Solid Earth Discuss., 5, C433–C435, 2013
www.solid-earth-discuss.net/5/C433/2013/

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Interactive comment on "Assessing accuracy of gas-driven permeability measurements: a comparative study of diverse Hassler-cell and probe permeameter devices" *by* C. M. Filomena et al.

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Received and published: 15 August 2013

Referee report Journal: SE Title: Assessing accuracy of gas-driven permeability measurements: a comparative study of diverse Hassler-cell and probe permeameter devices Author(s): C. M. Filomena et al. MS No.: se-2013-33 MS Type: Research Article

General: This is a useful paper that helps dealing with different types of permeability data. It is not novel in a scientific way, but straightforward technical. After fixing some shortcomings it should make a nice publication that would be of interest to people

dealing with perm measurements of different kinds.

My main objections are:

-The poor description of the samples. They should be described with respect to depositional environment, mineralogy, sorting, rounding, porosity, lithification/burial depth and age. Are these correlations relevant for someone working on carbonates, for example? Line 22 is one place where this needs to be addressed + Table 1

-Sample size. How can you measure permeability at the end of a 1-inch plug and compare it with outcrop measurements? Holding the miniperm against a more or less planar outcrop surface forces the air to move through a much longer path/larger volume of rock. This needs to be discussed. It would be interesting to know how much of a difference this makes for rocks with different porosity/permeability values. The difference may be different for low-perm and high-perm rocks/samples.

-Compare with data presented by Fossen et al. 2011, where we drilled continental sandstones at the exact locations where TinyPerm measurements were first taken. The relatively well-established correlation is given in our paper. Perhaps plot this data in your diagram.

-The reference list is incomplete.

-Language needs some fixing.

Detailed comments are given in a separate pdf Good luck to the authors, and I am looking forward to seeing the final version of this paper.

Haakon Fossen

Interactive comment on Solid Earth Discuss., 5, 1163, 2013.

Solid Earth Discuss., 5, 1163–1190, 2013
www.solid-earth-discuss.net/5/1163/2013/
doi:10.5194/sed-5-1163-2013

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Assessing accuracy of gas-driven permeability measurements: a comparative study of diverse Hassler-cell and probe permeameter devices

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Received: 1 July 2013 – Accepted: 15 July 2013 – Published: 2 August 2013

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Published by Copernicus Publications on behalf of the European Geosciences Union.

Abstract

Permeability is one of the most important petrophysical parameters to describe the reservoir potential of sedimentary rocks, contributing to problems in hydrology, geothermics, or hydrocarbon reservoir analysis. Outcrop analog studies, well core measurements, or individual sample analysis take advantage of a variety of commercially available devices for permeability measurements. Very often, permeability data derived from different devices need to be merged within one study, e.g. outcrop mini-permeametry and lab-based core plug measurements. To enhance accuracy of different gas-driven permeability measurements, device-specific aberrations need to be taken into account. The application of simple one-to-one correlations may draw a wrong picture of permeability trends. For this purpose, transform equations need to be established.

This study presents a detailed comparison of permeability data derived from a selection of commonly used Hassler cells and probe permeameters. As a result of individual cross-plots, typical aberrations and transform equations are elaborated which enable corrections for the specific permeameters. Permeability measurements of the commercially available ErgoTech Gas Permeameter and the TinyPerm II probe-permeameter are well-comparable over the entire range of permeability, with $R^2 = 0.967$. Major aberrations are identified among the TinyPerm II and the mini-permeameter/Hassler-cell combination at Darmstadt University, which need to be corrected and standardized within one study. However, transforms are critical to their use, as aberrations are frequently limited to certain permeability intervals. In the presented examples, deviations typically tend to occur in the lower permeability range < 10 mD. Applying standardizations which consider these aberration intervals strongly improve the comparability of permeability datasets and facilitate the combination of measurement principles. Therefore, the utilization of such correlation tests is highly recommended for all kinds of reservoir studies using integrated permeability databases.

Fig. 1.