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Investigation of Geochemical Sections in Exploratory Boreholes of Mesgaran Copper Deposit in Iran

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Abstract: Mesgaran copper deposit is located in Sarbisheh city of South Khorasan province of Iran. To investigate the geochemical changes of the elements with increasing depth in the deposit, geochemical sections for important minerals related to mineralization in the area including copper, lead, zinc and cobalt were drawn for 9 exploratory boreholes. In these sections, the trend of changes of different elements versus depth is shown and the resulting diagrams were drawn for different boreholes. As a result, there is a significant relationship between the elements. With increasing the drilling depth, the amount of copper decreased and the amount of copper in each section was determined according to its cause.

Keywords: Geochemistry, Copper deposit, Exploratory borehole, geochemical section.

I. INTRODUCTION

Mesgaran mineral area is a small part of the structural zone of eastern Iran. This area in the eastern of Central Iran Zone, between Nehbandan fault (in the west) and Hariroud fault (in the east), in 800 km long and 200 km wide, there are thick accumulations of flysch deposits that have ophiolite rocks attached to oceanic crusts. The area in question, which has undergone evolutionary stages from oceanic to continental crust, is one of the derivations of the "young Tethys" type. [1-9]

In this area, 9 exploratory boreholes were drilled and 148 samples were analysed. In order to investigate the geochemical changes of the elements by increasing the depth in this deposit, the results of sample analysis were used [10-18].

The purpose of these studies is to find out the grade changes of the elements with respect to the depth and also to find the reason for a better understanding of the correct geochemical interpretations of the area. With the correct understanding of this process and its connection with geological information, mineralization and its type can be clarified [19-28].

II. GEOLOCATION AND GEOLOGICAL SETTING

An Mesgaran mining area is located 29 km south of Sarbisheh city. It has an area of 10 square kilometers and is rectangular in shape. The geographical location of the range in the UTM system is between latitudes 0770500 to 0773000 East and latitudes 3577500 to 3581500 North (Figure 1).

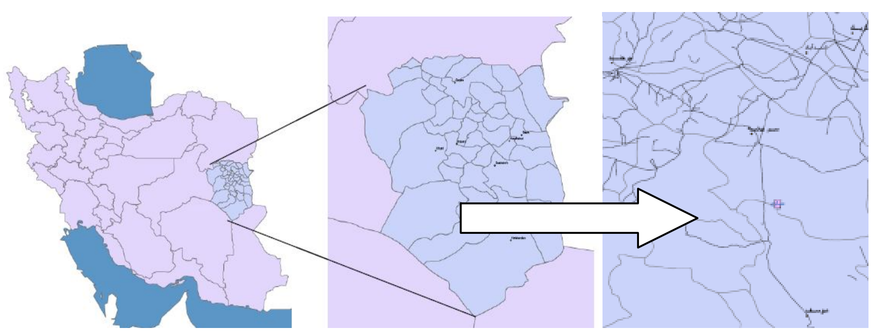

Fig 1 : Location of the study area in South Khorasan Province, Sarbisheh [3]

Access to this area is possible through the main road Sarbisheh-Nehbandan [1].

There are no rough heights in this area and it is mostly in the form of hills and plains. Roads are available in most places and can be easily accessed anywhere in the area [29].

Due to the presence of mafic and ultramafic rock assemblages (ophiolite sequences) and erosion performance on these units, the topography of the area is in the form of soft hills. Sedimentary parts of the region, especially areas with limestone, have a harsher topography than the mineral boundary [6-8, 25].

The study area is a small part of the structural zone of eastern Iran in terms of structural-sedimentary divisions of the country and is metallurgically located in the northern part of the Ahangaran-Bandan gold zone. [18, 25, 30]

Lithologically, the area includes ultrabasic units, diabase dykes, pillow basalts, limestone outcrops, phyllite and schist lenses. One of the newest lithological units is travertine units. This complex is exposed in the form of porous travertine around the travertine springs. The rock units that are exposed in the area of Mesgaran show a complete ophiolite sequence, but due to the compressive stresses in the area, the boundaries of these units are mainly faults and the protrusion of supralithic rocks, basalts and ocean sediments do not have a special trend.

