BALKANMINE 2009

3rd BALKAN MINING CONGRESS
3. BALKAN MADENCİLİK KONGRESİ

October 1-3, 2009
İzmir-TURKEY

This Congress is supported by TÜBİTAK (The Scientific and Technological Research Council of Turkey)

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SUNUŞ

Odamız, gerek bilimsel ve teknik bilginin paylaşılması, gerekse ulusal ve evrensel meslek ilkeleri ve sorumlulukları temelinde uluslararası dayanışma amacıyla, diğer ülkelerin meslek örgütleriyle ve üniversiteleriyle iletişim içerisinde bulunmayı önemsemektedir.

Bu çerçevede söz konusu örgütlenmeler ile iletişime geçilmesi hususunda çalışmalar başlatılmıştır. Bu doğrultuda birincisi 2005 yılında Sofya'da, ikincisi 2007 yılında Belgrat'ta düzenlenen Balkan Madencilik Kongresi'nin üçüncüsü Odamızın ev sahipliğiyle ülkemizde düzenlenmektedir.

Dünyada bilim ve teknoloji alanında çok hızlı bir gelişim ve değişim süreci yaşanmaktadır. Üretilen bilginin her 2-3 yılda ikiye katlandığı ileri sürülmektedir. Bilime ve teknolojiye hakim olan güçler dünyayı da egemenlikleri altına almaktadır. Bu nedenle gelişmiş ülkeler bütçelerinden mühendislik- bilim teknoloji ve eğitim alt yapısına ayırdıkları payı gün geçtikçe arttırmaktadır.

Madencilik sektöründe aramadan uç ürüne kadar her aşamada ileri teknoloji kullanılmalıdır. Üretim ve kaynak performansının iyileştirilmesine ve yeni ürünlerin elde edilmesine yönelik olarak yeni gelişen teknolojilerin kullanımı, bu sektörün ülke kalkınmasına katkısı bakımından son derece önemlidir. Bu nedenle sektörde yüksek teknoloji kullanımı ve üretilmesine yönelik araştırma-geliştirme çalışmalarına öncelik verilmelidir. İleri üretim teknolojilerinin geliştirilmesi ve kullanımı, daha temiz ve daha etkin madencilik süreç ve ürünlerinin temini bakımından önkoşuldur.

Bu Kongre'de sektördeki teknolojik gelişmeler paylaşılırken, ülkemizin madencilik sektörünün tanıtımı da yapılacaktır. Balkan ülkelerindeki maden mühendislerinin ve yerbilimcilerin bir araya geleceği toplantılar da deneyimlerin ve teknik bilginin paylaşımı amaçlanmıştır.

Kongre'nin gerçekleşmesine katkı koyan Yürütme Kurulu Başkanı Bahtiyar ÜNVER başta olmak üzere tüm Yürütme Kurulu üyelerine, Balkan Madencilik Kongresi Koordinasyon Kurulu Üyesi Tevfik GÜYAGÜLER'e ve emeği geçen herkese teşekkür ederiz.

Saygılarımızla

YÖNETİM KURULU

FOREWORD

The 3rd Balkan Mining Congress (BALKANMINE 2009) organized by Balkan Mining Association, BALKANMINE and The Chamber of Mining Engineers of Turkey is held between October 1-3 in İzmir, Turkey. The primary objective of the Congress is to promote operational, economical and scientific information pertaining to all aspects of mining technology, energy and sustainable development.

In conjunction with the Congress, 3rd Mining, Natural Resources and Technology Fair of Turkey, MINEX 2009 is organized at the same location for the exhibition of mining products together with companies offering machinery, equipment, instruments, software and services to mining, processing and energy industries.

The papers included in the proceedings volume have been grouped under ten specific themes including, Balkan Mining Industry; Mineral Resources and Mine Geology; Exploitation; Process Engineering; Rock Engineering and Design; Computer Applications in Mining and Processing; Management and Mining Economics; Ventilation and Safety; Mining and Environment; History and Mine Education. The 98 papers included in this volume have been prepared by authors from 14 countries. I am confident to state that papers included in this proceedings volume are testimonials to the vibrant role that mining technology plays in the identification and establishment of routes to sustainable resource development, environmental protection and globalization.

Every successful congress stems from a teamwork approach. We owe gratitude to the members of the Organizing Committee, Balkan Mining Association Coordination Committee, Executive Board of the Chamber of Mining Engineers of Turkey and Chairpersons of the technical sessions. There is no need to mention that this proceedings volume and the BALKANMINE 2009 would not come to reality without contributions of the speakers and authors. Our most genuine appreciation also goes to the delegates for their interest and contributions to the success of the Congress.

