Paper Number: 125

Determination of Cu mineralized zones utilizing number-size (N-S) fractal modeling in Takht-e-Gonbad porphyry deposit (SE Iran)

Eskandarnejad Tehrani, M.[1], Afzal, P.[2] and Ghaderi, M.[3]

[1]Young Researchers and Elite club, South Tehran Branch, Islamic Azad University, Tehran, Iran, mohammad.eskandarnejad@gmail.com
[2]Department of Mining Engineering, South Tehran Branch, Islamic Azad University, Tehran, Iran
[3]Department of Economic Geology, Tarbiat Modares University, Tehran, Iran

---

The purpose of this study is to determine different Cu mineralized zones using number-size (N-S) fractal modeling in Takht-e-Gonbad porphyry deposit (SE Iran). This deposit is situated about 70 km NE of Sirjan City, SE Iran. In addition, this porphyry deposit is located on the south of Kerman Cenozoic magmatic arc (KCMA), which most of Cu porphyry deposits of Iran occurred in this arc [1]. Based on geological map of Takht-e-Gonbad, Eocene volcanic-pyroclastic rocks and Neogene sediments are the main rock types. Moreover, phyllic alteration is the main alteration type in this deposit and also, hypogene ore zone consists of pyrite, chalcopyrite and minor magnetite and molybdenite.

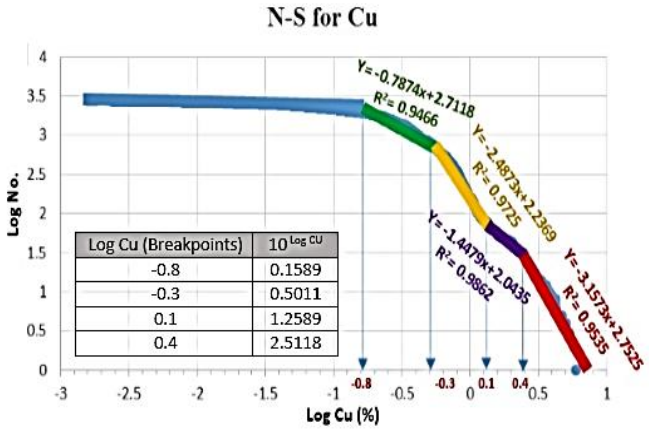

Figure 1: Cu N-S log-log plot in Takht-e-Gonbad deposit

The number-size fractal model proposed by Mandelbrot [4], can be used to describe the distribution of geochemical population without any pre-processing of data. The model can been expressed by the following equation:

$N(\geq r)=cr^{-D}$

Where r denotes the element concentration; N(≥r) is the cumulative number of concentration greater than or equal to r; c is a constant and D is the fractal dimension of the concentration distribution [2].

In this research, 2830 samples were collected from 39 drill cores in this deposit and analyzed by ICP-AES for elements that relate to Cu mineralization. Based on the subsurface data obtained from drill core, the deposit were modelled by RockWorks.15 software. 3D model of Cu distribution in this deposit was generated with kriging estimation. The N-S model was utilized to the lithogeochemical dataset of this deposit for separating Cu mineralization zones resulting from N-S log-log plot for Cu (Fig. 1). The severity of elemental enrichment is illustrated by slope changes of line segments (breakpoints) in log-log plots. Four breakpoints exist in N-S plot, the range of leached, oxidation, hypogene and supergene zones are 0.1589 % - 0.5011 %, 0.5011 % - 1.2589 %, 1.2589 % - 2.5118 % and >2.5118 %, respectively.

The result derived via the fractal model were controlled by mineralogical study and XRD analysis. Carranza [3] proposed a method for calculation of overlap correlation between two binary models by a logratio matrix. The supergene enrichment zone contains Cu≥2.51%. In addition, different mineralized zones can be detected via the N-S fractal modeling. The supergene enrichment, hypogene and oxidation zones delineated via N-S fractal model were correlated with geological zonation models along of the

application of logratio matrix. The overlapping results which reveals that the hybrid method is proper for outlining of mineralized zones in the porphyry deposit.

References:

[1] Asadi S et al. (2014) Earth-Sci. Rev. 138:25-46

[2] Mohammadi A et al. (2013) Arab J Geosci. 6:4387-4398

[3] Carranza E J M (2011) J. Geochem. Explor. 110:167-185

[4] Mandelbrot B B (1983) The fractal geometry of nature. W.H.Freeman, San Fransisco, 468 p.