Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02347, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02347
EGU General Assembly 2008


# Information integration processes and power-law models for prediction of undiscovered mineral deposits

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This paper introduces a new method for integrating evidential layers of geo-data from different sources for updating geo-information for delineating mineral exploration targeting areas. Recombining geo-scientific data of different sources and types involves identification of evidential layers, quantification of association between evidential layers and locations of mineral deposits, and integrating multiple layers of evidences for mapping posterior probability of mineral deposit occurrence. We show that the posterior probability calculated from integrating multiple evidences may follow power-law relation with the size of the target areas. The model can be applied to determine cut-off values for delineation of mineralization anomalies. Several power-law models for prediction of mineral deposits and for mineral resources assessment have been introduced: (1) a power-law model for quantifying local singularities and the strengths of geoanomalies related to mineralization and mineral deposits; (2) a power-law model for modeling the spatial and frequency distributions of singularities and undiscovered mineral deposits; and (3) a power-law model for probabilistic estimation of total mineral resources in a mineral district. A case study of prediction of Sn/Cu mineral resources potential in the Gejiu mineral district Yunnan, China was used for model validation and application demonstration. Datasets used in the example include discovered Sn/Cu mineral deposits, geochemical concentration values of trace and major elements in stream sediments, geophysical aeromagnetic data and gravity data. Local singularities were calculated on the basis of geochemical data using a windows-based

singularity analysis method, and the optimum spatial correlation determined between the strength of singularity and the location of discovered mineral deposits was applied to separate mineralization-related geochemical anomalies from the geochemical background values. Multiple geological evidential layers of maps including the distance from intrusive bodies and the distance from intersections of faults in the area were further integrated to map the posterior probability of mineral deposits in the area.