We acknowledge with gratitude the financial support provided by TÜBİTAK, The Scientific and Technological Research Council of Turkey. We also owe gratitude to İZFAŞ, İzmir Fair Services Culture and Art Affairs Trade Inc., for their professional effort in the preparation of the Congress venue.

Once again, I thank all of the participants of the BALKANMINE 2009 for their contributions which will become instrumental in the enhancement of our scientific and professional development. I am delighted to reiterate that it is a great pleasure for me to welcome all friends and colleagues to İzmir, to a congress that you will find technically stimulating and socially enjoyable.

Dr. Bahtiyar ÜNVER

for the Organizing Committee

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PROCESS ENGINEERING

CEVHER HAZIRLAMA

Heavy Metals in the Water of the River Kalnistanska and the Vicinity

O. Spasovski & R. Dambov
Faculty of Mining and Geology, Stip

ABSTRACT The paper presents the results and conclusions from the investigations carried out on the water contamination with heavy metals in the River Kalnistanska and its vicinity. For the increased content of heavy and toxic metals in the near vicinity of river Kalnistanska, especially in the water systems, large contribution have increased ore mineralization of the area, sewage waters from the feces of the town and neighboring villages, and industrial objects (battery factory etc.).

The examinations are an attempt to determine the real and the physical state of heavy metals in the river water and its tributaries. Samples were analyzed with ICP-AES method. Earlier experiences indicated that the following elements should be expected: Mn, Fe, Al, Zn, As, Cd, Cu, Ni, Co, Ag, Cr, Ti with possible occurrence of increased concentrations of maximum allowable amounts.

Analysis and data interpretation yielded increased concentrations of Mn, Fe, Al, Pb, Zn, As, Cd and Cu. The entire drainage system in the Kalnistanska in the Municipality of Probistip has been polluted. It was found that the major pollutants are the Zletovo Mine and the discharge of waste waters containing heavy metals.

1 INTRODUCTION

Investigated area is located in the eastern part of the Republic of Macedonia near to town of Probistip. River Kalnistanska flow through mountain, lowland and canyon terrains. There are many hills above the Probistip where the river Kalnistanska is situated and it is lay down along the fault lines.

After the exit at village Kalniste, along the river Kalnistanska valley alluvium is wide spread with width of 300 to 1000 m. Left bank is flatland with characteristic little uplifts.

Hydrographic net of this area belongs to the river Bregalnica which has water through the whole year. Left affluent of river Bregalnica is river Zletovska in which river Kalnistanska influents. These rivers are with permanent flow through the whole year. In the rainy days there are enough water, and in rainless summers water potential decreased. Only river Kalnistanska could dry up (rarely).

Over the past few decades environmental pollution was not given sufficient attention. However, the issue was given a priority over the few years. Heavy and toxic metals in drinking water has been of special concern. It is of note that the wells from which the population in several municipalities receive water for the water supply system are located in the River Kalnistanska alluvion. This has been a serious problem for the people in the Municipality of Probistip.

People in the area use the waters from several tributaries for drinking water and household needs. They also use the water for irrigation, agriculture particularly in the

production of many kinds of vegetables. Investigations carried out so far point out possible water pollution.

Another reason for the implementation of the project is the strict laws on the quality of the human environment.

The studied area included the Rivers Kalnistanska and Zletovska as far as its estuary to the Bregalnica (Figure 1). The area marked with an oblong is the place where water samples were collected.

Figure 1. Map of the Republic of Macedonia with location of investigated area.

2 METHODS OF WORK

Preliminary field activities were carried out in order to obtain data on the situation of the terrain.

Field sampling also defined measurement points and cross-section lines. Topography of sampling stations was defined including the cross section lines for sample collection. The initial phase consisted of collecting water samples in the middle of the river course in a 1-l. clean plastic vessel. Sample collection also included filtering through paper the openings being 45 μm. Before closing the vessel acidifying with 0.4 ml nitric acid (HNO_3) of 50 % was done to avoid possible metal settling on the wall and the bottom of the vessel. Laboratory examinations included ICP-AES method and their interpretation.

3 RESULTS AND DISCUSSION

The results obtained from flowing water samples are given in Table 1, with comparison between maximum allowable (MAC) concentration of heavy and toxic metals for III – IV classes.

Data shown in Table 1 make it possible to define the amount of heavy metals in the Kalnistanska River water and its tributaries and the reasons for their occurrence.

