

Spatial Patterns of Mineral Deposits Across Geographic Scales: Their Exploration Significance

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English Abstract

Mineralization and the spatial pattern of its products (i.e., mineral deposits) result the interplay of various processes controlled by the geological setting where they exist. Research in this context has gradually established that many discernible processes involved in mineralization exhibit fractal distribution (i.e., they are scale-invariant). Therefore, despite the apparent complexity of the spatial pattern of mineral deposits across a range of geographic scales, some regularity exists in it. If examined properly, this orderly spatial pattern can be informative to various fields relevant to mineral exploration. In this presentation, the spatial pattern of iron oxide-copper-gold deposits in the world-class Carajás Mineral Province of Brazil is examined at the regional-scale, local-scale and micro-scale. The spatial pattern of ore minerals at the micro-scale is largely non-random, displays fractal distribution and exhibits discernible trends that mimic those of ore bodies at local-scale and deposit locations at regional-scale. The fractality of the spatial pattern of mineral deposits is largely due to structural controls on mineralization, as certain geological structures are major controls on fluid flow. Hence, the key factor that governs the perceived fractality of the spatial pattern of mineral deposits is structural permeability, which is largely linked to multi-scale geological structures.