Study of Heavy and Main Elements Concentration in Waters Supplies of Shour River in Sarcheshmeh Copper Mine (An Approach to Medical Geology)

Ali Baniasadi[1], Feizollah Sharafinejad[1], Mohamad Hossein Baniassadzadeh[2], Sedigheh Akbari[3]

[1]Olang Mining Services Company, Sarcheshmeh Copper Complex,
[2]Department mine; Azad University of Kerman,
[3]Department Metallurgy; Azad University of Shahrbabak

Abstract Sarcheshmeh copper Complex contains of hygienically, industrial and mineral waste waters that enters into Shour River or its springs through different units of complex. These waste waters are resulting from mining operations, productive, industrial and hygiene processes. In this article, for studying the concentration of main and heavy elements in the Shour River, 20 samples of Shour River water were chosen (pick up) in different routes and mineral waste waters of region. These samples were sent to a central laboratory of Sarcheshmeh copper Complex for studying the concentration of heavy elements. The obtained results were shown that some elements such as Zn, Fe, Mn, Cr, Cd, As, Cu, Ni, Mo and Pb have a concentration higher than the standard of WHO. The values of metal index or MI for whole samples are indicating the pollution to the above mentioned heavy metals. The experimental results from waste waters were shown that the concentration of heavy metals in mine drains water and the beginning of Shour River is higher than the discharge standards.

Key Words Heavy Metals, Waters Supplies, Sarcheshmeh copper mine, Medical Geology

Introduction

Human being is always subjected to harmful pollutions, in their environment, for example in air, water, soil, rock, food or work place. Rare metals are important in environment pathology, due to their wide range of toxic reactions and potential harmful effects on non-biological functions of bio systems. Contact with toxic rare metals has been the subject of many geo-chemicals and environmental researches and many studies have also been conducted and reported on the short term (sthenic) or long term (protensive) effects of contacting with such maters. Therefore, the study of geographical distribution of rare elements and metals in nature can explain the natural deficiency or toxicity and discover the relation between the existed epidemics and natural distribution of elements.

Heavy metals enter the ecologic cycle and food chain and act such as the cumulative poisons is higher consumers (Seng and et al, 1995). Since metals are less soluble and are mostly found in solid part and the measuring methods for water and animal and plant tissue extracts are not reliable due to low concentration of metals and chemical interferences, therefore, distribution of heavy metals in water of Shoor river is most suitable choice as pollution index of river ecosystem (Literathy and et al, 1987; Warren, 1987).

Therefore we studied water of Shour river in order to find a general point of view about distribution of toxic elements along the river.

Geographical situation of studied area

The Sarcheshmeh Cupper Mine, in 160 km south west of Kerman city, 50km south west of Rafsanjan, 30 km north of Pariz, is located in eastern attitude of 53° and 55' and northern latitude of 29° and 58'. The mean height of this area is 2620 from sea level and its the highest point is 3100 meters from sea level (Bani Asadi, 2008). The situation of the Mine, the factory, the sedimentary dam, and main streams in the Sarcheshmeh watershed are shown in the Fig 1.

Materials and Methods

In this research, 6 stations were selected for water sampling and measuring the metal distribution along Shoor River. The situations of the stations are given in table 1. Samples are taken by hand in 500—1000 (ml) polyethylene plastic bottles. 10 (ml) of Nitric Acid per 1000 (ml) water is added to some bottles to fix the samples until chemical analysis, immediately (Xavier, 1990). After preparation, samples are taken to Sarcheshmeh Cupper Complex's laboratory and the total amount of Pb, Zn, Cd, Co, Ni, Cr, Mo, Fe, Mn, Cu, are measured in each sample, by Atomic absorption set. For analysis of heavy metals in PPM level, the flame atomic absorption and in PPB level, the ICP methods are used. GPS set is used to determine and record the location of sampling stations and the WHO standards are used for comparison.

Results and discussion

In order to study the concentration of heavy and main elements in Shoor River of Sarcheshmeh

