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HYDROGEOLOGICAL CHARACTERISTICS OF TREPÇA DEPOSIT, KOSOVO

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ABSTRACT

In the north part of Kosova is the Trepça metallogenic district which is near Mitrovica town. This region dominated by numerous lead – zinc deposits as well as numeral occurrences of: iron, manganese, antimony, molybdenum, wolfram, cooper, gold, silver and non metallic raw materials linked to the endogen processes of Tertiary magmatism. Hydro geologic characteristic of Trepça region are very complicated. Rocks that determine hydro geologic characteristic in this region are: calcareous, tuffites, slates, diabases, quartz latite and other rocks that are part of this region. All rocks in this region are porous, but the importance of the porosity is not the same. Based to the hydro geologic features all rocks in the region are shared in two groups: collector rocks and insulator rocks.

In this research paper are presented hydrogeological characteristics of Trepça deposit. The purpose of this paper is to determine the surface depression artificially created by the exploitation of the Trepça mines and the problem of protecting the working proceedings by flooding with underground waters.

Keywords: *hydrogeology, water inflow, mining horizons, Trepça*

INTRODUCTION

The Trepca Belt, which comprises part of what has been previously described as the Kapaonik District (Forgan, 1948; Jankovic *et al.*, 1997), includes numerous lead-zinc deposits. The geological studies of useful minerals deposit is one of the most important geological services in the economy. During the opening and exploitation of these deposits usually appear underground waters, which further harden and complicate the progress of normal exploitation of minerals.

The hydrogeology of deposits task is the study and calculation of possible the inflow waters in mining area (Jeffery 1983). As such it enters the deposits with average water abundance with the water coefficient 10-15. The Trepça deposits are characterized by maximum water inflows in mining workings 4 m^3/min.

Water inflows are mainly associated with karts limestone which composes the ore basements. Whereas the coverings composed from rocks of tuffites may play a second role the water inflow in mining area. For this reason a detailed hydro geological research is required for the Trepça mining on one side and for the surface on the other.

2. Hydrogeological characteristics of Trepça deposit

Hydro geological characteristics of the Trepça region are very complicated (Avdullahi 2003). Rocks which define hydro geological characteristics in this region are: limestone, tuffites , phyllite, schistes and andesite, also important are serpentines, gabbro, diabase, quartzite and other rocks that compose ore field. With intense volcanic activity of new tertiary (Miocene) and of orogenice phase, the magma eruption occurred and formed the tuffites, which cover Paleozoic old rocks. Of particular importance for the hydrogeology of the region is the possibility of determining the surface under which the Paleozoic limestone are placed under the cover of tuffites.

All rocks in the explored region are porous, but the importance of porosity is not the same. Depending on the litho logical composition,

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hypsometric level and size of rock measures, the porosity value is broad enough. Based on the formation of pores, and the relation to the rock measures, we can distinguish two genetics types of porosity: primary and secondary (Aston, 1982).

Based on the prevalence of pore type, the size of pore and the way that granules communicate between its pores, in the region there are three main three types of pores: cracks, the caverns and inter granular (Motyka 1998). The cavern porosity plays an important role in the region. The volume of these caverns moves from cm^3 to several m^3. Based on the hydro geological properties all rocks of the region are divided into two groups: indescribable and collector's rocks.

In the explored region, although the limestone is spread in a relatively small area as a good hydro geological collector, it is interrupted by a large number of cracks with irregular shapes. The tuffites serie is a very porous rocky mass. The can easily infiltrate the surface waters. In essence the tuffites are spread in a very large area and cover the major part of the paleorelief, solving the hydro geological problems of this series is of great importance for the region. The indescribable rocks (schistes, phyllite, diabase, gabbro) are also spread in the region as much as the above mentioned rocks, their impact on hydrogeological conditions is not small.

However, as hydro geological collectors, their impact on the direction of underground water movements most often create indescribable screens showing the importance of these rocks, from the hydro geological point, in the region.

2.2. The water inflows in Trepça mines

The study of underground water flows is one of the most important tasks on the hydrogeology of deposits of useful minerals. Depending on the hydrogeological characteristics, different methods are used to deal with underground water, among which the most common method is studying the way, the water inflows into the mines and drying. (Dunn, 1982).

The use of deposits located in difficult geological conditions, require performing many preliminary hydro geological work in order to become more useful and normal the exploitation of minerals.

The inflows of the water in the mines depends on a number of factors, the most important are: atmospheric precipitation, climate characteristics, terrain morphology, the rate of release of the ore to the surface water infiltration from surface flows, litho logical composition of rocks, tectonic conditions in the area of deposit (Rapantova et al., 2007). The main part of the water mines, in our opinion comes, through infiltration from Trepça River and surrounding streams, in the sector where limestone rocks are spread the valley of river Trepça.

The source of Pb-Zn in Trepca ore is the one that faces the greatest problem of underground waters that effect normal exploitation. With further development of the Trepça site (expansion and deepening of mining works) underground water are a major problem which means that further detailed studies hydro geology are needed. Underground waters that appear in Trepça mines have mostly originated from atmospheric rainfalls that infiltrate in depth, a small part comes from the surface waters (river and streams Trepça), while a very small portion comes from the evaporation of water within the mines which condenses in the form of water drops.

