

PREDICTIVE MODELING FOR MINERAL POTENTIAL MAPS USING AIRBORNE GEOPHYSICAL SURVEYS DATA

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A new predictive model to identify mineral exploration target areas using remotely sensed airborne-geophysical surveys containing magnetic, electro-magnetic (EM), and gamma ray spectrometry (radiometry), and GIS based geoscience information such as bedrock lithological maps and geochemical survey data has been developed as a exploration tool. The basic idea of the model is that the two distribution functions of the spatial data from the mineralized and non-mineralized subareas are distinctly different, and the difference is highlighted by the likelihood ratio function of the two distribution functions. In addition, the likelihood ratio function has been further enhanced by using the rank order statistics rather than the original observations. The predictive model has been applied to the spatial data sets in the Bathurst Mining Camp in Canada and the Siguiri Basin area in Guinea, West Africa. To evaluate the prediction results, cross-validation techniques were carried out. From the cross-validation analysis, the probability that an undiscovered volcanogenic massive sulphide (VMS) deposit is located within the most promising 41 km² areas (1% of the whole study area) from the final prediction map in the Bathurst Camp is estimated as 40.5%. That is, approximately 4 out of 10 new deposits are expected to be located within these 41 km² areas. Similarly, we have identified 25 km² areas in the Siguiri Basin area for exploration target of lateritic deposits, and the probability that an undiscovered lateritic deposit is located within the 40 km² areas is estimated as 42.4%. The model also allows us to study the contribution of each data layer to the prediction results. The most significant input data for the VMS deposits in Bathurst camp were the low frequency conductivity (from EM survey) layer. For the lateritic deposits in Guinea, potassium (from radiometric survey) data layer and magnetic (from magnetic survey) layer were the two most contributing information.