

The influence of sample geometry on the permeability of a porous sandstone

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Although detailed guidelines exist for measuring the physical and mechanical properties of laboratory rock samples, guidelines for laboratory measurements of permeability are sparse. Provided herein are gas permeability measurements of cylindrical samples of Darley Dale sandstone (with a connected porosity of 0.135 and a pore- and grain-size of 0.2-0.3 mm) with different diameters (10, 20, and 25 mm) and lengths (from 60 to 10 mm), corresponding to aspect (length/diameter) ratios between 6.2 and 0.4. These data show that, despite the large range in sample length, aspect ratio, and bulk volume (from 29.7 to 1.9 cm³), the permeabilities of the Darley Dale sandstone samples are near identical (3-4 × 10-15 m²). The near identical permeability of these samples is considered the consequence of the homogeneous porosity structure typical of porous sandstones, and the small grain- and pore-size of Darley Dale sandstone with respect to the minimum tested diameter and length (both 10 mm). Laboratory permeability measurements on rock samples with inhomogeneous porosity structures, or with larger grain- and pore-sizes, may still provide erroneous values if their length, diameter, and/or aspect ratio is low. Permeability measurements on rocks with vastly different microstructural properties should now be conducted in a similar manner to help develop detailed guidelines for laboratory measurements of permeability.