III. INVESTIGATION OF GEOCHEMICAL BOREHOLES SECTIONS

Geochemical sections were plotted for important mineralization-related elements in the area, including copper, lead, zinc and cobalt. In these sections, the trend of changes of different elements versus depth is shown. Due to the large differences in the amount of some elements compared to other elements and in order to facilitate the comparison of the process of change of different elements with each other, in the resulting diagrams, instead of the amount of elements, their size logarithm was used in the analyzed sample. The resulting graphs are shown in Figures 2 to 9 for different boreholes. The results of these graphs are as follows:

A. borehole # 1

In this borehole, the amount of copper decreases from top to bottom so that the maximum amount corresponds to the first 15 meters. This could be due to supergene enrichment near the ground. The diagram Zn / (Zn + Cu) shows the changes in the amount of zinc relative to copper in this borehole. As shown in Figure 2.

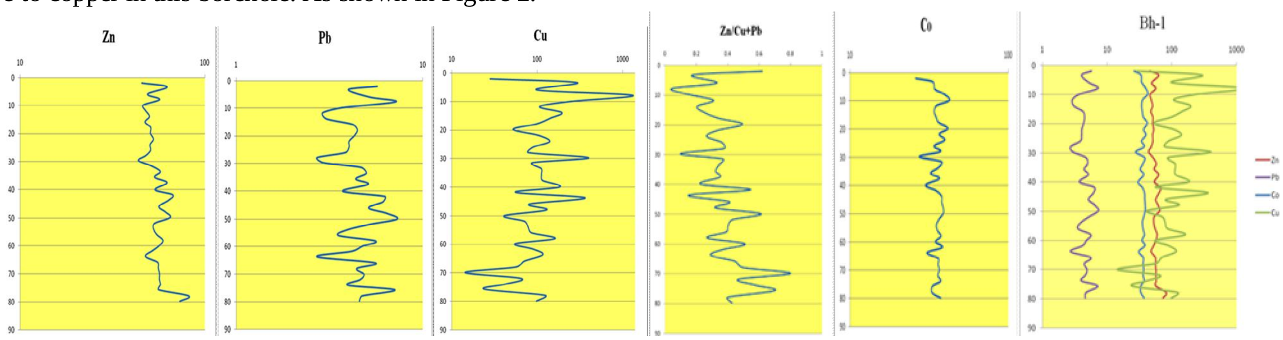

Fig 2: Geochemical sections obtained from the analysis of borehole 1

In this borehole the zinc increases from top to bottom of the deposit as the amount of copper decreases. Cobalt and lead have a relatively constant trend. Comparing the diagrams of the four elements mentioned, a relatively good agreement between the trend of changes in zinc, lead and cobalt can be seen in this borehole, but no special agreement is seen between these elements and copper.

B. borehole # 2

Graphs of this borehole show an increase in lead, zinc and cobalt from top to bottom; But this increase is not significant. Copper has the highest amount at a depth of about 10 meters and then decreases. Excluding the amount of copper at a depth of 10 meters, in other parts of the borehole a good agreement between copper with the increasing trend of zinc, cobalt and lead can be seen in this borehole (Figure 3).

