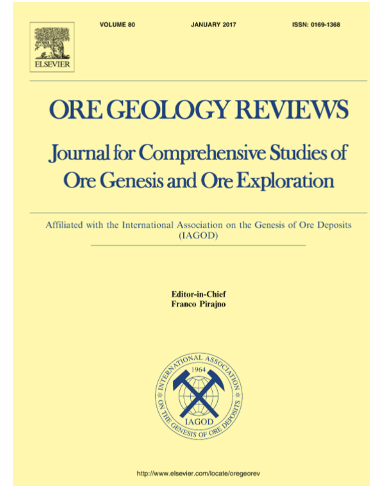

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A fractal measure of mass transfer in fluid–rock interaction

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Abstract

Exploring the mechanism of mass transfer is critical for characterizing geochemical behaviour of elements in fluid–rock interaction and is useful for understanding the sequence of hydrothermal alteration. The focus of this study is on identifying the spatial relationship between the concentration variation of elements and the distance of samples to the source of the hydrothermal fluid. A mobility index (MI) was applied to represent the mass changes. A value of MI > 1 indicates gain of elements, < 1 loss of elements, = 1 no mass changes. Two data sets are used to quantify the mass transfer in fluid–rock interaction at a decimeter–scale. A fractal relation between MI and distance (x) from alteration to the source of hydrothermal fluids is observed. For the enriched and depleted elements, the relation can be expressed as MI = cx^{-d} and MI = cx^{d}, respectively, where c is a constant, and d is the fractal dimension. Such relations indicate a power-law decrease/increase of MI with the decreasing degree of alteration. The fractal dimension provides an objective measure of the mass gain or loss. The larger the fractal dimension, the larger the mass change. The fractal dimension sequence quantitatively reveals the activity of ore–forming elements and the degree of mass changes in the process of hydrothermal fluid–rock interaction, which can provide critical information on hydrothermal alteration.