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

Ali Baniasadi¹, Feizollah Sharafinejad¹, Mohamad Hossein Baniassadzadeh², Sedigheh Akbari³

¹Olang Mining Services Company, Sarcheshmeh Copper Complex,
²Department mine; Azad University of Kerman,
³Department 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 Heavy Metals, Waters Supplies, Sarcheshmeh copper mine, Medical Geology

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 altitude 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
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.

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

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

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

<table>
<thead>
<tr>
<th>Sample</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Index</td>
<td>808.38</td>
<td>157.87</td>
<td>61.54</td>
<td>468.52</td>
<td>1846.93</td>
<td>602.70</td>
</tr>
</tbody>
</table>

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.
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's 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 int 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**


