

A Positive Correlation with Ni and Ni/Co of Disseminated Ore in Poyi and Poshi Magmatic Ni-Cu Sulfide Deposits in Beishan Region, NW China

Xiao Liu¹ and Xinbiao Lü^{1,2,3*}

¹Institute of Geological Survey, China University of Geosciences, Wuhan 430074, China

²Faculty of Earth Resources, China University of Geosciences, Wuhan 430074, China

³State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan 430074, China

*E-mail, 754192781@qq.com

The Early Permian ultramafic-mafic Pobei intrusions in the western Beishan rift, located in Xinjiang, NW China, host several medium and large economic Cu-Ni sulfide deposits, including Poyi and Poshi. Based on a cutoff grade of 0.2 wt % Ni, the Poyi and Poshi magmatic sulfide deposits are estimated to contain 1.3 Mt Ni and 1.47 Mt Ni, respectively. Sulfide mineralization is dominated by disseminated sulfides with a range of 0.2 to 0.97 wt % Ni. The sulfide assemblages are composed of pyrrhotite, pentlandite, and chalcopyrite, which occur in the steeply dipping lherzolite layers. Through regression analysis of Ni contents and Ni/Co ratios from 3833 samples containing visible sulfides from 20 drill holes in Poyi and 2980 samples from 35 drill holes in Poshi, there is an obvious positive correlation between Ni contents and Ni/Co ratios. In addition, the majority of Ni-rich ores spatially coincide with the high Ni/Co ratios of 3D models. Moreover, this phenomenon is also confirmed at the Jinchuang deposit and Alexo mine.

Although both Ni and Co are siderophile elements, their sulfide liquid-silicate melt partition coefficients ($D_{Co}^{sl/sm}$) are controlled by oxygen fugacity, sulfur fugacity, and the composition of the sulfide liquid. Furthermore, the $D_{Co}^{sl/sm}$ depends more weakly on oxygen fugacity than does $D_{Ni}^{sl/sm}$, $D_{Ni}^{sl/sm}$, which decreases from 1300 to 200 as the f_{O_2} increases and $D_{Co}^{sl/sm}$ varies from 30 to 50. Therefore, the concentrated degree of Ni is much higher than Co as f_{O_2} increases. The oxidation state of the melt has been widely considered to be one of the principal factors controlling the solubility of iron sulfide in a silicate melt. In addition, the Ni/Co ratio could be a significant clue for Ni-rich exploration in Ni-Cu magmatic sulfide deposits.