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LOST METALS THROUGH PROCESSING POLYMINERAL LEAD AND ZINC IN THE FLOTATION STAN TERG, TREPÇA

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ABSTRACT

In this paper we presented lost metal through mineral processing poly-mineral lead-zinc in concentrator Stan Terg (Tuneli pare) in Trepça - Kosovo. Reasonable for studying this issue is losing metal while processing minerals in practice on flow of Stan Terg flotation. Research in lost metals has theoretical but more practical importance where we need this mines lead zinc with flotation seven year ago restarting production processing. On this base we reach in conclusion for optimal choose processing for decrease louts metal along processing mineral.

Keywords: lead, zinc, processing, lost metals, flotation, ore deposit, Trepça.

INTRODUCTION

Kosovo is known for self potential mineralization, enough interesting occurrences and polymineral deposits of Pb, Zn and Ag in the South and South East part of Trepça Mineral Belt (Hyseni, Large 2003 and 2010). The important ore fields mineralization locations are: Trepça, Hajvali-Badovc-Kizhnica, Artana and Cernac etc (Figure-1). According to current geological data for this mineral belt, the presence of lots of mineralized occurrence suggests mineralization potential that can be used for economical interest, not only for today but for future of Pb, Zn and Ag mineralization (Hyseni, Durmishaj; 2007 and Hyseni; 2010).

DEPOSITS OF LEAD AND ZINC ORES

The Stan Terg Pb, Zn and Ag deposit is located within the Vardar zone of the Trepça mineral belt, consisting of Palaeozoic basement rocks, Jurassic-Cretaceous sediments and rocks of ophiolitic affinities. These rock units have been foliated during the early Tertiary. During the late Tertiary, the Balkan area was heavily affected by plutonic, sub-volcanic and volcanic processes with the deposition of mainly granodioritic magmas at depth, andesite, dacites and quartz latite flows and dykes as well as pyroclastic rocks, mostly tuffs, lapilli tuffs and ignimbrites. Structurally, the Stan Terg deposit is situated in the centre of the so called Trepça Mineral Belt. This tectonic zone, within which the Balkan Pb, Zn, Ag and Au deposits are located, is marked by very strong lineaments and a fracture zone striking NW-SE. Thanks to knowledge in the last 40 years on the mineralogy, petrography, genesis and pre-genesis characteristics in the Pb and Zn deposits in Stan Terg, we distinguish four ore zone: skarn, sulphide, sulphide-olgonite and the olgonite zone.

MINERALOGICAL DEPOSIT STAN TERG

In the mineral deposit, 51 minerals have been determined so far. The formation of minerals associations in deposit is closely related to chemical–physical character of the environment where the mineral are deposited.

The main mineral deposits in Trepça includes: sphalerite, galena, pyrites, and pyrrhotite. The amount of ore in the minerals is: pyrites 24%, pyrrhotite 35%, galena 9% and sphalerite 7% silicate minerals, carbonates Fe-Mn 20% and other compounds 5% (Simič; 1965). The mineral association and physico-chemical conditions have classificate four stages of mineralization in mineral deposit. Mineralogical deposits of Pb-Zn content these minerals: FeS_2, ZnS, PbS, $FeAsS_2$, FeS_2 (marcasite), $Fe_{1-x}S$, $CuFeS_2$, 2PbS Cu_2S Sb_2S_3, 5PbS $2Sb_2S_3$, 4PbS FeS 3 Sb_2S_3, $CuAsS_{3-4}$, $CuFe_2S_3$, 4(Fe, Cu) S-3(Mg, Al) $(OH)_2$, Cu_2FeSnS_4, Cu_5FeS_4, Cu_2S, and CuS. Accessory mineral are: cerusite, anglesite, malachite, melanterite, gypsum, limonite, and waste mineral quartz, calcite, ankerite, and olgonite (Smejkal; 1960). Of all these, the minerals which have higher intensity are: pyrhotite, sphalerite, galena, chalcopyrite and pyrites, while extensity source of minerals are: pyrhotite, chalcopyrite, sphalerite, arsenopyrite, galena and pyrites. According to data classifications, rich ore mineral deposits are: Pb - 5.10%, Zn - 3.17% and Ag-80.5 gr/t.

