Renormalisation Constraints on Boundaries of Geochemical Anomalies

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Because the significance of geochemical anomalies is affected by certain stochastic factors, such as the differences of geological backgrounds and micro-geochemical landscapes of ore deposits from those of geochemical anomalies, some mineral deposits have been found away from geochemical anomalies. Nevertheless, mineral deposits and geochemical anomalies exhibit intrinsic relations. To quantitatively capture the variations in physical variables at various scales, the proposed renormalisation theory was derived from the quantum field theory. Similar to the fractal theory and chaos theory, the quantum field theory is attributed to nonlinear theory and has become an important application in the study of asymptotic behaviour of high energy. To clarify this, the dimensional quantitative relation between mineral bodies and different scales of geochemical anomalies are discussed. First, the relation was deduced from theory. Mineralisation probability at level n : $p_n = 3p_n^4 - 8p_n^3 + 6p_n^2$. The correlation length, $L(p) = L_0 \mid p - 0.2324 \mid^{-v}$, for scales of 1:200,000, 1:50,000 and 1:10,000, was calculated as v =1.087. Under the probability of 0.05 of anomalous data, the impact sphere or renormalisation boundaries of geochemical anomalies in the scales of 1:200,000 and 1:50,000 should be extended outward by 5 and 0.13 km, respectively, from the anomalies delineated. Then, the correlation lengths for different scales or p for the Daijiazhuang Pb-Zn deposit reveal that scale plays an important role in the calculation of correlation lengths when the frequency of anomalous data is less than 10%. The renormalisation boundary implies that there could be undetected anomalies aside from those delineated by the renormalisation boundary. This should not be neglected in prospecting for ore deposits.