AAPG International Conference: October 24-27, 2004; Cancun, Mexico

Permeability and Porosity Trends from Thin Sections Using Lattice Boltzmann Method

Ayako Kameda[1], *Jack Dvorkin*[2], *Youngseuk Keehm*[1], *and Amos Nur*[3]. *(1) Department of Geophysics, Stanford University, Stanford, CA 94305, phone: 650-723-6106, kamedaa@pangea.stanford.edu, (2) Geophysics Department, Stanford University, Stanford, CA 94305-2215, (3) Geophysics Department / Rock Physics Laboratory, Stanford University, 397 Panama mall, Stanford, CA 94305-2215*

We obtain the permeability of porous rock by numerically simulating fluid flow at the pore scale in 3D. For practical reasons, only a small subset of the rock, just several grains across and not necessarily statistically representative of the whole sample, can be used in this procedure. To understand how the resulting spatial variability of the digital samples affects the final permeability value, we calculate the permeability of sandstone, using the Lattice-Boltzmann method, from a large number of 2D microimages obtained via 3D microtomography. Both the 2D porosity and corresponding permeability show a significant variation and deviate from the physically measured 3D porosity and permeability of the sample. However, the cross-plot of the numerical permeability and porosity results forms a distinctive trend that is similar to that observed in Fontainebleau sandstone and other similar data sets. The practical implication is that a suite of small 2D images, which individually may not be statistically representative of a larger rock volume, can still be used to establish a valid permeability-porosity trend specific for the sample under examination. This trend can also be described by the Kozeny-Carman equation.