Journal of Mineral Resources Engineering, 8(2): 41-59, (2023)

Imam Khomeini International University
Vol. 8, No. 2, Summer 2023

نشریه مهندسی منابع معدنی
Journal of Mineral Resources Engineering
(JMRE)

Research Paper

Quantitative Assessment of Podiform Chromite Deposits, Based on Three-Part Assessment Method in Naeen's Ophiolites

Esmaeili M.[1], Soltani-Mohammadi S.[2*], Banitaba S.A.[3]

1- Ph.D Student, Dept. of Mining Engineering, University of Kashan, Iran
2- Associate Professor, Dept. of Mining Engineering, University of Kashan, Iran
3- M.Sc, Dept. of Mining Engineering, University of Kashan, Iran

Received: 03 Jan. 2022 **Accepted: 06 Jun. 2022**

Abstract: Chromite is one of the most used strategic metals. Among different types of Chromite deposits, Padiform Chromite is more considerable economically. On other hand, decision-making for mineral exploration investigation requires accurate estimation of the quality and quantity of new deposits. For estimation of the quality and quantity of deposits, quantitative mineral resource assessments are required. Quantitative mineral resource assessment is based on descriptive, density, and average grade-tonnage models. In this research, a three-part assessment method has been used to estimate podiform chromite deposits in Naeen's Ophiolites. The three-Part assessment method is based on an inverse relationship between the permissive area for a specific deposit type and the number of deposits. Evaluation by the three-part assessment method shows that the understudy region is high potential. Results show a 50% chance of at least 19 deposits with at least 69400 metric tons of chromite & 10% chance of at least 40 deposits with at least 46700 tons of chromite existing in the understudy region. Geochemical anomalies have been used for validation. These anolmalies have been separated based on the concentration-area (C-A) and singularity index methods. At least three geochemical anomalies in the east margin of Naeen ophiolite were identified.

Keywords: Three-part assessments, Estimation of undiscovered deposits, Chromite Naeen.

How to cite this article
Esmaeili, M., Soltani-Mohammadi, S., and Banitaba, S. A. (2023). *"Quantitative assessment of podiform chromite deposits, based on three-part assessment method in Naeen's Ophiolites"*. Journal of Mineral Resources Engineering, 8(2): 41-59.
DOI: 10.30479/JMRE.2022.16755.1571

*Corresponding Author Email: *saeedsoltani@kashanu.ac.ir*

INTRODUCTION

Chromite is one of the most used strategic metals. In Iran, Padiform Chromite is more considerable economically. On the other hand, decision-making for mineral exploration investigation requires accurate estimation of the quality and quantity of new deposits. For estimation of the quality and quantity of these deposits, quantitative mineral resource assessments are required. Mineral deposit models are important in quantitative resource assessments for two reasons: 1) numbers per unit area of deposits and grades and tonnages of most deposit types are significantly different, and 2) types occur in different geologic settings that can be identified from geologic maps [1]. In this research, the Three-part assessment method has been used to estimate podiform chromite deposits in Naeen's Ophiolites.

MATERIALS AND METHODS

In the first modern quantitative resource assessment, Allais (1957) used a Poisson distribution to model the occurrence of mineral deposits[2]. Later, Singer et al. developed Three-part assessment models for the estimation of undiscovered deposits[3,4]. Three-part assessment method calculates the deposit density model for a fully discovered region and uses the frequency distribution either directly to provide estimation or indirectly as a strategy in other methods[5]. In this method, fully discovering the region, is not necessary, but the area ratio and the number of discovered deposits are essential. Root et al. presented an algorithm based on the three-part assessment that estimates the number of deposits by 90, 50, and 10 present chance[6-8]. In this research, the probability of occurrence of Chromite deposits with different tonnages was determined by a three-part assessment method. This model could be used for paragenesis of chromite, like Platinum, Iridium, Rhodium, Ruthenium, and, Palladium. All calculations are carried out in the Eminer software.

RESULTS AND DISCUSSION

Evaluation by the three-part assessment method shows that the understudy region is high potential (Figure 1). Results show that a 50% chance of at least 19 deposits that contain at least 69400 metric tons of chromite, 90% chance of at least 40 deposits that contain at least 46700 tons of chromite & 10% chance of at least 90 deposits that contain at least 2140000 metric ton chromite, exists in understudy region (Figure 2).