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Figure-1. Map of Kosovo showing TREPÇA mines concentrators and final processing facilities.

TECHNOLOGICAL PROCESS OF FLOTATION

Ore from the mine is transported by tram (1) a carrying composition of 80-100 t / h (Figure-2). Primary crusher of ores has capacity of 600 m^3 / h and the degree of disaggregation is 600/120mm (2). Plate provider (Q = 215-650 m^3 / h) and tape transporter minerals in the bunker slope bears (3) dedicated to storage of the crushed ore in the first instance. The capacity of this bunker is 2000 t with steep ore tape is transferred to crusher grinder cone (Q=170-340 m^3/ h) with 120/30 mm reduction.

A sieve vibration (4) with inertia, has capacity of 500 t / h, unload cargo in secondary crusher. Tertiary crusher (6) with capacity Q = 160-220 m^3 / h, breaks down the mines - 15 mm. The mineral on a scale reduce to 30 / (5-15).

The crushed ore carrier tape is transferred to the process of separate definitive sieves sector (7) in separator vibration (Q = 430t / h). By production sieves sector represents the crushed ore definitely tape 12mm and transferred to the crushed ore bunker (9) and sieves on product the process returns to tertiary crumbling (Figure-2). In the bar before the ore bunker crushed a record amount of automatic scales that crushed ore on product finally instead, download this tape is put on automatic equipment for receiving and shortening the ore sample. Recipient sample (8) shared 1% of the flow of ore. The sample is divided and represented for determining the composition of metals in ore entrance and serves for daily calculating
In more between the mines and flotation.

Removal of ore from the bunker becomes the donor in the form of "star" Last strip before entering the mills is equipped with automatic scales. Ore crusher performs on a stage and ends in farm fields working in closed cycle spiral classifier. Classifier flow will gain ground with the composition of ore over 65 % of the class - 0.074mm (or -200 meshes). Ore milling sector consists of two parallel sections with each ore processing capacity of 500 t / h. Water in the process enters the entrance of the mill together with minerals and if necessary can be added at the entrance of classifier. Classifier sand load in the form of circular back at the entrance of the grinding mill for re. Leak classifier treated following the flotation process

Flotation process of Pb minerals is carried out in two identical parallel sections, each with a capacity of incoming ore processing in 1764t/day. Pulp-containing 35-42% solid phase, with free fall brought in conditioner (11) that has volume 22m^3. Pulp conditioning lasts for 10 min. Flotation process base and controller flotation double grade flotation made in mechanical pneumo cleaning. The three degrees and cleaning controller flotation a scale performed on machines of flotation. Conditioned pulp to decline flotation process entered base flotation. Concentrate based flotation sent to three-scales cleaning. After sampling, cleaned final concentrate Pb, is transferred by automatic pumping system to the process of decantation and filtration (15).

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The flow of treated base flotation flotation's process controller double grade.