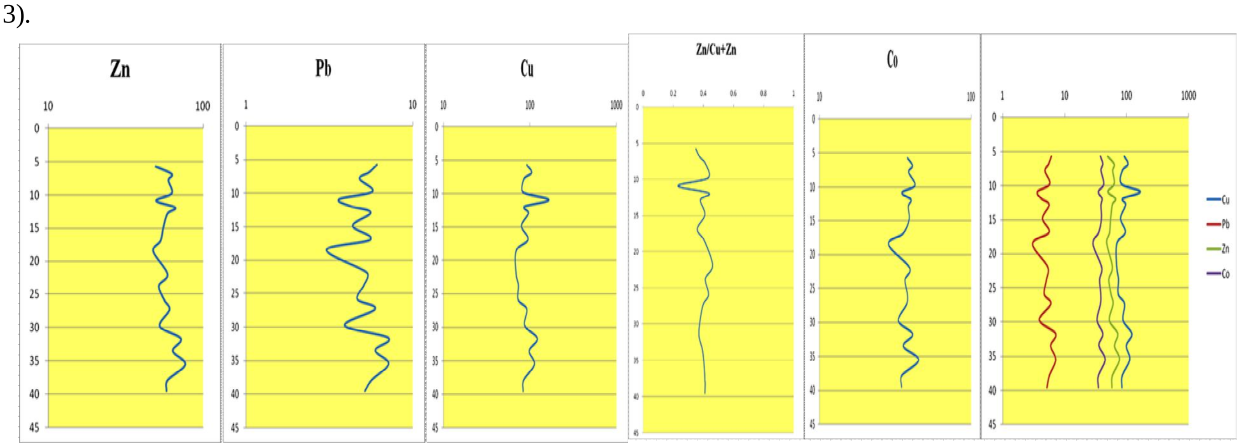

Fig 3: Geochemical sections obtained from the analysis of borehole 2

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C. borehole # 3

The results of plotting this borehole show a decrease in zinc content, a relative increase in lead and cobalt from the top to the bottom of the borehole. The highest amount of copper corresponds to a depth of 25 to 30 meters. Other elements also have their greatest amount at this depth (Figure 4).

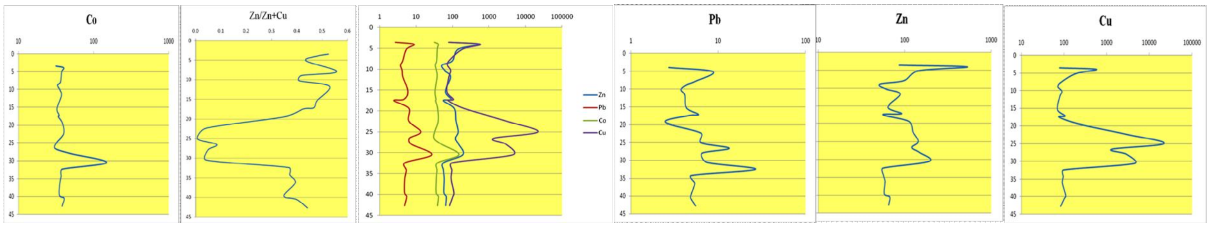

Fig 4: Geochemical sections obtained from the analysis of borehole 3

D. borehole # 4

The amount of copper, zinc, lead and cobalt elements decreases from the top to the bottom of the deposit. The ratio of zinc and copper in this borehole increases from the top to the bottom of the borehole. This is due to a sharp decrease in copper at a greater depth than the yield (Figure 5).

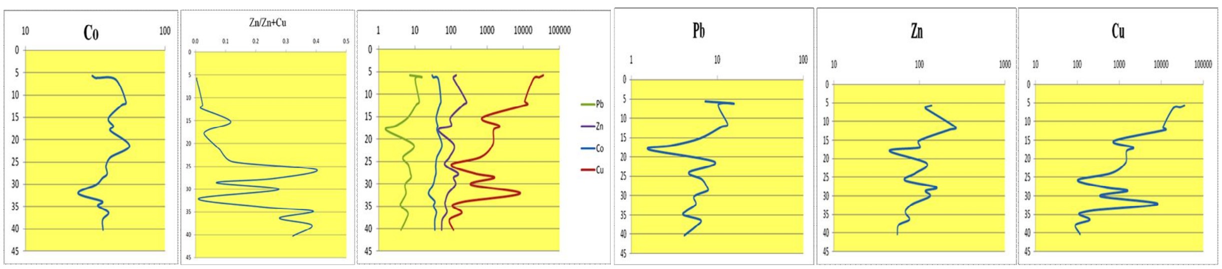

Fig 5: Geochemical sections obtained from the analysis of borehole 4

E. borehole # 5

The amount of copper, zinc, lead and cobalt elements decreases from the top to the bottom of the deposit. The decrease in copper content is very severe downwards. This element reaches its maximum in depth of approxIt is 6 meters close to the ground, which can be related to the supergene process (Figure 6).