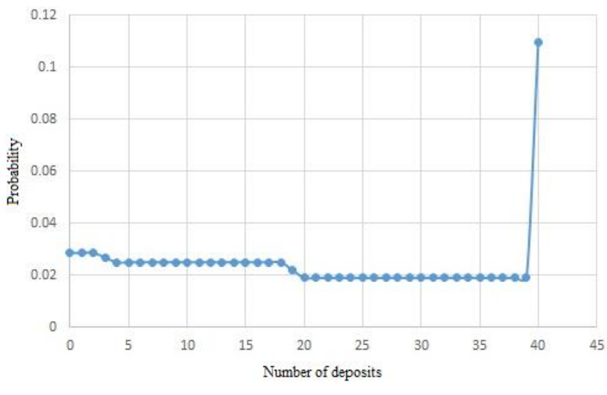

Figure 1. Probability of Cr deposits existence versus the number of deposits

Geochemical anomalies have been used for validation. These anolmalies have been separated based on the concentration-area (C-A) (Figures 3A and 3B) and singularity index (Figures 3C and 3D) methods. At least three anomalies in the east margin of Naeen ophiolite were identified. This comparison shows that the north of Naeen is a high potential region for chromite.

CONCLUSION

The purpose of mineral resource assessments is to accurately estimate the quality and quantity of new deposits for economic decisions. Three-part assessment method based on the inverse relationship between the permissive area for a specific deposit type and the number of deposits. So the number of discovered deposits and their tonnage is estimable. Results show that a 50% chance of at least 19 deposits, 90% chance of at least 40 deposits & 10% chance of at least 90 deposits, exists in the understudy region.