Concentrate flotation second level along with flow controller turns on the air conditioner cleaners, and the flow of the second degree flotation presents definitive tailings forming minerals such as Pb and conditioning three-scales sent prior to the cycle of flotation the ore of Zn (12). Completion time of flotation of the mineral Pb is 16min. Flotation technological scheme of the Zn ore is identical to that of Pb flotation. Pulp at the entrance of the Zn flotation process has a phase composition of 33-38% solid phase. Duration of flotation process of this mineral is 20 min. Concentrate after cleaning and automatic sampling is sent to decantation filtering, whereas the flow as the second flotations controls sterile flotation defenitiv the process of sent Zn concentration magnetic cycle pyrrhotite. (13). If the market does not claim to pyrrhotite the entire the all amount is transferred by pumps tailings as mine Stan Terg for hydro filling. Magnetic Concentration $Fe_{1-x}S$ had done in two sections identical processors each with a capacity of 1764 t/day. Tailings from the section of the concentration of Zn (which has 29-33 % solid phase), first classified in hydro cyclone. (Fraction easy by 14 %) solid, sterile pumps transmitted as definitive of the tailings flotation. Hydro cyclone sand separator using a proportional split into two equal flows - the supply of two parallel batteries Magnetic separators in the context of one department. In a battery there are sets of three magnetic separators tumbler. Tumblers are permanent magnets and the average intensity of the magnetic field is 1200 gauss. Flotation process concentrate is transferred to pyrrhotite decantation process and filtration, and tailings sent flotation process of mineral-pyrites FeS_2. Here is a hydraulic transmission opportunity of this material at the mine for the needs of hydro filling, in the case when price is not commercially profitable pyrites. Flotation process of pyrites (14) performed in two identical sections, each with a capacity of processing 1764 / day. Base flotation and double grade controller flotation are done in mechanical machines. Clean flotation process on three-scale and cleaner's flotation controller is performed in flotation mechanical machines. The flow of magnetic separation with composition solid composition 37-40%, firstly decantation in two scales for 20 min time extension. From conditioners the pulp is brought in the process of base flotation. The concentrate this flotation is transferred in the process of cleaning three-tier scale and controller cleaning one-tier. Clean concentrate represents the definitive concentrate of pyrites which is further decanted and filtered. Flotation flow controller flotation base goes two levels lower. Flotation tailings the controller and joins cleaners and pumping system, transported in the preparation of hydro filling station (160 or alternatively may be transferred to landfill damps.

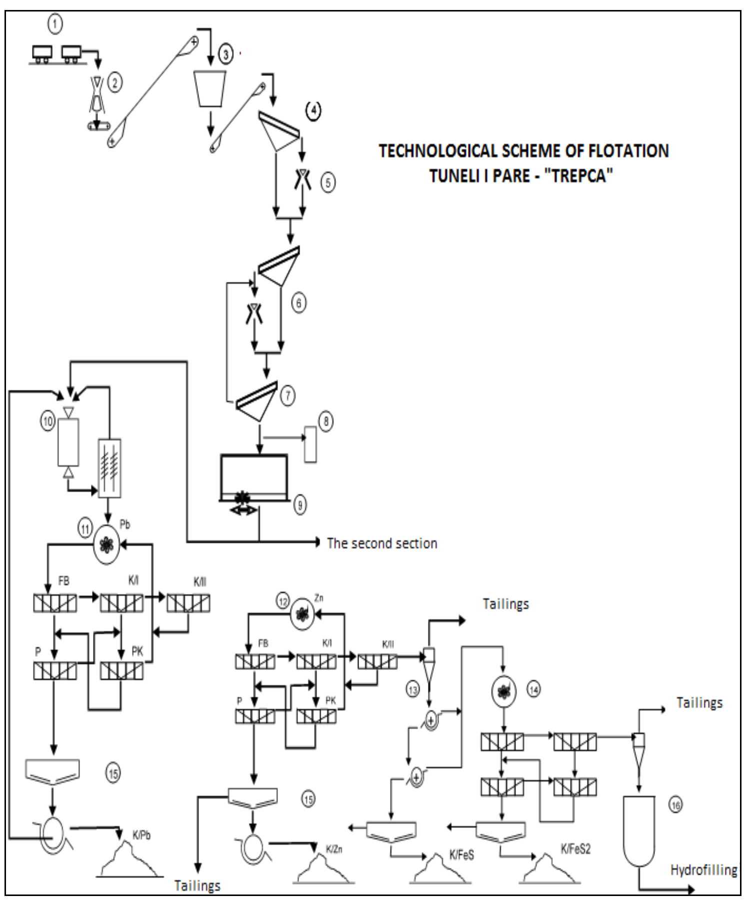

Figure 2.

Table-1.