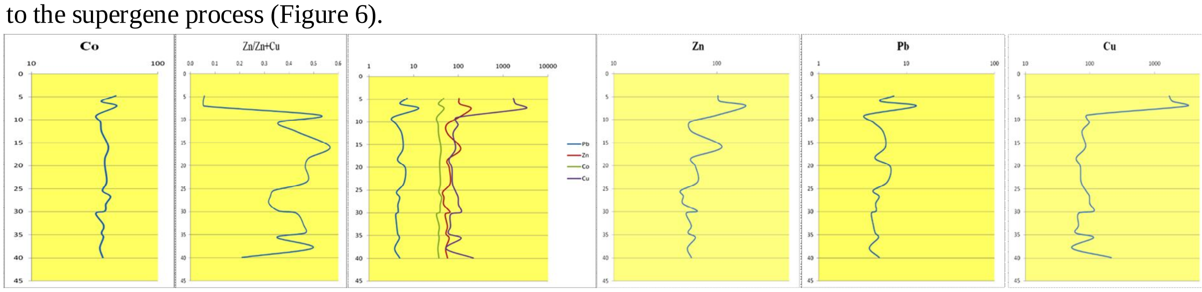

Fig 6: Geochemical sections obtained from the analysis of borehole 5

F. borehole # 6

Concentrations of copper, zinc, lead and cobalt from the top to the bottom of the deposit show an increasing trend. The highest amount of these elements can be seen at a depth of about 35 meters. The process of change of these elements is well adapted to each other and shows a genetic correlation between them. The ratio of Zn / (Zn + Cu) from the top to the bottom of the deposit shows a decreasing trend, which is higher than the zinc at depth due to the large increase (Figure 7).

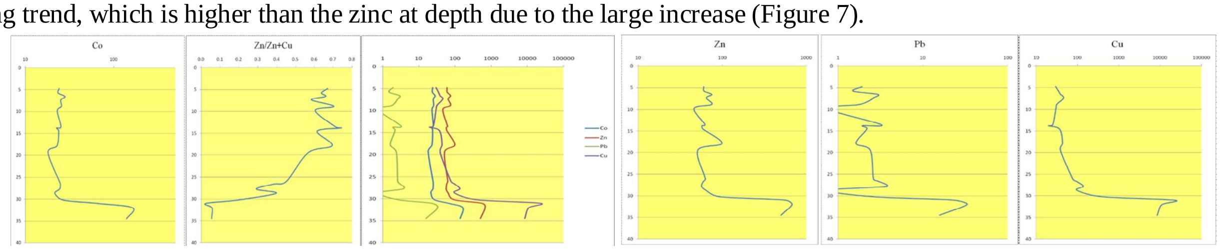

Fig 7: Geochemical sections obtained from the analysis of borehole 6

G. borehole # 7

According to the graphs of this borehole, the amount of copper, zinc, lead and cobalt elements decreases from top to bottom of the deposit. This decreasing trend continues to a depth of 10 to 20 meters, and increases at a depth of 25 meters and again decreases. The changes of these elements are similar to each other and are compatible with each other (Figure 8).

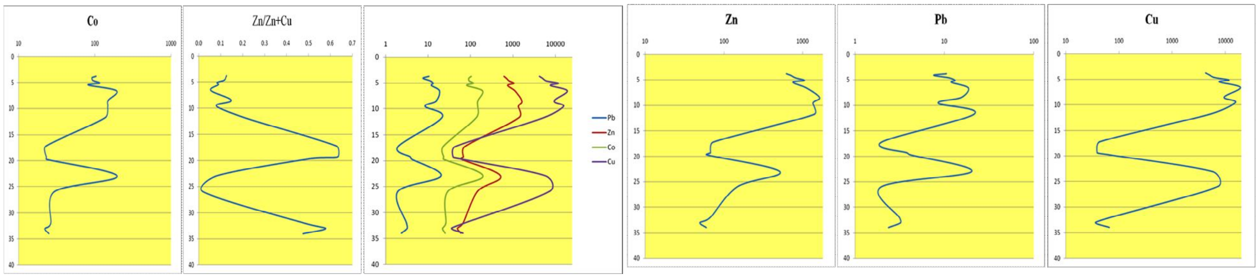

Fig 8: Geochemical sections obtained from the analysis of borehole 7

H. borehole # 8

In this borehole, unlike other boreholes, the graphs show a high amount of zinc relative to copper, although the amount of these elements alone is low. The changes of the four elements zinc, lead, copper and cobalt are relatively constant and do not show a sharp increase or decrease and are consistent. It seems that no special mineralization has taken place at the site of this borehole.