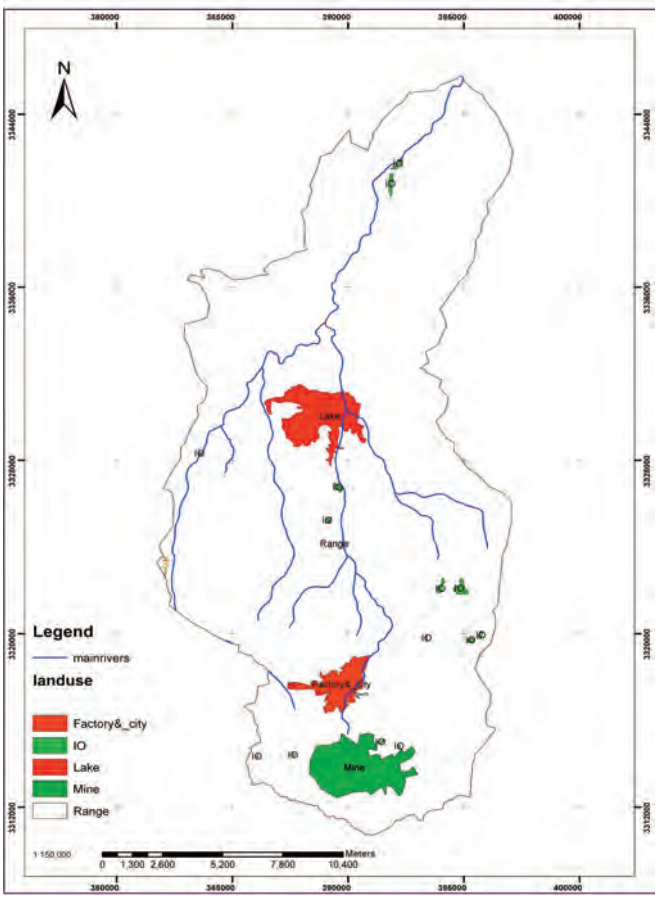

Figure 1 *Geographical position of the Mine, the factory, the sedimentary dam, and main streams in the Sarcheshmeh.*

Sample	*Cr*	*Ni*	*Fe*	*Mn*	*Zn*	*Cd*	*Se*	*As*	*Pb*	*Cu*
s1	0.05	0.72	1.3	37.5	10.9	0.08	5	0.8	0.13	100
s2	0.01	1.31	0.3	20.18	10.9	0.08	0.01	0.01	0.01	14.83
s3	0.25	0.31	0.03	9.87	5.27	0.04	0.02	0.02	0.01	1.72
s4	0.01	0.49	0.01	9.2	3.1	0.04	3.9	0.08	0.08	0.83
s5	0.18	9.3	183	54	28	0.21	5	0.08	0.21	50
s6	0.02	0.06	6.1	22	7.4	0.06	4.6	0.08	0.12	43
Mean	0.05	2.03	31.79	25.46	10.93	0.09	3.09	0.18	0.09	35.06
WHO	0.05	0.02	0.3	0.4	3	0.003	0.01	0.01	0.01	2

Table 1 *Concentration of heavy and main elements in water samples in studied area.*

Sample	*S1*	*S2*	*S3*	*S4*	*S5*	*S6*
Metal Index	808.38	157.87	61.54	468.52	1846.93	602.70

Table 2 *MI index in water samples of studied area.*

Cupper Mine, 20 samples were taken from the water of the river. 6 samples were taken to central laboratory of Sarcheshmeh Cupper Complex. The element concentrations are shown in PPM, in Table 1.

Results show higher concentration of some heavy metals (As, Cd, Cr, Mn, Fe, Zn, Pb, Mo, Ni, Cu), than WHO standards. Metal Index (MI) can always be used to study the water quality of the river.

$$MI = \sum_{i=1}^{N} \frac{Ci}{(MAC)i}$$

As the concentration of the heavy elements exceeds its allowable amount (MAC), the water quality is worse. The MI in samples of Shoor River is given in Table 2, considering the mentioned metals.

The MI in all samples is more than 1 that shows the increasing of pollution in water. This pollution can also have anthropogenic source (factory sewage).

Conclusion

Comparison the concentration of heavy metal with WHO' standards shows that the concentration of mentioned metals is higher than standards. MI in all samples is more than 1 for Cd, Cr, Mn, Fe, Zn, Pb, Mo, Ni, Cu, As. Geogenic and anthropogenic (such as factory sewage) factors have a considerable effect on the trend of variation of the concentration of elements in water, so that they vary in accordance with increase or decrease of mentioned elements in various places of the factory and mine. Cumulating the elements either from geogenic or anthropogenic sources and their availability and their absorption in plant tissues and animal and human consumption of the plants and storage of the in vital organs make important changes in bio existences.

Acknowledgments

Special thanks to National Iranian Copper Industries (N.I.C.I.Co.) for supporting this research.

Reference

Baniasadi, A (2008) Heavy metal pollution in sediments and water of the Penag River, M.Sc.thesis, Faculty of Earth Sciences, Shahrood University of Technology.

Literathy, P., L.Nasser Ali, M.A. Zarba, and M.A. Ali (1987) the role and problems of monitoring bottom sediment for pollution assesment in the coastal marine environment. Wat, sci.Tech, 19,781—792.

Seng, C. E., P.E.Lim, P.K. Chong, and L.M. Wong (1995) Heavy metal pollution in sediments and water of the Penag River, Malaysia, Water Qual, Res. J. of Canada, Vol, 30(1):39—43.

Warren, L. J (1981) Contamaination of sediments by lead, zinc and cadmium:A review. Environ. Pollut. (Ser.B)Vol.2(6):401—403.

Xavier, R.N (1990) Environmental-biochemical aspect of heavy metals in acid mine water.", International Symposium on acid water in Pyritic Environment, Lisbon.