Based on the data presented in Tab. 1, certain constants can be given concerning the presence of particular heavy metals in the waters of the Kalnistanska River.

The data for the concentration of zinc (Table 1) indicate its increased presence in most of the samples which were analyzed. The greatest concentrations of zinc are found

in the sample Kr-9, which are 0.28 mg/l. The increased concentrations of zinc are also found in the samples: Kr-1, Kr-3 and Kr-5. In the remaining samples the concentration of zinc is present in amounts less than the standard ones. Generally, it can be concluded that the entire research area is contaminated with zinc. The increased concentrations of zinc are a result of the active working of the Mine for lead and zinc Zletovo.

Table 1. Contents of heavy metals in flowing waters in the Kalnistanska River (mg/l).

Sample	Fe	Mn	Zn	Pb	Cu	Cd	As	Ag
Kr-1	0.290	0.016	0.1700	0.013	0.007	0.0120	0.014	0.0029
Kr-2	0.050	1.150	0.0130	0.011	0.005	0.0007	0.018	0.0041
Kr-3	0.043	0.210	0.2400	0.024	0.034	0.0008	0.028	0.0022
Kr-4	0.029	0.017	0.0580	0.019	0.019	0.0012	0.044	0.0040
Kr-5	0.072	1.310	0.1800	0.043	0.023	0.0010	0.026	0.0025
Kr-6	0.110	0.025	0.0072	0.010	0.005	0.0180	0.070	0.0015
Kr-7	0.180	0.120	0.0440	0.010	0.010	0.0010	0.055	0.0043
Kr-8	0.240	0.025	0.0310	0.029	0.016	0.0011	0.022	0.0015
Kr-9	0.280	0.218	0.2800	0.006	0.003	0.0110	0.016	0.0017
Standard	1.0	1.0	0.2	0.03	0.05	0.01	0.05	0.02

The increased concentration of lead are noticed in the samples Kr-5 (0.043 mg/l), Kr-8 (0.029 mg/l), Kr-3 (0.024 mg/l) and Kr-4 (0.019 mg/l). It is obvious that increased concentrations of lead are found in most of the samples, but the great sample concentrations of lead are found in those samples where increased concentrations of zinc were also found, which confirms the statement of the great influence of the hydro-waste dump and the active working of the Mines Sasa for the pollution of the environment with these metals.

In all the samples cadmium is found in extremely larger concentrations compared to maximum allowed concentration. The great sample concentrations of cadmium are noticed in the samples Kr-1 (0.12 mg/l) Kr-6 (0.018 mg/l) and Kr-9 (0.011 mg/l). This behaviour of the cadmium is due to its geochemical characteristics (easily soluble, low mobility). The increased concentrations of cadmium follow the parts which are contaminated with zinc because it geochemically follows the minerals in the zinc.

The increased concentrations of copper are found in most of the samples, but the great sample concentrations of copper found in the samples Kr-3 (0.034 mg/l), Kr-4 (0.019 mg/l), Kr-5 (0.023 mg/l) and Kr-8 (0.016 mg/l), while in the remaining samples the concentrations of copper are close or less than in maximum allowed concentration. The presence of the copper in the waters of river Kalnistanska is a result of the occurrence of chalcopyrite in an association with the minerals of the lead and zinc.

Iron is present in concentrations lower than maximum allowed concentration and is not a significant contaminant of the drainage system of the river Kalnistanska.

Attention should be paid for the high concentrations of the manganese in the samples: Kr-2 (1.15 mg/l) and Kr-5 (1,31mg/l). The reason for the occurrence of the manganese in high concentrations in the waters of the river Kalnistanska as a presence of the waste waters from the Mines Zletovo.

4 CONCLUSION

Data obtained with laboratory examinations on heavy metal contents in the waters of the Kalnistanska and its tributaries indicate that a number of heavy metals occur in increased amounts, some of them in amounts lower than the maximum allowable.

The most important contaminants are lead, zinc, cadmium, silver, arsenic and silver.

The increased concentrations of heavy metals are a consequence of the geological composition of the terrain, anthropologic activities such as early mining and stockpiling of waste material, the use of fertilizers in agriculture as well as the physical and chemical character of the water solutes.

It can be said in the end that the largest distribution and resulting contamination with heavy metals were found in the mine and flowing into the Kalnistanska. From ecological point of view this entails the need of rehabilitation of the area in order to prevent flora and fauna intoxication in the water medium an the surrounding and prevent the negative effect on the health of the population.

The metal concentration in flowing waters is also influenced by their geochemical characteristics and pH and Eh factors.

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