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Can multfractals be used for mineral resource appraisal?

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Various models have been proposed for modeling the worldwide resources of minerals and hydrocarbons. Most of these models assume either a lognormal or a Pareto distribution for the high-value tails of the size-frequency distributions of known deposits and assume that undiscovered deposits would satisfy these statistical models as well. The lognormal size distribution often provides a good fit to all sizes except for the largest deposits. Pareto-type models allow for tails that are thicker than those of the lognormal. With respect to the spatial distribution of the deposits, various statistical discrete frequency distribution models including the Poisson and negative binomial are commonly used. However, these models are based on the assumption that mean point concentration is independent of size of area used for measuring deposit density. Fractal-multifractal point distribution models can provide better results.
A good approach to worldwide deposit modeling would consist of (1) quantification of 2-D boundaries of permissive terrains for different types of deposits; (2) assuming that the mineral deposits are spatially distributed as fractals or multifractals; and (3) adopting Pareto-type frequency distributions for the largest mineral deposits. In this paper, examples will be presented of cases in which (a) the fractal/multifractal approach provides better results for spatial distribution of deposits than classical statistical models, and (b) the Pareto is performing better than the lognormal as size distribution model for the largest mineral deposits. In recent years, large worldwide mineral deposit data bases have become available. Statistical analysis of these data confirms the idea that amounts of metals in ore deposits generally satisfy the lognormal model except in their high-value Pareto-type frequency distribution tails.