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Investigation of Regional Fractures and Cu Mineralization Relationships in the Khezrabad and Shahr-e-Babak Area: Using Fry and Fractal analysis

Alireza Zarasvandi[1], Babak Samani[1], Houshang Pourkaseb[1], Zahra Khorsandi*[1]and Yaghoub Jalili[2]

1) Faculty of Earth Sciences, Shahid Chamran University of Ahvaz, Ahvaz, Iran
2) Department of Geology, Birjand University, Birjand, Iran

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Introduction

Two main principal aspects for the genesis of porphyry copper deposits have been determined. The first genetic model concerns the petrologic and geochemical processes and the other relates the genesis to crustal deformation and geodynamic conditions (Kesler, 1997). Recent studies (e.g., Padilla Garza et al., 2001) show that the generation and emplacement of porphyry copper deposits may not only be dependent on magmatic and hydrothermal processes, but also that the regional and local tectonic setting plays an important role. Therefore in determining the suitable setting for emplacement of copper and other porphyry intrusions, determination of location of partial melting of the lower crust, generation of batholiths, and their volatile-rich derivative intrusions in the crust seems to be necessary (Carranza and Hale, 2002). Almost all porphyry copper deposits in Iran are located in the Urumieh-Dokhtar magmatic belt. These deposits show distinct spatial and temporal relationship with Miocene granodiorite plutonic rocks emplaced along strike slip faults (Mehrabi et al., 2005). Accordingly, the tectonic setting of ore deposits seem to be the most important factor for regional exploration of porphyry copper systems (Vearncombe and Vearncombe, 1999). There are several methods for analysis of distribution of ore deposits. In this research the role of structural control in the spatial distribution of porphyry deposits has been studied using Fry and Fractal methods. Here, the Fry method is used as a complementary method for Fractal analysis.

Materials and methods

Fry analysis is a self-adaptive method that is used for point objects. Fry analysis offers a visual approach to quantify the spatial trends in groups of point objects. Fry analysis can also be used to search for anisotropies in the distribution of point objects. More specifically it can be used to investigate whether a distribution of point objects occurs along linear trends, and whether such linear trends occur at a characteristic spacing. There is 37 and 42 copper point's index in the Khezr-Abad and Shar-B-Babak areas. The Fry patterns of copper index for two areas were determined with application of Dot Proc software. Fractal analysis is another technique for determination of regional distribution of faults. In this research the fractal dimension of joints and faults was determined in different locations using box-counting fractal method and drawing the logarithmic graphs.

Results

- The major faults show NW/SE trends in the Khezr-Abad area. They have a similar trend with Dehshir-Baft fault. Other sets of faults show NE/SW trend. These faults are younger than the Dehshir-Baft and release sinistral sense of shear.
- Intrusion of two intrusive bodies leads to the accumulation of strike-slip faults in the vicinity of intrusive rocks. In this region faults and joints mainly show NW/SE and NE/SW trends.
- The results of Fry analysis show that the mineralization in the Khezr-Abad occurred in the Cretaceous (and younger) rocks with NE/SW and NW/SE orientations. In the other words, these areas of mineralization are mainly related to the secondary faults or (P faults) in the pull basins and cross cutting points of these faults which have similar strike with the Dehshir-Baft fault. NE/SW mineralization is probably related to the tensional

*Corresponding authors Email: khorsandiz@yahoo.com

stress direction or faults having the general trends of central Iran structures.

- The calculations of fractal dimension show that the southeastern parts of the Khezr Abad have higher amounts of fractal dimension (Db= 1.7002). Also there is a relatively higher copper index in this part, indicating a logical relation between fault structures and mineralization.

-The generated maps indicate that the mineralization in the Shahr-e-Babak area occurred at the intersection of faults and volcanic system and the Fry analysis shows a NE/SW and NW/SE trend of ore concentration.

- Northwestern parts of the Share-e-Babak show higher fractal dimension (Db= 1.748) that occurs in the areas with more volcanic rocks and copper indexes.

- Results show that the porphyry copper mineralization mainly occurs near the great faults and related to the fault structures and shear zones in the Urumieh-Dokhtar structural zone. In the other word fault lineaments are the main factors in the local concentration of the ore deposits.

Discussion

The Study of geometry and mechanism of faults related to porphyry copper deposits is very important for determining the suitable location of ore concentration (Zarasvandi, 2004). For example, shear zones, pull apart basins, and step over along the strike slip faults are proper locations for concentration of porphyry ore deposits (Carranza and Hale, 2002). In this research the Khezr-Abad and Shahr-e-Babak areas have been studied. Plotted rose diagrams show the main role of the Dehshir-Baft shear zone for generating the joints and faults in the KhezrAbad area. In this area faults with NNW/SSE and NW/SE trends are the main direction of ore concentration. They are mainly related to the Dehshir-Baft fault. NE/SW faults show sinistral sense of shear and generally are younger than before mentioned sets. Finally the latest fault sets show N/S trend. The Shahre-e-Babak area is mainly dominated with Eocene igneous rocks. Volumetrically, andesite units are more abundant. Rose diagrams represent the existence of two main conjugate fault sets with NW/SE and NE/SW trends. The main copper indexes are located in the intersection of volcanic rocks with these two fault sets. Also the results of Fractal analyses reveal the higher Fractal dimension in the Northwestern part of the Shahr-e-Babak area. In the other words the most density of joint and faults occurred in this region.

References:

Carranza, J.M. and Hale, M., 2002. where are porphyry copper deposits spatially localized? A case study in Benguet province, Philippines. Natural Resources Recearch, 11(13): 45-59.

Kesler, S.E., 1997. Metallogenic evolution of convergent margins: Selected ore deposit models. ore Geology Reviews, 12(3): 153-171.

Mehrabi, A., Rangzan, K. and Zarasvandi, A., 2005. Where is significant location for the porphyry copper Deposits? A case study in south centeral Iranian volcanic belt. 9th symposium of Geological Society of Iran, The teacher Training University, Tehran, Iran.

Padilla Garza, R.A., Titley, S.R. and Francisco Pimentel, B., 2001. Geology of the scondida porphyry copper deposit, Antofagosta region, Chile. Economic Geology, 96(2): 307-344.

Vearncombe, J. and Vearncombe, S., 1999. The Spatial Distribution of Mineralization: Applications of Fry Analysis. Economic Geology, 94(4) :475-486.

Zarasvandi, A., 2004. Magmatic and structural controls on localization of the Darreh-Zerreshk and Ali-Abad porphyry copper deposits, Yazd Province, Central Iran. Ph.D. thesis, Shiraz University, Shiraz ,Iran, 280 pp.