Pb ore	**Zn ore**	**Pb** (K/Pb)	**Zn** (K/pb)	**Ag** (K/Pb)	**Pb** (K/Zn)	**Zn** (K/Zn)	**Pb tailing**	**Zn tailing**
4.02	4.04	79.66	0.53	0.00	1.02	51.23	0.44	0.37
3.95	3.52	73.67	0.60	0.00	0.23	50.00	0.23	0.39
3.91	3.64	74.10	0.87	0.00	1.22	51.33	0.28	0.45
3.74	3.33	72.87	0.22	0.00	0.00	49.16	0.39	0.52
3.99	3.95	75.35	0.28	0.00	0.00	50.39	0.40	0.42
5.35	4.10	75.82	1.21	0.00	1.84	50.38	0.53	0.44
3.66	3.94	73.74	0.25	0.00	1.85	50.34	0.25	0.39
2.96	2.96	72.61	0.27	0.00	0.61	47.82	0.36	0.47
2.22	2.22	69.48	1.40	0.00	0.60	48.42	0.21	0.38
5.34	3.86	75.30	1.21	0.00	0.60	49.81	0.33	0.95
4.16	4.35	75.42	0.78	0.00	0.74	50.38	0.32	0.60
2.28	1.96	72.59	1.74	0.00	0.68	46.52	0.22	0.42

Average	3.80	3.49	0.00	74.22	0.78	0.00	0.78	49.65	0.00	0.33	0.48	0.00
Standard deviation	0.98	0.75	0.00	2.45	0.51	0.00	0.61	1.43	0.00	0.10	0.16	0.00
N	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Confidentiality per.	0.55	0.43	0.00	1.39	0.29	0.00	0.35	0.81	0.00	0.06	0.09	0.00
Low level	3.25	3.06	0.00	72.83	0.49	0.00	0.44	48.84	0.00	0.27	0.39	0.00
Medium level	3.80	3.49	0.00	74.22	0.78	0.00	0.78	49.65	0.00	0.33	0.48	0.00
High level	4.35	3.92	0.00	75.60	1.07	0.00	1.13	50.46	0.00	0.39	0.57	0.00

According to the results presented above for the production year concentrator Trepça (Tuneli i pare), the degree of exploitation (Table-1) of lead and zinc metal was: Pb - 91.32%, Zn - 86.25%, while the average quality of concentrates is: Pb - 74.22% and Zn - 49.65 % (Figures 3 and 4). Output of Pb and Zn concentrations in the past also had values in these limits or even higher. Production a year in concentrate average of Fe is 5.87 % of Pb and Zn in concentrate Fe content is very high 12.91% (Figure-5). Metal losses of Pb and Zn in the flow are presented in Figure-6. The average loss of Pb and Zn metal for a production in concentrator years (for 2010) are: Pb - 0.33% and Zn - 0.48% and it shows the significant losses of metal in sterile. Except lead and zinc metals also lose in tailing accompanying elements associated with lead and zinc. With increasing depth of deposit (from level VII-X), increases the participation of pyrites, pyrrhotite minerals, and galena sphalerite (marmatite) regulations do not show the distribution with increasing depth in the mineral deposit. Content of elements that increase while depth increases are Ag, In, Ga, Cu, As, Ni, Co, and Cd whereas decreased these elements, Tl, Se, Sb, Sn, Bi, Mn (Kepuska. H. 1998, Hyseni. S. 2011).

CONCLUSIONS AND RESULTS

According to the results the rate of loss of Pb and Zn metals is too high in production. Medium change flows of Pb and Zn monthly for a year in tailing are 0.33 % Pb and Zn it is 0.48%. This amount of flow of Pb and Zn metals wash flotation is quite large losses in the process. It is proposed that except for improving the technological process in flotation, the mineral composition of the mineral deposit mineralogy's should be taken into account. Ore which we now exploitation in deposit (the depth of deposit level VII-X and beyond), is mainly pyrrhotite, pyrite, galena and sphalerite (marmatite). The content of Fe is very high in minerals and concentrates average of 12.91% Zn. This high content of Zn comes not only from pyrite, but also pyrrhotite, sphalerite (type of marmatite) type affecting flotation process but also the high participation of Fe to reduce the value of concentrate here. Low level of ore exploitation which contains many other economic value elements (Ag, In, Ga, Cu, As, Ni, Co, Tl, Se, Sb, Sn, Bi) reduces the value concentrate. Based on the results achieved from ore, concentrates and tailings (sterile), we can conclude that the concentration is not satisfactory. Therefore, we must make efforts to improve the technological parameters. Especially it is important to spend efforts to computerize the technological process and in addition, focus on receiving Pb and Zn concentrate to get pyrite and pyrrhotite.

