinc concentrate (t) | 18.329 | 18.107 | 16.888 | 10.953 |
| Copper concentrate (t) | 542 | 907 | 1.376 | 868 |
| Pyrites (t) | 41.120 | 45.006 | 45.558 | 26.417 |
| Pyrrhotite (t) | - | - | 6.738 | 4.176 |
| Lead | 11.325 | 18.382 | 19.220 | 8.760 |
| Silver, (kg) | 13.461 | 6.340 | - | 1.258 |
| Bismuth, (kg) | 7.939 | 45.133 | 18.957 | 9.257 |

2.1. Lead and silver metallurgy

The Yugoslav government, by two decrees, allowed the Englishmen on June 30, 1938 to build lead smelting and refinery plants in Zvečan, and Englishmen accepted the conditions of Government on July 15, 1938, and commenced the construction (Author group, 1979). First tank furnace commenced its operations in December 21, 1939, and ending with February 1941, it produced 17,003 t of refined lead (Jovanović, 2008).

After the takeover of Trepča from Englishmen and occupation in 1941, the Germans also continued to build and expand the metallurgical capacities during the war, as follows:

- they erected two more boilers with capacity 280 t, two cupellation furnaces, small shaft furnace cross section 0,9 m² in 1942, which has significantly increased the capacity (Janjušević 1974; Đokić 1977).

In these first five (pre-war and war) years, Trepča lead metallurgy in Zvečan produced 76,200 t of refined lead, 22.700 kg of silver anode. In the next two years (1945 and 1946), another 31,145 t of refined lead and 10,730 kg of silver anode was produced (Trajković 2010; Đokić 1977).

At this time, the ore from Stari Trg contained a 8 - 10% Pb, in 1931 even 12.6% Pb (Nikolić, 1999), so the lead concentrates obtained in flotation in Zvečan and processed in lead metallurgy in Zvečan by direct melting in tank furnaces, contained over 80% of lead. In addition to concentrates, dust and limestone, the batch of tank furnaces contained about 15% of fine coke as well.

Since that in lead minerals, including the lead concentrates, there are silver, gold, bismuth, copper, antimony, accompanying useful metals, therefore the development of metallurgy of lead implies the increase in production not only of lead, but also present accompanying metals.

2.2 Working conditions in mines

Difficult working conditions in Trepča - Stari Trg mine, have caused the resistance and homogenization of the miners. Very important and famous are miners' strikes in Stari Trg in 1936 and 1939, due to which the ore production was lower in those years.

At the beginning of World War II, as a resistance against the German occupiers, workers of Trepča tore down a pillar of the aerial tramway (Stari Trg - Zvečan) in July 30, 1941, and another one near the village of Orahovo in September 2, 1941, and also performed diversion in Belo Brdo in October 2, 1941. Nine former employees of Trepča were declared as national heroes, such as: Sava Kovačević, Vladimir Četković, Ibrahim Perviz, Rade Milićević, Milun Ivanović, Bogoljub Čukić, Nikola Bubalo, Miloje Zakić i Petar Vojvodić. Following the decision of the Central Committee of the Communist Party of Yugoslavia (Tomo Žarić, *Metohijske vatre* - monograph) during 1941, the partisan resistance against the occupiers in Kosmet is not needed, it's early, so the patriots, workers of Trepča joined the partisans in Kraljevo district.

As seen from the Table 1, the ore production during the war was about 40% lower than during previous years.

3. CONCLUSION

Due to importance of the topic and the volume of material that we have, the entire paper will be divided into three parts: the first part will treat the period of the mine and processing plant from 1927 to 1945, the second part from 1945 to 1977, and the third part from 1977 to 1999 and later.

The first part of this paper treated the commencement of the exploration of Trepča - Stari Trg and Belo Brdo mines. The ore reserves of both mines were identified, the concessions for the right of exploitation were bought. The Englishmen established a company *Selection Trust Company* in early 1926, which subsequently, once reserves were proven, took over all rights, and during 1927 established two separate companies: *Trepča Mines Limited* and *Kopaonik Mines Limited*. The concession on Kopaonik in 1938 was merged with concession Trepča, so that Belo Brdo mine on Kopaonik was administered by the company *Trepča Mines Limited*.

By construction of facilities for opening and preparation for exploitation of both Trepča-Stari Trg and Belo Brdo mines, the construction of supporting facilities for the processing of lead-zinc ores have commenced, such as the production of flotation in 1930 in Zvečan, construction of aerial tramway Stari Trg - Zvečan with a length of 6.35 km, also aerial tramway Belo Brdo-Lešak in the length of 10.5 km, and for the needs of supplying electrical energy, the power plant was built in Zvečan. In 1938, the construction of the lead smelting and refinery plants commenced in Zvečan. First tank furnace began operation in late 1939, then two boilers with capacity of 280 t were constructed, a small shaft furnace cross-section of 0.9 m². Until 1941, in flotation 5,907,501 t of lead-zinc ore were processed, from which

is obtained 652,483 t of lead concentrate with a content of 78.73% Pb, 700,000 tons of zinc concentrate with 50.15% Zn and 6,708 t of copper concentrate.

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