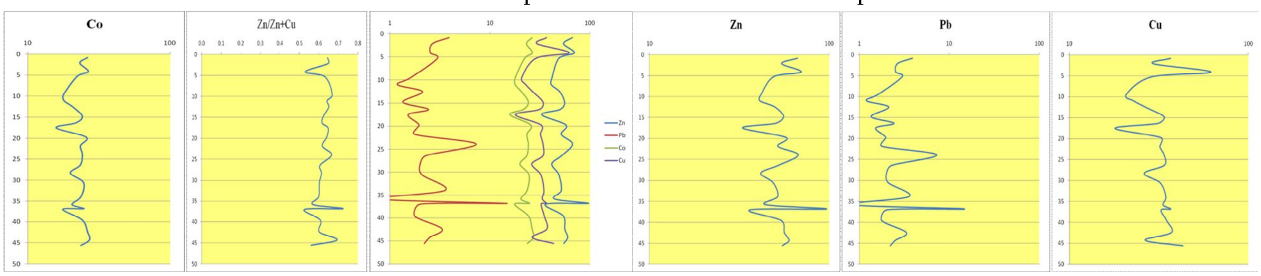

Fig 9: Geochemical sections obtained from the analysis of borehole 8

I. borehole # 9

In this borehole, copper has a high concentration near the earth's surface and after a decrease, shows an increasing trend with increasing downward depth. This increasing trend in lead, zinc and cobalt is also almost visible. Except near the Earth's surface, the trend of change of these four elements coincides (Figure 10).

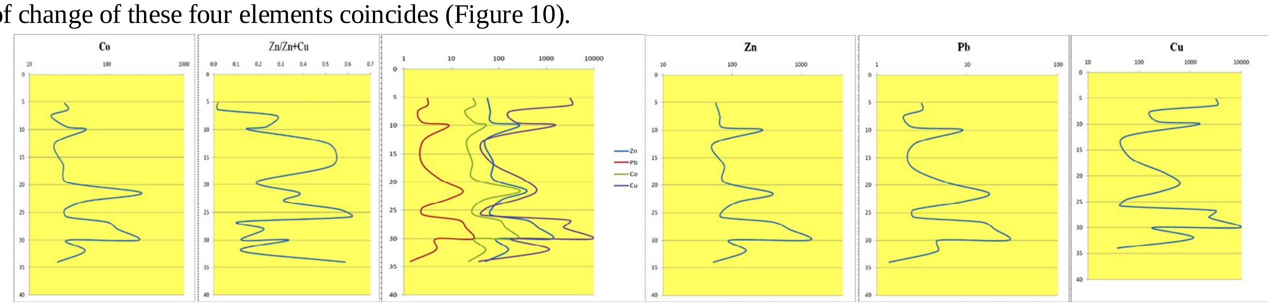

Fig 10: Geochemical sections obtained from the analysis of borehole 9

IV. CONCLUSIONS

Mesgaran copper deposit is located in Sarbisheh city of South Khorasan province of Iran. In order to investigate the changes in geochemical concentrations of important elements in this deposit (copper, lead, zinc and cobalt) against depth, the results of analysis of 148 samples from 9 exploratory boreholes were used. The results of these graphs, which show the changes in the concentration of each element from the surface to the depth of the earth, show the correlation between the elements copper, lead, zinc and cobalt in these boreholes. Adaptation of changes in the concentration of these elements with each other, especially in cases where copper mineralization is seen, indicates a close relationship between these elements and mineralization in the region. According to the graphs obtained from the boreholes, it can be generally stated that copper anomalies that occurred at shallow depths are related to the supergene zone, while deeper enrichments are more related to the initial mineralization.

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