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A Geologist's Introduction to Permeability Averaging and the Effects of Scale on the Permeability of Heterogeneous Rocks

by

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ABSTRACT

Most naturally occurring porous media exhibit some degree of spatial permeability variation, usually referred to as heterogeneity. Few rocks are homogeneous, although some are more variable than others. One of the consequences of heterogeneity is scale dependence. That is, the permeability of a large volume of rock, often called the "effective permeability," will in general be different than the permeabilities of smaller volumes within it.

In this presentation I will use published measurements to illustrate the effects of scale on permeability. Then I will outline some important theoretical predictions concerning effective permeability and show how these theories offer a powerful framework for understanding the behavior of heterogeneous rocks. Finally I will suggest a permeability averaging method that can be used to reconcile observations at different scales and to predict effective permeability for reservoir modeling purposes.