The highest amount of water in the mines comes from atmospheric rainfalls that infiltrate using cracks in the rock masses. According to meteorological data in the northern and northeastern parts of the terrain the average water fall is 750mm (Avdullahi *et al.*, 2008).

An important role also plays the artificial depression in Trepça mines. The artificial depression rains the surface waters in Rashan, northern village near Mazhiq, Vidishiqi and Bare part of the village Melenic and the northern and eastern parts of the Maja e Zeze.

Schistose area in the southern part of the mines, in the valley of the Trepça River and north to Mazhiq can be considered as isolator area. Thus the atmospheric water is not drained in this region or it is drained in a very small amount (Singh et al., 1985). The highest amount of atmospheric water flows in the Trepça River or evaporates. While a small amount of atmospheric water that infiltrates the underground goes to shallow depths, and in special cases through contact with schistes limestone, enters in the mining areas.

The atmospheric water and the surface water are infiltrated along the covering of tuffites and

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other irregular karts channels and gravitate towards the mines. Another fact that enforces this conclusion is the evaporation of a water spring near the village Rashan after a horizon has been opened.

This depressed area around the mining Stan Terg includes an area of about 17.5 km^2 (Figure 1.). Besides the evaporation of a water spring located near the village Rashan, there is another drying of a thermal spring, near the river Trepça. Another drying is the Bare stream near the village Vidishiq and this is something that I have faced myself while on the ground. There also may be other cases that are not reported and surely have happened while working in the horizons.

Depending on the morphology, the vegetation that we have in the region and lithological composition (as is the case of the area explored) we may conclude that about 25% of the atmospheric water infiltrate, about 42% evaporate and the rest of rainfall, respectively 33%, flows within the rivers around the region.

Table 1. The amount of underground water in the Trepca mining

Trepça mines horizons		**The total amount of the flow of the underground water.**		**The amount of water flow in the channel horizons**	
		l /s	l / min	l /s	l / min
I	610	0.5	30	1	60
II	545	0.5	30		
III	485	0.1	6		
IV	435	0.66	40		
V	375	0.75	45	2.01	120
VI	315	0.25	15		
VII	255	0.08	4.8		
VIII	195	0.25	15		
IX	135	92	5520	0.58	34.8

The table 1 clearly shows that the largest amount of underground water occurs in the ninth horizon. In this horizon we have large kartstic cavern called "The core", from which comes quantity of water of 85l/s, while all other sources in this horizon provide a range of 7l/s.

The amount of underground water in all horizons except IX is 3.51 l/s. From this quantity, 0.58 l / s occurs in the VI, VII, VIII horizons, while the amount of underground water in the II, III, IV and V horizons is 2.01 l/s. Thus based on what has been stated above the quantity of underground water in the Trepça mine is 96 l/s.

Drying of the Trepca mines.

There is a complicated problem in choosing the way how to remove (dry) the water from the mines. Below are some of the ways used to dry the mining area:

- drying the water through the main pit (well) of the mining;
- drainage of underground water by underground pumping;
- the way of sticking the filter;
- the aquifer screen, etc.

The usage of the adequate methods is depended on the hydro geological characteristics and quantity of water inflow in to the mines. Drying the Treça mines is a huge problem. The most common method used for drying the water in the horizons is by drying it with pumps through the pit of the mining.

The horizons are opened in the way so that the water from the VI, VII, VIII horizons, accumulates in the IX horizon, where a large water collector is built. In this collector are mounted three centrifugal pumps with general capacity of 17.6 m^3/min, and from here the water moves up in the water collector which is located on the fifth (V) horizon. Whereas the waters from the II, III and IV horizons, are accumulate by channels and pour in the fifth (V) horizon. And from there the water moves through the pumps in

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the first horizons where it is used for different purposes.

It is used hygienic purposes; another part goes to the flotation and the rest in the river Reka.

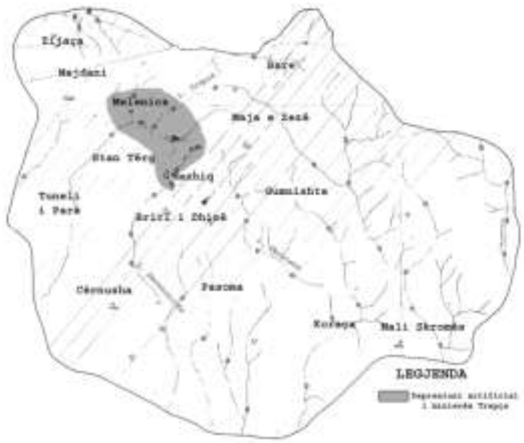

Fig 1. The region of hydro geological research

CONCLUSIONS

Regional hydro geological characteristics define these rocks as: limestone, tuffites, phyllite and schistes, quartz latite and andesite. Limestone, which arises in a relatively small space, is good collector of water, whereas as good isolators we have schistes, phyllite etc. In the Trepça deposits of lead–zinc, waters cause a huge problem. During this work i tried to determine the surface of the artificial depression which drains the water toward Trepça mines. Since some of the waters that flows in the Trepça mines come from the river Trepça and other streams around, I believe we should deviate or fix the banks of the river flow.

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