Potential Scale Dependence of Effective Matrix Diffusion Coefficient

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Abstract

It is well known that matrix diffusion (mass transfer between fractures and the rock matrix through molecular diffusion) can significantly retard solute transport processes in fractured rock, and therefore is important for analyzing a variety of problems, including geological disposal of nuclear waste. Matrix-diffusion-coefficient values measured from small rock samples in the laboratory are generally used for modeling field-scale solute transport in fractured rock. However, by compiling results from a number of field tracer tests corresponding to different geological settings, this study demonstrates that the effective matrix diffusion coefficient at field scale is generally larger than that at lab scale and tends to increase with testing scale. Preliminary interpretations of this observation are also investigated. We found that this interesting scale dependence may be related to the complexity of flow-path geometry in fractured rock.