# Mineral Resources Potential Mapping using GIS-based Data Integration

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**Abstract:** In general, mineral resources prospect is performed in several methods including geological survey, geological structure analysis, geochemical exploration, airborne geophysical exploration and remote sensing, but data collected through these methods are usually not integrated for analysis but used separately. Therefore we compared various data integration techniques and generated final mineral resources potentiality map.

**Keywords:** Mineral Resources, GIS, Potential Mapping

## 1. Introduction

With the rapid industrial development and the improvement of living standard, the demand for energy and mineral resources is soaring in Korea, but this country in which natural resources are deficient, is importing 90% of minerals from overseas. Moreover, because of the free trade under the WTO system, it is highly possible that resources may be misused as weapons in the international society. Thus it is necessary to cope actively with resource supply/demand environments by securing potential sites of resources for sustainable long-term supply of necessary resources.

In general, mineral resources prospect is performed in several methods including geological survey, geological structure analysis, geochemical exploration, airborne geophysical exploration and remote sensing, but data collected through these methods are usually not integrated for analysis but used separately. With the recent advances in information technology, GIS-based data integration and spatial analysis techniques have been developed since the 1990s. Foreign countries such as Canada, USA, Australia and so on have developed and applied the quantitative data integration techniques to any predictive geological applications such as mineral potential mapping. In Korea, however, spatial data analysis relying on experts' subjective experiences and judgments are still prevailing, thus it is necessary to develop the data integration techniques to produce more objective results than traditional subjective ones.

In this study, we applied various GIS-based data integration techniques to the mineralized area in Mt. Taebaek in Korea. In order to verify the accuracy of results from the different prediction techniques, the estimation capability and the prediction rate curves based on it were computed and used for quantitative comparison. According to the result of prediction using estimation capability, we created mineral resources potentiality map.

## 2. Study Area and Database

The study area is located in the mineralized area of Mt Taebaek in Korea. The site lies between latitudes 37°14'N and 37°30'N, and longitudes 128°40'E and 129°00'E, and covers an area of 815km$^2$. The geology of the study area consists of Cambro-Ordovician Joseon Supergroup and Carboniferous Pyeongan Supergroup.

The multiple geological data sets include the location of ore deposit sites, geological maps, geological structure maps, lineament map and geochemical data with various chemical elements. And GIS-based spatial database was built using these maps. As for data on ore deposit sites, the study area has 83 ore vein maps of 21 mines located in the subject area. As for the geological map, the 1:50,000 scale maps of Jeongseon, Imgye, Yemi and Homyeong were integrated and reclassified into a total of 21 classes. Lineament maps were made by integrating lineaments interpreted from satellite images and shaded relief images and a total of 6 classes were defined with a unit distance of 100m from the center of lineaments. For the geochemical data, additionally, eight geochemical elements related to the genesis of ore deposits were selected and thematic maps were generated by distinguishing the area into 10 classes of the same interval according to the contents of the elements.

## 3. Verification of Mineral Resources Potentiality Analysis Methods

The mineral resources potentiality was performed using conditional probability, certain factor, weights of evidence, and fuzzy gamma methods randomly selected ore veins of the study area, and the analysis results verified using the remainder ore veins. The verification method was performed by comparison of existing ore

vein data and mineral resources potentiality analysis results for the randomly selected ore veins of the study area. In order to verify the accuracy of results from the different prediction techniques, the estimation capability and the prediction rate curves based on it were computed and used for quantitative comparison. The comparison result is shown in Fig. 1 and finally mineral resources potentiality map is displayed in Fig. 2.

## 4. Conclusions

In this study, we compared verified various data integration techniques. According to the result of prediction using estimation capability, the weights of evidence model and certainty factor model were found to produce higher prediction capability than that from the fuzzy gamma and conditional probability model.

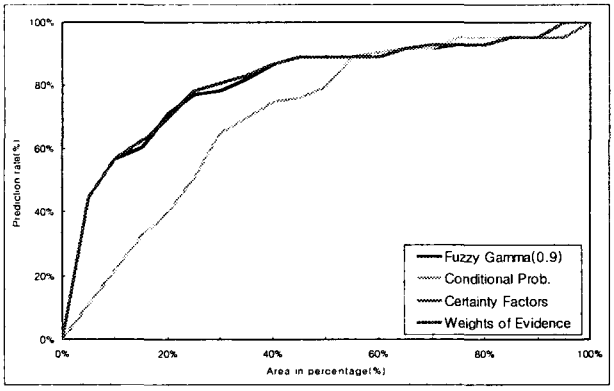


**Fig. 1. Prediction rate curve for quantitative comparison**

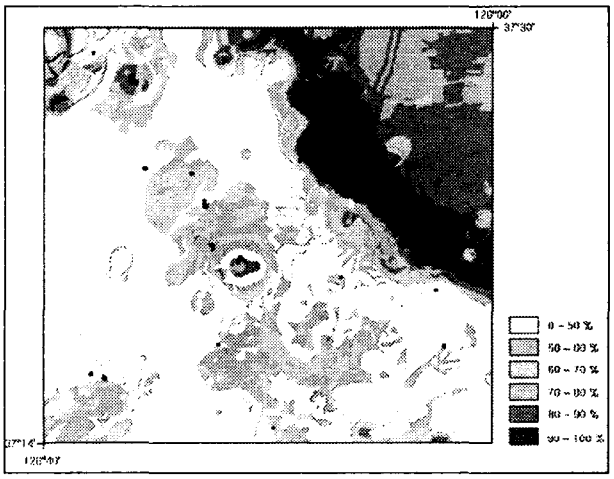

**Fig. 2. Mineral resources potentiality map**