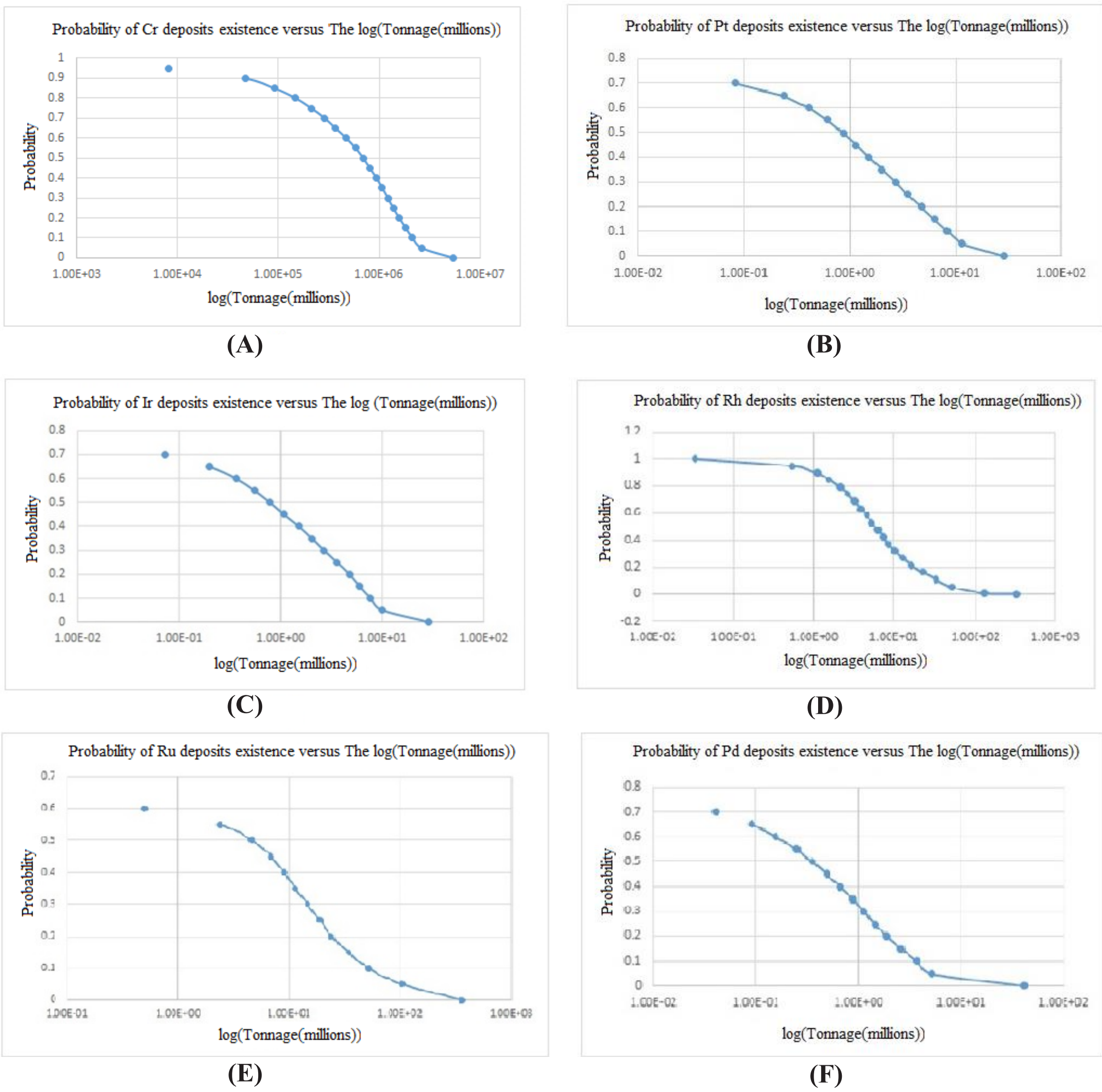

Figure 2. A: Probability of Cr deposits existence versus The log(Tonnage(millions)) in Naeen region, **B:** Probability of Pt deposits existence versus The log(Tonnage(millions)) in Naeen region, **C:** Probability of Ir deposits existence versus The log (Tonnage(millions)) in Naeen region, **D:** Probability of Rh deposits existence versus The log(Tonnage(millions)) in Naeen region, **E:** Probability of Ru deposits existence versus The log(Tonnage(millions)) in Naeen region, **F:** Probability of Pd deposits existence versus The log(Tonnage(millions)) in Naeen region

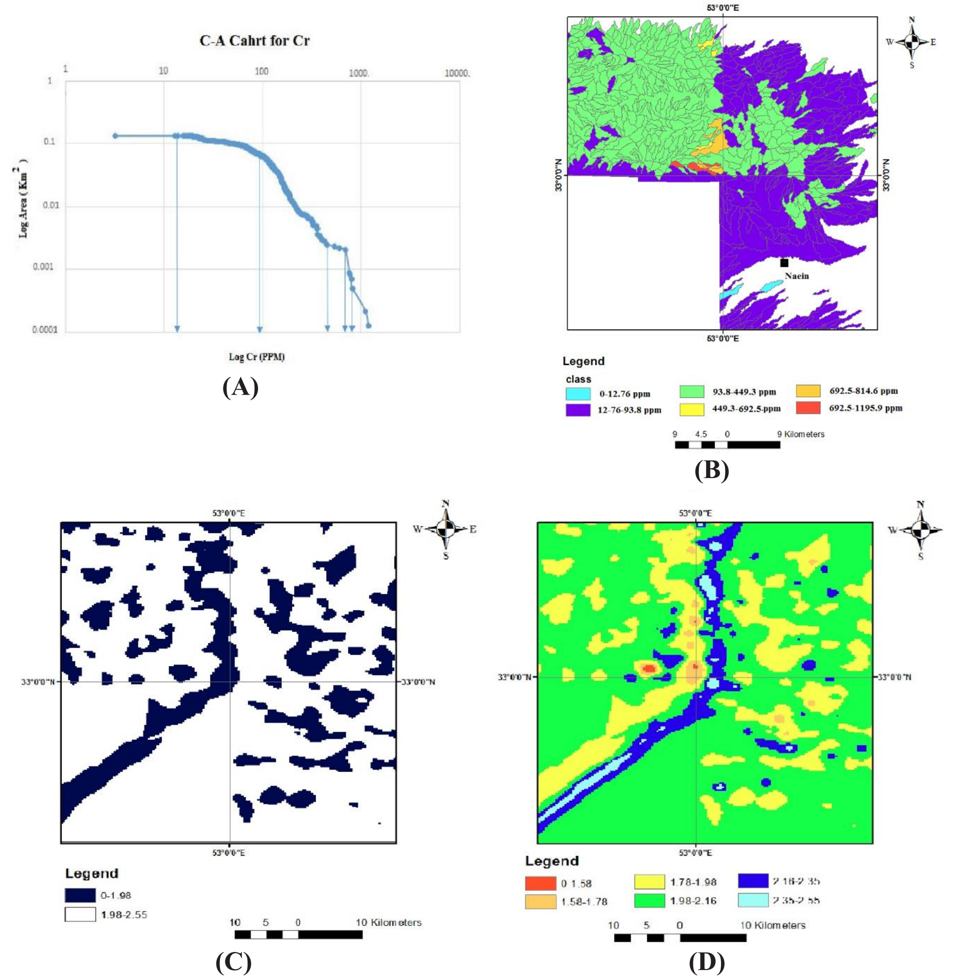

Figure 3. A: C-A chart for Cr in understudy region, **B:** Mapping Cr geochemical anomalies using C-A method, **C:** Mapping Cr geochemical anomalies using singularity index (SI>1.98), **D:** Mapping Cr geochemical anomalies using singularity index

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