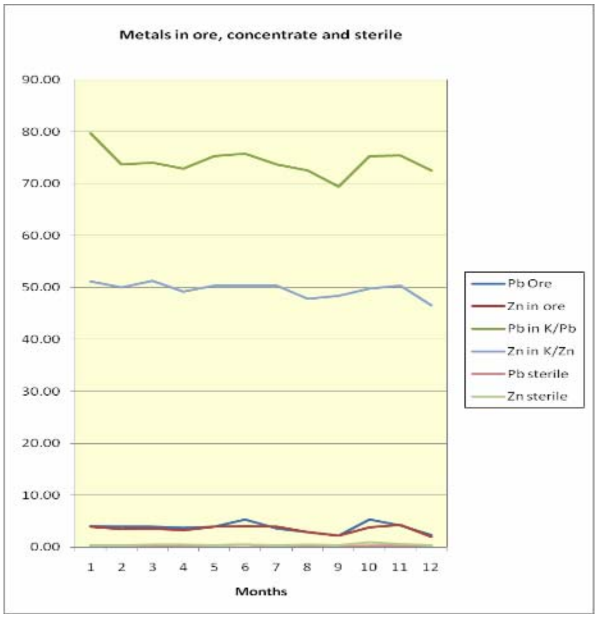

Figure-3.

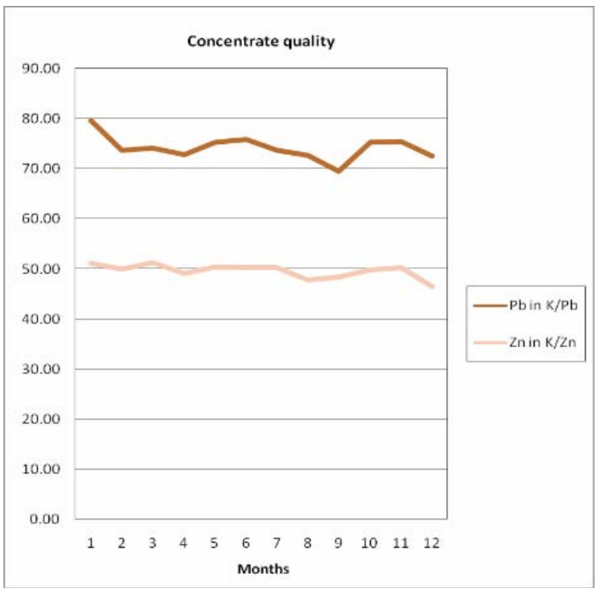

Figure-4.

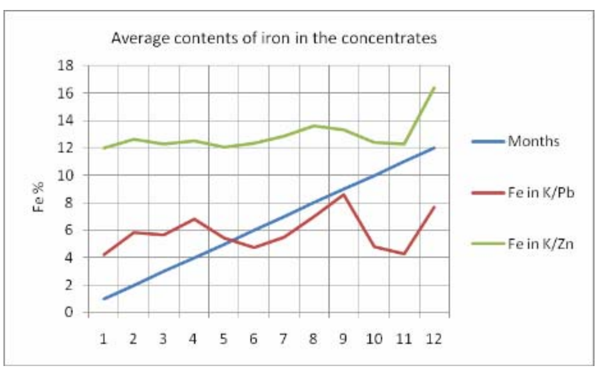

Figure-5.

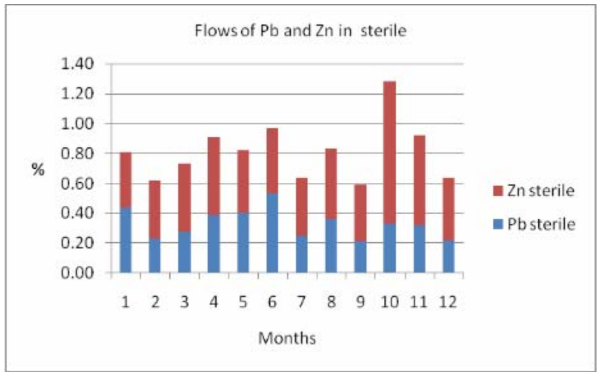

Figure-6.

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